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Neglected Clubfoot

Prof. Md. Iqbal Qavi

The prevalence of congenital talipes equinovarus, coupled with the limited availability of health care in many developing regions, has led to presence of neglected clubfeet. Ideally, the care of clubfeet in these regions may be improved through two avenues, assuming that sufficient resources and qualified health care personel can be mobilized. The first would focus on early identification and treatment of new cases in infancy, while the second would provide care for neglected cases in childhood and adolescence.

Campaigns to raise public awareness may help to identify cases early, and adequate training of both nonmedical and medical personel at the village level may help to extend care to greater numbers of children. Additionally, the length of treatment and importance of close follow up to achieve a successful result mandates that clubfeet be managed within each given community. Several published techniques should be appropriate to implement at the village level, within a setting of limited resources.

The Ponseti technique has achieved considerably popularity recently, and the published results from many centers have been very encouraging. Although this method has not been applied to neglected clubfeet in older patients, the applicability and potential benefits in the developing world are significant. Nonmedical personel can be trained in the technique, which would enable more patients to be serviced. This approach is already being applied in Uganda, and several other regions are being evaluated as training sites. The treatment method described by Sengupta has been employed in more than 5000 patients in India with adequate results. Although published studies dealing specifically with the management of neglected clubfeet in older patients may be limited, a variety of well described options are available, some of which have been commonly used to manage recurrent deformities.

The available information on natural history suggests that most patients do not experience significant pain (at least in the first several decades), and that they are able to ambulate successfully. Perhaps a greater issue is the cosmetic and sociocultural implications of this deformity. A detailed functional assessment of untreated clubfeet in older patients is not available. The recommended surgical approaches necessarily depend upon the age of the patient, and have included the following procedures either alone or in combination: soft tissue release, osteotomy, arthrodesis, and gradual correction using the Ilizarov device or an equivalent form of external fixation. A staged approach has been advocated by several authors. Secondary procedures may be required to address tibial torsion and forefoot deformity, in addition to residual deformities or complications following the primary treatment. For patients in childhood, options include soft tissue release with or without shortening of the lateral column, or gradual correction with an external fixator. Although a report of successful triple arthrodesis in children younger than 8 years is available, this should probably be reserved as a salvage procedure. Similarly, talectomy should be reserved for salvage. In older patients, options include soft tissue release with osteotomy (dorsolateral wedge resection most commonly), gradual correction with an external fixator (usually with soft tissue release/ osteotomy), or triple arthrodesis. A preliminary soft tissue release, with or without serial casting, may be required prior to triple arthrodesis in severely deformed feet. Wedge resections of the hindfoot joints are usually required to achieve adequate alignment. The Ilizarov device (or locally produced equivalents) may be applied in the developing world, but do require more intensive training and experience. The method is labor intensive, requires close followup, and is certainly associated with complications. Gradual correction of these severe deformities is attractive for several reasons. Shortening of the foot, as might be seen with wedge resection or triple arthrodesis, is not observed. The chance of neurovascular compromise is diminished in comparison with an acute correction, and wound related concerns (including

Director & Professor NITOR, Dhaka

closure) are minimized. In addition, joints are spared. Although the basic concepts are similar, published series have varied somewhat in the implants used and in the technical details of frame construction. Basically, fixation needs to be achieved at the level of the tibia, the hindfoot, and the forefoot. These anchor points may then be connected by rods which enable differential compression or distraction to affect changes in alignment between the segments.

Differential distraction between the tibial and hindfoot segments enables correction of hindfoot equinus and varus, while similar forces between the hindfoot and forefoot segments addresses the adduction, supination, and cavus components. Studies using this approach have varied in their recommendations for whether or not to overcorrect the deformity, the length of time in the frame after correction is achieved, the type and length of immobilization after removal of the frame, and the use of an orthosis after immoblization is discontinued. Additionally, lateral transfer of the tibialis anterior has been suggested to help maintain correction after frame removal. This methodology may be applied in combination with soft tissue release and/or osteotomy, especiallyin stiffer feet that have previousely been treated surgically. When correcting these deformities without osteotomy, one relies upon achieving sufficient mobility at the involved joints to enable realignment. Additionally, bony remodelling may also play a role in the ultimate alignment achieved, especially in those under 8 years of age.

Although it seems reasonable to attempt correction of these neglected deformities in all age ranges, and the short term results in published series are promising, the ultimate (unction at long term followup is unknown. The optimal treatment approach remains to be determined.

Intra Articular Steroid for Primary Frozen Shoulder: Effect on Early Recovery and Progression of Disease

AHM Rezaul Haque[1], Takbirul Islam[2], Most Maksuda Begum[3], Mollah Ershadul Haq[4]

Abstract:

The purpose of the study is to assess the timing if intra articular steroid in frozen shoulder recovery and disease progression.

Eighty one shoulders of 70 patients of primary frozen shoulder phase I and II with minimum duration of two months were selected for the study. The solution injected 5cc of 1% lidocaine and 2cc of methyl prednisolone. 4cc of solution given in glenohumeral joint and 3cc given in sub-acromial space via posterior approach. After the intra-articular injection, patients were advised to perform range of movement exercises within limits of pain and increase thereby.'

All the 44 patients of clinical phase I recovered in the mean time of 4 weeks (range 3-6 weeks). 12 of 16 patients of clinical phase II recovered within 4 months. 4 patients did not recover satisfactorily within 6 months.

Therefore, intra articular steroid in patients of frozen shoulder phase I and phase II causes early recovery and decreases late complications.

Introduction :

The management of frozen shoulder has been an area of controversy in orthopaedics since the original use of the term Codman[1], and although much work on the disease has been performed, it remains something of an enigma. Primary and secondary frozen shoulder may be now understood as distinct entities, and the condition can be divided into 2 groups: [1] "primary" frozen shoulder in those patients with no inciting event and no abnormality on examination other than a global loss of movement, and [2] "secondary" frozen shoulder which encompasses cases of post traumatic stiffness, frozen shoulder associated with diabetes mellitus, post myocardial infarction pain, and inflammatory disorders among others.[2]

Primary frozen shoulder has three clinical phases –

I. Painful phase : in this phase, there is gradual starting of shoulder pain which becomes worse at night and lying by on affected side. This phase continues from 1-9 months.

II. Stiffening or frozen phase. There is progressive stiffness & loss of motion which may lead to disuse atrophy of muscle around the shoulder. This phase lasts for 4 to 12 months.

III. Thawing phase: in this phase, the patient notices gradual improvement in the range of movement and decreases in pain. This phase lasts for 5 to 12 months.

Traditionally, frozen shoulder has been regarded as a self-limiting condition, lasting 18 to 30 months and with no significant long-term sequelae. However, long –term follow-up studies have shown that at a mean of 7 years from the onset of the condition, 50% of patients still have pain or stiffness of the shoulder, although only 11% report functional limitation[3].

To decrease time to recovery and improve the results of this condition, a number of different treatment modalities have been used. These include control of pain and inflammation with non-steroidal anti-inflammatory drugs[4],

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controlled physiotherapy[5], open release of the coracohumeral ligament[6], arthroscopic divisions of adhesions[7], hydrostatic distension of the capsule[8], and manipulation of the shoulder under anaesthesia. Retrospective study have shown up to 70% of patients return to work at a mean of 3 months after intra articular steroid, with significant improvements in shoulder function. However, prospective studies of this technique have concentrated on the late results of intra articular steroid, which may be indistinguishable from the natural history of the disease without intervention.

It is our opinion that the major role of intra articular steroid in frozen shoulder is to shorten this time span and to achieve an early pain-free functional range of movement in the shoulder.

PATIENT AND METHOD

The criteria for inclusion included

1.Clinical diagnosis of frozen shoulder phage 1 & phage11 with no abnormality on plain radiograph.

We have focused on the early response to intra articular injection. Therefore the aims of this study with respect to the immediate time scale after injection are as follows: (1) to assess the effectiveness of intra articular steroid in the management of primary frozen shoulder in restoring function as measured with the Constant-Murley score, (2) to assess the effect of intra articular steroid on restoration of range of movement, and (3) to assess patient satisfaction with the procedure and(4) to assess the outcome of frozen shoulder

The frozen shoulder was diagnosed on history and clinical examination.

Pain increased on shoulder movement, Range of movements at shoulder was recorded, Especially active & passive forward flexion, abduction, internal & external rotation.

The solution injected contained 5 cc of 1%lidocaine HCL & 2cc of methylprednisolone

Acetate. All patient were injected ones. The posterior approach was used to inject Glenohumeral joint & in the same prick by changing direction of needle 3cc of solution given in sub-acromial space The site of entry was same as used for traditional post portal for arthroscopy of shoulder. This portal is located 2 to 3 cm inferior & 1 cm medial to the postero lateral tip of the acromion.

After intra-articular injection patient were advised to perform exercise within limits of pain for 5 minutes.

Both active & passive range of movement were assessed before & after injection at all subsequent visit.

Patient who have regained range of movement within 15^{o} of the contralateral normal side

Especially in forward flexion, ext rotation & int rotation were considered recovered.

We have prospectively evaluated the results of intra-articular steroid in primary frozen shoulder, and we report our early and midterm results.

RESULTS:

Between June 2010 - June 2012 80 patient 92 shoulders underwent intra articular steroid injection.Ten patient were not available for follow-up and are therefore not included further, leaving 70 patient 81 shoulder. There were 44 pt. of phage i & 16 pt. of phage ii There were 49 female & 21 male patient with a mean age of 52 year range (40 to 64).The right arm was affected 23 pt & left arm affected in 37 patient. Non-dominant hand affected in 34 cases.

The mean time from onset to intra articular steroid was 5 months (2 months to 9 months)

The median Constant score was 34 range (27 to 56) before intra articular injection. Before Intra articular steroid the range of movement was 90^{o} of abduction, 25^{o} of ext. rotation& 30^{o} Inter rotation. At initial 3-6 wk. follow up the range of movement had improved to median 125o abduction, 45^{o} of ext. rotation & 45^{o} internal rotation. The constant score had risen to a median70^{o} (35 -90).This trend continued at 3 months follow up with the constant score Rising to a mean 74^{o} (35-90). All patients were inquired about satisfaction, and exercise. It was found that those patients who did not do the exercise they did not improved satisfactorily. Overall 94% of patient declared themselves to be satisfied with the procedure.

Results of Intra-Articular Steroid in Frogen Shoulder

	Phase I & Phase II				
	External Rotation	Internal Rotation	Abduction	Constant Score	Satisfaction
Pre-Injection	25^{o}	30^{o}	90^{o}	34	0
3-6 weeks	45^{o}	45^{o}	125^{o}	70	80%
3 months	50^{o}	50^{o}	140^{o}	74	90%
> 6 months				84	94%

DISCUSSION:

The pathophysiology of frozen shoulder has not been clearly define although Bunker has shown abnormal lipid proliferation & active fibroblast & myofibroblast proliferation. As a result management often depends on the individual clinicians preferences. Because the cause is unclear treatment is directed at relief of pain and improvement of function. Most of the series dealing with frozen shoulder look at the late result. It is reported that the vast majority of patient will improve whether treated or not.

However, if left untreated progress can be slow & frustrating for the patient. Some patient develop muscle atrophy. It has been shown that those patient with the longest stiffness

Stage have high tendency of development of restriction of movement

Intra articular steroid in frozen shoulder prevents the adhesion formation between capsule & bone by fibrinolysis due to its anti-inflammatory effect.

Those patient with renal function impairment get relief of NSAID.

Dudklewiezi et al 2004 in their study of 54 patient with mean follow up .9-2 yr claim that conservative primary treatment for frozen shoulder with physiotherapy & intra articular steroid was effective long term treatment method.

Majority of patient of stage ii & all patients of stage (i) have very good result.

Patient who followed the home exercise programme properly were early to recover & had good result

CONCLUSION:

In conclusion we have found a significant improvement in early shoulder function after intra articular steroid in primary frozen shoulder . It is a simple procedure with a high patient satisfaction & a low complication rate. I would recommend its use in reducing the duration of morbidity and early pain free mobility.

REFERENCES:

1. Codman EA The shoulder: Rupture of the supraspinatus tendon and other lesions in or about the sub-acromial bursa, Boston; Thomas Todd co,1934.
2. Lundberg BJ. The frozen shoulder Acta Orthop scand. 1969; (suppl) 119:1658.
3. Reeves B, The natural history of frozen shoulder syndrome. Scand J Rheumatol. 1975;4:193-6.
4. Ogilive Harries DJ, Biggs DJ, Fitsialos DP , Mackay M. The resistant frozen shoulder. Manipulation versus arthroscopic release, Clin Orthop 1995;319:238-48.
5. Melzev C , Wallay T,Wirth CJ,Hoffmans.Frozen shoulder-treatment & results. Arch Orthop Trauma Surgery. 1995;114:87-91.
6. Ozaki J ,Nakagawa,Sakurai G,Tamai S.Recancitrant chronic adhesive capsulitis of the shoulder.J Bone Joint Surg Am. 1989: 71: 1511-5.
7. PollakRG,Duralde XA,Flatow EL ,Bigliani LU.The use of arthroscopy in the treatment of resistant frozen shoulder. Clin Orthop.1994; 304:30-6.

Original Article

Deltoid Contracture: Study on Eleven Cases

Dipankar Nath Talukder[1], Ishtiaque Ul Fattah[2], M.A. Hannan[3], Faruqul Islam[4], Mohsenuzzaman Khan[5]

Abstract

Abduction deformity of shoulder due to deltoid contracture is not uncommon in Bangladesh. Contractures of deltoid often do not have definite etiology. Aim of our study is to find out the etiopathogenesis of deltoid contracture and evaluation of its surgical results.

Eleven patients with deltoid contracture operated between January 2005 and July 2014 were enrolled for a single centered prospective study. The surgery was indicated in patients with abduction deformity of more than 25° at the shoulder and age more than 5 years. The etiology of deltoid contracture was intramuscular injection in deltoid muscle (*n* = 5), idiopathic (*n* = 4), post infective (*n* = 1) and blunt trauma (*n* = 1). All were operated by distal release. The average follow-up was of 5 years (range 6 months - 9 years). They were evaluated based on parameters like pain, persistence of deformity, range of shoulder movements and strength of deltoid.

All patients recovered painless full range of shoulder motion except 1. The correction of deformity was achieved full in all patients and there was no significant loss of strength of deltoid compared to the opposite side. The complications observed were hypertrophic scar (*n* = 1), painful terminal restriction of shoulder movements (*n* = 1) and superficial wound infection (*n* = 1).

Repeated and voluminous intramuscular injection into deltoid is the most incriminating factor followed by idiopathic cause for deltoid contracture. Infection and trauma are also the factors in its etiopathogenesis. Distal release of the deltoid muscle is the very useful method of treatment for deltoid contracture of any aetiology.

Key Words: Deltoid Contracture, surgical release.

INTRODUCTION

Deltoid fibrosis is a disorder marked by intramuscular fibrous bands within the substance of the deltoid muscle. These bands lead to secondary contractures that affect the function of the shoulder joint.[1] Scapular winging and secondary scoliosis may also be related to this condition.[2] Similar contractures have also been seen in the quadriceps and gluteal muscles.[3, 4] Some patients exhibit contractures in both the upper and lower extremities. Deltoid fibrosis has most commonly been related to intramuscular postinjection events, with trauma, congenital factors, and progressive idiopathic factors also playing roles.[7] Antibiotics, analgesics, and other commonly injected medicat ions seem to influence contractures of the deltoid.[8, 9]

Contractures of the deltoid have been seen most commonly in the middle portion. The second most common site for contracture is the posterior portion. It is thought that these areas are involved most commonly because injections are placed there to avoid the cephalic vein anteriorly.[3,11,13,14]

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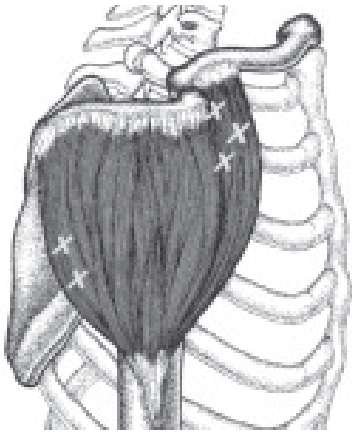


Fig.-1: *Fiber of deltoid*

Although these factors seem to play a leading role, the exact cause of fibrous development is unknown. Chen et al found that siblings of affected children had similar contractures in only 30% of cases,[5] despite a similar frequency of injections.

Development of deltoid fibrosis is not limited to children. Multiple cases have been reported of fibrosis development in older adults who received frequent injections. However, Manske reported findings of contractures in infants with no history of injections.[10] These children had been exposed only to physical trauma and birthing complications. Chatterjee and Gupta also examined multiple patients presenting with deltoid fibrosis that denied a significant history of intramuscular injections, indicating that other factors must be contributing to fibrosis formation.[11]

The condition is not adequately reported in world literature. Often the diagnosis is missed. The present study aimed to analyzes the etiopathogenesis of deltoid contracture and evaluate the results of surgical treatment.

METHODS

From January 2005 and July 2014, 11 patients admitted in Sylhet MAG medical college hospital with a deltoid contracture. 5 patients were in the age group of 6-10 years, 3 patients were between 10-15 years, 2 patients were between 15-20 years and 1 patient age was 23 years. 7(64%) patients were male. All patients had unilateral affection. Left side (73%) was predominantly affected. All patients presented with abduction deformity of shoulder of more than 25° and age of the patient was more than 5 years.[12] 1 had history of infection, 1 had blunt trauma, 5 had a history of intramuscular injection in the deltoid in childhood and rest 4 were idiopathic. There was no sibling affection in the series.

On palpation, most of the patients had palpable contracture band in the lateral segment of the deltoid, of which 1 had additional contracture bands extending up to the posterolateral segment of the deltoid and 1 patient had diffuse contracture.

The abduction deformity in our patients ranged from 25 to 45° with further full abduction possible in all the patients Table 1. All the patients presented with a cosmetic deformity of winging of the scapula. On attempted passive adduction at the shoulder, the scapula became unusually prominent. Apart from deformity, pain in the neck, shoulder and upper arm was the most common symptom. There was no secondary deformity of the spine or chest wall. There was no contracture seen in other parts of the body. Skiagrams of the shoulder revealed some typical features like tapering of the clavicle and drooping of acromion covering the greater tuberosity of the humerus, maldevelopment of shoulder joint. Abduction deformity of more than 25° at the affected shoulder was an indication for surgical treatment in our series.

OPERATIVE PROCEDURE

After general anesthesia patient was positioned supine with a folded sheet under the affected shoulder. The band was approached by longitudinal incision over the contracture band. The contracture band was then identified and separated from muscle mass completely. Distal release, i.e. excision of the band near the insertion of the muscle was performed in most of the cases. Full adduction was done and the band was then sutured with fibers of deltoid. Apart from the main band, sometimes it was necessary to divide a few accessory bands. These accessory bands were present within the posterior part of the muscle, which were identified by adducting the shoulder which made them more prominent. Hemostasis was secured meticulously. Postoperatively the affected limb was strapped to the body in full internal rotation and adduction of shoulder till the stitches were removed on the 10th postoperative day. Active shoulder movements were then allowed as soon as the patient was able to perform within the limits of pain.

Table-I

Clinical details of patients

Case	Age (year)	Sex	Side	Etiology	Type of contracture	Abduction deformity (in degrees)	F/U(Years)
1	6	M	L	Idiopathic	Lateral	30	9
2	10	M	R	Post injection	Lateral	25	8
3	8	F	L	Idiopathic	Lateral	25	8
4	14	M	L	Post injection	Lateral	45	7.5
5	7	F	L	Post injection	Lateral	30	6
6	16	M	R	Idiopathic	Lateral	40	6
7	19	M	L	Blunt trauma	Lateral	45	4
8	9	M	L	Post injection	Lateral with posterolateral extension	45	3.5
9	8	F	L	Idiopathic	Lateral	25	2
10	12	F	L	Post injection	Lateral	35	1.5
11	23	M	R	Post infective	Diffuse	45	0.5



Fig: *Pre-operative* *Per operative* *Post- operative*

DISCUSSION

In present series of deltoid contractures, there was history of intramuscular injection in early childhood in five cases. Male sex was predominant. No deformity was seen in brother and sister our study but idiopathic contracture was found in four cases.

In our series muscular fibrotic contracture (MFC) of the deltoid was found to be prevalent after six years of age. Most of the contractures were segmental full-thickness contractures usually lateral in all cases. It was more commonly seen on the left side. All the five patients associated with history of intramuscular injection showed deep lateral contracture bands. Among them four had history of repeated intramuscular antibiotic injection and single dose large volume injection victim was one patient. We had no anterior contracture band in any case. Therefore, repeated intramuscular injection may be considered as the incriminating factor resulting in significant deltoid contracture. Infection and blunt trauma related contracture had a diffuse superficial lateral band as well as posterolateral extended additional band. Superficial lateral band was also affected on idiopathic group. Similar results was found by Banerji et al.[15]

In the all cases we utilized distal incision for release (near the insertion). We found that all of our patients including idiopathic group, the contracture bands radiated from a point situated distally near the insertion of the muscle. Hence we used distal longitudinal incision to excise the primary contracture and additional band completely.

However, all our cases showed satisfactory functional results with disappearance of abduction deformity of shoulder and winging of scapula. Superficial wound infection was developed in one patient at 5th POD which was controlled by regular dressing and antibiotic according to C/S. A small area of skin slough out was occurred which was managed by skin graft. This patient presented late with hypertrophic scar. We had no recurrence of the abduction deformity at the shoulder or winging of scapula in our cases.

CONCLUSION

Thus, we can conclude from the current study that repeated and large volume intramuscular antibiotic injection has the incriminating factor in etiopathogenesis of deltoid contracture and affect mainly deep lateral fiber. Infection and blunt trauma also play role but affect mainly superficial lateral fiber. Distal release of the deltoid contracture and incorporating the contracted band with remaining healthy fiber in full adduction of shoulder using distal longitudinal incision is the very effective method of treatment for this condition.

REFERENCES

1. Kibler WB, Sciascia A, Wilkes T. Scapular dyskinesis and its relation to shoulder injury. *J Am Acad Orthop Surg*. Jun 2012; 20(6): 364-72. Medline.
2. Scott DA, Alexander JR. Relapsing and Remitting Scapular Winging in a Pediatric Patient. *Am J Phys Med Rehabil*. Mar 30 2010;Medline.
3. Wolbrink AJ, Hsu Z, Bianco AJ. Abduction contracture of the shoulders and hips secondary to fibrous bands.*J Bone Joint Surg Am*. Jun 1973;55(4):844-6. Medline.
4. Mir NA, Ahmed SM, Bhat JA. Post-Injection Gluteal Fibrosis: A Neglected Problem. *JK Science*. Jul-Sept 2002;4(3):144-6.
5. Chen SS, Chien CH, Yu HS. Syndrome of deltoid and/or gluteal fibrotic contracture: an injection myopathy.*Acta Neurol Scand*. Sep 1988;78(3):167-76. Medline.
6. Ngoc HN. Fibrous deltoid muscle in Vietnamese children. *J Pediatr Orthop B*. Sep 2007;16(5):337-44. Medline.
7. Chen CK, Yeh L, Chen CT, Pan HB, Yang CF, Resnick D. Contracture of the deltoid muscle: imaging findings in 17 patients. *AJR Am J Roentgenol*. Feb 1998;170(2):449-53. Medline.
8. Cozen LN. Pentazocine injections as a causative factor in dislocation of the shoulder. *J Bone Joint Surg Am*. Oct 1977; 59(7): 979. Medline.
9. Davidson LT, Carter GT, Kilmer DD, Han JJ. Iatrogenic axillary neuropathy after intramuscular injection of the deltoid muscle. *Am J Phys Med Rehabil*. Jun 2007; 86(6): 507-11. Medline.
10. Manske PR. Deltoid muscle abduction contracture. *Clin Orthop*. Oct 1977; (128): 165-6. Medline.
11. Chatterjee P, Gupta SK. Deltoid contracture in children of central Calcutta. *J Pediatr Orthop*. Jul 1983; 3(3): 380-3. Medline.
12. Minami M, Yamazaki J, Minami A. A postoperative long-term study of the deltoid contracture in children. *J Pediatr Orthop*. Sep 1984; 4(5): 609-13. Medline.
13. Groves RJ, Goldner JL. Contracture of the deltoid muscle in the adult after intramuscular injections. *J Bone Joint Surg Am*. Jun 1974;56(4):817-20. Medline.
14. Ogawa K, Yoshida A, Inokuchi W. Deltoid contracture: a radiographic survey of bone and joint abnormalities. *J Shoulder Elbow Surg*. Jan-Feb 1999;8(1):22-5. Medline.
15. Banerji D,De C,Pal AK,Das SK,Ghosh S,Dharmadevan S. Deltoid contracture: a study of nineteen cases.Indian J Orthop.Apr-Jun 2008:42(2):188-191. PubMed

Original Article

Management of Distal Radial Fractures by Universal Mini External Fixator

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Abstract

Background: Distal radial fractures are very common injuries, that account for up to one sixth of all fractures. The treatment of such injuries, especially the severely comminuted & intra-articular fractures can be difficult and demanding. Patients & methods: This prospective study was carried out at the NITOR, Dhaka and some other private hospitals in Dhaka, from January 2003 to October 2013, on 110 patients with distal radial fractures, who were treated by UMEX. Resuls: Among the the 110 cases, 85 were males and 25 were females with a male female ratio of 17:5. The mean age was 38.5 (18-66) years; 70 were right and 40 were left distal radial fracture, with a right left ratio of 7:4; 81 (73.6%) were closed distal radial fractures, and the rest 29 (26.4%) were open distal radial fractures (Gustillo I & II); 80 (72.7%) were intra articular fractures & 30 (27.3%) were extra articular fractures. Union of the fractures were achieved in a mean of 5.4 weeks, ranging from 4-8 weeks. 5 patients were missed during the 10 year follow up. So, out of 105 cases, 34 (32.4%) had excellent, 46 (43.8%) had good , 19 (18.1%) had fair & 6 (5.7%) had poor outcome, in the context of both in union & hand function. Conclusion: UMEX is an effective method of treatment of comminuted & intra-articular distal radial fractures.

Key words: Distal radius fractures, Universal Mini External Fixator (UMEX)

INTRODUCTION

Distal radial fractures are very common injuries, estimated to account for up to one sixth of all fractures, [1] described initially by Pouteau (1783) and Colles (1814).[2] These fractures occur most commonly as a result of excessive loading of the wrist in extension or in flexion, axial load, a shearing mechanism, or a direct blow. The most common mechanism is a fall on an outstretched hand. These injuries are seen in all decades of life. Generally, a higher-energy mechanism of injury is required to induce a distal radius fracture between the second and sixth decade of life. There is a significant predominance of distal radius fractures in women beyond the sixth decade by trivial trauma, because of the prevalence of osteoporosis.[2]

Accurate description of the fracture may be difficult. Numerous classification systems have been proposed, like Frykman classification, Melone classification, Fernandez, Rayhack, Mayo, AO classification,etc. however, universal acceptance of any of these systems has not occurred because of a variety of shortcomings. For practical purposes, 4 basic types of displaced radius fractures exist; Type-I extra-articular,Type-II intra-articular radioulnar, Type-III intra-articular radiocarpal & Type-IV radioulnar.[3]

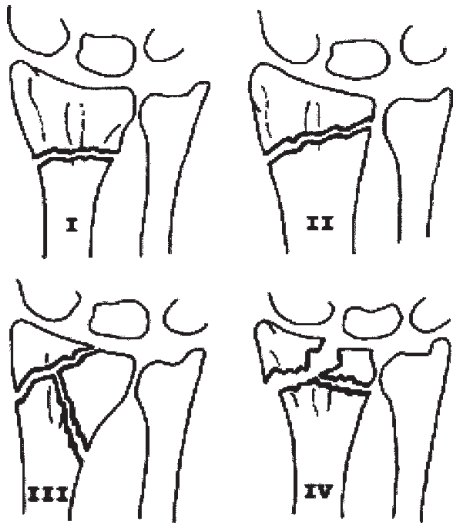


Fig. 1 : Practical classification of distal radial fractures.

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The treatment of such injuries can be difficult and demanding, especially when the fracture is severely comminuted or has intra-articular involvement. The incidence of complications, like stiffness, malalignment, etc. can be as high as 31%.[4]

Different options for the management of the distal radial fractures are, closed reduction with plaster cast immobilization, closed reduction with percutaneous pinning, open reduction and internal fixation,[5] external fixation,[6] augmented external fixation, etc.[7]

External fixation was introduced by Ombredanne. A number of exernal fixators have been tried till now, including Ombredanne's fixator,[8] Hoffmann fixator, fixator with distraction element by Burni, Vidal, Asche, Clyburn device, etc.[9,10,11]

Comminuted and intra articular distal radial fractures continue to be a difficult therapeutic problem, where restoration of the radial length is the most important factor of reduction. Universal Mini External Fixator (UMEX) is an efficient device to maintain this radial length till bony union. The principle by which reduction is achieved by UMEX is ligamentotaxis. UMEX involves minimal trauma to the bones and soft tissues and provides stable and rigid fixation of complex distal radial fractures.[12, 13] Agee applied multiplanar ligamentotaxis across the wrist joint to achieve an anatomical position of the distal radial fractures.[14]

PATIENTS & METHODS

This prospective study was carried out at the National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka and some other private hospitals like City Hospital, Dhaka, from January 2003 to October 2013. This study was performed on 110 patients with distal radial fractures, who were treated by UMEX both at the emergency, indoor & the outpatient department. Total follow up period was 10 years. The functional outcome was evaluated by the scoring system by Sarmiento.[16] Data were analysed, and was expressed as percentage.

OPERATIVE TECHNIQUE

Under appropriate anaesthesia (brachial block or general anaesthesia, including ketamine anaesthesia), the patient was placed supine on the operating table. After drapping & painting, the forearm was held in supination. 8 pieces of K-wires of similar lengh & diameter were selected for passage through the bones in the coronal plane of both the forearm & hand, almost perpendicular to the long axes of the radius, ulna & the metacarpals.

The 1st K-wire was passed through the radius in the coronal plane, at the junction of upper two third and lower one third (5 cm proximal to the radio-carpal joint, approximately), to engage both cortices of the radius. The 2nd K-wire was passed through the same plane about 0.5-1 cm distal to the first one, to engage both cortices of the radius. The next 2 K-wires were passed through the ulna from the medial aspect at the similar levels, in the coronal plane. The 5th K-wire was passed through the base of the 2nd metacarpal in the coronal plane and advanced to engage both the 2nd & 3rd metacarpals. The 6th K-wire was passed through the neck of the 2nd metacarpal in the same plane to engage both the 2nd & 3rd metacarpals. The next 2 K-wires were passed similarly into the 5th & 4th metacarpals from the ulnar side in the coronal plane, through the base & the neck of the 5th metacarpal, repectively. Then the distraction-compression (D-C) assembly or distractor was connected to the K-wires with Beta clamp on radial side. A straight 3 mm rod was connected to the K-wires with Alpha clamp on ulnar side. The fracture was then reduced by traction and manipulation. Keeping the traction, the connecting D-C assembly on radial side and knurled rod on ulnar side were fitted in desired position by tightening the Beta and Alpha clump respectively. Reduction was adjusted by either increased or decreased distraction on the D-C assembly and was verified by C-arm or portable x-ray.

POST-OPERATIVE CARE

The forearm was kept elevated and then rested in a collar sling. Active finger, elbow & shoulder movement exercises were encouraged from immediately after recovery from anaesthesia. The patients were allowed to go home in the same afternoon or on the next day, and were advised for follow up visits at every 3 weeks till the first 3 months in the outpatient department, for both clinical & radiological evaluation. After being ascertained about union, both clinically & radiologically, the implants were removed; usually after 6 to 8 weeks. Full weight bearing was allowed after 3 months. Thereafter they were advised for follow up visits at every 3 months till 1 year, then at every year. The total period of follow up was 10 years.



Fig.2 : *Pre-operative x-ray*

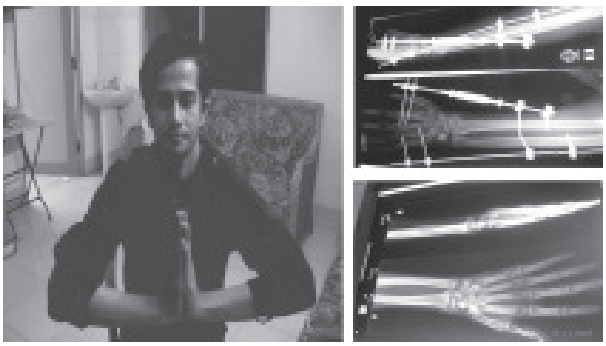


Fig. 3 : *Post-operave x-ray*



Fig. 4 : *Final follow up*

RESULTS

Among the the 110 cases, 85 were males and 25 were females with a male female ratio of 17:5. Among the 85 males, 34 (40%) were of above 50 years of age, and among the 25 females, 21(84%) were of above 50 years of age. The mean age of the patients was 38.5 years, ranging from 18 to 66 years. Regarding the side of involvement, 70 were right and 40 were left distal radial fracture, with a right left ratio of 7:4. Among the cases, 81 (73.6%) were closed distal radial fractures, and the rest 29 (26.4%) were open distal radial fractures (Gustillo I & II); 80 (72.7%) were intra articular fractures & 30 (27.3%) were extra articular fractures. Regarding the cause of injury, 77 (70%) were due to road traffic accident, 17 (15.5%) were due to fall from height, 11 (10%) due to machinery injury, & rest 5 (4.5%) were due to other causes. The time interval between fracture & the application of UMEX were 1 to 12 days. Among the 110 cases, 96 (87.3%) were performed manually & 14 (12.7%) were performed under C-arm guidance. Union of the fractures were achieved in a mean of 5.4 weeks, ranging from 4-8 weeks.

Regarding complications, mal-alignment was noted in 7 cases; among them, 5 had poor result with deformity, pain & stiffness, and rest 2 were missed. 4 had transient pin tract infection, cured by antibiotics & removal of the implant. 2 had reflex sympathetic dystrophy, which were cured by physiotherapy & anti-depressants. In 1 case, late distal radial collapse was noted to provide poor outcome.

5 patients were missed during follow up. So, the rest 105 patients were available for final evaluation. The total period of follow up was 10 years. At every follow up, functional evaluation was done both clinically & radiologically. Clinical evaluation included were residual deformity & subjective evaluation, range of motion and grip strength. Radiological evaluation were the assessment of radial length, volar tilt & radial inclination.[15]

The functional outcome was evaluated by the functional criteria outlined by Sarmiento.[16] Out of 105 cases, 34 (32.4%) had excellent, 46 (43.8%) had good , 19 (18.1%) had fair & 6 (5.7%) had poor outcome, in the context of both in union & hand function.

DISCUSSION

External fixators have been used for distal radial fractures for about 90-95 years.[3] In the cases of communition in 3 or more cortices, along with radial shortening of more than 5 mm with or without intra-articular involvement in the radiocarpal or inferior radioulnar joint, Penning & Gausepohl recommended the use of external fixator to restore the radial anatomy. [6] External fixation is used to maintain the axial length, while reduction is attained by mannipulation of fractured fragment with ligamentotaxis in both intra & extra-articular fractures. [17]

Here, the prevention of possible complications, like re-displaement, pin-tract infection, late collapse, etc. should be paid attention. [6]

In this study on 110 cases of distal radial fractures, The mean age of the patients was 38.5 years, ranging from 18-66 years. The fractures were united within 4-8 weeks, with a mean of 5.4 weeks. In a study by Huang, et al, on 70 consecutive patients, the mean age was 58.9 years, ranging from 14-87 years. All fractures were united in a mean of 5.8 weeks, ranging from 4-10 weeks, [18] which were not much different from this study.

Among the 110 case in this study, 85 were males and 25 were females with a male female ratio of 17:5. In another study, 31 were males & 39 were females. [18] This reflects that, men are more prone to this injury in the perspective of our country, as they have go outside home for work, more than the women. Again, women at old age are more prone to this injury due to osteoporosis.[2] Among the 25 females in this study, 21(84%) were of above 50 years of age.

Regarding the side of involvement, 70 were right and 40 were left distal radial fracture, with a right left ratio of 7:4. Which may be as part of reflex protective mechanism by dominant side while sustaining injury.

All the cases in this study were treated by close reduction and fixation by Universal Mini External Fixator (UMEX). Here, the principle of maintenance of reduction is ligamentotaxis. The UMEX is light, rigid, non corrosive and cosmetically more acceptable to the patient than the conventional external fixator. It is a uni-planer bi-axial fixator. Here, frame on the ulnar side prevents undue ulnar deviation of the wrist. This study was performed with UMEX, manufactured by Adler Mediequip Pvt. Ltd India, [19] which provides more stable fixation around wrist, so chance of loss of reduction is less. Agee applied multiplanar ligamentotaxis across the wrist joint to achieve an anatomical position of the distal radial fracture.[14]

In this study, the functional outcome was evaluated by the functional criteria outlined by Sarmiento.[16] Out of 105 cases, 34 (32.4%) had excellent, 46 (43.8%) had good , 19 (18.1%) had fair & 6 (5.7%) had poor outcome, in the context of both in union & hand function. In another study on 70 cases of distal radial fractures, 22 patients (31.4%) had excellent results, 36 (51.4%) had good results, 9 had fair and 3 (4.3%) had poor results.[18] Regarding the outcome, this study corresponds to the other studies. Here, longer follow up (10 years) helped us to evaluate the log term outcome.

One limitation in this study was, most of the cases had to be done without C-arm guidance due lack of availability in the early stage. Otherwise placement of K-wires, fracture mannipulation, reduction, etc. could have been more appropriate, so the outcome could have been better.

CONCLUSION

UMEX is light, rigid, and cosmetically more acceptable to the patient. It is a uni-planer bi-axial fixator, that provides more stable fixation around the wrist. It is minimally invasive. Being kept for ony 4-8 weeks, it causes less complications. It is an effective method of treatment of comminuted & intra-articular distal radial fractures.

REFERENCES

1. Owen, RA, Melton, LJ III, Johnson, KA, Ilstrup, DM, Riggs, BL. Incidence Of Colle's fracture in a North American community, *Am J Public Health*, 1982; 72: 605-13
2. Cooney, WP III, Dobyns, JH, Linscheid, RL. Complications of Colle's fracture, *J Bone Joint Surg Am*, 1980; 62: 613-9
3. Gausepohl, T, Penning, D, Mader, K. Principles of external fixation and supplementary techniques in distal radial fractures, *Injury*, 2000; 31: 56-70
4. Seiler, JG. Distal radial fractures,Ed, Essentials of hand surgery, 1st ed, Lippincott William & Wilkins, , 2002; 8: 102-3
5. McBirnie, J, Court- Brown, CM, McQueen, MM. Early open reduction and bone grafting for unstable fractures of the distal radius, *J Bone Joint surg Br*, 1995; 77: 571-5
6. Penning, D, Gausepohl, T. External fixation of the wrist, *Injury*, 1996; 27: 1-15
7. Dunning, CE, Lindsay, CS, Bicknell, RT, Patterson, SD, Johnson, JA, King, GJ. Supplemental pinning improves the stability of external fixation in distal radius fractures during simulated forearm motion, *J Hand Surg*, 1999; 24A: 992-1000
8. Ombredanne, L'osteosynthese temporaire chez les enfants, *Press Médicale*, 1929, p 52
9. Vida,l J, Buscayret, C, Paran, M, et al, Ligamentotaxis, In: Mears DC, ed, *External skeletal fixation*, Baltimore: Wilkins, p 493
10. Asche, G. Stabilizierung von handgelenksnahen Speichenstúckfrakturen mit dem Midifixatoer externe, *Handchirugic*, 1983;15:38
11. Clyburn, TA. Dynamic external fixation for comminuted intra-articular fractures of the distal end of the radius, *J Bone Joint Surg Br*, 1987;69:248-54
12. Cooney, WP, Linsched, RL. External pin fixation of unstable Colles' fracture. *J Bone Joint Surg Am*, 1979; 61A: 840-845.
13. Seitz, WH, Putman, MD, Dick, HM. Limited open surgical approach for external fixation of distal radial fractures, *J Hand Surg Am*, 1990; 15: 288-93
14. Agee, JM, Distal radius fractures: multiplanar ligamentotaxis, *Hand Clinics*, 1993; 9; 577
15. Gartland, JJ, Wirley, CW. Evaluation of healed Colle's fractures, *J Bone Joint Surg Am*, 1951; 33: 895-307
16. Sarmiento, A G, Nell, P, Berry, C, Sinclair, WF. Colle's fracture functional bracing in suppuration, *J Bone Joint Surg Am*, 1975; 57A: 311-7
17. Walter, H, Short, G. Biomechanics of the distal radius fractures, *J Hand Surg*, 1987; 12A: 529-34
18. Huang, TL, Huang, CK, Yu, JK, Chiu, FY, Liu, HT, Liu, CL, Tain-Hsiung Chen, TH. Operative Treatment of intra-articular distal radius fractures using the small AO external fixation device, *J Chin Med Assoc*, 2005; 68: 10-14
19. Laud, NS. The Universal Mini External Fixator, *Adler Mediquip* Pvt. Ltd, India: CD-ROM

Evaluation of the Results of Repair of Flexor Digitorum Superficialis and Flexor Digitorum Profundus Tendon Injury of the Hand at Zone-v"

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INTRODUCTION:

Hand is the most important organ of a man. For proper functioning of hand intactness of tendons (both flexor and extensor) are essential. Injury to the tendons in hand producing nonfunctioning or deforming hand. Deformity is more when tendon injury occurred in zone- v (specially when injury occur in FDS and FDP). Flexor tendon injury is one of the most common hand injuries. Zone-V flexor tendon injuries may involve major nerves and arteries as well as the wrist and finger flexors. Although these injuries are not infrequent, few studies have reported functional outcomes. To regain the function of the hand by repair of flexor tendons in zone-v and reback to their orginal work. Total 17 patients repaired zone-v flexor tendons injuries were followed up for an average of 2.5 to 12 months. The postoperative rehabilitation program consisted of a regime of modified kleinert technique. Outcome parameters of the hand function according to the Buck- Gramco (1983) assessment system, grip and key pinch strength values, and return to work status. Out of 17 patients functional results were excellent in 4 (23.54%) of the patients, good in 10 (64.70%) of the patients, fair in 2 (11.76%) of the patients, and poor in 1 (5.88%) patient. No tendon ruptures or tenolysis occurred in our series of 17 patients who were employed at the time of injury, 14 patients returned to their original occupations. Satisfactory functional results can be obtained when proper surgical technique was coupled with careful postoperative management in patients with zone-v flexor tendon injuries.

INTRODUCTION

Hand is the medium of introduction to the outside world. Its unique repertoire of pre-hensive movements and tactile activity sets us apart from all other species. We usually think of the hand as a sophisticated tools .Hand is a highly specialized organ, as it has grasping, pinching, and hooking functions, carried out by musculotendinous units. It can give information about the position, size, and shape of an object by its highly developed sensory mechanism and described as third eye .Flexor tendon injury is one of the most common hand injuries. Surgical repair of flexor tendon requires an exact knowledge of anatomy, careful adherence to some basic surgical principles, sound clinical judgment, strict atraumatic surgical technique and a well planned post operative programme. Hand function will be grossly impaired if flexor tendon is injured as muscle activity is finally carried out by intact tendon attached to the bone. For injured flexor tendon in the hand, the goal of treatment is recovery of functionally acceptable digital motion with intact tendon. Repair of all divided flexor tendons in zone-V has been encouraged because of the contributions of the FDS tendons to grip strength, their action in making

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pinch and flexion of the proximal interphalangeal (PIP) joint more stable and their effect in providing superior individual finger flexion Repair of flexor tendon in zone v is easier than zone-II because presence of pulleys, which maintain gliding and prevent of bowstring effect of tendon during flexion and extension of fingers. If pulleys are injured, first reconstruct the pulleys then tendon by tendon graft. In zone-v tendon excursion is more than zone-II that's why tendon repair is more easier by positioning of hand. Hand is the most important organ of a man. For proper functioning of hand intactness of tendons (both flexor and extensor) are essential. Injury to the tendons in hand producing nonfunctioning or deforming hand. Deformity is more when tendon injury occurred in zone-v (specially when injury occur in FDS and FDP). Deformed or nonfunctioning hand of a man producing burden not only to the family but also to the society. With the development of human civilization or the development of medical science day by day injured hand can repair. After repair of tendons in hand by proper technique hand function can normal or near to normal and patient can able to re-back his/her normal job. Although several works have been done in developed country. According to best of my knowledge no such work has been done in our country. As such present work carried out to evaluate the beneficial effect of this surgery "Evaluation of the results of repair of flexor digitorum superficialis and flexor digitorum profundus tendon injury of the hand at zone-v"

Details of tendon repaired procedure: All operations were done as routine case. The patients were operated by general anesthesia. Supine on the table with injured limb on side trolley at right-angle to body. Tourniquet was applied and continued for 75 minutes and released for 5-10 minutes and reapplied when needed. Painting of the limb by povidone iodine after soap water washing. The cut tendons were exposed by Lazy-s incision. Skin and palmar fascia were dissceted in a single layer. Tendon sheath and neurovascular bundles were carefully identified and protected. Proximal and distal end were identified. If needed proximal cut ends were exposed through extending the incision proximally to the forearm. All tendons except palmaris longus were repaired, 4 '0' atraumatic prolene for core suture and 6 '0' prolene for epitendinous suture. After exposing the both cut ends were repair by modified Kessler's method with epitendinous suture by prolene. Skin was closed by interrupted sutures with a drain in situ. Tension measurement: Full traction was applied to flexor digitorum profundus muscultendinous unit and then released 20 percent tension, and attached. If tension would adequate, the fingers were extended when wrist was passively flexed.

Postoperative Management: The patients were examined at the evening and vital signs, such as pulse, blood pressure, respiration, swelling of the hand, circulation of the fingers and collection in the drain were noted. On the 2nd POD, drain was removed, 3rd or 4th POD, bulky dressing was replaced by light one and advised for passive flexion and active extension of the fingers in the plaster slab for 2 weeks. On the 12th POD, stitches were removed and active contraction of flexor muscles of forearm were advised with wrist and fingers in fist position along with passive flexion and active extension of fingers and were advised to attend after 3 weeks outpatient department. At the end of 3 weeks, the patients were advised for controlled active flexion of the fingers to reduce the distance between fingers tip and palm by measuring the breadth of the fingers of other hand. During this period, patients were advised to remove the cast intermittently for 3 times a day and warm water and wax bath was advised at home or at physiotherapy department. They were also instructed to do gradual extension of the wrist with the fingers in passive flexion to improve the gliding of tendons and to maintain tendon length. After exercise, re-application of the cast was



Fig.-1: *Pre-operative photograph.*



Fig.-2: *Post operative follow up photograph*

advised. At 1 month, the patients were advised to remove the cast at day time and controlled active flexion exercise to continue. Passive hyperextension was strictly forbidden. Deep friction massage was also advised. Patients were also advised for controlled passive extension of the fingers and to apply cast at bed time. After 6 weeks, the cast was totally discarded and patients were instructed to start light activity like to hold glass, tea cup. At the end of 8 weeks, the emphasis was on the grip strengthening of the fingers along with controlled hyperextension of the fingers. Grip strengthening included squeezing of sponge roll, table pulley activity. Heavy resistance exercise was advised after 3 months and emphasis was on return to work.

METHOD AND MATERIALS:

The prospective study was carried out between January 2008 to December 2009 at BSMMU, Dhaka. 31 patients were treated with lacerations (sharp weapon) involving the flexor aspect of the wrist and /or distal third of the forearm. Of these 23 patients were selected for this study. 2 of these 23 patients sustained only partial division of the digital flexor tendons were excluded from the study. There were 21 patients with complete division of at least one digital flexor tendon in the study period. 2 patients were below 12 years with a glass laceration of the wrist were also excluded as he was not expected to comply with post operative physiotherapy regimen. 19 patients were eligible for entry to the study. 2 patients failed to return for follow up for a minimum period of 2.5 months. So 17 patients (77% follow up rate). with lacerations of the flexor aspect of the wrist or distal forearm who had a total of 61 FDS and 51 FDP divisions were reviewed. The number of structures divided in these 17 wrists is summarized in table- v. There were 12 male and 5 female patients with age ranging 12 to 58 (mean 35) years. The follow up ranged from 2.5 to 12 months. In 10 cases the mechanism of injury was laceration by broken glass. 3 cases were caused by sharp mechinary (sharp weapon) at work. 2 wrists were cut with a knife. 2 of these having been self inflicted injuries. The of deformity was determined by Buck-Gramco (1983) evaluation criteria.

RESULTS IN TABLES:

Table-I

Distribution of patients in different age groups (n= 17)

Age group (years)	Number of patients	Percentage
11-20	2	11.76
21-30	8	47.06
31-40	4	23.53
41-50	2	11.76
51-60	1	5.89

Table-II

Distribution of patients according to

Sex	Number of patients	Percentage
Male	12	70.59
Female	5	29.41

Table-III

Distribution of patients by occupation (n= 17)

Occupation	Number of patients	Percentage
Businessman	5	29.41
Service-holder	4	23.53
Student	4	23.53
Housewife	3	17.65
Farmer	1	5.88

Table-III

Distribution of patients by occupation (n= 17)

Occupation	Number of patients	Percentage
Businessman	5	29.41
Service-holder	4	23.53
Student	4	23.53
Housewife	3	17.65
Farmer	1	5.88

Table-IV

Flexor tendon division (n= 17)

	No of wrists	Total no of fingers with flexor tendon division	No of fingers with FDS division only	No of fingers with FDP division only	No of fingers with FDS+FDP division
All injuries	17	61	19	0	40
"FDS injuries only" group	5	15	15		
"FDS+FDP injuries" group	12	46	4	0	40

Table-V

Multiplicity of divided digital flexor tendons per wrist(n=17)

	No of wrists with division of				No of wrists with division of			
	One FDS tendon	Two FDS tendons	Three FDS tendons	Four FDS tendons	One FDP tendon	Two FDP tendons	Three FDP tendons	Four FDP tendons
All injuries (n=17)	0	2	3	12	0	0	0	10
"FDS injuries only" group(n=5)	0	2	1	2				
"FDS+FDP injuries" group (n=12)	0	0	2	10	0	0	0	10

Table-VI

Distribution of fingers

Finger	No with FDS divisions	No. of these with independent FDS action (%)
Index	10	5(50)
Index (adjusted)*	6	4(66)
Middle	15	10(66)
Ring	14	9(64)
Little	9	5(55)
Little (adjusted)*	7	3(42)

Table-VII

Associated nerve injury (n=17)

Associated nerve injury	Number of wrist	Percentage
With nerve injury	12	70.58
Without nerve injury	5	29.41

Table-VIII

Incidence of mode of injury (n=17)

Mode of injury	Number of patients	Percentage
Sharp cut (knife)	02	11.76
Broken glass	10	58.82
Machinery injury(sharp weapon)	03	17.65
Self inflicted	02	11.76

Table-IX

Side of involvement (n=17)

Side of involvement	Number of patients	Percentage
Right	13	76.47
Left	4	23.53

Table-X

Side of involvement according to sex.

Side of involvement	Male	Percentage	Female	Percentage
Right	10	58.82	03	17.6
Left	2	11.76	2	11.76

In left side male 2(11.76%), female 2(11.76%); In right side male 10(58.8%), female 3 (17.6%).

Table-XI

Distribution of patients by time interval between injury and operation (n=17)

Time interval (weeks)	Number of patients	Percentage
2-8	7	41.18
9-12	3	17.65
13-16	2	11.76
17-20	1	5.88
21-24	4	23.53

Table-XII

Distribution of time of follow-up (n=17)

Time of follow-up (months)	No. of patients	Percentage
2.5-6	8	47.03
7-8	1	5.88
9-10	3	17.64
11-12	5	29.41

Table-XIII

Number Of Longitudinal Structure Involve In Wrists (Spaghetti Or Non-Spaghetti Wrists)

	Total no of wrists	Average no of structures divided	No of spaghetti wrists*	No of non spaghetti wrists
All injuries	17	8	10	7
FDS injuries only	5	6	0	5
FDS+FDP injuries	12	9	10	2

* spaghetti wrists means 3-10 structures are divided in wrist (Structures are nerve, artery and tendons)

Table-XIV

Distribution of incidence of complications (n=17)

Complications	Number of patients	Percentage
Neurological deficit	2	11.76
Ugly scar	1	5.88
Adhesion formation	2	11.76

Table-XV

Distribution of preoperative & postoperative motor power (grip) of the hand (n=17).

Motor power of the hand (grip)	Pre-operative	Percen-tage	Post-operative	Percen-tage	P
Involved	17	100	3	17.65	0.
Not involved	0	0	14	82.35	00

Data was expressed as mean ±SD- .82±.39 Statistical analysis was done by paired t-test P value <0.001 n= Number of cases

Table-XVI

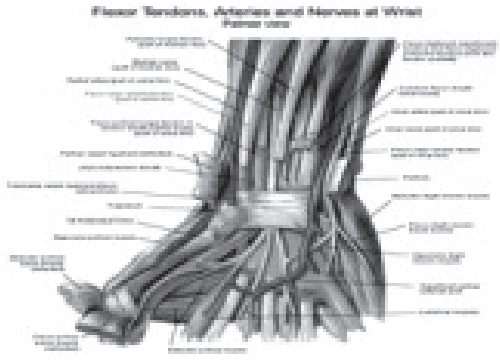
Distribution of patients by final functional outcome by Buck-Gramco (1983) evaluation criteria. (n= 17)

Results	Number of patients	Percentage
Excellent	4	23.52
Good	10	58.80
Fair	2	11.76
Poor	1	5.88

Statistical analysis

	Frequency	P
Satisfactory (Excellent + Good)	14 (82.32%)	0.000
Unsatisfactory (Fair + Poor)	3 (17.68%)	

Data was expressed as mean ±SD- .82±.39
Statistical analysis was done by paired t-test
P value <0.001
n= Number of cases



DISCUSSION:

Injuries to the flexor tendons were common. Each specific movement of the hand relies on the finaly tuned biomechanical interplay of the intrinsic and extrinsic musculotendinous forces. Flexor tendon injury at zone-v of hand always presented as a problem in the management. There is no conservative management of this injury. Most of the times, the injury involves both tendons that causes significant morbidity to the patients due to loss of grip and other fine activities. In Bangladesh, the injury was mainly due to broken glass and earning members were affected in a lot of cases. They need proper management with early return to their activities. But the procedure and aftercare was lengthy to achieve a full functional recovery. As there was no conservative treatment available, repair was the method of depending upon the necessity of the individual patient involved.A small number of retrospective series of zone-v flexor tendon injuries have been published previously (Hudson and de Jager, 1993; Pucket and Meyer, 1985; Rogers et al, 1990; Stefanich et al, 1992;). They have concentrated largely on the injuries to the median and ulnar nerves and not on injuries of the finger flexors. I have been able to find a few prospective study to analyze these injuries in terms of the effect on overall hand function. When only flexor digitorum profundus is injured in a less important finger of nondominant hand with intact flexor digitorum superficials. But most of the times, the injury involves both tendons that causes significant morbidity to the patients due to loss of grip and other fine activities. As there is no conservative treatment available, repair is the method of choice depending upon the necessary of the individual patient involved. In this series, a little bit early mobilization programme was used which have many advantages. Early mobilization programme that attempt to allow tendon healing by decreased surrounding adhesion formation. Researchers have demonstrated that repaired tendon stressed through a early mobilization programme heal faster, gain tensile strength faster and have less adhesion and better excursion that unstressed repair. Some type of early mobilization programme is currently the accepted postoperative treatment after flexor tendon repair (Culp and Taras, 2000).In this series, age of the patients varied from minimum 12 to maximum 58 years. Among them, 2 (11.76%) patients were within 11-20 years of age group, 8 (47.06%) in between 21-30 years and 4 (23.53%) above 31 to 40 years, 2 (11.76%) patients were within 41-50 years, 1 (5.89%) patient is within 51-60 years. The man age of the patients was 18 years, which corresponds with other

series where mean age was 19 years (Charles L. Puckett, MD, 1984). 8 patients (56.25%) in the age group 21-30 years corresponds to similar age group of series by Kunzle et al, (1964).Age of this patient range from 1 to 61 years within average 22 and median age 19. But in this series age of the patients ranged from 12 to 58 years, average 18 years. Which almost correspond to series by (charles L. Puckett, MD, 1984) . There were 12 male (70.58%) and 5 female (29.41%) patients, which corresponds to the series of Hunter and Salisbury (1971), but does not correspond with the series of Chaka (1974), where male-female ratio was 51:12 and 12:1, respectively. Male predominated far more than females in all other series. In this series, male-female ratio was 3:1.In this series 4 patients (23.53%) were service-holder, 5 (29.41%) businessmen. 4 (23.53%) students, 1(5.88%) farmer and 3 (17.67%) housewife .In case of flexor tendon division of 5 patients sustained division of the FDS tendons to 15 fingers but no division of FDP tendons and constitute the "FDS injuries only" group. The remaining 12 patients, who constitute the "FDS+FDP injuries" group sustained division of a mixture of 46 FDS and FDP tendons, with 4 fingers suffering division of FDS tendons only, no fingers suffering division of FDP tendons only, and 40 fingers suffering division of FDS and FDP tendons . In all 19 fingers suffered division of FDS only, no finger suffered division of FDP tendons only, and 40 fingers suffered division of FDS and FDP where the tendons passed through 17 wrists and distal forearm included in this study.Incidence of involved fingers shows that number of FDS division in 10 that involve of index finger and independent FDS action 5(50%), index(adjusted) FDS division 6 and independent FDS action 4(66%), number of FDS division in middle finger 15 and independent FDS action 10(66%), number of FDS division in ring finger14 and independent FDS action 9 (64%), number of FDS division in little finger 9 and independent FDS action 5(55%), in little fingers(adjusted) FDS division 7 and independent action 3(42%) in this series.. This results similar to YII N. W. et al. (1998), In this series, associated nerve injuries were in 12 (70.58%) wrists. This result corresponds to the series of Charles L. Puckett, MD (1984), who found 79 percent. Ten patients (58.82%) out of total 17 patients had broken glass cut injury and 3 (17.64%) lacerated injury by machinaries. The most frequent mechanism of injury was a glass cut (31 patients of total 38 wrists). This result was also similar to the series of Charles L. Pcukett, MD (1984). Tang and Song (1993) showed that 60 percent patients had sharp cut injury, 26.66 percent machine saw injury and 13.33 percent compression cut injuries. Chacka (1974), in which the result was 81.61 and 15.38 percent, respectively. Sharp cut injury was mainly by knife of hijacker. Which did not correspond to our series. It may be due to their industrialization and social security. Flexor tendon injury in this series was more in right dominating hand, 13 (76.47%) versus 4 (23.53%) in left non-dominating hand. Among them male right side 10(58.82%), left side 2(11.76%); female right side 3(17.60%), left side 2(11.76%). This corresponds to the series of Jaffe and Eeckesser (1967) who found 56.66 and 63.63 percent in dominating hands, respectively, and 43.33 and 36.63 percent non-dominating hands, respectively. In this series, none of the patients were treated within the first 2 weeks of injury, 7 (41.18%) patient was operated within 5-8weeks interval, 3(17.65%) was operated within 9-12 weeks interval, 2(11.76%) between 13-16 weeks, 1(5.88%) between 17-20 weeks,4(23.53%) between 21-24 weeks. Twenty nine percent of the patients were treated between 17-24 weeks interval since injury. This result does not correspond with the results of Kunzle et al. (1984), where 40 percent patients were operated within 4 weeks of injury, 24 percent within 5-12 weeks, 20 percent within 13-24 weeks, 12 percent within 25-60 weeks and four percent after 1 year. It was due to ignorance of our patients and lack of expertise in the tendon surgery at the peripheral hospitals in our country and also delayed diagnosis and delayed referral. In a series of Kunzle et al. (1984), the length of time from injury to operation seemed to have little effect on the results. It also corresponds with this series where time interval between injury and operation was not a factor.The range of postoperative follow-up from2.5 to 12 months, which was similar to that of Dr. Debashis Biswas (2002), but in this series average follow-up was 8.18 months versus 8.28 months.In this series involvement of total wrists are 17 in number, among them spaghetti wrists 10, non-spaghetti wrists 7, average structures were divided in each wrist was 8 in number. FDS injuries occurred in 5 wrists, average structures were divided in each wrist is 6 in number, FDS and FDP injuries occurred in total 12 wrists ,among them spaghetti wrist 10, non-spaghetti wrists 2, average 9 structures were divided. In this series 17(100) patients had involved motor power (grip). After operation 14(82.35%) had no motor involvement (grip) while 3(17.65%) patients had residual involvement. Here very highly significant difference was observedFunctional outcome was satisfactory (excellent plus good) in 82.32 percent of

fingers; excellent 4 hands (23.52%) and good 10 hands (58.80%). In a series by N. W. YII et al. (1998), the excellent or good results were 90 percent of fingers which had repair of completely divided flexor tendons in zone-v and independent FDS action was achieved in 66 of the fingers. The unsatisfactory (fair plus poor) result was observed in 17.67 percent fingers in this series compared to 5.8 percent in patient with zone-v flexor tendon injuries of Hassan H. Noaman, MD (2007). Ahamad M et. al, (2007) showed that 97 percent satisfactory (excellent plus good) results in a series of 33 patient, 39 fingers. In their series, unsatisfactory (fair only) result was only 3 percent fingers and there was no poor result.In most of the published series, there was no infection, but one patient (2.63%) developed infection in a series by Grobbelaar and Hudson (1994) out of 38 children. In this series, 1 patient (5.88%) developed ugly scar over the fingers and palm. It impaired the function of gliding of the flexor tendons with a fair result. Neurological deficit was observed in 2 patients (11.76%), one on the radial side of index and one on the ulnar side of the little finger. There were two-point discrimination of >10 mm. There was adhesion formation in 2 (11.76%) patients, which is a very common problem when injured tendon is repaired end-to-end with repair of sheath (Wright, 1998). Adhesion sometimes significantly reduces the active digital motion. Interestingly the passive motion remain normal or near normal.Surgical release of non-gliding adhesions that form along the surface of a tendon after injury or repair was a useful procedure in the salvage of tendon function. Tendon adhesion occur whenever the surface of a tendon is damaged either through the injury itself, be it lacerated or crushed or by surgical manipulation. At any point on the surface of the tendon where violation occurs, an adhesion would likely to form in the healing period (Potenza, 1963). Whenever these adhesions cannot be mobilized by therapy techniques, tenolysis should be considered. This procedure was demanding as tendon repair and itself cannot be undertaken lightly. It represents another onslaught in an area of previous trauma and surgery. Independent FDS action can be impeded by adhesion formation in zone-v repairs, which can be reduced with early motion. To permit early active motion the tendon repair must be strong enough to minimize the risk for gap formation and rupture (Bradon J. et. al, -2005).In this series, I tried to do the procedure on the patients those who developed adhesion but none of the patients were willing to do the second operation.

CONCLUSION:

Satisfactory functional results can be obtained when proper surgical technique was coupled with careful postoperative management in patients with zone-v flexor tendon injuries.

REFERENCES:

1. Ahmad M et. al, 2007, 'Flexor tendon injuries of hand: experience at Pakistan Institute Medical Sciences', Islamabad, Pakistan, J Ayub Med Coll Abbottabad, vol. 19, no. 1.
2. Bradon j, Wilhelmi MD 2005, 'Optimizing independent finger flexion with zone v flexor tendon', Journal of Hand Surgery, vol.30A, pp. 230-236.
3. Buck-Gramco, D 1983, 'Report of Committee on Tendon Injuries', Journal of Hand Surgery, 8(Pt 2).
4. Chacka, P 1974, 'Free autologus composite tendon grafts', J Bone Joint Surg, vol.56A, pp. 960-9.
5. Culp RW, Taras JS 1998, 'Primary care of flexor tendon injuries', In Mackin EJ, editor, Rehabilitation of the hand and upper extremity, Vol.1, 5thed, St. Louis, Mosby-Year Book, Inc., pp.415-30.
6. Debashish D 2002, 'Evaluation of the results of one stage tendon reconstruction in old flexor tendon injury of hand at zone II', (Thesis submitted for MS degree, University of Dhaka,)
7. Grobbelaar AO, Hudson DA 1994, 'Flexor tendon injuries in children' Journal of Hand Surgery, vol. 19B, pp. 696-698.
8. Hudson DA, de Jager LT 1993, "The spaghetti wrist" 'Simultaneous lacerations of the median and ulnar nerves with flexor tendons at the wrist', Journal of Hand Surgery, vol. 18B, pp. 171-173.
9. Hunter JM, Salisbury RE, 1971, 'Flexor tendon reconstruction in severely damaged hands: a two stage procedure using a silicon Dacron reinformed grafting prosthesis prior to tendon grafting' J Bone Joint Surg, vol. 53A, pp. 829-53.
10. Jaffe S, Eeckesser E 1976, 'Profundus tendon grafting with the sublimis intact', J Bone Joint Surg, vol. 49A, pp. 1298-308.
11. Kleinert HE, Kutz JE, Atasoy E, Stormo A 1973, 'Primary repair of flexor tendons', Orthopaedic Clinic of North America, vol. 4, pp. 865-876.
12. Kleinert HE, Meares A 1974, 'In quest of the solution to severed flexor tendons', Clinical Orthopaedics and Research, vol. 104, pp. 23-29.
13. Kunzle AL, Brunelli G, Orsi R, 1984, 'Flexor tendon graft in the fingers', Journal of Hand Surgery, vol. 9B, pp. 126-8.

14. Noaman NH 2007, 'Management and functional outcomes of combined injuries of flexor tendons, nerves, and vessels at the wrist', Microsurgery, vol. 27, no. 6, pp. 536-43.

15. Netter FH 2003, Atlas of Human Anatomy, 3rded, USA, RR Donnelley. Potenza AD, 1963, 'Critical evaluation of flexor tendon healing and adhesion formation within artificial digital sheath, J Bone Joint Surg, vol. 45A.

16. Puckett CL, Meyer VH 1985, 'Results of treatment of extensive volar wrist lacerations: "The spaghetti wrist", Plastic and Reconstructive Surgery, vol. 75, pp. 714-719.

17. Solomon L, Warwick DJ, Nayagam S 2003, 'The Hand', In Appley's System of orthopaedics and fractures, 8thed, London, Butterworth an Co. Ltd, Arlond, p. 333.

18. Strickland JW 1998, 'Flexor tendons: acute injuries', In Green DP, Notchkiss RN, Pederson WC, editors, Green's operative hand surgery. Vol. 2, 4thed, New York, Churchill Livingstone, pp. 1851-97.

19. Wright PE II 1998, 'Flexor and extensor tendon injuries', In Canale ST, editor, Campbell's operative orthopaedics, Vol. 4, 11thed, New York, Mosby-Year Book, Inc., pp. 3851-3912.

20. YII NW, Urban M and Elliot D 1998, 'A prospective study of flexor tendon repair in zone v', Journal of Hand Surgery(Br), Oct; vol. 23, no. 5, pp. 642-8.

Original Article

Evaluation of The Results of Volar Locking Plate Osteosynthesis for Unstable Distal Radial Fracture

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Abstract

Distal radial fractures are most common traumatic problem. It accounts 20% of whole skeletal injuries. Majority are considered as unstable that requires surgical fixation because in non-surgical treatment an obvious clinical deformity developed. More over closed treatment cannot produce an adequate result for unstable distal radial fracture.

This prospective interventional study was conducted over a period of one and a half year between January 2010 to June 2011(18 months) at DMCH, NITOR and Private Hospitals at Dhaka.

A total of 20 patients of unstable distal radial fractures were selected but 5 patients were lost during the follow up period. The mean age of the patients was 39± 5.52 years. Among them 11(73.33%) were male and 4(26.67%) were female. Most of them were businessman 4 in number (26.67%), followed by service holder 20%, house wife 20% , Drivers-13,33%, farmers-13.33%,others-6.67%.

Most 9 (60%) were victims of fall on out stretched hand and affected on left side were 9 (60%). Associated injury was minimum. The average time between injury and management is 6.83 + 2.34 days. Fernandez- type-ll fractures were (40%), followed by type - lll were (26.67%0, type-l(20%), type-lV were 13.33% and V was(6.7%). Most patients (66.67%) were return home within 5.5 + .76 days from admission in the hospital. Average bony union time was 5.2 +0.75 weeks and 100% in rate. Maximum patients took physiotherapy for less than six weeks (93.33%) of which eight patients (53.33%) gained excellent results and six patients gained good results (40%). No severe post operative complications were observed. Only one (6.67%) patient needs carpal tunnel release, one patient (6.67%) complained about wrist pain and one (6.67%) about some reduction of grip strength which were treated successfully. In one case post operative infection occurred which was cured by appropriate antibiotic. According to the preset criteria on anatomical and functional outcome, excellent and good outcomes are considered as satisfactory and fair and poor outcomes are considered as unsatisfactory. In the final follow-up the satisfactory result (excellent and good) was 80% both on anatomically and functionally. Of which on the basis of anatomical final outcome 13.33% was excellent and 66.67% was good and on the basis of functional outcome 20% was excellent and 60% was good results.

The result of volar locking Plate osteosynthesis for unstable distal radial fracture demonstrated excellent to good result in majority of cases.

INTRODUCTION

The distal end of the radius begins at the proximal border of the pronator quadratus and ends at the carpometacarpal articulation (Matthew D. Putnan, M.D. 1953).

Hughston reported a 92% failure in non operative treatment (Matthew D. Putnan M.D. Mark Fischer M.D, 1993).

Severely displaced fractures tend to heal with malunion when treated conservatively and it does not prevent early collapse (Cannegieter DM, Juttmann, J. W. 1997).

If the joint surface is damaged and heals with more than 1–2 mm of unevenness, the wrist will be prone to post-traumatic osteoarthritis (Wikipedia, the free encyclopedia Vilke GM, 1999).

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Use of VLPOS in unstable distal radial fracture allows direct restoration of the anatomy, stable internal fixation, a decreased period of immobilization, and early return of wrist function. Locking plates address metaphyseal comminution and preserve articular congruity (Nana AD, Joshi A, Lichtman DM.2005).

Advantages of volar locking platting system include more stable fixation, direct fracture reduction and minimum soft tissue damage (Willis AA., Mut'sumi K., Zobitz K., Cooney WP, 2006).

The goal of treatment is to restore the anatomy, painless average range of motion and early return to normal activities. Unstable distal radial fractures require surgical fixation of the broken bone because close reduction is not often sufficient to maintain the reduction. Operative management has evolved extensively over the past decade (Kevin C. Chung et al, 2006).

Distal radial fractures are associated with a colorful history since their first description by Ponteau in 1783 and Abraham Colles in 1814. Still they continue to be one of the most common and challenging orthopedic injuries, specially unstable type of distal radial fractures treated by the Orthopedic Surgeons (Sreejith T.G, Sudheer U, et al, 2007).

Closed reduction and casting of comminuted fractures of lower radius often unsatisfactory (Sreejith T.G, Sudheer U, et al, 2007).

A fracture with an offset of 2 mm or more in any plane or involving the articular surface is considered displaced. Instability is defined as a high risk of secondary displacement after initial adequate reduction (Robin Smithuis, 2008).

The volar locking plating system appears to provide effective fixation (Kevin C. Chung, Elizabeth A. Petruska, 2007).

Previously distal radial fractures were classified as Colles', Smith and Barton but now according to AO principles, collectively referred as distal radial fracture. (Kangzhao River, Zheng-Xiang Wang et al, 2010).

The Müller AO Classification of Fractures of radus are A = extra-articular fracture, B = partial articular fracture, C = complete articular fracture. (Robin Smithuis, 2010)

Fractures of the distal radius are very common since they account for 20% of all fractures (J. Chappuis. P. Boute, P. Putz, 2010).

Because of demographic changes in industrialized countries, the incidence is expected to rise by a further 50% by 2030 (Figl M, Weninger P, et al, 2010).

The application of locking plate shows 92% excellent result in unstable distal radial fracture (Kangzhao River, Zheng-Xiang Wang, et al, 2010).

The incidence of unstable distal radius fracture has increased during the last 50 years. High-energy trauma in younger adults and low energy trauma in elderly may cause fractures. This common fracture must be evaluated thoroughly and treated adequately. Volar locking plate osteosynthesis for unstable distal radial fractures can result in good-to-excellent outcomes in relative low cost with a limited number of complications. It also provides early mobilization with accepted union time and rate.

In this study the distal radius fractures which needed ORIF was dealt by "Volar locking plate oteosynthesis" for "Good Functional Hand", and this should be considered as a better technique in the treatment for potentially unstable distal radial fractures.

MATERIALS AND METHODS

Type of study:
This was a prospective interventional study.

Place of study:
Dhaka Medical College and Hospital, Dhaka, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Private hospitals at Dhaka.

Study period:
January 2010 to June 2011.

Study population:
Patients with unstable distal radial fracture attending at the emergency and OPD of DMCH, NITOR and Private Hospitals.

Sample size:
Due to time limitation and financial constrain only 20 cases were selected during the study period but 15 cases were feasible to be included in the study, remaining 5 cases were lost during follow-up period.

Sampling technique:
Purposive sampling (non random) according to availability of the patients and strictly considering the inclusion criteria.

Inclusion Criteria:
1. Unstable fractures of distal radius will be included.
2. Only closed fractures will be included.
3. Fractures less than three weeks old.
4. Cases are purposively selected irrespective of sex, occupation, causes of injury and associated injuries.
5. All patients after epiphysis closure.
6. Age before 18 and after 70 years.

Exclusion criteria
1. Undisclosed/stable fractures treated by non operative methods.
2. Before 18 and after 70 years.
3. Infected cases and open fractures.
4. Fractures older than three weeks.

Final Outcome:

Criteria for Anatomical Results:

Sarmiento and Latta's modification for criteria for anatomical results by means of radiological out lined by Lidstorm, JBJS, 1975, vol. 57, pp. 311-5:

Result	Criteria
Excellent (Grade 1)	**No or insignificant deformity** Dorsal angulations not exceeding 0° (neutral) Radial shortening of less than 3 mm. Radial deviation loss not more than 4°
Good (Grade 2)	**Slight deformity** Dorsal angulation-1^0-10^0 Radial shortening-3-6mm Radial deviation-5^0-9^0
Fair (Grade-3)	**Moderate deformity** Dorsal angulation- 11°-14° Radial shortening-7- 11 mm Radial deviation- 10°- 14°
Poor (Grade 4)	**Severer deformity** Dorsal angulations- at least 15° or more Radial shortening- at least 12 mm or more Radial deviation- 15° or more.

Criteria for Functional Results

Sarmiento's modification of the criteria for functional assessment outlined by Gartland & Werley, JBJS (LAM), 1951, vol. 33, pp. 895-907.

Result	Points
Residual deformity	
Prominent lunar styloid	1
Residual dorsal tilt	2
Radial deviation of hand	2 to 3
Point range	0 to 3
Subjective evaluation	
Excellent- No pain, disability or limitation of motion	0
Good- Occasional pain, slight limitation of motion	2
Fair- Occasional pain, slight limitation of motion, feeling of weakness in wrist, activities are slightly restricted.	4
Poor- Pain, limitation of motion, disability, and activities are more of less restricted.	6
Point range	0 to 6
Objective evaluation	
Loss of dorsi-flexion	5
loss of Ulnar deviation	3
Loss of supination	2
Loss of palmar flexion	1
Loss of radial deviation	1
Loss of circumduction	1
Pain in distal radio-ulnar joint	1
Grip strength *-60% or less of opposite side	1
Loss of pronation*	2
Point range	0 to 5

Complication	
Arthritic change	
Minimal	1
Minimal with pain	3
Moderate	2
Moderate with pain	4
Severe	3
Severe with pain	5
Nerve complication (median)	1 to 3
Poor finger function	1 to 2
Poor finger function	1 to 2
Point range	0 to 5
End-result point Ranges	
Excellent	0 to 2
Good	3 to 8
Fair	9 to 20
Poor	21 & above
*Criteria added by Sarmiento.	

RESULTS

All patients were followed for a period of at least 3 months; mean follow-up period was 6 months.

SUMMARY

This prospective interventional study was conducted at Dhaka Medical college and Hospital, Dhaka, NITOR other private hospitals at Dhaka from January 2010 to june 2011

to evaluate the results of volar locking plate osteosynthesis for unstable distal radial fracture. A total of 20 patients of unstable distal radial fractures were selected but 5 patients were lost during the follow up period. The mean age of the patients was 39± 5.52 years. Among them 11(73.33%) were male and 4(26.67%) were female. Most of them were businessman 4 in number (26.67%), followed by service holder 20%, house wife 20% , Drivers-13,33%, farmers-13.33%,others-6.67%. Most 9 (60%) were victims of fall on out stretched hand and affected on left side were 9 (60%). Associated injury was minimum. The average time between injury and management is 6.83 + 2.34 days. Fernandez- type-ll fractures were (40%), followed by type - lll were (26.67%0, type-l(20%), type-IV were 13.33% and V was(6.7%). Most patients (66.67%) were return home within 5.5 + .76 days from admission in the hospital. Average bony union time was 5.2 +0.75 weeks and 100% in rate. Maximum patients took physiotherapy for less than six weeks (93.33%) of which 8 patients (53.33%) gained excellent results and 6 patients gained good results (40%). No severe post operative complications were observed. Only one (6.67) patient needs carpal tunnel release, one patient (6.67%) complained about wrist pain and one (6.67%) about some reduction of grip strength which were treated successfully. In one case post operative infection occurred which was cured by appropriate antibiotic. According to the preset criteria on anatomical and functional outcome, excellent and good outcomes are considered as satisfactory and fair and poor outcomes are considered as unsatisfactory. In the final follow-up the satisfactory result (excellent and good) was 80% both on anatomically and functionally. Of which on the basis of anatomical final outcome 13.33% was excellent and 66.67% was good and on the basis of functional outcome 20% was excellent and 60% was good results.

DISCUSSION:

This study designed to find out an appropriate and accepted technique for treatment of unstable distal radial fracture. As a tertiary hospital a lot of cases from far and near of the country come to Dhaka Medical College and Hospital, NITOR and other hospitals at Dhaka. A fracture with an intrinsic tendency to displace after reduction is called unstable fracture (MediLexicon 2004-2011).

Kevin C. et al (2006) stated that the best treatment for an inadequately reduced fracture of the distal part of the radius is not well established. They colleted data from patients undergoing volar locking plate osteosynthesis of an inadequately reduced distal radial fracture and finally found that the volar locking plate osteosynthesis appeared to provide effective fixation for the treatment of inadequately reduced distal radial fractures.

IT WAS A PROSPECTIVE STUDY.

Lattmann. T. (2011) did an study to evaluate functional, radiologic, and subjective outcome after volar locking plate osteosynthesis (VLPOS) for unstable distal radial fractures (DRF).

In our study, we also evaluated the results of volar locking plate osteosynthesis for unstable distal radial fractures and we also did a prospective study.

A consecutive series of patients, treated with volar locking plate osteosynthesis for distal radial fracture between 1 January,2010 and 30 June,2011 was studied by us. Recently a similar type of study was conducted by Matthias (2010), between 1 January,2005 and 31 December 2006.

We select patient of either sex in between 18 to 70 years of age with distal radial fractures. Handoll HHG(2008), reviewed a case where , patients of either sex who had completed skeletal growth, with a distal radial fracture were included.

Our off 15 patients, age were ranged from 18 to 70 years with a mean age of 39 years. Among them maximum (8) were between age of 31 to 45 years and next 4 were between 46 to 60 years. In a recent multi-centre review study in the United Kingdom, Handoll HHG(2008) ,reviewed a study where the mean age was 35 years.

Like all other trauma causes distal radial fractures are common in the male due to frequency of more activities and traveling. In this study out of 15 cases male were 11 (73.33%) and female were 4 (26.67%).

In a similar study by Robert W. (1993), male were 68% and female were 32%.

In the present series right and left sides affected in 6(40%) and 9(60%) patients respectively. This picture is similar to the study of Robert W. (1993,), in which right and left sides were affected in 44.9% and 55.1%. Among 15 patients according to profession, businessman were 26.67% followed by Service holder were 20%, House wife were 20%, Farmer and Motor drivers were each 13.33% and Student was 6.7%.

Most of the patients were victim of fall on out-stretched hand (9 in number) 60% and the rest 40% (4 in number) were the victim of MVA. In a study of Arvind D et al (2011), he showed that the typical mechanism of a displaced distal radius fracture is fall on an outstretched hand. He also stated that this type of injury results in

tensile forces across the volar surface (compression side), compressive forces on the dorsal surface (tension side), and supination of the distal fracture fragment.

Regarding classification of fracture of distal radius we used Frykman classification of distal radial fracture. In the study of 'distal third forearm fracture', by Arvind D et al (2011), stated that the Frykman system for classification of distal radius fractures has been used extensively in the medical literature.

Regarding post operative complication, in the study of Jesse B. Jupiter et al. all the complications of his work were considered as minor. In the study of Jorge Orbay (2005), he concluded that, stiffness and reflex sympathetic dystrophy (RSD) are not uncommon with this technique. In our study one patient developed persistent wrist pain and one experienced reduced grip strength which was improved by adequate analgesics and physiotherapy. Another patient developed carpal tunnel syndrome that, needed surgical release. In a study of J. Chappuis (2011), only one case of carpal tunnel syndrome was noted which was managed by surgical release.

Most of the patients (93.33%) responded to less than 6 weeks physiotherapy with 53.33% excellent and 40% good result. Only one patient had fair result due to lack of cooperation. In a study of Figl M (2009), concluded with the recommendation of early mobilization and physiotherapy.

As Matthias (2010), evaluated the cases by clinical and radiographic outcome by pre and post operative x-ray, we also evaluate the patients clinically and radio logically.

We conducted post operative follow-up according to Ayhan KILIC et al, (2009) protocol.

Results were expressed as arithmetic mean (SD). Calculations were performed using SPSS 15.0 version. In the study of Matthias (2010), he also use arithmetic mean and SPSS 15.O version.

In our study Mean follow-up period was 6 months. In another study by J. Chappuis (2011), the post operative measurements were taken at 6 months postoperatively.

In this study the anatomical results were evaluated by the radiological criteria outlined by Lidstrom. Lattmann. T. (2011), in a study, in this year also used the Lidstrom.'s score for evaluation of the outcomes of his study.

According to Sarmiento and Latta's modification criteria for anatomical results by means of radiological out lined by Lidstorm, (1975), in our study, final follow up results showed,13.33% had excellent and 66.67% had good results. So the satisfactory outcome was 80%.

On the basis of Sarmiento's modification criteria for functional assessment outlined by Gartland and Werley, (1951), in our study, 20% had excellent and 60% had good results. So the satisfactory outcome was 80%. The findings were nearer to the result of Arora R (2009) where the satisfactory results were 75%.

The overall experience with volar locking plate osteosynthesis for unstable distal radius fracture has been favorable, and for this reason the technique has gained widespread acceptance recently. It is an easy to learn, simple, and reproducible procedure that has improved the outcome of this common injury. (Jorge Orbay, MD, 2005).

In conclusion it can said that early Volar Loking Plate Osteosynthesis can results good to excellent outcomes in most of the cases with a limited number of complications.

David H. Wei (2009) also concluded his study as, 'in conclusion, this study provides new evidence supporting the trend toward fixation of distal radial fractures with locked volar plates'.

CONCLUSION:

Unstable distal radial fractures are common injuries. This study reveals that proper diagnosis and early treatment with volar locking plates is the key to success.

This series was conducted only in 15 cases and mean follow-up period was 6 months. So, further prospective study with larger sample and longer duration of follow-up is recommended.

LIMITATIONS

- Sample size was small due to limited time period.
- Effects of soft tissue damage due to surgery on fracture healing could not be observed.

REFERENCES

1. Louis Solomon. Apley's System of Orthopaedics and Fractures,9TH ed. London, Butterworths Publication.2010 .P-692.
2. Andrew H. Crenshaw, Jr. Edward A Perez, 'Fracture of shoulder girdle, arm and forearm in S. Terry Canale, MD, James H. Beaty MD.Campbell's operative Orthopedics, 11th ed. Mosby Elsvier, Philadelphia, 2008, p-3372-3460.
3. Arora R., Gabl M., Gschwentner M., Deml C. Krappinger D.Lutz M. 'A comparative study of clinical and radiologic outcomes of unstable colles type distal radius fractures in patients older than 70 years: nonoperative treatment versus volar locking plating'. *J Orthop Trauma* . 2009,Vol. 23,PP- 237-242.

4. Ayhan Kilic, Yavuz kabukcuoglu, Ufuk Ozkaya, Murat Gul, Sami Sokucu, UMIT Ozdogan, 'Volar locking plate fixation of unstable distal radius fractures'. *Acta Orthop Traumatol Turc*. 2009. Vol.43(4),pp-303-308.

5. Arvind D Nana, MD., Distal-Third Forearm Fractures. 2011.www. medscape.com, vol.6 pp-646-58.

6. Asim Kumar Datta, 'Essential of Human Anatomy'. 2nd Edition, Calcutta.Current Books International. 1995. pp-13-15.

7. BT Young MD. Closed Reduction of Distal Radius Fractures*, J. and Surg.* 2011, Vol 25-A. p 19-28

8. Cannegieter D. M., J. W. Juttmann, How to classify distal radial fractures . *The journal of bone and joint surgery.* 2008. Vol-7, pp- 678-688.

9. Cannegieter DM, Juttmann JW. 'Cancellous grafting and external-fixation for unstable Colles' Fracture.' *JBJS,* 1997, vol. 79B, pp 428-32.

10. Chris Colton, Joseph Schatzker, Peter Trafton, Locking versus nonlocking plates - Advantages to a locking plate/screw system. *AO surgery reference,* 2009, vol.10, pp987-991.

11. Cooney W.P., Dobyn J.H., Linshncid R.L. 'Complication of Colles fracture'. *JBJS,* 1953. Vol.35-A, pp-643-658.

12. Chung KG and Petruska EA. 'Treatment of Unstable distal radial fractures with the volar locking plating system'. *JBJS,* 2007, vol. 89, Part 2, pp 256-66.

13. David L. Helfet, MD, Norbert P. Haas, MD, Joseph Schatzker, MD, Peter Matter, MD, Ruedi Moser, DVM and Beate Hanson, MD, MPH. AO Philosophy and Principles of Fracture Management-Its Evolution and Evaluation. *The Journal of Bone and Joint Surgery (American*), 2008. vol. 85. pp.1156-1160

14. David H. WEI. Noah M. Raizman, Clement J. Bottino, Charles M. Jobin, J. Strauch , Melvin P. Rosenwasser. Unstable distal radial fractures treated with external fixation, a radial Colum plate, or a volar plate. A prospective randomized trial. *J Bone Joint surgery*. . 2009 Vol. 91.pp-1568-1577.

15. Elisabeth Brogren. Michael Petranek. and Isam Atroshi, , Incidence and characteristics of distal radius fractures in a southern Swedish region. *BMC.* 2007 vol.8, pp 48-50.

16. Eric J. Strauss, MD, Ran Schwarzkopf, MD, Frederick Kummer, PHD, and Kenneth A. Egol, MD, The Current Status of Locked Plating: The Good, the Bad, and the Ugly. *J Orthop Trauma* , 2008, vol.22. pp.479–486

17. Figl M., Weninger P., Liska M., Hofbauer M., Leixnering M. Volar fixed-angle plate osteosynthesis of unstable distal radius fractures: 12 months results. *Archives of orthopaedic and trauma surger ,* 2009. Vol. 129(5) , pp 661-669.

18. Figl M., Weninger P. Jurkowitsch J. Hofbauer M., Schauer J. Leixnering M. Unstable distal radius fractures in the elderly patient—volar fixed-angle plate osteosynthesis prevents secondary loss of reduction. *The journal of trauma*, 2010, Vol. 68 (4), pp-992-998.

19. Frykman G. 1967, 'Fracture of the distal radius including sequeale: a clinical and experiment study. Acta Orthop Scand, vol. 108,PP1-55.

20. Figl M. Weninger P.Liska M. Hofbauer M. Leixnering M. volar fixed –angle plate osteosynthesis of unstsble distal radius fractures : 12 months results. Arch *Orthop Trauma Surgery*. 2009. Vol. 129(5): pp-661-669

21. Gartland JJ, Werley C. 'Co evaluation of healed Colles fracture.' *JBJS (LAM*), 1951, vol. 33, pp 895-907.

22. *Geissler*, *William B. MD*, *Fernandez*, *Diego L. MD*, *Lamey*, *David M. MD*., Distal *Radioulnar Joint Injuries Associated With Fractures of the Distal Radius,* Clinical Orthopaedics & Related Research, 1996, *Vol. 327, pp 135-146*

23. Handoll HHG, Vaghela MV, Madhok R, Percutaneous pinning for treating distal radial fractures in adults (Review), *The Cochrane Library,* 2008, Vol.4.pp-354-367

24. Jesse B. Jupiter, MD, M. Marent-Huber, Operative Management of Distal Radial Fractures with 2.4-Millimeter Locking Plates: A Multicenter Prospective Case Series: Surgical Technique. *JBJS Essential Surgical Techniques* 2010, Vol. 92, pp. 96-106

25. Jesse B. Jupiter, M.D. Boston, Massachusetts, Current Conce pts Review Fractures of the Distal. End of the Radius, *The Journal of Bone. and Joint Surgery* . 1991, vol.34, p69-98

26. Jorge Orbay, MD, Volar Plate Fixation of Distal Radius Fractures, *'Hand Clin'.* , 2005, Vol. 21, pp.347–354

27. J. Chappuis . P. Boute, P. Putz, Dorsally displaced extra-articular distal radius fractures fixation: Dorsal IM nailing versus volar plating. A randomized controlled trial. Orthopaedics & Traumatology: Surgery & Research, 2010, vol.96,pp-265-260

28. Jupiter JB and Huber MM. 'Operative management of distal radial fractures with 2.4 millimeter locking plates.' *JBJS,* 2009, vol. 91, pp 55-65.

29. Kaukonen JP, Karaharizu E, Luthie P, Porras M. 'Ext-fixation in Colles' fracture.' *Acta Orthop Scaband*, 1989, vol. 60, p 54-56.

30. Kangzhao River, Zheng-Xiang Wang, JI Hung-Chuen, Wei Meng, LUI Fong, Locking plate for treatment of unstable distal radius fractures. J Orthop Trauma; 2010, Vol.20, pp-222-225.

31. Kevin C. Chung, MD, MS, Elizabeth A. Petruska, BS, , The Volar Locking Plating System: Surgical Technique, The Journal of Bone & Joint Surgery. 2007 Vol. 89.PP-256-266.

32. Kevin C. Chung, Andrew J. Watt, Sandra V. Kotsis, Zvi Margaliot, Steven C. Haase, H. Myra KIM, Treatment of Unstable Distal Radial Fractures with the Volar Locking Plating System. JBJS, 2006. Vol. 88, pp-2687-2694.

33. Kevin C.C., Andrew J. W., Sandra V. K., Zvi Margaliot, ,Steven C. Haase, H. Myra KIM, Treatment of Unstable Distal Radial Fractures with the Volar Locking Plating System. JBJS, 2007. Vol. 60, pp-565-569.

34. KK Wong, KW Chan, TK Kwok, KH Mak, Volar fixation of dorsally displaced distal radial fracture using locking compression plate. Journal of Orthopaedic Surgery. 2005. Vol.13(2. pp153-157

35. Leung F, TU Y, Chew YC and Chow S. 'Comparison of external and percutaneous pin fixation with plate fixation for intra-articular distal radial fractures., JBJS, 2008, vol. 90, pp 16-22.

36. Lattmann T, Meier C, DIetrich M, Forberger J, Platz A. Results of volar locking plate osteosynthesis for distal radial fractures. Trauma. 2011 Vol. 70(6), pp-1510-18.

37. Lindstorm, Sarmiento and Latta's modification for criteria for anatomical results by means of radiological outline. JBJS, 1975. Vol.57, pp-311-315.

38. Locking plate principles, 2011, Locking versus nonlocking plates – adva ntages to a locking plate/screw system from www.AOfoundation.org

39. Matthew D. Putnan, M.D., Fractures and Dislocations of the Carpus Including the Distal Radius,In Gustillo RB, Fracture and Dislocation, London,1993, pp. 553-602.

40. Medical dictionary, 2011 from www.medilexicon.com Matthew D. Putnan, M.D. Mark Fischer M.D, Forearm Fractures, In Gustillo RB, Fracture and Dislocation, London, Mosby-year Book Inc. 1993,pp. 5oo-552.

41. Matthias Jacobi, Peter Wahl, Georges Kohat. Repositioning and stabilization of the radial styloid proses in comminuted fractures of the distal radius using a single approach: the radio-volar double plating technique. 'Journal of orthopaedic surgery and researc'h. 2010 Vol.5, pp- 55-61.

42. Nana A.D., Joshi A., Lichtman D.M. Plating of the distal radius. The Journal of the American Academy of Orthopaedic Surgeons; ., 2005 .vol.13(3) pp 159-171.

43. P. Niemeyer, N. P. Südkamp, Principles and Clinical Application 0f the Locking Compression Plate (LCP). Acta Chirurgiae Orthopaedicae. 2006, Vol.73. pp-121-128

44. R. Frigg, A. Frenk, N.P. Haas & P. Regazzoni, 'LCP: 'The locking compression plate System, Bone Zone. 2006, Vol.6. pp32-34

45. Robert W. Bacorn; John F. Kurtzke, Colles' Fracture -A Study of Two Thousand Cases from the New York State Workmen's Compensation Board , The Journal of Bone and Joint Surgery, 1993,vol.35(3),pp 643-58.

46. Robin Smithuis, Wrist – Fractures. The radiology assistant; 2008. Vol.6:pp789-796.

47. RONALD McRAE, Clinical Orthopaedic Examination. 5TH ed. London. Elsevier. 2004,pp.96-98

48. Rosemont, The treatment of distal radius fractures. 'American Academy of Orthopaedic Surgeons'. 2009 Vol 208 p.96

49. Sarmiento, Gilbert AW, Pratt N, Berry C, Sinclair WS. 'Colles' Fracture; Functional Bracing in Supination'. JBJS, 1975, vol. 57, pp . 311-5.

50. Smith DW and Henry MH. 'Volar fixed-angle plating of the distal radius.' J Am Acad Orthop Surg, 2005, vol. 13, pp 28-36.

51. Sreejith T.G., Sudheer U., Anwar Marthya, Gopinathan Pattinharayil, Raveendran M.K. Functional Outcome of Comminuted Fractures of Lower End of Radius Treated by Ligamentotaxis Vs Conservative Management. J. orthopaedics . 2007.vol. 4.pp- 972-978.

52. VILKE GM, 1999.The Free Encyclopedia from www.wikipedia.com Willis A.A., Mut'sumi K., Zobitz K., Cooney W.P. Internal fixation of dorsally displaced fractures of the distal part of radius. JBJS; 2006.Vol. 88A no.2. pp- 2411-2417.

53. Zhang Yan-Xiang, WU KAI-QIU, Wang HE-JU, Treatment options for distal radial fractures, 'Hainan Medical Journal', 2011 vol.56, pp.67-70

54. WWW.MEDICINENET, INC.COM, 2011.

55. Periarticular Distal Radial Dorsal Locking Plates,2011 from www. zimmer.com

56. Technique distal volar locking plate, 2007, from www.smith-nephew.com,surgical.

Original Article

Results of treatment of displaced supracondylar humeral fractures in children by percutaneous K wire fixation technique

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Abstract:

Nineteen children with displaced type II and III supracondylar fractures of the humerus were managed with percutaneous k wire fixation technique from January 2013 to January 2005. There were 14 boys and 5 girls with a mean age of 6.1 ± 3.07 years. All patients were operated within 24 h after trauma using percutaneous 2 pins from lateral side & 1 pin from medial side technique. Patients were followed up for a mean period of 6.1 ± 2.6 months and assessed both radiologically for union; and functionally and cosmetically according to Flynn's criteria. All patients achieved solid union. Functionally, all patients achieved satisfactory results, while cosmetically, 91.4% of patients had satisfactory results and 8.6% had unsatisfactory results. The most frequently occurring complications were minor pin tract infection in six patients, deep infection in two patients. There was no iatrogenic neurological injury either for the ulnar or for the radial nerves. The obtained results and minor complications reported signify this technique as a viable treatment method for displaced type II and III supracondylar fractures in children.

Keywords: Humeral supracondylar fracture, k wire fixation.

Supracondylar fractures of the humerus are the most common type of elbow fractures in children and adolescents accounting for 50–70% of all elbow fractures[1]. There has been an argument concerning the ideal method of treatment of displaced supracondylar humeral fractures. Recommended treatment modalities vary from no reduction and immobilisation to open reduction and internal fixation. Because of the difficulty in maintaining an adequate reduction with cast immobilisation, stabilization of the reduced fractures with pins placed percutaneously has become the universally accepted method of treatment[2].

There have been numerous variations of recommended pinning techniques. Swenson[3], Flynn et al.[4], and Nacht et al.[5], using two pins, inserted medially and laterally through the medial and lateral epicondyles. The risk of iatrogenic ulnar nerve injury is always a concern during insertion of the medial pin with a reported incidence of 2–8% [6–10]. Arino et al. [11] recommended inserting the two wires through the lateral epicondyles to avoid ulnar nerve injury. Biomechanically, fixation provided by the two lateral pins is less secure, as it may allow rotation of the fracture, with the medial column rotating posteriorly. It was found that the torque required to produce 10° of rotation is 37% less with the use of two lateral parallel pins than with the use of medial and lateral pins [4, 12].The aim of the present study is to evaluate the results of percutaneous k wire fixation technique in treatment of unstable or irreducible type II and III supracondylar humeral fractures in children.

MATERIALS AND METHODS:

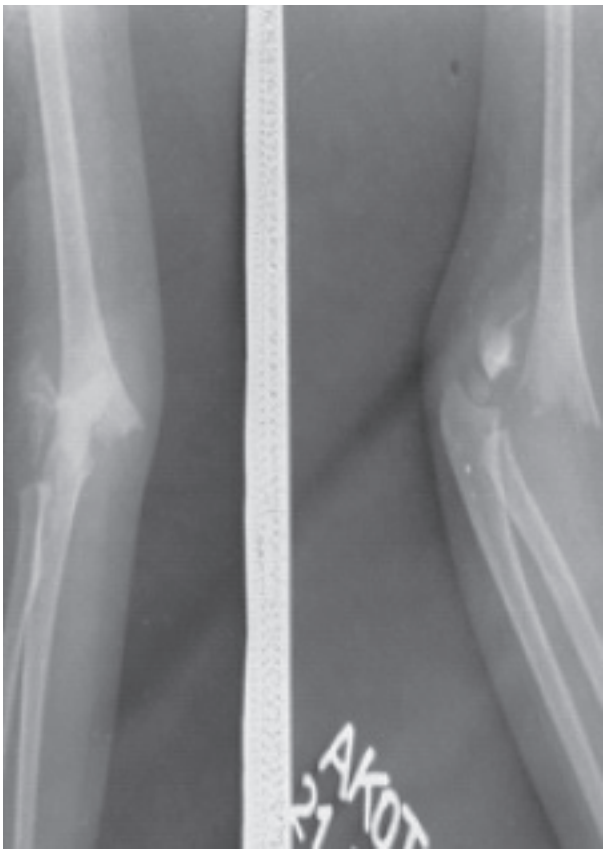
Between January 2013 and January 2015, 19 children with unstable displaced type II and type III supracondylar humeral fractures were managed with the percutaneous k wire fixation technique in TRAUMA CENTER, Dhaka. There were 14 boys (73.7%) and 5 girls (26.3%). Their age ranged from 1 to 13 years with a mean of 6.1 ± 3.07 years. Both right and left sides were nearly equally affected. Most of the injuries were due to falling during playing(60%). On

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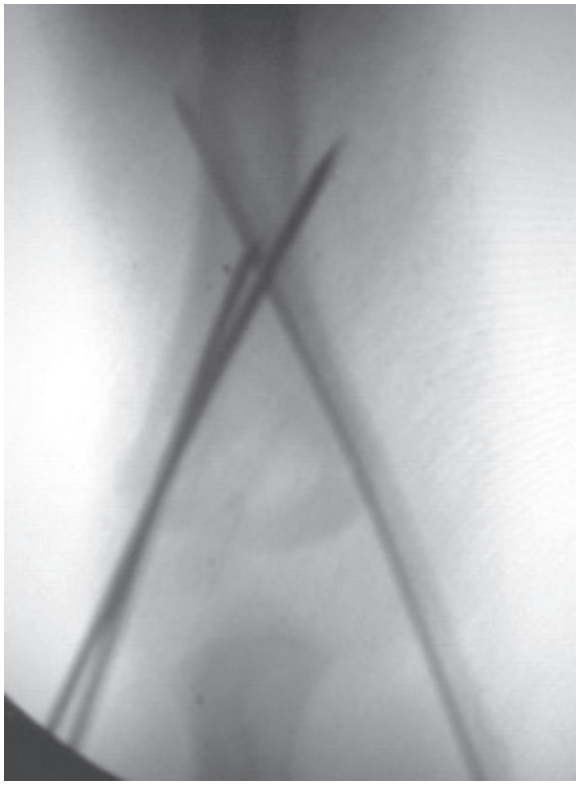
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presentation, patients were fully assessed clinically both generally and locally. Special attention was paid to peripheral circulation and neurological status.

Closed fractures were encountered in 16 patients (84.2%), while open fractures were found in 3 patients (15.8%), all 3 were grade open fracture. Radial pulse was absent at first presentation in four patients, All the patients suffered extension type fractures. Fractures were classified according to Gartland's classification[14]. All patients were operated within 24 h after trauma, utilizing 2 pins from lateral side & 1 pin from medial side as shown in Fig.1. Closed reduction of the fractures by traction and manipulations was done in all patients .



Pre operative X-ray



Postoperative X-ray

Immediate postoperative neurological assessment for median, ulnar, and radial nerves was performed. Period of hospitalisation was 3–5days. Patients were followed up at 10th post operative day for radiological confirmation of maintenance of reduction, at 4 weeks to remove the K wires and start movement, monthly for a minimum of 4 months, and then with a mean period of 6.1 ± 2.6 months. At the last follow-up, patients were assessed both radiologically for union and functionally according to Flynn's criteria[5] as shown in Table 1. Internal rotation deformity was measured by the method described by Yamamoto et al.[15], with the patient bending slightly forward. The patient's arm is held at the side with the elbow in flexed at 90° and the shoulder held in maximum extension. In this position, maximum internal rotation strain is applied to the patient's arm. The angle formed between the horizontal plane of the back and the midline of the forearm represents the internal rotation deformity.

Table-I

Flynn's criteria for cosmetic and functional assessment of results

Outcome	Rating	Cosmetic factor (carrying angle loss in degrees)	Functional factor (movements loss in degree)
Satisfactory	Excellent	0–5	0–5
	Good	6–10	6–10
	Fair	11–15	11–15
Unsatisfactory	Poor	>15	>15

The results were tabulated as frequency distribution for different qualitative values. Using the standard version of the SPSS program (release 10), the arithmetic mean and standard deviation were collected for quantitative variables. Comparison between those with satisfactory outcome and those with unsatisfactory outcome was done using ζ^2 (chi square) test of significance.

RESULTS:

Functionally, all patients had satisfactory results; 16 patients had excellent results (84.2%) .3 patients had good results (15.8%) and no patient had poor result. Cosmetically, 91.4% had satisfactory results and 8.6% had unsatisfactory results;

There was no statistical difference in the functional results between boys and girls; all patients in both groups had satisfactory results, while girls yielded better cosmetic results than boys, but the difference was statistically insignificant. Also functionally, there was no statistical difference in the results between patients below 6 years of age and those above 6 years; all patients had satisfactory results. All patients had cosmetically satisfactory results except for 5.9% of patients above the age of 6 years, with statistically insignificant difference between the two age groups

Regarding the type of the fracture and degree of displacement, there were 8 patients with Garteland type fractures and 11 patients with type fractures; all of them had satisfactory functional and cosmetic results except for 11.5% of patients with type III fractures who had unsatisfactory statistically insignificant cosmetic results .

Complications were represented in the present study in the form of 2 patients (10.5%) who had minor pin-site infection that resolved after K-wire removal and oral antibiotics;one patient(5.2%) with grade 1 open fracture developed bone infection at the site of entry of the pins; and cubitus varus deformity, which was related to the quality of the reduction, was noted in three patients (15.7%), whose reduction quality was unsatisfactory. All these three patients had Gartland type III fractures with two failed trials of preoperative manipulations. Internal rotation angle was measured according to Yamamoto test[15] in these six patients and planned for later corrective osteotomis.

DISCUSSION:

Supracondylar fractures of the humerus are the commonest types of elbow fractures in children and adolescents accounting for 50–70% of all elbow fractures and are seen most frequently in children between the age of 3 and 10 years[1]. There has been no uniformity of opinion concerning the ideal method of treatment of displaced supracondylar fractures. Several treatment modalities have been recommended including closed reduction and plaster immobilisation[16,17], open reduction and internal fixation[16,18-21], traction[16,18,22-25], and closed reduction and percutaneous pinning[11,16,19,26].

While closed manipulation and percutaneous Kirschner wire stabilization is the accepted treatment of displaced supracondylar fractures of the humerus in children, there is still argument on the optimal configuration of those Kirschner wires. Danielsson and Pettersson[20] used only one pin and noted a loss of reduction. Swenson[3], Flynn et al.[4], and Nacht et al.[5] have, using two pins, introduced through the medial and lateral epicondyles, respectively. The two-wire cross-fixation is the most commonly used and good results have been reported, but injury of the ulnar nerve when inserting the medial wire has been documented ranging from 2 to 8%[6-10].

There have been numerous reports of modified fixation techniques to prevent fracture redisplacement and ulnar nerve injury with varying degrees of stability, redisplacement neurological injuries, and functional and cosmetic results[10, 12, 27, 28].

In the present study, we studied closed reduction & percutaneous 2 pins from lateral side & 1 pin from medial side technique. While this technique does not include supporting biomechanical data, the crossed-wire configuration obtained by inserting both wires from the lateral side is identical to that obtained via the traditional medial and lateral technique.

In Shannon's[13] series (20 patients), all children had a full range of the elbow motion compared with their other (normal) side, and the mean carrying angle of the injured elbow was 15° (range 10°–20°). There were no intraoperative complications; of note, there were no ulnar nerve injuries. All complications were related to the Kirschner wires.

In the present study, no median or ulnar nerve injuries were found in any patient. In contrast to Cramer et al. [29] and Dormans et al.[30], no iatrogenic nerve injuries were encountered in any of the patients.

Shannon[13] reported on one patient with a minor pin-site infection. While in our study, there were three patients (15.7%) with minor pin-site infection that resolved after K-wire removal and oral antibiotics. Also, one patient (5.3%) developed bone infection at the site of entry of the pin

with a sinus discharging pus that does not respond to antibiotics given according to the culture taken from the sinus; these patient responded to debridement and curettage of the bone through lateral approach. The relatively increased infection rate in the present study may be attributed to the larger number of patients encountered and to the presence of three patients with open fractures.

In contrast to results obtained by Shannon[13], cubitus varus deformity was noted in three patients (15.7%) in the present study. This was related to unsatisfactory reduction of the fracture before pinning. The three patients suffered posteromedially displaced type fracture with two failed trials of reduction. No revision surgeries were done. A fear of possible increased incidence of myositis ossificans prevented further closed or open reduction trials, and reductions were rated as accepted.

CONCLUSION:

Within the obtained results, complications, and limitations of the present study closed reduction & percutaneous 2 pins from lateral side & 1 pin from medial side technique is a viable solution for fixation of displaced supracondylar fractures in children. It provides good fracture stability & good union rate. A further long-term study will be conducted by the authors on all patients to assess late complications, e.g., fish tail deformities with a minimum of 2 years of follow-up.

REFERENCES:

1. Hanlon CR, Estes WL (1954) Fractures in children: a statistical analysis. J Bone Joint Surg Am 87:312
2. McIntyre W (1996) Supracondylar fractures of the humerus. In: Letts RM (ed) Management of pediatric fractures, vol 11. Churchill Livingstone, New York. pp 167–198
3. Swenson AL (1948) Treatment of supracondylar fractures of the humerus by Kirschner wire trans-fixation. J Bone Joint Surg Am 30:993–997 [PubMed]
4. Flynn JC, Mathews JG, Benoit RL (1974) Blind pinning of displaced supracondylar fractures of the humerus in children. J Bone Joint Surg Am 56:263–273 [PubMed]
5. Nacht JL, Eker ML, Chug SMK et al (1983) Supracondylar fracture of the humerus in children treated by closed reduction and percutaneous pinning. Clin Orthop Relat Res 177:203 [PubMed]
6. Brown IC, Zinar DM (1995) Traumatic and iatrogenic neurological complication after supracondylar fractures of the humerus in children. J Pediatr Orthop 15:440–443 [PubMed]
7. Campbell C, Waters P, Emans J et al (1995) Neurovascular injury and displacement in type III supracondylar humerus fractures. J Pediatr Orthop 25:47 [PubMed]
8. Royce RO, Dutkowsky JP, Kasser JP et al (1992) Neurological complication after K-wire fixation of supracondylar fractures of the humerus in children. J Pediatr Orthop 11:191–194 [PubMed]
9. Skaggs DL, Hale JM, Bassett J et al (2001) Operative treatment of supracondylar fractures of the humerus in children. The consequences of pin placement. J Bone Joint Surg Am 83A:735–740 [PubMed]
10. Topping RE, Blanco JS, Davis T (1995) Clinical evaluation of crossed pin versus lateral pin fixation in displaced supracondylar fractures of the humerus. J Pediatr Orthop 15:435–439 [PubMed]
11. Arino VC, Lluch EE, Ramirez AM et al (1997) Percutaneous fixation of supracondylar fractures of the humerus in children. J Bone Joint Surg Am 59:914 [PubMed]
12. Zionts LE, Mckellop HA, Hathaway R (1994) Torsional strength of pin configuration Used to fix supracondylar fractures of the humerus in children. J Bone Joint Surg Am 76:253–256 [PubMed]
13. Shannon FJ (2004) Dorgan's percutaneous lateral cross wiring of supracondylar fractures of the humerus in children. J Pediatr Orthop 24:376–379 [PubMed]
14. Hotchkiss NR, Green PD (1991) Fracture and dislocation of the elbow. In: Rockwood CA, Green DP, Bucholz RW (eds) Fractures in adult, vol 1, 3rd edn. JB Lippincott Company, Philadelphia, pp 739–827
15. Yamamoto I, Ishii S, Usui M, Ogino T, Kuneda K (1985) Cubitus varus deformity following supracondylar fracture of the humerus: a method for measuring rotational deformity. Clin Orthop Relat Res 201:179–185 [PubMed]
16. Celiker O, Pestilci FI, Tuzuner M (1990) Supracondylar fractures of the humerus in children: analysis of the results in 142 patients. J Orthop Trauma 4:265 [PubMed]
17. Eid AM (1978) Reduction of displaced supracondylar fractures of the humerus in children by manipulation in flexion. Acta Orthop Scand 49:391 [PubMed]
18. Pirone AM, Graham HK, Krajbich JI (1988) Management of displaced extension type Supracondylar fractures of the humerus in children. J Bone Joint Surg Am 70:641–650 [PubMed]
19. Wilkins KE (1990) The operative management of supracondylar fractures. Orthop Clin North Am 21:269 [PubMed]

20. Danielsson L, Pettersson H (1980) Open reduction and pin fixation of severely displaced supracondylar fractures of the humerus in children. Acta Orthop Scand 15:249 [PubMed]

21. Hart GM, Wilson DW, Arden GP (1977) The operative management of the difficult supracondylar fracture of the humerus in the child. Injury Br J Accid Surg 9:30 [PubMed]

22. Millis MB, Singer IJ, Hall JE (1984) Supracondylar fracture of the humerus in children: further experience with a study in orthopedic decision-making. Clin Orthop Relat Res 188:90 [PubMed]

23. Sutton WR, Greene WB, Georgopoulos G, Dameron TB Jr (1992) Displaced supracondylar humeral fractures. Clin Orthop Relat Res 278:81 [PubMed]

24. Kramhoft M, Keller IL, Solgaard S (1987) Displaced supracondylar fractures of the humerus in children. Clin Orthop Relat Res 221:215 [PubMed]

25. Alburger PO, Weidner PL, Betz R (1992) Supracondylar fractures of the humerus in children. J Pediatr Orthop 12:12 [PubMed]

26. Aronson DD, Prager PI (1987) Supracondylar fractures of the humerus in children: a modified technique for closed pinning. Clin Orthop Relat Res 219:174–184 [PubMed]

27. Mubarak SJ, Davids JR (1994) Closed reduction and percutaneous pinning of supracondylar fractures of the distal humerus in the child. Master techniques in orthopedic surgery. In: Morrey BF (ed) The Elbow. Raven Press, New York, pp 37–51

28. Lee SS, Mahar AT, Miesen D et al (2002) Displaced pediatric supracondylar humerus fractures: biomechanical analysis of percutaneous pinning techniques. J Pediatr Orthop 22:440–443 [PubMed]

29. Cramer KE, DeVito DP, Green NE (1992) Comparison of closed reduction and percutaneous pinning versus open reduction and percutaneous pinning in displaced supracondylar fractures of the humerus in children. J Orthop Trauma 6:407–412 [PubMed]

30. Dormans JP, Squillante R, Sharf H (1995) Acute neurovascular complications with supracondylar humerus fractures in children. J Hand Surg (Am) 20:1–4 [PubMed].

Original Article

Evaluation of Results of Exchange Nailing by Sign Nail for Nonunion of Femoral Shaft Fracture Treated by Kunstcher Nailing

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Abstract:

This prospective study of ''Evaluation of result of exchange nailing by SIGN nail for nonunion of femoral shaft fracture treated by kuntscher nailing'' was carried out during the period of January 2006 at National Institute of Traumatology and Orthopaedic Rehabilition (NITOR),Dhaka , Bangladesh.The objectives of the study was to evaluate the effectiveness of the exchange nailing for nonunion of femoral shaft fracture which were previously treated by kuntscher nailing.Thirty two patient were selected by fulfilling the inclusion and exclusion criteria .Four patients were lost to follow up.Therefore the result of the study based on 28 patients.The age range from 21-80 years.The average ages were 44.71 years.Road traffic accident (RTA) were the commonest cause of fracture & found in 60%scases.Second most common causes of injury were fall from height (21.43%).The union time were 28.09 weeks.About 78.57%(22)causes have united without any additional procedure.Clinical results were analyzed by using classification system for results of treatment citied by Thoresent et al (1985).Excellent functional outcome found in 17 cases (60.71%), good in 6 causes (21.43%), fair in 3 cases (10.72%) and in 2 causes (7.14%). Regarding the overall results satisfactory result were found in 23 cases (82.14%) and unsatisfactory result in 5 cases (17.86%)

INTRODUCRION

Femur is the largest and longest bone the body . It is one of the principle loads bearing bone in the lower extremity. Fracture in this bone may result in prolong morbidity & extensive disability unless treatment is appropriate. It is one of the most common high energy trauma encountered in Orthopaedic practice.

Management of these fractures depend upon varuius factors such as type of fractures, site of fractures degree of comminution, age of the patients, associated conditions (Head injury, Chest injury Abdominal injury), patients socio-economic status, facility available and so on.

The useful means by which these can be treated are traction, traction & spica cast immobilization, traction and cast bracing, fixation by kuntscher nail, plating, external fixator and interlocking nails.

Kuntscher (1940) introduced intramedullary nailing of the femur & revolutionized the treatment of femoral shaft fracture (kuntscher 1968), In 1950 kuntscser introduced reaming of medullary canal & further improved the results of his technique. However all the fractures (fractures of the proximal or distal 1/3rd, long oblique, spiral fractures & comminuted fractures with loss of segmental continuity) are not suitable for the kuntscher nailing.

The Ideal fracture for kuntscher nail fixation is transverse or shot oblique fracture in the isthmus with serration. Previously and even now kuntscher nail is used to treat some of these fractures despite of its limitation (WU & Shih 1992).

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There is high incidence if complications like nonunion, shortening, angulation, malrotation, proximal migration of nail, breakage & bending with knee stiffness are noted in cases of K. nail fixation

For treatment of nonunion of femoral shaft fracture following kuntscher nailing, several factors have to be considered, like type of nonunion, presence or absence of sepsis, age of patient, gap between the fracture fragments, shortening of limb etc.

The methods that can be used for treatment of aseptic nonunion of femoral shaft fractures following kuntscher nailing are:-

- Use of removable splint,
- Functional bracings,
- lCreation of Pulsed electromagnetic fields and application of low frequency pulsed Ultrasound.
- Application of BMP
- Fixation by Flute nail,
- Compression & distraction Osteogenesis by application of Ilizarov rxternal fixator.
- Exchange nailing by an interlocking system.

To achieve union, among these various methods of treatment, exchange nailing with an interlocking system is a better option in these failed cases. Exchange nailing shows an excellent result in union and functional outcome of limb and thereby rehabilitation of patients (Lavelle 1998).

Exchange nailing has low morbidity, may obviate the need for additional bone grafting if it is done closely. In case of open procedure however.

onlay cancellous bone grafting should be done routinely. Exchange nailing allows early weight bearing and early active rehabilitation of patients (Hak,Lee & Goulet 2000)

There are several varieties of interlocking nails availavle for clinical use. In thesis the SIGN interlocking intramedullary nail were used.

AIM & OBJECTIVES:

Evaluation of effectiveness of exchange nailing by SIGN nail for nonunion of femoral shaft fracture treated by kuntscher nailing.

PATIENTSAMETHODS

Type of study:

A Clinical trial.

Place and the period of study :

This study was carried out at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, during the period from january 2005 to December 2006.

SELECTION OF THE SUBJECT:

Inclusion Criteria

i) Nonunion of the fracture shaft of femur previously treated by kuntscher nailing

ii) Age >18 yrs.

Exclusion criteria

1. Patients with any type of septic focus
2. Pathological fractures
3. Other fixation failure cases

Measurements of the outcome of variables :

After enrollment of the patient, following outcome of variables were measured.

Demographic variables.

(a) Age
(b) Sex

Clinical variables.

(a) Cause of Injury
(b) Side involvement
(c) Time interval between 'K' nail fixapion & exchange nailing
(d) Post operative hospital stay
(e) Time taken for union
(h) Post operative complications
(i) Clinical results
(j) Overall results

Surgical Techniques:

Patient Positioning : Lateral position.

Removal of 'K' nail : 'K' nails were removed from the femur either through gluteal region or through the fracture site. The fracture site reached through lateral approach

Preparation of femur (fracture site & medullary canal) :

Fracture site freshened by removing the fibrous tissue & sclerosed bone ends and reaming of medullary canal. Reaming were done with karger diameter reamer, so the a wider diameter nail could inserted. During reaming the entry point (pyriform fossa) & proximal portion of canal (about 4 cm) over reamed to accommodate the proximal portion of nail

Fracture fixation by SIGN nail:

a) Assembly of the jig/T-handle/ nail construct
   - Attachment of T-handle to the nail
   - Attachment of assembled T- handle & nail to the proximal target arm
   - Determination of Placement of distal target arm
   - Tightening of the distal target arm to the proximal target arm
   - Alignment of the distal target holes with the distal interlock holes
   - Removal of the jig from T-handle.

b) Nail Insertion with the help of T-handle

c) Placement of locking screws:
   - Re attachment of jig to the T-handle
   - Insertion of distal screws
   - Insertion of proximal screws.

d) Removal of the T -handle with jig

Placement of a drain

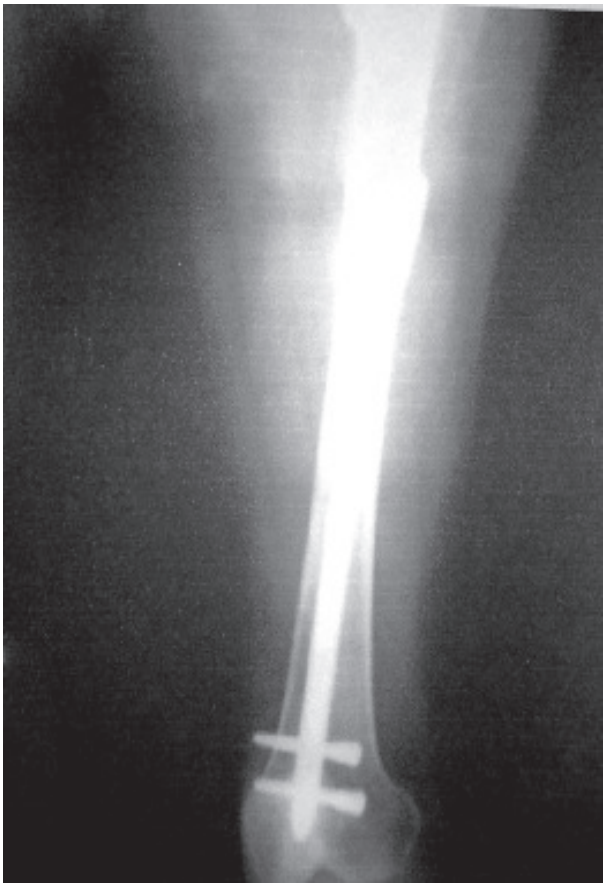
After thorough irrigation of the wound a drain was placed through the most dependent part of the thigh.

Placement of bone graft :

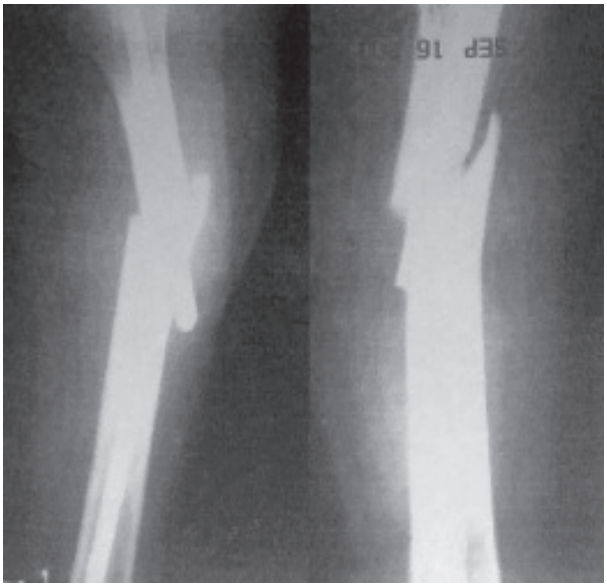
Autogenous cancellous bone graft harvested from iliac crest applied around the fracture site.

Wound closure:

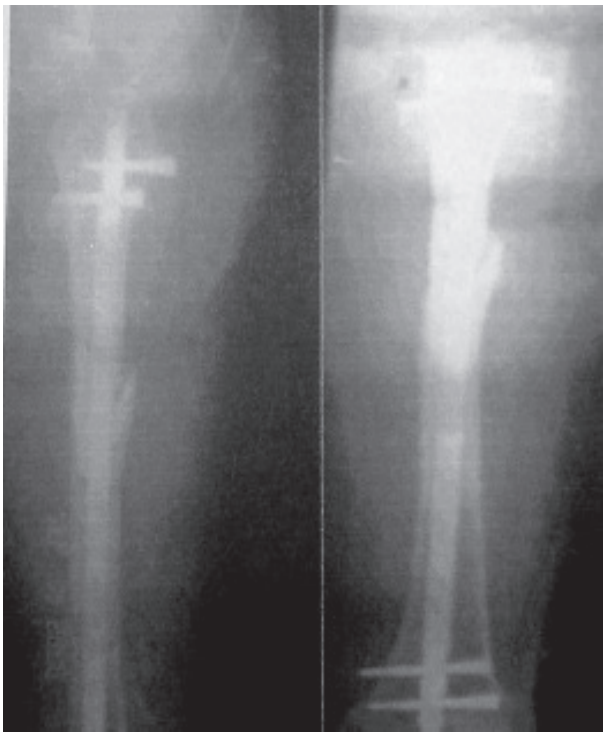
All wounds were closed in layers after proper haemostasis.



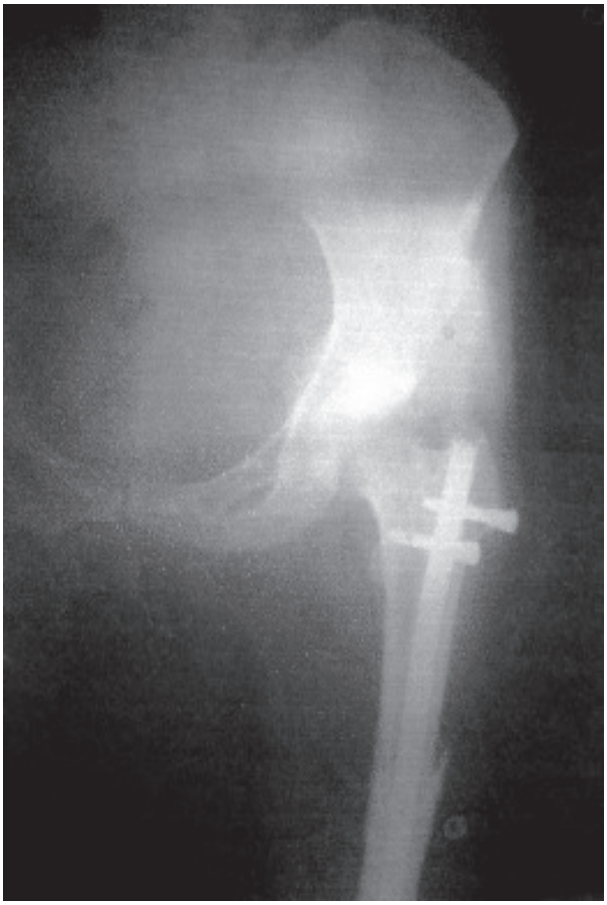
After 6 Weeks



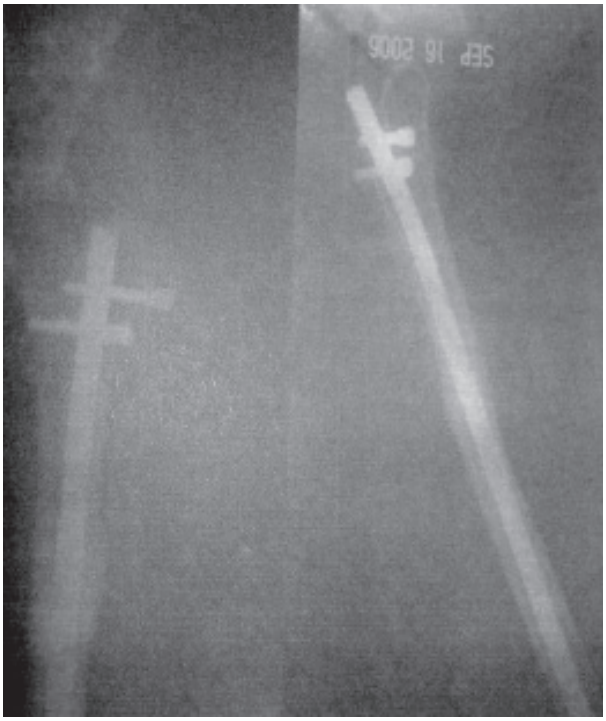
Pre Operative X-ray



Post Operative X-ray



After 6 Weeks



After 24 Weeks

Observations and Results

The present prospective study was conducted between January 2005 and December 2006 at NITOR. Total 32 patients were selected for this study, but out of these, 4 cases were lost during follow-up. So, remaining 28 cases were finally available for evaluation. All the patients were properly investegated and treated with antegrade interlocking SIGN nail with open autogenous cancellous bone graft and followed up for at least 6 months and maximum up to 21 months.

Table I

Mean age and distribution of Patients by Sex.

Mean agein years	Sex				Total
	Male		Female		
	No.	%	No.	%	
44.71	17	60.71	11	39.29	28

Table- I. Shows mean age of patients were 44,71 years and about 60.71 % patients were male & 39.29 % were female.

SIDE INVOLVEMENT:

This clinical trial comprises 28 patients. Among them right Femur involved in 18 cases (64.29%)& Left Femur involved in 10 cases (35.71%).

Cause ,

Shows majority (89.29%) suffered from high energy trauma.

Time interval between 'k' nailing $ exchange nailing:

The time interval between 'k' nailing $ exchange nailing varies from 6 months to 24 months with mean of 24.82 months

Post operative hospital stay:

It were minimum 3 days to maximum 17 days with a mean of 7.43 days.

Table III

Clinical results
According to Theresa et al. (1985) grading system
(Appendix-IV)

Results	No. of Patients	Percentage
Excellent	17	60.71
Good	6	21.43
fair	3	10.72
Poor	2	7.14
Total	28	100

Table – III shows excellent results achieved 60.71% cases, good results achieved in 21.43% cases, Fair results achieved in 10.72% cases & poor results achieved in 7.14% cases.

For valid statistical analysis Excellent and good results were grouped as satisfactory and fair & poor results were grouped as unsatisfactory.

Table-IV

Overall results:

Results	No. of patients	Percentage
Satisfactory	23	82.14
Unsatisfactory	5	17.86
Total	28	100

Table: IV .shows satisfactory results in 82.14% cases & unsatisfactory results in 17.86% cases.

DISCUSSION

Nonunion following 'k'naling in the fracture shaft of femur is a common problem for the centers where 'k'nail is still widely used to fix the fracture shaft of femur despite of its ('k' nail) limitations. It is due to the lack of adequate facilities for interlocking fixation.

The causes of nonunion observed were, fixation of fractures which were less than ideal for 'k' nail fixation,use of undersized nail, lost of patient to follow up & early weight bearing etc.There are varios modalities of treatment available for treating these nonunion. Exchange nailing with or without open autogenous bone graft is the most common form of treatment among them especially in asceptic nonunion (curylo & lindsey1994).

At NITOR exchange nailing with an interlocking intramedullary nail for the nonunion of femoral shaft fracture following 'k'nailing gained acceptance in the recent years.

The international studies on exchange for nonunion of femoral shaft fracture following 'k' nailing or interloking nailing were carried out by 'k' nail for 'k' nail or interloking nail for 'k' nail or interlocking nail for interlocking nail. Some of these studies were prospective & some were retrospective.

This is a prospective study which includes 28 patients who were selected according to the inclusion & exclusioncriteria.

The average age of patients Was 44.71 years (range: 21 to 80 years) but in comparison with furlong et al. (1999) study it was 38.6 years (range:18-85 years).

In this study, right side affected more (64.29%) than left side (35.71%) .Which were comparable to the study of Yu, Wu & Chen(2002).

The major causes of fracture in initial injury RTA (60.7%) which were comparable with furlong et al . (1999) studies.

Besides nonunion 8 cases (28.57%) presented to us with nail bending , 5 cases (17.86%) with nail breakage & 4 cases (14.29%) with proximal migration of nails.

The mean time interval between 'K' nailing & exchange nailing was 24.82 months (10-108 months) but in furlong et al.(1999) study it was 54.7 weeks (28-108) weeks). Duration of post operative hospital stay was one of the important parts of this study. In this series it were minimum 3 days and maximum 17 days with a mean of 7.43 days . Longer hospital stay were required for patients having postoperative infection and other complications.

In this series postoperative infection (superficial wound infection) developed in 2 patients (7.14%). Which were controlled by regular dressing and sensitive antibiotics. But in the other study there were no infection.The infection of my series might be due to lack of strict asepsis in the operation theatre.

In present study the mean follow up period were 11.25 months (rage :6-21 months) but in Yu, Wu & Chen (2002) it were about 2.9 years (range :1.1-6.0 years).

In this series 22(78.57%) cases have united without the need for additional procedure,like application of BMP,nail dynamization,re exchange nailing etc.But in Yu & Chen (2002), furlong et al.(1999) and Web, Winquist & Hansen (1986), it were 91.7%, 96% &96% respectively .Among the remaining six cases 2 patients required application of BMP &l patient requied nail dynamization & united. Rest 3 cases showed delayed union and waiting for additional procedure .A comparatively low success rate of my series be due to small sample size, lack of adequate facility in the O.T inadequate technical expertise , poor general condition of some patients.

Union time of the fracture in this series were minimum 16 weeks and maximum 40 weeks (mean 28.09 weeks).In the study of Furlong et al.(1999) the mean time of union were 24.6 weeks (16-40 weeks),ln another study the Yu,Wu&

Chen (2002) showed that union achieved with a mean period of 16 weeks (12-32) and in cases of Web, Winquist & Hansen (1986), it were about 20 weeks.

Clinical results were analyzed by using classification system for the results of treatment cited by thoresen et al. (1985), and found 60.71% excellent, 21.43% good,10.72%

fair & 7.14% poor. Other studies that were available to us did not expressed the results as cli8nical results rather they expressed the results as an union rate without the additional procedure like application of BMP , nail dynamization and re-exchange nailing.

CONCLUSION:

Therefore, Exchange nailing by SIGN nail for nonunion of femoral shaft fracture treated by kuntscher nailing is an effective method of treatment for the ascptic nonunion of femoral shaft fracture. Less tissue handling, adequatic bone grafting, close postoperative follow up and active muscle exercise is essential for achieving the favourable outcome. The long term result is beyond the scope of this study. Long term follow up is needed to evaluate the final outcome of these patients.

REFERENCES:

1. Alho,A, Molster,A, Thoresen,BO, Gjerdej, NR, Ekeland, A & Polleras ,G 1992, 'Effect of rotational stability of intramedullary nailing or bone healing 'Acta orthop scand, vol.62, no.3,pp.573-6.
2. Allen,W, piotrowsky,G , Burnstein & Franklin,V 1968, Biomechanical principles of intramedullary fixation' , Clin. Orth.,vol.60,no,l,pp.13-20.
3. Allen,WC , Heiple,KG,&burnstein ,AH 1978, Fluted femoral intramedullary rod :Biomechanical analysis and preliminary clinical results, 'J Bone joint surg, vol.60-A,no.3,pp.506-15.
4. Bassett,CA, Mithell SN & Gastou, Sr 1982, Pulsating eletronmagnetic field treatment in ununited fractures and failed arthrodesis, 'JAMA.vo;.l.247,no.5,pp.623-8.
5. Beredjikllan ,PK,Rananja ,RJ & Heppenstall, RB 1999,'Results of treatment of 111 patients with nonunion of femoral shaft fractures", Univ Pennsyylvania orthopJ,vol.12,no.1,pp.52-5.
6. Brav,EA 1968,'The use of intramedukkary nailing for nonunion of femur ',clin orthop ,vol.60, no.l,pp,69-75 .
7. Brighton CT, Black,J Friendenberg,ZB, Esterhal,JL,Day,lJ & Connolly ,JF 1941 , 'A multicenter study of the treatnment of nonunion satisfactory results were found in 23 cases (82.14%) and unasatisctory results in 5 cases (17.86%) .
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9. With constant direct current',J. Bone Joint Surt. ,vol.63-A ,no.1,pp.2-13.
10. Browner,BD 1996, 'Science& practice of intramedullary nailing', William & Wilkins , Baltimore, USA .
11. Brumback,RJ, Ellison,TS, Poka,A, Lakatos,R,Bathon,H & Burgess,AR 1989, 'Intramedullary nailing of open fractures of the femoral shaft', J. Bone joint surg. (Am),vol. 71,no-8,pp.1324-31.
12. Brumback,RJ, Reily,Jp & P0ka,A 1988, 'Intramedullary nailing of femoral shaft fractures, Part I :Decision making errors with interlocking fixation', J. Bone joint surg. (Am) ,vol.70-A, no.10,pp.1441-52.
13. Brumback,RJ, Uwagie-Ero,S, Lakatos,RP, Poke,A, Bathon GH & Burgess,AR 1988, 'Intramedullary nailing of femoral shaft fractures,Part – II . Fracture healing with static interlocking fixation', J. Bone joint surg. (Am),vol.70-A,no.10, pp.1453-62.
14. Chapman,MW 1986, 'The role of intramedullary nailing of femorl shaft fracture', Clin orthop, vol.187,no. pp. 301-09.
15. Connolly,TF 1085, 'C0mmon available problems in nonunions', clin orthop, vol.194,no.2, pp.226-35.
16. Cove,JA, Llowe,DW, Jupiter,JB & Silsk,JM 1997, 'The management of femoral diaphyseal nonunions', J. Orthop Trauma ,voi11, no .4 ,pp.513-20.
17. Crawford,RA 1973, 'A history of the treatent of nonunion of fractures in 19 th century in the united states', J. Bone Joint Surg., vol. 55-A, no. 11, pp. 1685-97.
18. Curylo, LJ & Lindsey, RW 1984, 'Shaft nonunions current etiology & outcome of treatment",Orthop Int, vol.2, no.5, pp.465-73.
19. Evans,F, Pederson, H & Lossiner, H 1951, "The role of tensile stress in the mechanism of femoral fracture', J. Bone Joint surg, vol.33-A, no.3 , pp.485-501.
20. Furlong, AJ, Giannoudis, PV, DeBoer,P, Mathews,Sj, MacDonal, DA & Smith, RH 1999 , 'Exchange nailing for femoral shaft aseptic nonunion', INJURY, vil.30, pp. 245-9.
21. Grosse,A, Kempf, I & Lafforgne, D 1978, 'Treatment of femoral fractures with interlocking imtramedullary nails : A report of 40 cases', Rev clin orthop, vol.64 (suppl.2), pp.333-5.
22. Hak,DJ, Lee,SS & Goulet, JA 2000, 'Success of Exchange Reamed Intramedullary Nailing for Femoral shaft nonunion or Delayed union', J. orthop trauma, vol.14 ,no.3 ,pp. 178-82.

23. Haper, M & Carson, W 1987, 'Curvature of the femoral and the proximal entry point for an intramedullary rod', Clin. orthop, vol.220,no.1, pp.155-6.

24. Heiple, KG, Figgi, HE, Lacey, SH & Figgie, MP 1985, 'Femoral shaft nonunion treated by a fluted intramedullary nail', Clin. ortho, vol.194, no.2, pp. 218-25.

25. Heppenstall,RB 1984, 'The present role of bone graft surgery in treating nonunion', Orthop clin North Am, vol. 15, no.1, pp.113-23.

26. Jhonson, KD, Tencer, AF & Blumenthal,S 1986, 'Biomechanical performances of locked intramedullary nail systems in comminuted femoral shaft fractures', clin. orthop, vol. 206,n.1, pp.151-61.

27. Jhonson,KD, Tencer,AF & Sherman, MC 1987, 'Biomechanical factots affecting fracture stability and femoral stability and femoral bursting in closed intramedullary nailing of femoral shaft fractures with illustrated case presentation', J. orthop Trauma, vol.1, no.1, pp. 1-11.

28. Judet,J & Judet,R 1960 , 'L osteogenese et leg retards deconsolidation et les pseudoarthoses des os longs Huitieme congres', SICOT, pp.315-25.

29. kuntscher,G 1968, 'The intramedularlly nailing of fractures', Clin. orthop, vol.60, no. 1, pp. 5-12.

30. Kempf,I, Grosse,A & Beek, G 1985, 'Closed intramedullary nailing', J. Bone joint sutg. vil.67-A, no.5,pp. 709-20.

31. Kyle,RF 1985, Biomechanics of intramedullary nailing in fracture fixation', Orthopaedics, voi.8, no.9, pp.1356-9.

32. Laing,P 1953, 'The blood supply of the femoral shaft', J. Bone Joint Surg. vol. 35-B, no.4, pp.462-6.

33. Wu, CC & Shih, CH 1992 'Treatment of 84 cases of femoral nonunion' Acta orand, vol, no, 1 ,p.57.

Original Article

Primary hemiarthroplasty for intertrochanteric femur fracture in the elderly diabetic patients: our experience in BIRDEM hospital with a minimum of 2 years follow-up

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ABSTRACT:

Appropriate treatment method for osteoporotic trochanteric fracture in elderly people is rather controversial because of the poor quality of bone mass, difficult anatomical reduction and accompanying systemic disorders. Internal fixation in these cases usually involves prolonged bed rest, limited ambulation and implant failure secondary to osteoporosis. This might result in higher chances of complications like pulmonary embolism, deep vein thrombosis, pneumonia, and decubitus ulcer. The purpose of this study is to analyse the role of primary hemiarthroplasty in cases of osteoporotic intertrochanteric femur fractures in elderly patients with co-morbities.

This retrospective study was carried out to review the outcome of 120 cases of intertrochanteric fractures treated with hemiartrhoplastyin elderly diabetic patients. There were 85 female and 35 male. Mean age of the patients were 65.2 years (range, 60-85 years). Harris hip score (HHS) was used to assess the outcome at least for 2 years.

The mean Harris hip score at the two-year follow-up was 83.10 ± 10.90. A total of 25 patients were graded as excellent, 60 patients as good, 30 as fair and 5 as poor. It was observed that, patients with stable variety (Evans and) of intertrochanteric fractures had better outcome than the unstable variety in our study.

Hemiarthroplasty for osteoporotic intertrochanteric fractures in the elderly patient results in early ambulation and good functional results, although further prospective randomized trials are required before reaching to conclusion.

Keywords: Hemiarthroplasty, osteoporotic fractures, intertrochanteric fractures, elderly patient.

INTRODUCTION:

Trochanteric femur fracture is one of the most important health problems amongst the elderly population. There were an estimated 1.66 million hip fractures worldwide in 1990[1]. This worldwide annual number is rising rapidly [2, 3] with an expected incidence of 6.26 million by the year 2050[1, 4]. An increase in these fractures is on the rise due to the increased life expectancy of the people and osteoporosis[1,2,3,4].

Appropriate treatment method for trochanteric fracture, particularly in elderly people, is rather controversial because of the poor quality of bone mass, accompanying systemic disorders and discordancy of these patients [5]. Rigid internal fixation and early mobilisation are the vital points of the treatment[6]. Trochanteric sliding plate fixation

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(DHS), intramedullary nailing, methylmethacrylate or absorbable ceramic application and proximal femoral osteotomies are the recently used treatment modalities. But these options are not commonly accepted, because of the inadequate stabilization, shortening of the leg and abductor weakness after treatment [7, 8].

Intertrochanteric fractures in elderly patients are associated with high rates of morbidity and morbidity[9, 10]. Comminution, osteoporosis, and instability often preclude the early resumption of full weight bearing in spite of use of internal fixation[10]. Reported overall failure rate with internal fixation in intertrochanteric fractures has been reported to be 3–16.5% [11, 12].In the elderly, fracture instability, comminution and osteoporosis worsen theprognosis [12, 13]. Moreover, there is a high rate of general complications associated with internal fixation due to prolonged recovery time taken after surgery [14]. Excessive collapse of the fracture site and varus displacement is a common problem of sliding hip screws combined

with plates or femoral nails especially in elderly diabetic women who often suffer from osteoporosis and poor bone quality [15].

Another treatment option for trochanteric fracture is endoprothesis application aiming early mobilization with weight bearing although it isn't the ideal treatment option for stable trochanteric fractures. Various authors have reported successful outcomes after the use of hemiarthroplasty and total hip arthroplasty in these patients [16, 17]. After hip arthroplasty, patients can bear weight immediately, they can be encouraged to walk early and exercise the involved limb, thus reducing the period of bed rest and rate of complications [18, 19].

While relative consensus exists about the treatment of femoral neck fractures for elderly patients, the optimal treatment for per- and intertrochanteric fractures is stillunder debate [21, 22].The purpose of this study is to analyze the role of primary hemiarthroplasty in cases of osteoporotic intertrochanteric femur fractures in elderly patients with co-morbities.

MATERIALS AND METHODS:

This retrospective study was carried out to review the outcome of 120cases of intertrochanteric fractures treated with hemiartrhoplasty after at least 2 years follow-up. These surgeries were performed between 2002to 2008 in the BIRDEM hospital. Among the 120 patients, there were 85 female and 35 male. Mean age of the patients were 65.2 years (range, 60-85 years). Of the 120 procedures, 70 were on the right and 50 on the left (Table-1).

The fractures were classified according to Evans classification. Evans type and (stable), and III or IV (unstable)(Figure-1and 3) fractures were included in this study. There were 40 patients with stable variety and 80 patients with unstable variety. Patients with associated fractures that might significantly affect the final functional outcome, patients that were non-ambulatory before injury and patients with psychiatric disorders were excluded from the study. All patients were community ambulators, with or without walking aids, prior to trauma. All the patients were diabetic and had other co-morbidities.

Hemiarthroplasties were done by using a standard posterior approach in lateral decubitus position by the same surgical team under spinal anesthesia. A standard stem and a bipolar head were used. Out of 120 hemiarthroplasties, cement was used in 77cases(Figure-2 and 4) and rest were uncemented. In case of cemented prosthesis, stems were cemented using the modern cementing technique.

All patients underwent a routine postoperative physiotherapy protocol that included early gait training in form of walking with the help of a walker starting second day post surgery. The rehabilitation then progressed as tolerated by the patients. Patients were examined postoperatively at 6 weeks, 3 months, 6 months, 1 year, and thereafter annually. At each follow-up visit, a clinico-radiological examination was done and the patient was evaluated using the Harris hip score (HHS) and were graded as <70 poor, 70-79 fair, 80-89 good and 90-100 excellent. Anteroposterior radiographs of the hip were analyzed at each follow-up to note evidence of loosening.

Table-I

Demographic pattern of patients

Number of patients	Side involved		Age in years		Sex	
120	Right	Left	Range	Mean	Male	Female
	70	50	60-85	65.2	35	85

Table-II

Overall outcome according to Harris Hip Score (HSS)

Results	No. of Cases (Mean HSS-83.10 ± 10.90)
Excellent	25 (20.83%)
Good	60 (50.00%)
Fair	30 (25.00%)
Poor	05 (4.16%)



Fig.-1: *Preoperative x-ray of unstable intertrochanteric fracture*

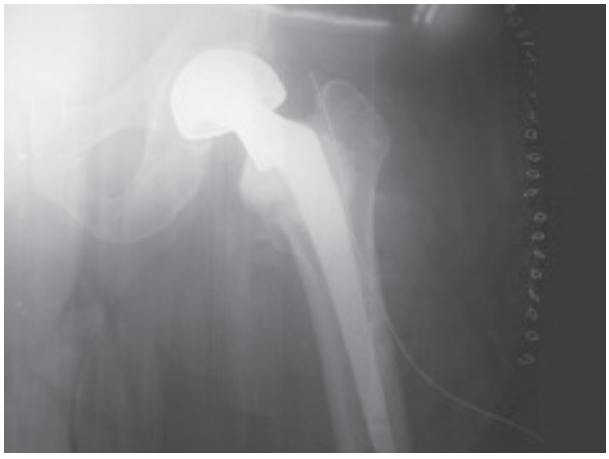


Fig.-2: *Hemiarthroplasty with cemented bipolar prosthesis*

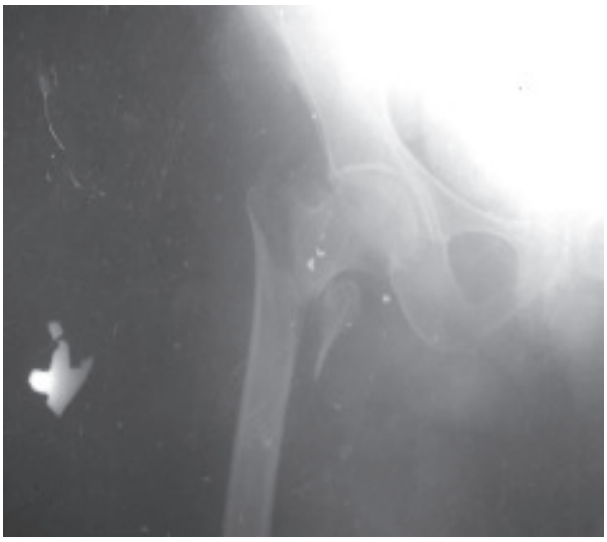


Fig.-3: *Preoperative X-ray of Unstable intertrochanteric fracture*

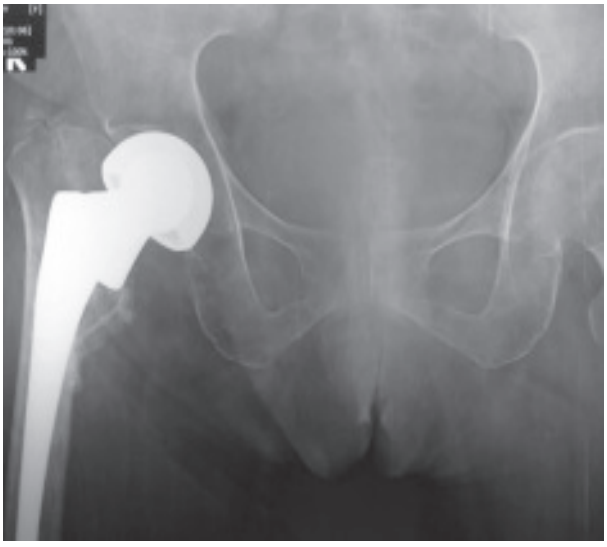


Fig.-4: *Hemiarthroplasty with cemented bipolar prosthesis*

RESULTS:

All patients were operated within 15 days (mean delay of 5.61± 3.73 days, range 2 days to 14 days) with delay due to patients presenting late and time taken for patients to be fit for anaesthesia. The mean operative time was 80 minutes (range, 60–110 minutes). Average intraoperative blood loss was 295 ml (range, 150–500) and the average postoperative drainage was 160 ml (range, 40–290). 33 patients needed single unit blood transfusion each postoperatively; rest of the patients did not require any blood transfusion. The patients started full weight bearing at an average 5.5 days after surgery (range, 3-9 days).One patient refused to walk after surgery and had a poor result (HHS 69). The average stay in the hospital was 10.96 days (range, 5-21 days). One of the patients developed bed sore postoperatively, and required a week more of hospital stay, till the healing of the sore. This patient was operated on 5th day post injury and did not have a pre operative bed sore.

Follow-up period ranged from 2 years to 3.5 years with a mean duration of 2.3 years. Out of the 120 cases, two patients, who were known cases of ischaemic heart disease, died postoperatively following myocardial infarction.

The mean Harris hip score at the two-year follow-up was 83.10 ± 10.90. A total of 25 patients were graded as excellent, 60 patients as good, 30 as fair and 5 as poor. It was observed that, patients with stable variety (Evans and) intertrochanteric fractures had better outcome than the unstable variety in our study.

At last follow-up (after 2 years), 95 patients were walking without any aid, 15 patients had a limp and used a stick for walking, 6 patients used a walker, and 4 was wheelchair bound. 15 patients had shortening of the operated limb with an average shortening of 1.1 cm (range, 5-15 mm) which was well compensated by giving a shoe raise. A total of 22 patients had an abductor lurch at 3-month follow-up; however, only 10 patients had abductor muscle weakness with a positive Trendelenberg test at final follow-up. Most of these patients however could walk well with the use of a stick. Among the patients with poor results, threepatients had a superficial wound infection which settled down with a course of intravenous antibiotics for 2 weeks. However, the patient continued to have diffuse pain along the incision site and walked with a limp. Other two patients of poor results also had pain and limp, but we could not find any obvious reason for the pain. There was a case of loosening of uncemented prosthesis, which was treated with cemented bipolar prosthesis. There no dislocation, periprosthetic fractures, or late infections.

DISCUSSION:

The incidence of all hip fractures is expected to double over the next 50 years as the population ages [23]. All our patients were elderly (mean, 65.2 years) with diabetes and other co-morbidities. Most of them had severe osteoporosis. The Intertrochanteric fractures make up 45% of all hip fractures [24]. Many of these fractures are stable two-part fractures that can be treated satisfactorily with a sliding hip screw. But 35–40% is unstable three and four part fractures that are associated with high rates of morbidity and mortality [24].

In this study, there were 80 patients with unstable and 40 patients with stable intertrochanteric femur fractures. However, all fractures were treated by hemiarthroplasty. We treated many trochanteric fractures with internal fixation (DHS) in our institution. However, our experience showed better outcome in hemiarthroplasty than internal fixation in case of elderly osteoporotic patients. The reported overall failure rate with internal fixation in intertrochanteric fractures is 3–16.5%[25, 26]. Our study was made with the purpose of presenting the role of primary hemiarthroplasty in cases of osteoporotic intertrochanteric fractures of femur in elderly patients with diabetes.

Since 1971 hemiarthroplasty has been used for unstable intertrochanteric fractures,[27] however less frequently as compared to femoral neck fractures[28] .Tronzo claimed to be the first to use long, straight-stemmed prosthesis for the primary treatment of intertrochanteric fractures[29]. Stern and Goldstein used the Leinbach prosthesis for the primary treatment of 22 intertrochanteric fractures and found early ambulation and early return to the prefracture status as a definite advantage[30]. Liang *et al.*[31]in their study of unstable intertrochanteric fractures concluded hemiarthroplasty is an effective method to treat the unstable intertrochanteric fractures in elderly. It can decrease the complications, reduce the mortality, improve the patient's living quality, and reduce the burden of the patient's family.

Grimsrud*et al*. [32]studied 39 consecutive patients of unstable intertrochanteric fractures treated with a cemented bipolar hip arthroplasty and observed good results.The technique allows safe and early weight bearing on the injured hip and had a relatively low rate of complications. In our series too there was only one case of pressure sores and three cases of superficial wound infection. Since most of the patients were out of bed on the second day postoperatively, and the recumbancy time was minimal, there were no chest and urinary tract infection in our series.

Rodop*et al*. [33] in a study of primary bipolar hemi-prosthesis for unstable intertrochanteric fractures in 37 elderly patients obtained 17 excellent (45%) and 14 good (37%) results after 12 months according to the Harris hip-scoring system. A total of 85 out of 120 patients in our study had a good to excellent result (71%). Thus the results of this modality of treatment are definitely promising especially in view of the variable results of osteosynthesis in this group.

The opponents of the technique stated increase blood loss, mechanical complications like dislocation, and infection as possible complications as compared to conventional internal fixation. In a comparative study of cone hemiarthroplasty versus internal fixation, Kayali*et al*.[34]found that the clinical results of both groups were similar. Hemiarthroplasty patients were allowed full weight bearing significantly earlier than the internal fixation patients. Broos*et al*. [35] concluded that the operative time, blood loss, and mortality rates were comparable between the two groups, with a slightly higher percentage (73% versus 63%) of those receiving a prosthesis considered to be pain free. Stappaerts*et al*. [36]found no difference between two groups except a higher transfusion need in

the replacement group. In our series the average blood loss was 295 ml with only 33 patients requiring postoperative blood transfusion and there was no incidence of dislocation and deep infection.

Conflicting reports about postoperative mortality in cases with primary hemiarthroplasty are cited in the literature. Kesmezacar*et al*. [37]reported postoperative mortality in 34.2% after a mean of 13 months and in 48.8% after a mean of 6 months in patients treated with internal fixation and endoprosthesis, respectively. Other studies have shown no differences in postoperative mortality in two groups[34, 36]. In present series only 2 patients out of the 120 died postoperatively due to unrelated causes (both secondary to myocardial infarction).

The purpose of the treatment of hip fractures seen in elder population is to prevent the probable complications by providing early mobilization and to help the patients in returning to their daily activities. In spite endoprosthesis surgery is an accepted method in the treatment of femoral neck fractures, there is still controversy for the treatment of trochanteric fractures, particularly in the stable variety. The aim of the internal fixation is to preserve the hip joint and to prevent complications related to prosthesis surgery. Although it isn't a treatment option, the advantage of the endoprosthesis surgery in the treatment of certain intertrochanteric femur fractures is to provide early mobilization and to prevent the systemic complications due to immobilization.

In our study, hemiarthroplasty was associated with better functional outcomes. Patients were able to perform their normal activities within a month. All patients demonstrated good functional achievement in spite of their advanced age.

We think that prefracture activity of the patient should be taken into consideration when making a decision for surgery. All our patients were community ambulators before injury and are expected to lead an active life after treatment and hemiarthroplasty is a better option than hemiarthroplasty.

CONCLUSION:

It is certain that the principal objective in intertrochanteric femur fracture is to prevent the possible complications by early mobilization and to help the patient returning to their daily life. These fractures must be treated with considering the age of the patient, mental status, bone quality, and type of the fracture. Primary hemiarthroplasty does provide a stable, pain-free, and mobile joint with acceptable complication rate as seen in our study; however a larger prospective randomised study comparing the use of intramedullary devices against primary hemiarthroplasty for unstable osteoporotic fractures will be needed.

We recommend hemiarthroplasty for only carefully selected elderly diabetic patients with osteoporotic bone.

REFERENCES:

1. Kannus P, Parkkari J, Siev´nen H, Heinonen A, Vuori I, J´rvinen M. Epidemiology of hip fractures. Bone 1996; 18:57S-63S.
2. Koval KJ, Zuckerman JD. Hip fractures are an increasingly important public health problem. ClinOrthopRelat Res 1998; 348:2.
3. Rockwood PR, Horne JG, Cryer C. Hip fractures: A future epidemic? J Orthop Trauma 1990; 4:388-93.
4. Frandsen PA, Kruse T. Hip fractures in the county of Funen, Denmark: Implications of demographic aging and changes in incidence rates. ActaOrthopScand 1983; 54:681-6.
5. Sarmiento A, Williams EM. The unstable intertrochantericfracture: treatment with a valgus osteotomy and I-beam nailplate.A preliminary report of one hundred cases. J Bone Joint Surg [Am] 1970; 52:1309-18.
6. Miller K, Atzenhofer K, Gerber G, Reichel M. Risk predictionin operatively treated fractures of the hip. ClinOrthopRelat Res 1993 ;(293):148-52.
7. DeLee JC. Fractures and dislocations of the hip. In:Rockwood CA Jr, Green DP, Bucholz RW, Heckman JD,editors. Rockwood and Green's fractures in adults. Vol. 2,4th ed. Philadelphia: Lippincott-Raven; 1996. p. 1659-825.
8. Eastwood EA, Magaziner J, Wang J, Silberzweig SB, HannanEL, Strauss E. Patients with hip fracture: subgroups andtheir outcomes. J Am GeriatrSoc 2002; 50:1240-9.
9. White BL, Fisher WD, Laurin CA.Rate of mortality for elderly patients after fracture of the hip in the 1980's. J Bone Joint Surg1987; 69-A: 1335–1340.
10. Said GS, Farouk O, El-Sayed A, and Said HG.Salvage of failed dynamic hip screw fixation of intertrochanteric fractures. Injury 2006; 37:194–202.
11. Haentjens P,Casteleyn PP, Opedecam P.Hip arthroplasty for failed internal fixation of intertrochanteric and subtrochanteric fractures in the elderly patient. Arch Orthop Trauma Surg1994; 113(4):222–227
12. Davis TR, Sher JL, Horsman A, Simpson M, Porter BB, Checketts RG.Intertrochanteric femoral fractures. Mechanical failure after internal fixation. J Bone Joint Surg Br 1990; 72:26–3.

13. KimWY, Han CH, Park JI, Kim JY.Failure of intertrochanteric fracture fixation with a dynamic hip screw in relation to pre-operative fracture stability and osteoporosis. IntOrthop2001; 25(6):360–362.

14. Baumgaertner MR, Curtin SL, Lindskog DM. Intramedullary versus extramedullary fixation for the treatment of intertrochanteric hip fractures. Clin Orthop1998; 348:87–94.

15. Jones HW, Johnston P, Parker M. Are short femoral nails superior to the sliding hip screw? A meta-analysis of 24 studies involving 3,279 fractures. IntOrthop 2006; 30: 69–78.

16. Faldini C, Grandi G, Romagnoli M, Pagkrati S, Digennaro V, Faldini O, Giannini S. Surgical treatment of unstable intertrochanteric fractures by bipolar hip replacement or total hip replcement in elderly osteoporotic patients. J OrthopTraumatol2006; 7(3):117–121.

17. Tronzo RG.The use of an endoprosthesis for severely comminuted trochanteric fractures. OrthopClin North Am 1974; 5 (4):679–681.

19. Haentjens P, Casteleyn PP, De Boeck H, Handleberg F, Opedcam P.Treatment of unstable intertrochanteric and subtrochanteric fractures in elderly patients. Primary bipolar arthroplasty compared with internal fixation. J Bone Joint Surg Am 1989; 71:1214–122.

20. Haentjens P, Casteleyn PP, Opdecam P.Primary bipolar arthroplasty or total hip arthroplasty for the treatment of unstable intertrochanteric and subtrochanteric fractures in elderly patients.ActaOrthopBelg 1989; 60(Suppl 1):124–128.

21. Blomfeldt R, Tornkvist H, Ponzer S, Soderqvist A, and Tidermark J. Comparison of internal Wxation with total hip replacement for displaced femoral neck fractures. Randomized, controlled trial performed at four years. J Bone Joint Surg Am 2005; 87:1680–1688.

22. Geiger F, Schreiner K, Schneider S, Pauschert R, Thomsen M. Proximal fracture of the femur in elderly patients: the influence of surgical care and patient characteristics on post-operative mortality. Orthopade2006; 35:651–658.

23. Zuckerman JD. Hip fractures. N Engl J Med 1996; 334:1519–1525.

24. Grimsrud C, Monzon RJ, Richman J, Ries MD. Cemented hip arthroplasty with a novel circlage technique for unstable intertrochanteric hip fractures. J Arthroplasty 2005; 20:337–343.

25. Haentjens P, Casteleyn PP, Opedecam P. Hip arthroplasty for failed internal fixation of intertrochanteric and subtrochanteric fractures in the elderly patient. Arch Orthop Trauma Surg 1994; 113(4):222–227.

26. Davis TR, Sher JL, Horsman A, Simpson M, Porter BB, Checketts RG. Intertrochanteric femoral fractures. Mechanical failure after internal fixation. J Bone Joint Surg Br 1990; 72:26–31.

27. Stern MB, Angerman A.Comminuted intertrochanteric fractures treated with a Leinbach prosthesis. ClinOrthopRelat Res 1987; 218:75-80.

28. Parker MJ, Handoll HH. Replacement arthroplasty versus internal fixation for extracapsular hip fractures. Cochrane Database Syst Rev 2006; 2:CD000086.

29. Tronzo RG. The use of an endoprosthesis for severely comminuted trochanteric fractures. OrthopClin North Am 1974; 5:679-81.

30. Stern MB, Goldstein TB. The use of the Leinbach prosthesis in intertrochanteric fractures of the hip. ClinOrthopRelat Res 1977; 128:325-31.

31. Liang YT, Tang PF, Guo YZ, Tao S, Zhang Q, Liang XD. Clinical research of hemiprosthesis arthroplasty for the treatment of unstable intertrochanteric fractures in elderly patients. Zhonghua Yi XueZaZhi 2005; 85:3260-2.

32. Grimsrud C, Monzon RJ, Richman J, Ries MD. Cemented hip arthroplasty with a novel cerclage cable technique for unstable intertrochanteric hip fractures. J Arthroplast 2005; 20:337-43.

33. Rodop O, Kiral A, Kaplan H, Akmaz I. Primary bipolar hemiprosthesis for unstable intertrochanteric fractures. IntOrthop 2002; 26:233-7.

34. Haentjens P, Casteleyn PP, De Boeck H, Handelberg F, Opdecam P. Treatment of unstable intertrochanteric and subtrochanteric fractures in elderly patients. Primary bipolar arthroplasty compared with internal fixation. J Bone Joint Surg Am 1989; 71:1214-25. 35. Broos PL, Rommens PM, Deleyn PR, Geens VR, Stappaerts KH.Pertrochanteric fractures in the elderly: Are there indications for primary prosthetic replacement? J Orthop Trauma 1991; 5:446-51.

36. Kayali C, Agus H, Ozluk S, Sanli C. Treatment for unstable intertrochanteric fractures in elderly patients: Internal fixation versus cone hemiarthroplasty. J OrthopSurg (Hong Kong) 2006;14:240-4.

37. Stappaerts KH, Deldycke J, Broos PL, Staes FF, Rommens PM, Claes P. Treatment of unstable peritrochanteric fractures in elderly patients with a compression hip screw or with the Vandeputte (VDP) endoprosthesis: A prospective randomized study. J Orthop Trauma 1995; 9:292-7.

Open Reduction and Internal Fixation of Capitellum Fracture

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Abstract

These rare capitellum fractures of four consecutive patients were treated with open reduction and internal fixation (ORIF). The purpose of this paper was to see the results of these four cases. Internal fixation was done by a 4 mm cancellous lag screw. Average follow up was 6 months (range 5 – 7 months). All four fractures united. Three patients obtained a full range of motion of elbow when compared to the uninjured opposite side. One patient had a residual 10 degree extension lag, but otherwise full return of range of motion was obtained.

Key wards: Capitellum, fracture, internal fixation.

INTRODUCTION

Isolated fracture of the capitellum is relatively rare.[1,2] It accounts 1% of all elbow fractures and 6% of distal humeral fractures[3]. They occur almost exclusively in adults and are more common in women. The injury is a result of shearing forces anterior to the centre of the capitellum transmitted by the radial head (Fig.-1). Capitellum fractures are classified according to their pattern of injury. Bryan and Morrey[1] were the first to classify these complex injuries into three subtypes; McKee *et al* [4] subsequently added a fourth type (Table-I).



Fig-1

Table-I

Bryan and Morrey classification of capitellum fracture

Type I	Complete osteochondral fracture,little or none of the trochlear
Type II	Superficial osteochondral fracture,articular cartilage of the capitellum with minimal attached subchondral bone
Type III	Comminutedor compression fracture
Type IV	Involve most of the trochlea.



Type I Type II Type III Type IV

Fig-2 *Capitellum fractures*

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Table-II

Grantham elbow assessment

Excellent	Normal stability, no pain and full range of movements
Good	Less than 10^0 of instability, mild pain and less than 40^0 restriction of range of movements
Fair	10-15^0 of instability, moderate pain or 40-60 degree of loss of range of motion
Poor	15^0 or greater instability, troublesome pain, or 60^0 or more of loss of range of motion

Operative Technique

The patient was placed in the supine position with the arm placed on a hand table. Under tourniquet, using extended lateral (Kocher's) approach [4,16,17,18] for ORIF of capitellum fracture. The extensor origin was elevated in all cases subperiosteally including the origin of the extensor carpi radialis longus. The origin of the lateral collateral ligamentous complex from the lateral epicondyle was not disturbed. The exposure is extended distally between the anconeus and the extensor carpi ulnaris. Keeping the forearm pronated the extensor carpi ulnaris is elevated anteriorly. Fracture stabilization was done with a 4mm partially threaded AO cancellous screws inserted in posterior- to- anterior direction (Figs. 2A and 2B) in all cases. Postoperatively, an above elbow posterior plaster splint was applied with the elbow at 90 degree flexion and the forearm in neutral rotation. Three weeks postoperatively, the plaster splint and sutures were removed; active and passive range of motion of the elbow and forearm was started.

RESULTS

Two patients were female and 2 were male. All patients were available for a minimum of 5 months of follow-up. The average age in the present series was 29.5 years (range, 18-40) and the average follow-up period was 6 months (range, 5-7). The mean time from injury to internal fixation was 12 days (range, 3-21). All injuries were the result of trauma (fall/RTA) and the nondominant side was affected 75% (3/4) cases. The most common mechanism of injury was a ground level fall (Table 3). All four fractures united and patients obtained a full return range of motion when compared to the uninjured contra lateral side. One patient, case 3, had a residual 10^0 extension lag but had otherwise obtained a full return of range of motion.



Fig-3a: *X-ray; Type-I capitellum fracture*



Fig-3b: *Per operative, reduction & fixation.*



Fig-3c: *X-ray showing after 6 months of fixation*



Fig-3d: *Full flexion and extension of elbow (L) 1 months later of operation*

Table-III

Data collection of the patients

Sr No	Age/Sex/Side	Mode of Injury	f/u(m)	Functional Results.
1	18/F/L	Ground Level Fall	7	Excellent
2	32/M/L	Ground Level Fall	6	Good
3	40/F/R	RTA	6	Excellent
4	28/M/L	Ground Level Fall	5	Good

F- Female; M-Male; L-Left; R-Right; RTA-Road Traffic Accident; f/u-follow-up; m-months.

DISCUSSION

Capitellum fractures are seen with greater frequency in females than in males; this is thought to be secondary to a greater carrying angle and an increased possibility of osteoporosis in females. Capitellum fractures may be associated with soft-tissue injuries (e.g., medial collateral ligament tears or lateral ligamentous complex tears) and/or other fractures (20% with radial head fracture).[15,23] Proper visualization of the capitellum fragment is sometimes not possible in the routine views of the elbow. Properly positioned lateral view is essential for diagnosis, A comparative view of the opposite elbow or CT scan will help in diagnosis. Displaced capitellum and trochlear fractures invariably lead to poor clinical outcomes if left untreated.[19] The bony fragments usually displace superiorly and may unite to the anterior humerus. This can cause a mechanical block to elbow flexion by obstructing the radial and/or coronoid fossa. The articular step-off created by the displaced fragment also predisposes the joint to the subsequent development of post-traumatic arthritis. [20] Treatment strategies for these injuries have evolved over time from conservative management to open surgical approaches. While favorable outcomes have been reported with cast immobilization, this treatment is not routinely advocated because of the inherent difficulties with maintenance of the reduction in a cast. [21] Surgical interventions have included both simple excision of the fragment and internal fixation. Although simple excision is straightforward and has been associated with favorable functional outcomes, excision of the capitellum can lead to contracture and instability. [15,19,22]

Currently, open reduction and internal fixation are regarded as the preferred method for treating this injuries.[3,9,11,12,13,17,18] Due to rarity of these fractures; it has been difficult to formulate a universally accepted method of fixation. Various internal fixation methods have been described; including K wires, 4 mm cancellous screws, Herbert screws and absorbable polyglycide pins. Kirschner wires do not provide enough stability for mobilization before fracture healing and also damage the articular cartilage. Headless screws can have problems if the patients develop AVN or chondrolysis, because erosion of the radial head is a possibility due to exposed implants. This problem is avoided by the 4 mm partially threaded screws, which could be easily removed through stab incisions. Articular damage is thought to be the reason for residual extensor lag in spite of anatomical reduction and early mobilization; when use the screw anterior to posterior.

CONCLUSION

Type I Isolated capitellum fracture is less due to rarity of the injury. The results of type I capitellum fracture fixation with partially threaded AO cancellous screw (4mm) through extended lateral Kocher's approach has given good results. Accurate anatomical reduction, rigid internal fixation & early mobilization give excellent results. Limitation of this study were sample size is small and no long term follow-up to document post-traumatic arthritis & AVN.

REFERENCES

1. Bryan RS, Morrey BF. Fractures of the distal humerus. In: Morrey BF, editor. The elbow and its disorders. Philadelphia: WB Saunders; 1985. 325-33.
2. Lane JM, Serota AC, Raphael B. Osteoporosis: Differences and similarities in male and female patients. Orthop Clin North Am 2006;37: 601-9.
3. Elkowitz SJ , Polatsch DB , Egol KA , Kummer FJ , Koval KJ : Capitellums fractures a biomechanical evaluation of three fixation methods. J orthop Trauma 2002;16:503-6.
4. McKee MD , Jupiter JB , Bamberger HB , Coronal shear fractures of the distal end of the humerus. J Bone joint surg Am 1996;78:49-54.
5. Christopher F, Bushnell LF. Conservative treatment of fractures of the capitellum. J Bone Joint Surg. 1935;17: 489-92.

6. Ma YZ, Zheng CB, Zhou TL, Yeh YC. Percutaneous probe reduction of frontal fractures of the humeral capitellum. Clin Orthop Relat Res. 1984;183:17-21.

7. Ochner RS, Bloom H, Palumbo RC, Coyle MP. Closed reduction of coronal fractures of the capitellum. J Trauma. 1996; 40:199-203.

8. Fowles JV, Kassab MT. Fracture of the capitulum humeri: treatment by excision. J Bone Joint Surg Am. 1974;56: 794-8.

9. Liberman N, Katz T, Howard CB, Nyska M. Fixation of capitellar fractures with the Herbert screw. Arch Orthop Trauma Surg. 1991;110:155-7.

10. Mosheiff R, Liebergall M, Elyashuv O, Mattan Y, Segal D. Surgical treatment of fractures of the capitellum in adults: a modified technique. J Orthop Trauma. 1991;5:297-300.

11. Poynton AR, Kelly IP, O'Rourke SK. Fractures of the capitellum—a comparison of two fixation methods. Injury. 1998;29:341-3.

12. Silveri CP, Corso SJ, Roofeh J. Herbert screw fixation of a capitellum fracture. A case report and review. Clin Orthop Relat Res. 1994;300:123-6.

13. Simpson LA, Richards RR. Internal fixation of a capitellar fracture using Herbert screws. A case report. Clin Orthop Relat Res. 1986;209:166-8.

14. Jakobsson A. Fracture of the capitellum of the humerus in adults; treatment with intra-articular chrom-cobalt-molybdenum prosthesis. Acta Orthop Scand. 1957;26: 184-90.

15. Grantham SA, Norris TR, Bush DC. Isolated fracture of the humeral capitellum. Clin Orthop Relat Res. 1981;161:262–9.

16. Stamatis E, Paxinos O. The treatment and functional outcome of type IV coronal shear fractures of the distal humerus: a retrospective review of five cases. J Orthop Trauma. 2003;17:279-84.

17. Mahirogullari M, Kiral A, Solakoglu C, Pehlivan O, Akmaz I, Rodop O. Treatment of fractures of the humeral capitellum using Herbert screws. J Hand Surg Br. 2006;31:320-5.

18. Mighell MA, Harkins D, Klein D, Schneider S, Frankle M. Technique for internal fixation of capitellum and lateral trochlea fractures. J Orthop Trauma. 2006;20:699-704.

19. Alvarez E, Patel MR, Nimberg G, Pearlman HS. Fracture of the capitulum humeri. J Bone Joint Surg Am 1975;57:1093-6

20. Guitton TG, Doornberg JN, Raaymakers EL, Ring D, Kloen P. Fractures of the capitellum and trochlea. J Bone Joint Surg Am 2009;91:390-7.

21. Ochner RS, Bloom H, Palumbo RC, Coyle MP. Closed reduction of coronal fractures of the capitellum. J Trauma 1996;40:199-203.

22. Fowles JV, Kassab MT. Fracture of the capitulum humeri: Treatment by excision. J Bone Joint Surg Am 1974;56: 794-8.

23. Nalbantoglu U, Gereli A, Kocaoglu B, Aktas S, Turkmen M. Capitellar cartilage injuries concomitant with radial head fractures. J Hand Surg Am. 2008;33(9):1602-7.

Original Article

Comparison of Functional Outcome of Fixation of Unstable Intertrochanteric Fracture with Proximal Femoral Locking Compression Plate (PF-LCP) and Dynamic Condylar Screw (DCS)

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Abstract

Unstable intertrochanteric fracture fixation is always a challenge in orthopaedic surgery in which there is comminution of greater trochanter and there is no contact between proximal and distal fragment because of displaced posteromedial fragment. It commonly occurs in elderly population in which the bone is osteoporotic. Although many fixation methods are available, a better fixation method in these cases can bring a good outcome.

This randomized clinical trial was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh from January 2011 to December 2012 to compare the functional outcome between fixation of unstable intertrochanteric fracture with proximal femoral locking compression plate (PF-LCP) and dynamic condylar screw (DCS). Twenty adult patients of both sexes were included in the study. Ten patients were treated by fixation with PF-LCP (Experimental group) and ten patients with DCS (Control group). Followups were carried out after 4, 12 and 24 weeks of operation. Functional outcome was observed according to Harris Hip Score.

All the patients of PF-LCP group had excellent (score 100-90) outcome compared to 50% in DCS group. Two of the DCS patients had good (89-80) and three had fair score (79-70). This difference is statistically significant ($p<0.05$).

The functional outcome of fixation of unstable intertrochanteric fracture with PF-LCP is better than with DCS.

Key words: Unstable intertrochanteric fracture, Proximal femoral locking compression plate (PF-LCP), Dynamic condylar screw (DCS).

INTRODUCTION:

Most intertrochanteric femoral fractures occur in patients older than 70 years old and the commonest cause is fall (about 90%)[3]. In younger patient these fractures usually result form high energy trauma. Unstable intertrochanteric fracture fixation is always a challenge in orthopaedic surgery. In these fractures there is comminution of greater trochanter and there is no contact between proximal and distal fragment because of displaced posteromedial fragment. Intertrochanteric hip fractures account for approximately half of the hip fractures in the elderly; out of this more than 50% fractures are unstable. Unstable pattern occur more commonly with increased age and with low bone mineral density[1]. Although many fixation

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methods are available including dynamic hip screw (DHS), dynamic condylar screw (DCS) and proximal femoral nail (PFN), a better fixation method in these cases can bring a good outcome. The recently introduced proximal femoral locking compression plate (PF-LCP; Synthes)[4] is an innovative and viable option for stable fixation of complex proximal femur fractures[2].

MATERIALS AND METHODS:

This randomized clinical trial was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh from January 2011 to December 2012 to assess the functional outcome of fixation with proximal femoral locking compression plate (PF-LCP) and dynamic condylar screw (DCS) in the treatment of unstable intertrochanteric fracture. Twenty adult patients of both sexes were consecutively included in the study and randomized by lottery. Variables of interest were recorded in a structured data collection form. Ten patients were treated by fixation with PF-LCP (Experimental group) and ten patients with DCS (Control group). Followups were carried out after 4, 12 and 24 weeks of operation. Data were processed and analysed using SPSS. Functional outcome was observed according to Harris Hip Score.

RESULTS:

A total of 20 patients with trochanteric fractures (10 patients in DCS group and another 10 patients in PF-LCP group) included in the study to compare the outcome of fixation between unstable intertrochanteric fracture with dynamic condylar screw and proximal femoral locking compression plate.



Fig.-1: *Preoperative view of left trochanteric fracture*



Fig.-2: *24 weeks after operation fixed with PF-LCP*



Fig.-3: *The patient can stand and stair up without railing after 24 weeks*



Fig.-4:*The patient can sit comfortably after 24 weeks*



Fig.-5: *Preoperative view of left trochanteric fracture.*

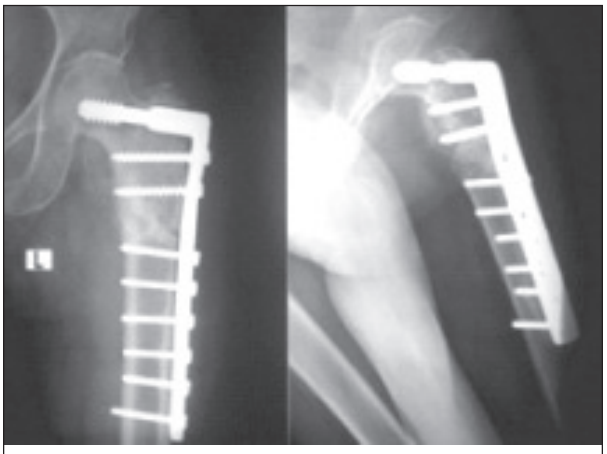


Fig.-6: *24 weeks after operation fixed with DCS.*



Fig.-7: *The patient can stand 24 weeks after operation, but needs walking aid.*



Fig.-8: *The patient can sit on a chair with some difficulty 24 weeks after operation.*

Age distribution:

Table-I

Age distribution of patients between two groups (n=20)

Age (years)	Group		p-value
	DCS	PF-LCP	
	(n = 10)	(n = 10)	
< 50	5(50.0)	5(50.0)	p > 0.05
> 50	5(50.0)	5(50.0)	
Mean ± SD	47.3 ± 10.03	47.2 ± 10.80	

In both groups 50% patients were more than 50 years and 50% were less than 50 years and mean age were 47.3 ± 10.03 SD years in DCS group and 47.2 ± 10.80 in PF-LCP group (Table-I)

Sex and occupation:

Male patients were predominant in the both groups (70% in DCS group, and 80% in PF-LCP group) than that in female (30% in DCS group, and 20% in PF-LCP group). The distribution of occupations (service holder, housewives, labour, businessman and farmer) were comparable in both groups.

Injury profile:

The causes of injury were accident at home (about 50% in both groups), RTA and fall from height with equal distribution to right and left trochanter.

Management of fracture:

Time required for operation was 79.5 ± 10.6 SD minutes in DCS group and 95.0 ± 4.7 SD minutes in PF-LCP group. All patients required intraoperative blood transfusion but postoperative blood transfusions were needed in 7 patients (70%) in DCS group and 4 patients (40%) in PF-LCP group.

Status of union at 3rd follow up (at week 24):

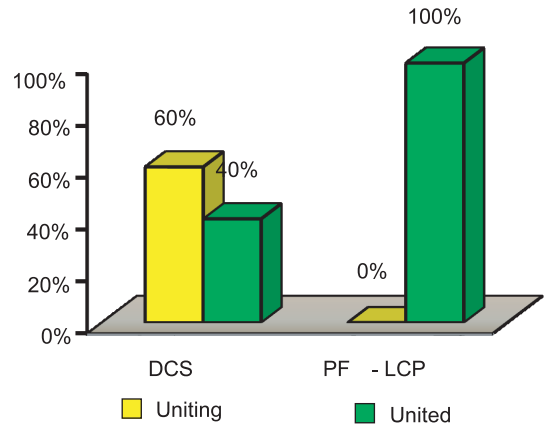


Chart-I : *Status of union at week 24 (n=20)*

Follow up at different time interval:

Table-II

Follow up at week 4, at week 12 and at week 24 (n=20)

Follow up	Group		p-value
	DCS (n = 10)	PF-LCP (n = 10)	
1st follow up (at week 4)			
Infection	00	00	-
Pain			
No pain	1(10.0)	7(70.0)	p < 0.05
Mild	5(50.0)	3(30.0)	
Moderate	4(40.0)	00	
Fracture alignment (intact)	10(100.0)	10(100.0)	-
Visible callus	3(30.0)	10(100.0)	p < 0.005
Positioning of screw (intact)	10(100.0)	10(100.0)	-
2nd follow up (at week 12)			
Infection	1(10.0)	00	p > 0.05
Pain			
No pain	6(60.0)	10(100.0)	p < 0.05
Mild	2(20.0)	00	
Moderate	2(20.0)	00	
Fracture alignment (intact)	10(100.0)	10(100.0)	-
Visible callus	10(100.0)	10(100.0)	-
Positioning of screw (intact)	10(100.0)	10(100.0)	-
3rd follow up (at week 24)			
Infection	2(20.0)	00	p > 0.05
Pain			p > 0.05
No pain	6(60.0)	10(100.0)	
Mild	4(40.0)	00	
Fracture alignment (intact)	10(100.0)	10(100.0)	-
Visible callus	10(100.0)	10(100.0)	-
Positioning of screw (intact)	9(90.0)	10(100.0)	p > 0.05

Range of motion at 3rd follow up (at week 24):

Table-III

Range of motion at week 24 (n=20)

Range of motion	Group		p-value
	DCS (n = 10)	PF-LCP (n = 10)	
Hip flexion (degree)	122.0 ± 12.1	139.0 ± 2.1	p < 0.001
Hip internal rotation (degree)	21.0 ± 5.2	37.0 ± 6.7	p < 0.001
Hip external rotation (degree)	36.5 ± 5.8	42.0 ± 3.5	p < 0.05
Hip adduction (degree)	18.0 ± 4.2	31.0 ± 5.7	p < 0.001
Hip abduction (degree)	27.0 ± 4.2	42.0 ± 2.6	p < 0.001
Knee flexion (degree)	102.5 ± 13.0	142.5 ± 6.3	p < 0.001

Harris Hip Score:

Table-IV
Comparison of Harris Hip Score between two groups (n=20)

Harris Hip Score	Group		p-value
	DCS (n = 10)	PF-LCP (n = 10)	
100 – 90 (Excellent)	5(50.0)	10(100.0)	
89 – 80 (Good)	2(20.0)	00	p < 0.05
79 – 70 (Fair)	3(30.0)	00	

p value was less than 0.05 and the result was significant.

DISCUSSION:

Some of the findings of the study presented in the earlier section needs to be compared and contrasted to come to a conclusion. The age distribution of the patients was identical between the groups with mean age of the patients being 47.3 ± 10.03 and 47.2 ± 10.80 years in DCS and PF-LCP groups respectively (p > 0.05). Males were predominant in both groups (70% in DCS group, and 80% in PF-LCP group). In both groups fractures were primarily caused by accident at home (60% in DCS and 40% in PF-LCP) (p > 0.05). The average time interval between injury and operation were comparable between PF-LCP and DCS groups (12.2 ± 6.8 vs. 11.8 ± 5.8 days, p > 0.05). All patients of either group required open surgical procedure and received transfusion of blood during operation. DCS required shorter operation time than that required by PF-LCP (79.5 ± 10.6 vs. 95.0 ± 4.7 min, p <0.001).

At 24 weeks followup 40% patients in DCS group had mild pain and total two patients in the in DCS group had infection at operative site and one of them ultimately required removal of implant (Figure-9). Sixty percent of patients in DCS group at 24 weeks of follow up exhibited fractures in a state of uniting, while all of the PF-LCP patients had their fractures united by. All the patients of PF-LCP group had excellent (score 100 – 90) outcome in terms of Harris Hip score compared to 50% in DCS group (p < 0.05). Two (20%) of the DCS patients had good (89 – 80) and three (30%) had fair score (79 – 70).

The union rate of PF-LCP was 100% at 24 weeks in this study as compared to 98% in 6 months in the study of Zha et al.[5] He reported some failure rate as nonunion, breakage of implant and technical complications. The reported complication rate of fixation of intertrochanteric unstable fracture with DCS ranges from 3% - 15%[2]. This study also showed higher complications in DCS group with significantly lower functional outcome.



Fig-9: *Operative site photograph and radiograph after removal of implant in a patient in DCS group who had deep infection at 12 weeks.*

The proximal femoral locking compression plate (PF-LCP) has certain advantages over dynamic condylar screw:

1. The proximal femoral locking compression plate (PF-LCP) provide multiplanar fixation of the proximal femur.
2. An anatomic contour that allows the implant to be used as reduction aids.
3. Complete avoidance of abductor devitalization, and
4. The applicability of the all fractures of the proximal femur.

CONCLUSION:

In the light of the findings of the present study, it can be concluded that patients of trochanteric fracture fixed by proximal femoral locking compression plate (PF-LCP) usually remain free from postoperative pain and infection, enjoys 100% fracture union by 24 weeks of postoperative follow up, while the patients fixed with dynamic condylar screw (DCS) became free from pain after 24 weeks of intervention, infection rate is no less and a substantial proportion of the fractures remain at a stage of uniting

even after 24 weeks of intervention . The patients fixed with PF LCP also enjoy wide range of hip and knee movements by 24 weeks of postoperative period, but the patients of DCS do not enjoy the same advantage. So, PF-LCP can be considered as a rational choice in the treatment of complex unstable intertrochanteric fracture of femur.

REFERENCES

1. Babhulkar, S.S., 2006. Management of trochanteric Fractures, *Indian journal of orthopaedics,* 40(4), pp 210-218.

2. Hasenboehler, E.A., Agudelo, J.F., Morgan, S.J., Smith, W.R., Hak D.J. and Stahel, P.F., 2007. Treatment of complex proximal femoral fractures with the proximal femur locking compression plate. *Orthopedics*, vol. 30, no. 8, pp. 618-623

3. Lavelle, D.G., 2008, Fractures and dislocations of the hip. In: S.T. Canale and J.H. Beaty, eds. 2008. *Campbell's Operative Orthopaedics*, Volume 3: 11th ed., Philadelphia PA: Mosby Elsevier, Ch.52. pp. 3237-3308.

4. Synthes, 2007. *LCP Proximal Femoral Plate 4.5/5.0.: Technique Guide.* [pdf] Oberdorf. Available at: <http://synthes.vo.llnwd.net/o16/Mobile/Synthes%20International/KYO/ Trauma/PDFs/036.000.403.pdf> [Accessed 20 April 2012]

5. Zha GC, Chen ZL, Qi, X.B. and Sun, J.Y., 2011. Treatment of pertrochanteric fractures with a proximal femur locking compression plate. *Injury*, 42, pp. 1294–1299.

Original Article

Comparative Study Between Arthroscopic Assisted Anterior Cruciate Ligament Reconstruction by Bone Patellar Tendon Bone (BPTB) and Quadrupled Semitendinosus Graft for Chronic Anterior Cruciate Ligament in injury

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Abstract

Rupture of ACL is a common sports injury, which often markedly reduces athletic activity and the quality of life. Loss of the function of ACL following injury with or without menisci leads to instability of the joint and subsequent degenerative changes. The bone patellar tendon bone graft (BPTB) and hamstring tendon graft are commonly used graft material for arthoscopically assisted anterior cruciate ligament reconstruction. The choice of graft material for ACL reconstruction is believe to play a major role in outcome but still there are controversies about graft selection for primary ACL reconstruction.

Prospective study. From July 2007 to June 2009, 16 patients were included in this prospective study. Each group consists of 8 patients and they were selected according to their wish after proper counseling regarding advantages and disadvantages of the methods. All patients were operated in similar surgical set up, rehabilitated by similar rehabilitation protocol and followed for six months.

Median, post operative thigh atrophy (22.5 mm) was higher than the median pre-operative thigh atrophy (18.5 mm) in BPTB group. In hamstring group the median post operative thigh atrophy (24.0 mm) was also slightly higher than the median pre-operative thigh atrophy (22.5 mm). So, none of the operation showed to achieve significant improvement in thigh atrophy at six months. Post operativeflexion deficit was more in hamstring group and extension deficit was in BPTB group. Loss of sensation at the lateral aspect of tibial incision site was found in 75% cases in hamstring group but in BPTB group had only 37.5%. Irritation at tibial AO fixation post site was present in 50% cases of hamstring group. Kneeling pain and patello-femoral pain were predominant in BPTB group.Osteoarthritic changes of knee develop in 75% patients of BPTB and a bit higher 87.5% in hamstring group. No tunnel widening was seen in BPTB group but 50% patient developed tunnel widening in hamstring group. Both group had significant improvement of Lysholm score after operation.

Both BPTB and Hamstring tendon grafts provided good subjective and objective stability. Statistically no significant differences were noted in terms of final outcome between study groups.

INTRODUCTION

The knee is a mechanically complex joint and depends primarily on soft tissue for stability, this joint oscillates through a large range of motion and supports high forces at tibio-femoral and patello femoral articulation Due to its capsule, intra and extra articular ligaments and controlling muscles the knee is able to function effectively as a mechanism of support, balance and thrust.

The bony structure of the knee joint is inherently unstable. The ligaments along with menisci of the knee function together to maintain the kinematics of the knee joint

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through out the range of motion. Anterior cruciate ligament is the primary structure to prevent anterior tibial displacement.

Histologically ACL composed of longitudinal bands of collagen fibers arranged in fascicular subunit within larger functional bands. Grigis, Marseall and Al-Monajin described the ACL has two bundled ligament that includes small anteromedial band which become taught during flexion and act as primary resistance to anterior tibial translation and larger posterolateral band prevents hyperextension.

The cruciate ligament provide both anterior-posterior and rotational stability. They also help to resist excessive valgus or varus angulation. Injury of these ligamentare common, particularly in sporting pursuits but also in road traffic accident where they may be associated with fractures or dislocation. ACL tears accounted for approximately 50% of ligament injuries, making it most frequently injured knee ligament during sporting activities and particularly involve the sporting pursuits. The greater participation in sporting and recreational activity by the general population continuous to expose more individual to a risk of ACL rupture.They very in severity from a simple sprain to complete rupture.

Chronic ACL rupture may be divided as isolated or combined. True isolated injury is rare because associated meniscal injury and cartilage damage are frequently caused by the original trauma or by subsequent episode of giving way. Although some patient functions exceptionally very well with an ACL - deficient knee, but most patients experience pain and recurrent episode of instability. In ACL- deficient knee the menisci, articular cartilage and other restraining structures around the knee are highly susceptible to injury during instability.

About 71 % of medial meniscal tear and 27 % of lateral meniscil tear present with ACL injury. As a result of abnormal loading and shear stress in the ACL deficient knee, the risk of late meniscal injury is high and appears to increases with time from the initial injury. Most of the late meniscal tear occurred in the medial meniscus because of its firm attachment to the capsule.

ACL reconstruction has become one of the most popular orthopedic operations because of the increasing number of people of all age with a desire to be active in sports. The increase accuracy of diagnosis of an ACL lesion and the improvement in techniques and results of ACL reconstruction that seem to offer the patient a good opportunity to return to their desired activity level.

Numerous methods for reconstructing the ligaments exist, including the use of patellar tendon auto graft, hamstring tendons, gracilis tendon and allograft material. Among available autograft the HTs tendons and the central part of the BPTB are the most commonly used by surgeon. Recently many surgeons have turned to autgenous semitendinosus tendon graft for ACL reconstruction due to the morbidity associated with patellar tendon graft. Study shows four stranded hamstring graft has stiffness nearly three times than normal ACL and four times than patellar tendon auto graft and another biggest advantage is preservation of normal extensor mechanism, but the long term result is not as patellar tendon auto graft regarding its laxity and another disadvantage is fixation of hamstring graft and delayed bony incorporation.

Significant advances in arthroscopic techniques have led to wide spread performance of arthoscopically assisted ACL reconstruction. Properly performed reconstruction has provided to be successful clinically. The surgeons who perform ACL reconstruction must be familiar with techniques for both autograft hamstring and bone patellar tendon bone ACL reconstruction for ACL deficient knee. The arthroscopic techniques allow sccessful treatment of most of ACL deficient knee. Arthrooscopic ACL reconstruction is a highly demanding procedure, with the possible risk of significant knee disability if the ACL graft is placed improperly. Proper patient selection, surgical technique and post operative rehabilitation remain the foundation for successful ACL reconstruction. A statistical survey was carried out at NITOR, Dhaka during July 2007 to June 2009 over the patients of ACL insufficiency diagnosed on the basis of presenting complaints, clinical examination and investigations. Effort was made in this work to extract certain relevant facts in connection with ACL insufficiency and mode of their management and finally to evaluate the comparative outcome between different modalities of ACL reconstruction with the hope that it will impart us a better understanding for further treatment of this particular injury.

PATIENTS AND METHODS:

It is a Prospective study fromJuly 2007 to June 2009 at National Institute of Traumatology &Orthopaedic Rehabilitation, Dhaka. The male patients had chronic ACL injury diagnosed on the basis of presenting complaints, clinical examination and investigations, aged between 20 to 30 years who were admitted in NITOR, Dhaka during the study period were selected for the study.The modalities of the treatment were discussed with the patient with their merits and demerits. The follow up and

rehabilitation protocol were also explained to the patients. Those who accepted these were included in this study. Patients were grouped in BPTB and ST/G according to their wish after proper counseling regarding advantages and disadvantages of those treatment modalities. Total 16 patients, each group consists of 8 patients, whom were under gone for operation during the study period and fulfilled the enrolment criteria.

SURGICAL PROCEDURE:

ACL reconstruction were performed by quadrupled semitendinosus graft using endo-button and tibial AO fixation post for one group and bone patellar tendon bone graft fixed with interference screw for another group. Prior definitive procedure, through arthroscopic examination was carried on through standard anterolateral and anteromedial portals using 4mm 30 degree oblique fore lens arthroscope. The preoperative diagnosis was confirmed and associated pathologies were detected. Associated meniscal injury was treated by partial meniscectomy and collateral ligaments are managed conservatively.

GRAFT HARVESTING AND PREPARATION:

1) Quadrupled semitendinosus graft:

Skin Incision:

A 2 to 3cm oblique incision is made directly over the pesanserinus, 1cm medial to the tibial tubercle and 5 cm bellow the joint line. Plan is to harvest the graft and drill the tibial tunnel through this incision. Incise the subcutaneous fat and strip the subcutaneous tissue from the pes.

Exposure of the tendon:

Identify the superior border of the pes with finger. The tendon can be rolled under finger. Incise the fascia along the upper border. Continue the incision medially, like a hockey stick fashion, aim is to remove the attachment of tendon. A Kocher forceps is used to retract the flap. The flap of the pes is turned down to expose the conjoined tendons of the gracilis and semitendinosus. Look for the most inferior tendon, the semitendinosus and lift it up with the tip of the scissors and grasp with the kocher forceps.

Tendon Release:

Freed the distal end of the tendon with the scissors. Make sure to achieve the full length distally. Grasp it with kocher forceps and traction was applied firmly. Many of the bands can be released with the traction and freed by blunt finger dissection.

Stripping of the tendon:

The tendon stripper is pushed up along the course of the tendon. Using short, sharp stokes while maintaining distal tension with the clamp. The key is to keep tension on the distal end, to prevent the tendon from folding over and being with off short. The total length is usually 28 to 32 cm.

Preparation of the graft:

The graft is taken to the graft master on the back table. It is laid out, measured and the muscles were removed with periosteal elevator. Tendon is cut to an equal two halves and again each half in folder over. Sutures of 2 Ti-con (Krakow's technique) are placed through the distal ends of all the tendons. All the four tendons were tied together with multiple 2/0 vicryl ties about 1cm apart each. The overall length is 8-9 cm. A mark was made with a sterile skin pen 3 cm from looped end, to determine the depth of graft in to the femoral tunnel. The graft was covered with moist gauze.

Graft sizing:

The size of the composite graft is measured and that's are usually about 7 cm to 8 cm long and 8mm to 9mm in diameter.

Graft tensioning:

The graft was pre tensioned by tying the sutures over the posts on the graft master; 15 pound is applied for 15 minutes to allow the sutures to settle into the tendon. It obviously stretches the tendon before it is implanted. This four-bundle graft will be four times the strength of a single strand of semitendinosus, as long as all bundles are tensioned.

2) Bone patellar tendon bone graft

Skin Incision:

The patella and tibialtuberocity landmarks were drawn on the skin, and a vertical incision is made from about 3cm proximal to lower pole of the patella to 2 cm bellow the tibialtuberocity and extended medially. Skin flaps are developed to identify the full width of the tendon. The paratendon was incised in the same line of skin incision and the patellar tendon was isolated.

Graft harvesting:

With the knee flexed 45 degree the central third of patellar tendon was cut longitudinally through its whole length using a double edged knife (10-mm catamaran blade) taking care not to cut or injury the fibers attached with patella and tibialtuberocity. The incision is carried 25 mm

proximally over the patella and 25mm distally over the tibialtuberocity. A small oscillating saw is used to cut the bone plugs to a depth of approximately 8-9 mm, and the bone plugs were carefully detached using a curve osteotom.

Graft preparation:

The bony edges of the graft were trimmed using a small nibbler to enable smooth passage through appropriate sized tunnels. Two holes perpendicular to each other were drilled on both tibial and patellar bony plug using a 2mm K wair or drill bit. A no 5 ethibond suture was threaded through each hole. The retropatellar fat was dissected off from the tendinous portion using Mayo scissors. The bone tendon junction on the femoral side of the graft was marked by a sterile marker pen.

Graft sizing:

The length of the graft and plugs were measured accurately and covered with moist gauze.

Graft tensioning:

The graft was pre tensioned by tying the sutures over the posts on the graft master; 15 pound is applied for 15 minutes. It obviously stretches the tendon before it is implanted.

Notch preparation:

The ligamentummucosum was excised together with all soft tissue on the lateral wall of intercondylar notch. Most of the remaining ACL tissue was removed except the tibial stump, because it was believed to enable proprioceptive function. (Watson & Haddad, 2006.)

Notch plasty:

Notch plasty was performed only in case of stenosed notches of less than 20 mm or when over the top position was not visualized.

Tunnel preparation:

1.Tibial Tunnel:

An ACL tibial jig's hook was positioned via the anteromedial portal. The internal landmarks of hook were 7 mm anterior to the PCL and in the middle of the intracondylar notch in the coronal plan. The cannulated guide of the jig was positioned at 55 degrees for semitendinosus group and 55, 60 and 45-50 degree for 35-40 mm, 40-55 mm and >55 mm length of BPTB graft respectively (Phillips, n.d.). Then the guide was pressed against the tibial cortex 1.5 cm medial to the tuberocity and 1 cm proximal to the pesanserinas tendons. A guide pin was drilled and observed arthroscopically as it enters the mentioned site on the intercondylar region. An adjusted sized reamer was used to prepare the tunnel over the guide pin, the length of the tibial tunnel was usually 4 cm.

2. Femoral Tunnel:

The tibial tunnel is used to drill the femoral tunnel. A femoral offset guide (bull's eye offset guide) was used to positioned the guide pin 7 mm anterior to the over the top position. Advance a 2.7 mm, 15 inch drill-tip through the tibial tunnel and brought out through the anterolateral femoral cortex mentaining the knee at approximately 90 degrees of flexion. The guide should aim toward the 11 o'clock for right and 1 o'clock for left knee. A 9mm reamer was used to create a foot print prior to final reaming. The foot print was confirmed to be 2.5 mm anterior to over the top position to prevent posterior blow out. The tunnel was drilled initially with a 6 mm reamer for the semitendinosus but an adjusted sized reamer was used to prepare the tunnel over the guide pin for BPTB graft. The length or depth of the femoral tunnel will be about 4 - 4.5 cm.

3. Tunnel Dilation (For Quadrupled semitendinosus graft):

The depth of tunnel will be measured by a calibrated depth probe and then the distal 2.5 - 3.0 cm of the tunnel will be over reamed by an adjusted sized reamer over the guide pin.

Graft placement and fixation

1. Quadrupled semitendinosus graft:

Secure no.5 polyester suture loop to the endo-button and the loop end of quadrupled graft. Subtract the length of the graft to be recessed in the tunnel (usually 20 mm) from the total femoral tunnel length (obtained from the calibrated depth probe) to obtained the appropriate length of the loop. Use a marker to make a circle 3 cm from each end of the graft. Place a no.5 non absorbable polyester suture in one end of the endo-button and a no.2 non absorbable suture in the opposite end. The no.5 non absorbable polyester suture was sated with the suture passing pin (beath pin) and the beath pin along with endo-button-graft complex was passed through the tibial tunnel into the femoal tunnel and the suture passing pin passing out through anterolateral skin of the distal thigh. When the mark on the graft enters the mouth of the femoral tunnel,

pull the no.2 suture to rotate the button into place. When the endo button deployed at the outer femoral cortex the graft was pulled back to confirm deployment of the button. Pull the graft taut and move the knee through a range of motion to ensure that no impingement or to prevent excessive graft positioning within the femoral tunnel. Maintain 8 to 10 lbs of tension for 3 minutes. The tibial site is fixed with sutures to the post technique at knee full extension. (AO fixation post -4.5 mm cortical screw and washer.)

2. Bone patellar tendon bone graft:

A suture passing pin (beath pin) was passed through the tibial tunnel into the femoal tunnel to exit through the anterolateral skin of the thigh. The graft was threaded through this beath pin with the patellar plug up. The beath pin was withdrawn from the femoral side by gentle hammering the plug was settled in the femoral tunnel. A 2mm kirschner's wire was placed into the femoral tunnel along the cortical surface of the graft at 110-120 degree knee flexion. An interference screw was threaded over it arthroscopically to fix the graft. The knee was cycled of flexion extension 5-10 times while applying tension to the tibial block to pretension the graft at the time of final fixation. The tibial site was fixed at knee full extension using 9mm interference screw.

Wound closure and dressing

The tourniquet was removed, wounds were closed in layers. Light sterile adhesive dressing was placed to cover the wounds and Jon's bandage was applied to prevent knee swelling.

Post operative management

After operation all patients were kept under observation in the post operative ward for next 24 hours. Proper fluid, electrolyte and haemodynamic balance were taken in consideration. Adequate analgesics and sedation were ensured by injection pathedine and diclofenac I/M as per need. Injectable antibiotic were continued for 72 hours post operatively. Limb was kept elevated.

First post operative day:

The patient was allowed to sit on the bed as directed by the comfort of the patient. Isometric quadriceps exercise was started, breathing exercise was also ensured. Plain anteroposterior and lateral X- ray of knee joint were obtained to analyze the position of fixation post, interference screw, endo button, joint spaces, articular surfaces of tibia, femur and patella.

Second post operative day

The patient was allowed to non weight bearing crutch walking & continued the isometric quadriceps exercise.

Third post operative day and onward The bulky bandage was removed keeping the adhesive dressing in situe. Patellar mobilization exercise was started along with isometric quadriceps exercise. A PROM brace was applied at 0-90 degree and the patient was asked to flex the knee. Non weight bearing crutch walking was continued. Wounds were checked on **fifth post operative day** and stitches were removed on **14th post operative day**. On discharge all patients were advised for physiotherapy / exercise as per the rehabilitation protocol (Appendix-V)and to come again for follow up.

Rehabilitation

The goal of rehabilitation after ACL surgery is to restore normal joint motion and strength while protecting the ligament graft. Appropriate rehabilitation is crucial to the success of ACL reconstruction. Some stress to the graft is desirable for healing and remodeling but should not be excessive and disruptive. Current evidence indicates that intensive rehabilitation can help to prevent early arthrofibrosis and restore strength and functions earlier.

All the patients were rehabilitatated on the basis of accelerated ACL reconstruction rehabilitation protocol.

Follow up

All patients were evaluated both clinically and radio logically during follow up.

1st follow up: After 2 weeks.

2nd follow up: After 6 weeks.

3rd follow up: After 18 weeks.

4th follow up: After 6 months.

RESULTS

The present clinical study was carried out between July 2007 to June 2009, at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka. A total of 17 patients were selected for the clinical study. Among the 17 patients one patient of BPTB group was lost from follow-up.Soremaining 16 patients, 8 patients of each group were finally available for evaluation. All these patients were followed up for 6 months.

Table - I: Shoes difference between demographic data of both groups.Meanage of the patients of BPTB group was 23.7 ± 3.15 years and ST/G group was 25.00 ± 2.56 years.

Mean duration of symptoms were 20.86 ± 19.35 months and 14.62 ± 8.66 months of BPTB and ST/ G group respectively.Statistically no differences were found regarding age (p=0.42) and duration of symptoms (p=0.55)

Table –II: Demonstrate subjective symptomatic differences.

The patients of both BPTB and ST/G group had post operative pain, swelling and stiffness but no statistically significant differences were noted between the groups. (P>0.05)

Table-III: Describes regarding the donor site symptoms at rest.

In both groups donor site symptoms were present at rest but no statistically significant difference were noted regarding tenderness and Irritation (P> 0.05).Regarding numbness marginally significant statistical difference was found (P=0.05)

Table-I

Demographic data of both groups.

Variable	BPTB(N=8)		ST/G(N=8)		Mann Whitney U	
	Mean	SD	Mean	SD	Z	P - value
Age (mean) years	23.75	3.15	25.00	2.56	1.23	0.423
Duration of symptoms (mean) months	20.86	19.35	14.62	8.66	2.13	0.556

Table-II

Subjective symptoms comparison (Post operative).

Variable		BPTB (N=8)	ST/G (N=8)	Total
Pain	Mild	7(87.5%)	5(62.5%)	12(75.0%)
	Moderate	0(.0%)	2(25.0%)	2(25.0%)
	No pain	1(12.5%)	1(12.5%)	2(12.5%)
Swelling	Mild	4(50.0%)	6(75.0%)	10(62.5%)
	Moderate	0(.0%)	1(12.5%)	1(6.3%)
	No swelling	4(50.0%)	1(12.5%)	5(31.3%)
Stiffness	Mild	4(50.0%)	5(62.5%)	9(56.3%)
	Moderate	1(12.5%)	2(25.0%)	3(18.8%)
	No	3(37.5%)	1(12.5%)	4(25.0%)

Table-III

Donor site symptoms comparison.

		BPTB (N=8)	ST/G(N=8)	Total
Tenderness	Absent	5(62.5%)	6(75.0%)	11(68.8%
	Present	3(37.5%)	2(25.0%)	5(31.3%)
Irritation	Absent	5(62.5%)	4(50.0%)	9(56.3%)
	Present	3 (Variable 37.5%)	4(50.0%)	7(43.8%)
Numbness	Absent	8(100.0%)	5(62.5%)	13(81.3%)
	Present	0(.0%)	3(37.5%)	3(18.8%)

Table – IV: shows the distribution of the patients by Joint line tenderness and effusion for clinical evaluation.

Joint line tenderness and Effusion were found to be similar in both the study groups without significant statistical differences (P>0.05).

Table – V: Shows clinical stability comparison of knee joint on the basis of Lachman test, Anterior drawer test and Pivot shift test.Post operativeLachman test, Anterior drawer test and Pivot shift test of two groups were found to be similar. Statistical test failed to reveal significant difference between the two groups. (P>0.05)

Table -VI: Demonstrate status of thigh atrophy of both groups.

In BPTB group median, post operative thigh atrophy (22.5 mm) was higher than the median pre-operative thigh atrophy (18.5 mm). However the difference was not statistically significant. (P>0.05)In ST/G group median post operative thigh atrophy (24.0 mm) was also slightly higher than the median pre-operative thigh atrophy (22.5 mm). And the difference was also not statistically significant. (P.>0.05)Statistically differences between post operative thigh atrophy of both groups were also insignificant. (P >0.05)

Table – IV

Clinical evaluation of both groups (Post operative).

Variable		BPTB		ST/G	
		Frequency	Percentage	Frequency	Percentage
Joint line tenderness	Non tender	7	87.5	7	87.5
	Tender	1	12.5	1	12.5
	Total	8	100.0	8	100.0
Effusion	Absent	4	50.0	4	50.0
	Mild	4	50.0	3	37.5
	Modarate	0	0	1	12.5
	Total	8	100.0	8	100.0

Table - V

Clinical evaluation for stability of both groups (Post operative).

Clinical Tests with grade		Group	
		BPTB (N=8)	ST/G(N=8)
Lachman test	1+(1-5mm translation)	6(75.0%)	8(100.0%)
	2+(5-10mm translation)	1(12.5%)	0(0.0%)
	Negative	1(12.5%)	0(0.0%))
Anterior drawer test	1+(1-5mm translation)	6(75.0%)	8(100.0%)
	2+ (5-10mm translation)	1(12.5%)	0(0.0%)
	Negative	1(12.5%)	0(0.0%)
Pivot shift test	1+ (slip)	4(50.0%)	3(37.5%)
	2+ (definite movement / Jump)	1(12.5%)	1(12.5%)
	Negative	3(37.5%)	4(50.0%)

Table -VI

Status of thigh atrophy of both groups.

Group	Thigh atrophy	Descriptive statistics				Wilcoxon Test	
		N	Meanmm	SD	Medianmm	Z	P value
BPTB	Pre operative thigh atrophy	8	20.62	9.500	18.50(29)	-.561	0.575
	Post operative thigh atrophy	8	22.87	10.07	22.5 (27)		
ST/G	Pre operative thigh atrophy	8	24.75	7.08	24.0 (20)	-.701	0.483
	Post operative thigh atrophy	8	30.00	17.87	22.5 (55)		

Table - VII

Comparison of range of motion (Post operative).

Range of motion (Post operative)		Group		Total
		BPTB (N=8)	ST/G (N=8)	
Flexion deficit	<5 degree	2(25.0%)	2(25.0%)	4(25.0%)
	5-10 degree	4(50.0%)	5(62.5%)	9(56.3%)
	>10 degree	0(.0%)	1(12.5%)	1(6.3%)
	Negative	2(25.0%)	0(.0%)	2(12.5%)
Extension deficit	<5 degree	2(25.0%)	0(.0%)	2(12.5%)
	5-10 degree	4(50.0%)	2(25.0%)	6(37.5%)
	Negative	2(25.0%)	6(75.0%)	8(50.0%)

Table – VII

Shows comparative evaluation of range of motion.
Post operative flexion deficit of two groups were found to be similar statistically (P>0.05).

Post operativeLysholm score	Operation	N	Mean	SD	t	P Value
	BPTB	8	84.87	7.41	.953	.357
	ST/G	8	81.12	8.30		

Extension deficit following operation of the study groups also showed insignificant difference(P>0.05). Extension deficit comparison

Table – VIII

Difference of radiological changes of both groups (Post operative).

Variable		BPTB (N=8)	ST/G(N=8)	Total
Joint space reduction	Absent	6(75.0%)	4(50.0%)	10(62.5%)
	Present	2(25.0%)	4(50.0%)	6(37.5%)
Osteoarthritic change	Absent	2(25.0%)	1(12.5%)	3(18.8%)
	Present	6(75.0%)	7(87.5%)	13(81.3%)
Tunnel widening	Absent	8(100.0%)	4(50.0%)	12(75.0%)
	Present	0(.0%)	4(50.0%)	4(25.0%)

Table – VIII: This table describes regarding post operative radiological changes. In both the study groups joint space reduction and osteoarthritic changes were statistically insignificant (P>0.05). But regarding tunnel widening the difference was significant (P=0.021)

Table - IX

Comparison between pre and post operativeLysholm score and post operativeLysholm score ofboth groups.

		Lysholm Scale	Descriptive Statistics			Wilcoxon test	
		N	Mean	SD	Median	Z	P value
BPTB	Pre operative	8	66.50	5.58	66.00 (17.0)	-2.524	.012
	Post operative	8	84.87	7.41	86.05 (23.0)		
ST/G	Preoperative	8	68.62	5.04	70.00 (16.00)	-2.524	.012
	Post operative	8	81.12	8.30	84.50 (22.00)		

Table - X

Subjective status comparison (Post operative).

Variable		BPTB (N=8)	ST/G(N=8)	Total
Patients satisfaction	Very satisfied	2(25.0%)	0(.0%)	2(12.5%)
	satisfied	6(75.0%)	5(62.5%)	11(68.8%)
	Unsatisfied	0(.0%)	3(37.5%)	3(18.8%)
Knee function	Normal	1(12.5%)	0(.0%)	1(6.3%)
	Slightly abnormal	7(87.5%)	6(75.0%)	13(81.3%)
	Severely abnormal	0(.0%)	2(25.0%)	2(12.5%)

Table - XI

Final outcome (TengerLysholm score) Comparison.

Final Outcome(Score)	BPTB (N= 08)	ST/G (N=08)	Total	Statistics &P value
Excellent (>90)	2 (25.0%)	0 (0%)	2 (12.5%)	Chi-Square = 2.28
Good (84 -90)	3 (37.5%)	4 (50.0%)	7(43.8%)	Df =2 P=.319
Fair (65-83)	3 (37.5%)	4 (50.0%)	7(43.8%)	
Total	8(100.0%)	8(100.0%)	16(100.0%)	

Table - IX: Shows comparison of Lysholm score before and after operation and comparison between post operativeLysholm score of two groups.

In BPTB group median, post operativeLysholm score (86.05) was higher than the median pre-operative Lysholm score (66.00) and the difference was significant. (P=0.01)

In ST/G group median post operativeLysholm score (84.50) was slightly higher than the median pre-operative Lysholm score (70.00), the difference was also significant. (P=0.01)

But statistically no significant differences were noted between post operativeLysholm score of two groups. (P >.05)

Table-X: Demonstratecomparison of subjective status between two groups.

The patients of both groups were either very satisfied or satisfied or unsatisfied but there were insignificant statistical difference. (P>0.05)Knee functional status of the study groups were almost similar and statistical test failed to reveal significant difference between the two groups (P>0.05).

Table XI Shows final outcome of the patients of both groups.BPTB groups showed 25% excellent, 37.5% good and 37.5% fair outcome and ST/G group 50% patients had good and 50% had fair out come on the basis of TengerLysholm scoring scale.

Statistical test revels insignificant differences between the study groups (P>0.05).

DISCUSSION

Arthroscopically assisted technique of ACL reconstruction has been developed in recent years with the advantage of the morbidity associated with open operation.

In the present study mean age of the patients of BPTB group was 23.7±3.15 years and hamstring group was 25.00±2.56 years. Ericsson. et al. (2001) made a study over 164 patients where mean age was 25.7+ 6.9 years which is consistent with present study.

Mean duration of symptoms were 20.86±19.35 months and 14.62±8.66 months of BPTB and ST/G group respectively. The study of Boonriong&Kietsiriroje, (2004) showed the duration between injury and operation was significantly shorter in hamstring group. This study also showed the duration of suffering is less in hamstring group.

Regarding subjective symptomepain is more common in BPTB group but hamstring group was more affected by swelling. Stiffness was almost similar in intensity and no patient of any group had suffered from giving way during their daily activity. Study of Pinczewski.et al. (2002) revels insignificant difference between the two groups for any time period and our study also shows insignificant differences between study groups (P>0.05).

Donor site symptoms at rest were present in both groups, among them tenderness and irritation had no dissimilarity but numbness was higher in hamstring group with marginally significant difference (p=0.05). Symptoms at graft site were significantly more in BPTB group (p=0.01) was the observation of Roe. et al. (2005) at 7 years after injury which were inconsistent with present study.

Clinical evaluation revel no significant difference in respect to joint line tenderness and effusion (P>.05). Manual Lachman test, anterior drawer test and pivot shift test were used for ligamentous stability testing. Preoperatively all patient had positive Lachman test and anterior drawer test (grade II or III). Post operatively BPTB group had Lachman test Gread 1+ positive in 75%, G+2 positive in 12.5% and negative in12.5% patients but all patients (100%) of hamstring group had G+1 positive Lachman test. Anterior drawer test had similar distribution between two groups as Lachman test. Pivot shift test were 50% G+1, 12.5% G+2 and 37.5% negative in BPTB group but hamstring group had 37.5% G+1, 37.5% G+2 and negative in 50% patients. The result of Boonriong&Kietsiriroje, (2004) revels no difference regarding the number and the distribution of grading of instability between study groups and present study also shows insignificant difference (P>0.05).

After six months thigh atrophy (22.5mm) was higher than the median pre-operative thigh atrophy (18.5mm) in BPTB group and in hamstring group the median post operative thigh atrophy (24.0mm) was also slightly higher than the median pre-operative thigh atrophy (22.5mm). So, none of the operation showed to achieve significant improvement of thigh atrophy within six months. Observation ofPinczewski. et al. (2002) demonstrate 81% of BPTB and 75% of hamstring group having thigh atrophy bellow 10 mm at 2 years and at 5 years these figure were 65% of BPTB and 64% of hamstring group that indicates with the passes of time thigh atrophy will improve. Shaieb.et al. (2002) observed 78% of BPTB and 81% of hamstring group having thigh atrophy bellow 10 mm and remaining 22% of BPTB and 19% of hamstring group having thigh atrophy between 10 mm to 20 mm and no significant difference were noted between the groups after two years. Present study also showed insignificant difference of post operative thigh atrophy of both groups. (P >0.05)

This study showed post operative flexion deficit was more in hamstring group and extension deficit was predominant in BPTB group but the difference was insignificant (p>0.05).Biau.et al. (2006) had similar observation that, hamstring tendon group reported fewer extension deficit than BPTB groupbut flexion deficit were more in hamstring group. The observation of Feller & Webster, (2002) also revelextension deficit was greater in BPTB group.

Post operative radiological changes demonstrate joint space reduction was 25% patients in BPTB and 50% patients in hamstring group of this study.Roe.et al. (2005)observedabnormal radiological findings in 45% patients of BPTB and 14% of hamstring tendon group which are dissimilar with this study. Osteoarthritic change present in 75% patients of BPTB and a bit higher 87.5% in hamstring group. Pinczewski. et al. (2002)observed early osteoarthritic change in 2 (4%) patients of the hamstring tendon group and 11 (18%) patients of BPTB group which was inconsistent with this study. 50% patient of hamstring group developed tunnel widening which was significant (p=0.02) but no tunnel widening was seen in BPTB group. Feller & Webster, (2002) also published similar observation that the radiological evidence of tunnel widening also greater in hamstring tendon group.

BPTB group showed median post operativeLysholm score was 86.05 which is higher than the median pre-operative Lysholm score 66.00 and median post operativeLysholm score was 84.50 which was also higher than the median pre-operative Lysholm score 70.00 in hamstring group. So, this study reveled significant improvement of Lysholm score post operatively (p= 0.012) in both group but post operative differences between study groups was insignificant (p >0.05). Significant difference (p = 0.0001) was observed by Boonriong&Kietsiriroje, (2004) between each group pre and post operatively but post operative comparison had insignificant difference (p=0.2116). A five year comparative study of Pinczewski.et al. (2002) demonstrate similar observation between two groups at any time period.

Subjective assessment regarding patient satisfaction reveled very satisfied 25% and satisfied 75% of BPTB patients but in hamstring tendon group 62.5% patients were satisfied and unsatisfied patient were 37.5%. Post operative knee functional showed slight abnormality in 87.5% and normal in 12.5% of BPTB and slight abnormality in 75% and severely abnormality showed in 25% patients of hamstring group. In this regard BPTB group had showed relatively better subjective satisfaction but this result is statistically insignificant (p=0.07). Observation of Sajovic.et al. (2006) also demonstrate good subjective outcome and objective stability, without significant difference between the study groups.

Loss of sensation lateral to the tibial incision site was found in 75% cases of hamstring group but in BPTB group had only 37.5%. Irritation at tibial AO fixation post site was present in 50% cases of hamstring group and one patient require operative removal of tibial AO fixation post after ten months of reconstruction. Jansson.et al. (2003) published in his paper that nearly all patients experienced numbness lateral to the tibial incision scar. In hamstring tendon group tibial AO fixation post was removed 2 years after operation in 32 cases out of 46 patients, who had discomfort at the fixation site. In the present study kneeling pain and patello-femoral pain was higher in BPTB group with out significant difference. Feller & Webster, (2002) also observed pain in kneeling was greater in BPTB group. Patients of hamstring group reported fewer anterior knee symptoms than BPTB group, was the observation of Biau. et al. (2006). All patient of hamstring group had at least one complication but no complication was found in 25% of patient of BPTB group of present study at six months.

BPTB groups had 25% excellent, 37.5% good and 37.5% fair outcome but poor result was absent. In Hamstring group 50% patients had good and 50% had fair out come but no patient showed either excellent or poor result. Statistical test failed to differentiatethe out come between the study groups (P=0.31).

CONCLUSION

Arthoscopicallyassisted ACL reconstruction is being widely practiced world wide and in our country due to less morbidity over arthrotomy. Autologus bone patellar tendon bone and hamstring tendon are mostly used graft material. Many authors made comparison between BPTB and quadruple hamstring graft but most of them found insignificant difference. Observation of this study showed insignificant differences regarding subjective symptoms, knee stability, range of motion, radiological changes, patient satisfaction and knee function. Both the operation showed significant improvement of post operativeLysholm score, with insignificant difference of final outcome between study groups.

REFERENCES:

1. Aglietti, P. &Giron, F., 2001. Anterior Cruciate Ligament Reconstruction for chronic injury. In: J. N. Insall, & W. N. Scott, eds. *Surgery of the Knee.* 3rded. New York : Churchill Livingstone, pp. 717- 80.
2. Amis, A.A. & Dawkins, G.P.C., 1991. Functional Anatomy of the ACL.*The Journal of Bone and Joint Surgery,* 73-B (2), pp. 260-66.
3. Bansal, S., Goradia, V. K., & Matthews, L. S., 2001. Sports knee rating System. In: J. N. Insall, & W. N. Scott, eds. *Surgery of the Knee*. 3rded. New York: Churchill Livingstone, p. 628.
4. Biau, J.D., Tournoux, C., Katshian C. et al. 2006. 'Bone-Patellar tendon-Bone AutograftVersus Hamstring Autografts for Reconstruction of ACL, meta-analysis. *BMJ,*http:/ bmj.hmj journals.com/egi/content [accessed 04 June 2008.]
5. Chaudhury, D., Monga, P., Joshi, D. et al. 2005. Arthroscopic reconstruction of anterior Cruciate ligament using bone patellar tendone bone autograft: Experience of first 100 cases. *Journal of Orthopaedic surgery*, 8, pp. 37-42.
6. Daniel, D.M., Stone M. L., Dobson, B. E. et al.1994. Fate of ACL – injured patient: a prospective outcome study. *American Journal of Sports Medicine,* 22, p.632.
7. Datta, A.K., 2005. *Human Anatomy*. 3rd ed. Kolkata: Current Book International. Eriksson, K., Anderberg, P., Hamberg, P. et al. 2001. A comparison of quadruple semitendinosus and patellar tendon grafts in reconstruction of anterior cruciate ligament. *Journal of Bone and Joint Surgery,* 83-B, pp. 348 -54.
8. Frank, C. B. & Jackson, D. W., 1997. Current Concept Review, The Science of Reconstruction of the ACL. *The Journal of Bone and Joint Surgery*, 79-A, (10) pp. 1556-65.
9. Gulick, D. T. & Yoder, H. N., 2002. Anterior Cruciate Ligament reconstruction : Clinical outcome of patellar tendon and Hamstring grafts. *Journal of Sports Science and Medicine*, 1, pp. 63 -71.
10. Ibrahim, S. A., AboElnas, M., Hamada, G. A .et al. 2002. Complications of Anterior Cruciate Ligaments reconstruction: patellar tendon versus Gracilis and SemetendinousAutologus Graft. *Kuwait Medical Journal,* 34 (2), pp.10 6- 13.
11. Jansson, K. A., Linko, E., Sadelin, J. et al. 2003 A prospective randomized study of patellar versus hamstring tendon autograft for anterior cruciate ligament reconstruction. *The American Journal of Sports Medicine,* 31(1), pp.12-18.
12. Lysholm, J. &Gillquist, J.1982. Evaluation of knee ligament surgery results with special emphasis on use of a scoring scale. *The American Journal of Sports Medicine,* 10, pp. 150 - 54.
13. McRae, R., 2004. *Clinical Orthopaedic Examination*. 5th ed. Edinburgh - London - New York : Churchill Livingstone.
14. Noyes, F.R., Matthew, D.S., Moor, P.A. et al.1983 The symptomatic anterior cruciate deficient knee: The result of rehabilitation, activity modification and counseling on

functional disability. *Journal of Bone and Joint Surgery,* 65 A, p. 163.

15. O'Brein, S.J., Warren, R.F., Panariello, R. et al. 1991. Reconstruction of the Chronically Insufficient ACL with the Central Third of the Patellar Ligament.*The Journal of Bone and Joint Surgery*, 73-A, pp. 278-85.

16. Refai, T. M. N., Shalaby M. S. M. &Noumer M. S., 2003. Arthroscopic Anterior Cruciate Ligaments reconstruction with Autogenous patellar tendon.*Pan Arab Journal of Ortho Trauma*, 7 (1), pp. 57-64.

17. Rosen, M. A., Jackson, D.W., Atwell, E.A. et al. 1992. The efficiency of continuous passive motion in the rehabilitation of anterior cruciate ligament reconstructions. *American Journal of Sports Medicine,* 22, p.122.

18. Shaieb, M.D., Kan, D.M., Chang ,S.K. et al. 2002. A prospective randomized comparison of patellar tendon versus semitendinosus and gracilis tendon autograft for anterior cruciate ligament reconstruction.*The American Journal of Sports Medicine,* 30 (2), pp. 214-20.

19. Veltri, D.M., 1997. Arthroscopic Anterior Cruciate Ligament reconstruction.*Clinics in Sports Medicine,* 16 (1), pp. 123-44.

20. Williams III, R. J., Hyman, I., Frank, P. et al. 2005. ACL Reconstruction with a Four-Strand Hamstring Tendon Auto-graft.*The Journal of Bone and Joint Surgery*, 87-A (1), pp. 51- 54.

Original Article

Evaluation of The Result of Close Tibial Diaphyseal Fracture Treated by Closed Interlocking Intramedullary Nailing

Md. Shafiqul Alam[1], Zahid Ahmed[2], Krishna Priyo Das[3], Md. Moffhakurul Islam[4], Indrojit Kumar Kundu[5] Provash Chandra Saha[6]

Abstract

The tibia by its location is exposed to frequent injuries as one third of its surface is subcutaneous. Treatment of tibial fracture in adult is a challenge to Orthopaedic surgeons due to poor soft tissue coverage and blood supply. The nail provides good stability against bending forces, while the interlocking screws control axial shortening and rotational instability. Closed insertion techniquesresulting in reduced operating time, minimal surgical trauma and consequently fewer postoperative complications. This prospective study was carried out in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU) during the period of Jan. 2011 – Dec. 2012. A total number of 30 patients were taken. Maximum tibial fracture was found in male (80%). Common age group was 18-25 years. Road traffic accident (RTA) 60% accounted the most common mechanism of injury. Middle third fractures were 50% and fracture with communition was found in 40% cases. All cases were done in closed method with static nailing. The duration of hospital stay was varied from 5 to 10 days and union occurred between 14 -27 weeks with a mean of 19.9 weeks. Among the post operation complications anterior knee pain (AKP) was the commonest (23.33%). Weight bearing was given after 12 weeks with walking aids. There were satisfactory results in 26 cases (86.66%) and unsatisfactory 4 cases (13.33%). The treatment of close tibial diaphyseal fractures with interlocking intramedullary nailing was satisfactory, cost-effective, and high acceptance among patients due to minimal hospital stay with early return to normal activities.

Key words: Tibial fracture, diaphyseal, closed nailing, interlocking.

INTRODUCTION

Fractures of the tibial shaft usually caused by high-energy trauma, such as road traffic accident (RTA). It accounts the most common single cause. Sports activity and fall from a height among the other mechanism of injury. [1]Patients present with pain and swelling of the affected leg, unable to stand, deformity of the leg. They can be either open or closed .The pattern of the fractured bone also varies such as spiral, transverse, oblique, segmented and comminuited/complex. Tibial shaft fractures may cause permanent disability like nonunion, malunion and limb length discrepancy.

Because of its subcutaneous position, the tibia is more commonly fractured, and more often sustains an open fracture, than any other long bone. Tibial shaft fractures usually involve young or middle-age people. Treatment of tibial fracture in adult is a challenge to Orthopaedic surgeons due to poor soft tissue coverage and blood supply. Moreover compartment syndrome, neurovascular injury and infection might add to this burden. Non union, delayed union, malunion and limb length discrepancy may occur. Closed reduction and cast immobilization have previously been regarded as the standard treatment for tibial shaft fractures[2]. About 40 years ago Charnley said,

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"we have still a long way to go before the best method of treating a fracture of the shaft of tibia can be stated with finality" [3]. Plating to treat tibial diaphyseal fracture needs extensive exploration which may invite infection and non-union. So, intramedullary nailing accepts as an alternative device.

The acceptable treatment goal for fracture of tibia like any other long bone is proper union with maintaining normal length, near anatomical alignment without rotation, deformity and limb length discrepancy. Intramedullary nail without interlocking device has been used for a long time for fixation of tibial shaft fracture [4]. It only prevents bending/angular force but does not prevents rotation and compressive force. An unlocked intramedullary device cannot resist compressive forces. It is a load sharing device and allows the bone to transmit the compressive force by maintaining axial alignment. Interlocking intramedullary rod is a load sparing device transmitting the compressive force from the proximal to the distal fragment through the fixation device itself, which relieves stress from the bone. However, during recent decades, the use of intramedullary interlocking nails has become popular, and many studies have shown that the outcome of treatment of a tibial shaft fracture with locked intramedullary (IM) nailing is superior to that of other modalities of treatment. Some complications have been noticed after intramedullary interlocking nailing, anterior knee pain (AKP) is the commonest one. Its incidence has been reported to be as high as 86% [5]. But this pain resolves gradually with the passage of time and assurance.

Previously this surgery was done in a limited scale due to lack of expertise and C-Arm faciltites But now a days both resources are available in many government and private hospitals. Initially the cost of implant was a bit high but now days it is cost effective because of more and more companies marketing this device with competitive value. Operative exposure is minimum with limited hospital stay which popularise this modalities of treatment.

MATERIAL AND METHODS

This prospective studies was conducted in Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU) during the period of Jan. 2011 – Dec. 2012 .Study subjects were selected purposively as per inclusion and exclusion criteria. A total number of 30 patient were taken. Inclusion criteria includes: Closed diaphyseal fracture of tibia, age between 18 to 55 years, types of fracture - (AO/ASIF classification) type A and B, duration of fracture less than 10 days. Open fracture, Pathological fracture, Childhood fracture, Complex fracture (Type C) and Old fracture >10 days were excluded.

The Study procedure was done by collecting data as per questionnaire proforma including the socio-demographic parameters, clinical parameters, diagnosis and investigations. Accordingly, 35 patients were selected and admitted for surgery but 5 patients were lost during follow-up. Therefore, a total of 30 patients were available for operation and follow-up for a period of 6-12 months. Possible surgical complications and outcome were discussed with the patients and then informed written consents were taken. Patients were counselled regarding the treatment procedure, postoperative sequale. With emphasis on the available treatment options along with merits and demerits of each. Intramedullary nail of appropriate size were selected by measuring the tibia both clinically and radiologically on the healthy side. All patients received prophylactic antibiotics. Spinal anesthesia was given in all cases. Patients were operated in supine position with the fracture limb suspended from the edge or side of the operating table with the knee in 90^0-100^0 flexion. Close reduction of the fracture was done by traction and manipulation and the accuracy of the reduction was checked by C-Arm.Proximally the nail was introduced transtendinous of patellar tendon. Proximal and distal interlocking screws were introduced with the help of targeting cannula introduced through jig holes.

Patients were follow-up at OPD of Department of orthopaedics, BSMMU at 2 weeks, 6 weeks, 12 weeks and 3 monthly interval and thereafter up to 12 months. Tucker's criteria were followed during assessment because it includes all the parameters[6].

Statistical analysis: Statistical analysis was performed using SPSS software for Windows version 11.5. Z test and Anova tests was performed when applicable. P value of <0.05 was considered significant. Descriptive statistics were reported as mean (±SD).

RESULTS AND OBSERVATION:

A total number 30 patients (n=30) were studied.

Clinical and epidemiological characteristics of study subjects:

Most commonly affected group, age between 18-25 years Mean ±SD was 20.3 ± 2.2. (Table I). 24 cases (80.0%) were

males and 6 cases (20.0%) were females. The difference was statistically significant (P<0.05) (Table II). Peoples from various occupations were affected**.** Outdoor workers like day labourer, farmer and driver were affected more than indoor workers like housewife. In this study affected outdoor workers were > 50% of cases. The mechanism of injury were 18 cases (60%) from RTA, 8 cases (26.67%) fall from height, and 4 cases (13.33%) due to assault. (Table III). Middle 1/3rd shaft fracture were the commonest 50%. Regarding the pattern of fracture, simple fracture with communition were common 40% (With in). Union time of fracture was 14 weeks to 27 weeks, with mean 19.9 ± 3.8 weeks. Hospital stay was from 5 days to 10 days, with a mean 7.8±1.3 days. Complications after surgery were, anterior knee pain (AKP) 7 cases (23.33%), Infection (soft tissue) 1 case (3.33%), and leg length discrepancy 1 case (3.33%) (Table IV). Excellent result were found in 20 cases (66.67%), good in 6 cases (20.00%), fair in 4 cases (13.33%). Satisfactory result (Excellent + good) = 86.67%. Unsatisfactory result (fair+ poor) = 13.33% (Table V).

Table I

Age distribution of the study patients (n=30)

Age (Years)	No. of patients	Mean/SD	Percent (%)
18-25	13	20.3 ± 2.2	43.33
26-35	10	30.5 ± 3.5	33.33
36-45	5	40.2 ± 3.1	16.67
46-55	2	50.5 ± 6.5	6.67

Table II

Sex distribution of the study patients (n=30)

Sex	No. of patients	Percent (%)
Male	24	80.00
Female	6	20.00

Z value=5.81; P value=<0.001

Table III

Distribution of the study patients according to cause of injury (n=30).

Cause of injury	No. of patients	Percent (%)
Road Traffic Accident (RTA)	18	60.00
Fall from height	8	26.67
Assault/ violence	4	13.33

Table IV

Distribution of the study patients according to complication (n=30).

Complication	Number of patients	Overall percent
Anterior knee pain (AKP)	7	23.33
Infection (soft tissue)	1	3.33
Leg length discrepancy (>1cm)	1	3.33

Table V

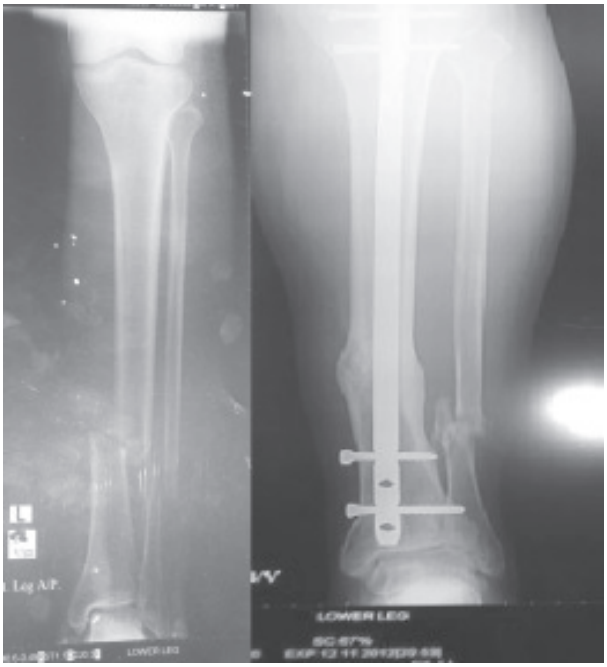
Distribution of the study patients according to grading of result (According to Tucker criteria) (n=30).

Grading of result	No. of patients	Percentage (%)
Excellent	20	66.67
Good	6	20.00
Fair	4	13.33
Poor	0	0.00

Z value=8.36; P value=<0.001

Postoperative follow-up criteria and outcome:

- Tucker criteria for evaluation of treatment of tibia fibula fractures (Tucker et al. 1992):
- Excellent: Fracture union
- Full knee extension and 125' flexion
- Ankle motion 70° of normal side (in bilateral fracture,
- Ankle motion should be above neutral and have 30° flexion)
- No leg length discrepancy more than 1 cm
- No angulations greater than 7 degrees in any plane
- No rotation greater than 5°
- No infection
- No pain on weight bearing
- Good: Fracture union and one criteria above missing
- Fair: Fracture union and two of the above criteria missing
- Poor: Fracture union with three criteria missing



Pre and Postoperative radiograph



Interlocking intramedullary nail instrument sets.



Insertion of interlocking nail



Postoperative image showing normal weight bearing and painless squatting.

DISCUSSION

A tibial shaft fracture is a common fracture, especially amongst young and middle-age people. There are variations in treatment of tibial fractures. It is very difficult to manage all the cases by a single method. Over last 50 years the management of tibial fractures has oscillated like a pendulum of a clock from non-surgical treatment to surgical treatment. In the past, tibial shaft fracture were managed by immobilization in a plaster cast .Thereafter functional brace has been used commonly .The first use of an intramedullary rod is attributed by Lambott in 1907, later on by Kyle [7]. In 1974 a semi-rigid triflange intramedullary nail was introduced for closed nailing in tibia without reaming. But problems remain with comminuted fractures and the nail does not provide rotational stability, collapse with normal length discrepancy. In 1960s and 1970s external fixation was most popular[8]. The plating resulted in higher incidence of non-union, infection and fixation failure. The external fixation resulted in pin tract infection and osteomyelitis of bone. To over come these problems close tibial interlocking nailing was advocated that minimize the chances of post-operative infection, rotation, collapses, angulation and shortening. This prospective study was carried out with an aim to determine the functional outcome of close tibial

diaphyseal fracture treated by closed interlocking intramedullary nailing. To assess the functional outcome Tucker's criteria was used.

A total number of 30 patients who came in the Department of Orthopaedic surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, during the period of January 2011 to December 2012 were included in this study. The present study findings were discussed and compared with previously published relevant studies.

In this study it was observed that people from various walks of life were victims of tibial fracture.The patients' ages with tibial fractures varied from 18 to 55 years and maximum incidence occurred between 18 – 25 years age groups. (Table I) Inam et al. and Kamruzzaman et al [9, 10] showed the average age of patient was 35 years and age range between 20 and 62 years and 35 years and age range between 25 and 65 yrs respectively. Tyllianakis[11] et al. showed the mean age of their patients were 39.8 years. The high incidence of young adult age group points to the higher rate of mobility for work as well as social violence in this age group.

In this study it was observed that 80.00% tibial shaft fractures involved men 20.00% occurred amongst women (Table II). Inam et al. showed 86.66% and 13.33% were male and female respectively. Kamruzzaman et al observed 70.59% male and 29.41% female in their study. The above findings are closely resembled with the current study. Males being the major working force of a society and are thus more consistently exposed to the external environment, which probably accounts for this discrepancy.

In this study it was observed that road traffic accident (RTA) accounted 60% cases, fall from height 26.67% and 13.33% due to assault. (Table III). Similarly, Inam et al. showed 90% factures were due to road traffic accident and 10.0% were due to fall .In another study, Kamruzzaman et al reported that 82.76% fracture was due to road traffic accident and 17.24% were due to fall. The above findings are consistent with the current study. Road traffic accident was major cause of fracture probably due to bad traffic conditions.

Regarding the pattern of fracture in this study it was observed that Transverse fracture was found 26.67%, oblique fracture in 33.33% and comminuted fracture in 40% cases. Middle third fractures were more common (50%).

It was observed that mean duration of hospital stay was 7.8±1.3 days varied from 5 - 10 days. Janssen et al. reported that patients stayed in the hospital for an average of 10 days with range from 4 to 15 days [12].This short period of hospital stay signifies cost-effectiveness as well as early mobilization. Patient's union time was taken 14 weeks to 27 weeks with average union time required 19.9 weeks. Karladani et al [13]. mentioned that the mean time-to union was 19 weeks. Ben-Galim et al [14] obtained unions was achieved after 17 weeks (mean) with interlocking nails, which are comparable with the current study.

Anterior knee pain (AKP) was found to be the commonest complication after surgery. In this study it was observed in 7 (23.33%) cases (Table IV) .The incidence of AKP varies from 10% to 86% in different studies. The etiology of AKP after IM nailing is multiple. Trauma-induced tissue damage, inappropriate methods of nailing, anatomical changes in the knee due to IM nailing, and more exposed proximal end of the nail over tibial tuberosity., All the 30 patients in the study were followed up for at least 6 months and up to a maximum of 12 months.

For evaluation of results, Tucker's criteria were considered. Excellent and good results were accepted as satisfactory, while fair and poor results were regarded as being unsatisfactory. In this study it was observed that satisfactory result 86.67% (excellent result 66.67%, good 20.0%) and fair 13.33% (Unsatisfactory) Table V. Lee, Suh and Kim et al obtained that 77% of patient showed satisfactory result [15]. Chai et al. showed 81.7% excellent, 14.3% good and 4.0% fair [16]. Satisfactory or excellent results were obtained in 86.3% of patients reported by Tyllianakis et al.

CONCLUSION

This study was done to determine the functional outcome of close tibial diaphyseal fracture treated by closed interlocking intramedullary nailing. The treatment of tibial diaphyseal fractures with close interlocking intramedullary nailing is effective; patient can return to work earlier than others treatment. Almost all patients can return to their previous work and pre-traumatic level of activity. Also a short period of hospital stay signifies cost-effectiveness as well as early mobilization with this modalities of treatment. Due to close technique the infection rate and rate of non-union was minimum. Interlocking technique minimises collapse at fracture site and leg-length discrepancy. So, overall this closed interlocking nailing provides an effective method of treatment in Tibial shaft fracture.

REFERENCES:

1. McGrath, L & Royston, S 2007, 'Fractures of the tibial shaft (including acute compartment syndrome)', Surgery, vol. 25, no. 10, pp. 439–44.
2. Sarmiento A 1970, 'A functional below-the-knee brace for tibial fractures', J Bone Joint Surg (Am), vol. 52, pp. 295-311.
3. Charnley, J 1963, 'The closed treatment of common fractures. 3rd ed. Churchill Livingstone, Edinburgh, London, New York
4. Lottes, JO 1974, 'Medullary nailing of the tibia with the triflanged nail', Clin Orthop, vol. 105, pp. 253.
5. Katsoulis, E, Court-Brown, C & Giannoudis, PV 2006, 'Incidence and aetiology of anterior knee pain after intramedullary nailing of the femur and tibia', J Bone Joint Surg, vol. 88-B, pp. 576–580.
6. Tucker, HL & Kendra, JC 1992, 'Management of Unstable Open and Closed Tibial Fractures Using llizarov Method', Clin. Orthop, vol. 280, pp. 125.
7. Kyle, RF 1985, 'Biomechanics of intramedullary nailing fracture fixation', Orthopaedics, vol. 8, pp. 1356-9.
8. Myers, SH, Spiegel, D & Flynn, JM 2007, 'External fixation of high-energy tibia fractures', J Pediatr Orthop, vol. 27, pp. 537-9.
9. Inam, M, Arif, M & Shabir, M 2008, 'Treatment Of Close Tibial Diaphyseal Fracture By Close Interlocking Nail', Journal of Postgraduate Medical Institute, vol. 22, no. 01, pp. 47-51.
10. Kamruzzaman, AHSM & Islam, S 2011, 'Result of closed interlocking intramedullary nail in tibial shaft fracture', Bang Med J (Khulna), vol. 44, pp. 15-17.
11. Tyllianakis M, Megas P, Giannikas D & Lambiris, E 2000, 'Interlocking intramedullary nailing in distal tibial fractures', Orthopedics, vol. 23, no. 8, pp. 805-8.
12. Janssen, KW, Biert, J & van Kampen, A 2007, 'Treatment of distal tibial fractures: Plate versus nail: A retrospective outcome analysis of matched pairs of patients', Int Orthop, vol. 31, pp. 709-14.
13. Karladani, HA, Granhed, H, Edshage, B, Jerre, R & Styf, J 2000, 'Displaced tibial shaft fractures. A prospective randomized study of closed intramedullary nailing versus cast treatment in 53 patients', Acta Orthop Scand, vol. 2, pp. 160–167.
14. Ben-Galim, P, Rosenblatt, Y, Parnes, N, Dekel, S, & Steinberg, EL 2006, 'Intramedullary Fixation of Tibial Shaft Fractures Using an Expandable Nail', Clinical Orthopaedics and Related Research, vol. 455, pp. 234–240.
15. Lee, CS, Suh, JS & Kim, JH 2008, 'A Comparative Study of Interlocking IM Nailing and LCP Fixation through MIPPO Technique in the Treatment of Distal Metaphyseal Tibial Fracture', Korean Foot Ankle Soc, vol. 12, no. 1, pp. 80-85.
16. Chai JW, Wu LS, Zhang CH, Xu L, Wei, JJ & Wu, SF 2008, 'Treatment of tibial fracture with interlocking intramedullary nail and tripus', Zhongguo Gu Shang, vol. 21, no. 2, pp. 118-20.

Original Article

Innovation and Application Technique of Antibiotic Cement Nail Replica for the Management of Diaphyseal Osteomyelitis in Adult Long Bone Following Fracture Fixation

Syed Anwaruzzaman[1], Faisal Ahmed Siddiqui[2], Mohammad Ali[3], Md. Sadiqul Amin[4]

Abstract

Infection is a dreaded complication of musculoskeletal trauma. It occurs most commonly after open fracture but can also develop after surgical treatment of closed fracture. The reported incidence ranges 10/1000 (0.1%) for Gustillo type-I open Fractures to 25 to 50 % of Gustillo type 3 Open Fractures. When it happens the treatment becomes more difficult and prolonged, management options are restricted and patient outcome is compromised. If infection complicates treatment of a long bone fracture cost of care is increased by an avg. of 25% per patients. And the length of hospital stay increases about an avg. of 36.2%. Conventional management protocol of the treatment of intramedullary infection after nailing, plating or Ex-fix includes removal of the hardware, debridement in some cases insertion of antibiotic impregnated cement beads- for high concentration of antibiotic delivery to the affected bone as because the standard I/V antibiotic treatment cannot deliver sufficient high concentration locally. Disadvantages of Antibiotic Beads are not being commercially available in our country. If it is kept for greater than two weeks removal is difficult. It cannot cover the whole intramedullary space and therefore there is some dead space. It does not provide any mechanical support as well.

We have innovated our own custom made intra-medullary nail replica with antibiotic bone cement (PMMA) and shaped it accordingly to fill the medullary canal diameter so that it can deliver higher concentration of antibiotics locally to all intramedullary surfaces. There is virtually no dead space & it is easy to introduce and extract.

This study was carried out at Comilla Medical College& Hospital in the Department of Orthopedics and traumatology. Study period was Between January-2011 to December-2013. All the cases were randomly selected from patients suffering from Chronic Osteomyelitis following diaphyseal fracture fixation. Total 20 cases were treated of which twelve were tibia and eight were femur about the fixation intramedullary nail was twelve, Ex-fix six, plating in two.

We have followed the cases for an average28wks, by clinically, lab parameters radiologically. All the lab. Parameters came down to normal level, discharging have been stopped, radiological progress to union, no pain and recurrence of infection. The antibiotic cement nail replica was removed between 6 to 8 weeks following insertion. After extraction Negative medullary cavity culture.

We conclude that this method is highly effective, relatively simple and inexpensive alternative for the treatment of diaphyseal osteomyelitis in adult long bone following fracture fixation.

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Objective

The purpose of this study was to assess the effectiveness of Antibiotic cement as custom-made intramedullary nail replica for the treatment of chronic osteomyelitis following fracture fixation, reduction of patient's sufferings and overall treatment cost.

Design

Prospective randomized clinical trial

Setting

The study was conducted at Dept. Of Orthopedics in Comilla Medical College & Hospital from July-2011 to December-2013.

Patients

All the patients were randomly selected from Orthopedic OPD of Comilla Medical College & Hospital; diagnosed as Chronic Osteomyelitis with discharging sinus following long bone fracture fixation with/without healing of Fracture irrespective of age and all were male with mean age 29yrs.(from 16 years to 59 years)

Total 20 cases were treated of which twelve were tibia (60%) and eight were femur(40%) and about the fixation intramedullary nail was twelve(60%) , Ex-fix six (30%) , plating in two(10%).

Methodology

Following admission all the patients were thoroughly examined for co morbid conditions (e.g. diabetes, HTN, metabolic disorders, TB, septic focus) in the body. Evaluated radiologically, the fracture fixation area and by lab parameters (e.g. Hb%, TC, DC ESR, CRP, S. Creatinine) and culture swab taken from discharging sinus/sinuses from all patients and antibiotics were stopped for 96 hours prior taking the swab.

Operative Technique

Preparing custom made antibiotic cement nail replica

Required material: Materials: Endoctracheal tube, Cerclage wire, Gentamycin cement, Gulley pot, Scalpel (Fig.1)

At first a twisted cerclage wire for core support of antibiotic cement nail replica is prepared (Fig.2). After measuring the diameter and length of infected nail or medullary canal (in case of plate and screw fixation or Ex-fix) appropriate sized endotracheal tube was selected (Fig.1). The Twisted wire was place in the Endotracheal tube and kept in mid position by tension. One end of the tube was closed. Then appropriate antibiotic impregnated cement (e.g. gentamycin/colistin) was mixed solvent properly and injected inside the endotracheal tube (Fig.3). A portion of cerclage was kept outside cement nail for later removal.

The shape of the endotracheal tube was molded according the previous nail and fixed manually until the cement sets (Fig.4). When the cast hardened we removed the endotracheal tube by peeling with two longitudinal incisions (Fig.5,6,7). Then the prepared custom made antibiotic cement nail replica was inserted inside the debrided medullary canal carefully. The smooth external surface of the nail assisted in easy insertion of nail into the medullary cavity. If any resistance felt nail was removed and medullary cavity was again reamed with one size larger reamer. Position was checked and operative site was closed keeping vacuum drain.

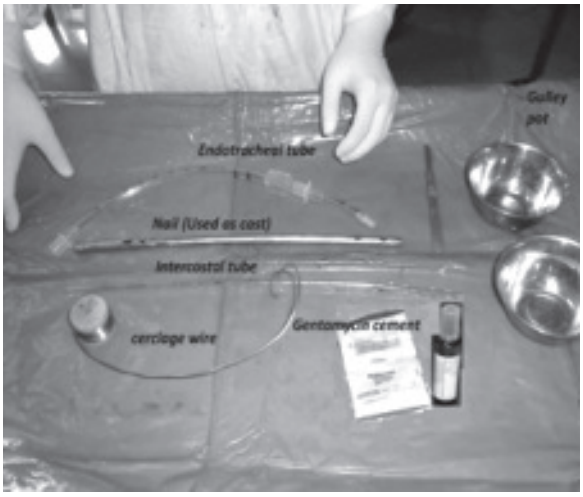


Fig.-1: *Materials: Endoctracheal tube, Cerclage wire, Gentamycin cement, Gulley pot, Scalpel,*



Fig.-2: *Preparation of twisted cerclage wire for core support*



Fig.-3: *Mixing of antibiotic cement rod*



Fig.-4: *Pumping of antibiotic cement inside ET tube*



Fig.-5: *Moulding shape according to the nail*

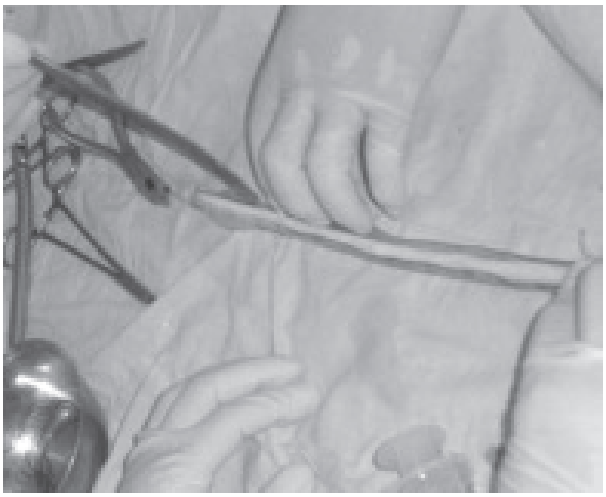


Fig.-6: *Shell out from ET tube*



Fig.-7: *Antibiotic nail ready for insertion*

Removal of hardwire and debridement

Following anesthesia the previous fixation device (e.g. intramedullary nail/ plate and screw or Ex-Fix) was removed. Then the medullary canal was thoroughly debrided with normal saline irrigation under pressure and repeated incremental reaming.

FOLLOW UP

On third post operative day we checked the dressing and discharging sinuses. We also sent blood for laboratory investigations

Every third day dressing was checked and blood sent for laboratory investigations until all the discharging sinuses stopped

By 2 to 4 weeks all patients had healed sinuses. Antibiotic cement nail was removed on 6^{th} to 8^{th} week. Patients with

non-union of fractures were re-fixed with solid intramedullary nails (SIGN NAIL) in same sitting.

After discharge patients were followed every 3rd week until the bone healed and followed for any recurrence of infection or discharging sinuses up to 28th week.

RESULT

All the lab. Parameters came down to normal level, discharging have been stopped, radiological progress to union, no pain and recurrence of infection. After extraction medullary culture was negative for all cases.

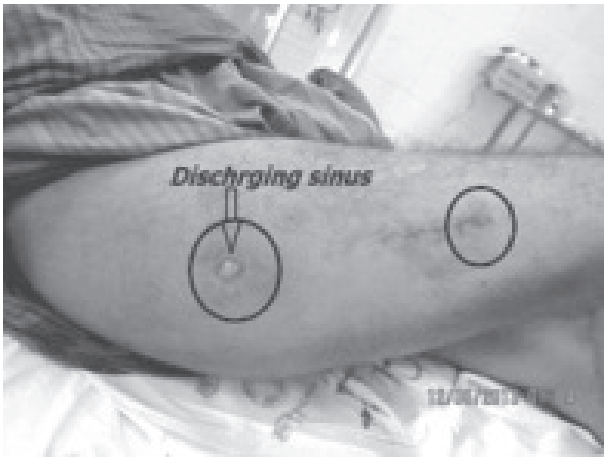


Fig. 8: *Multiple discharging sinus in a pt. with IMIL nail fixation*

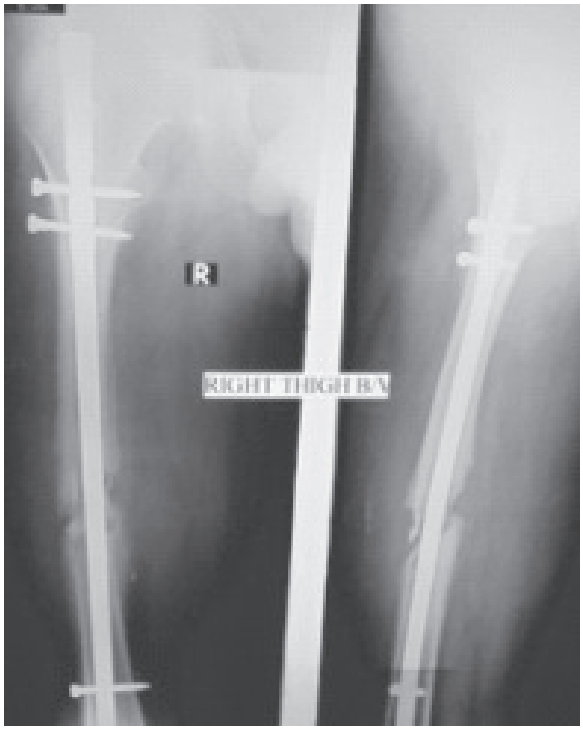


Fig.9: *X ray showing Infected nail with non union*



Fig.-10: *Healing sinuse after application*



Fig.11: *Antibiotic cement nail replica insitu*



Fig.12: *Subsequent fixation by SIGN IMIL nail.*

DISCUSSION

We believe that every physician take utmost care to his patients and no one expect post op osteomyelitis to his patient. But a few percentages of patients develop osteomyelitis all over the world and when it happens the treatment is difficult and prolonged. The patient is depressed psychologically. There is work loss exhausted financially and final impact on national economy. In the present series our effort was to find out an effective method of treatment of these patients and to reduce the suffering.

Thorough debridement, stable fixation, and prolonged antibiotics are the mainstay in the treatment of diaphyseal osteomyelitis with discharging sinuses in adult long bone with/without non-union.[1–2, 19–21] A variety of staged procedures have been described for the management diaphyseal osteomyelitis following fracture fixation. Intramedullary devices have been used in both primary stage of infection control[13–16] and in secondary stage of bone healing[22] with good results. Bone defect following debridement increases the complexity of the management.[23] We studied the appropriateness of the use Antibiotic cement nail replica in case of diaphyseal osteomyelitis of adult long bone with discharging sinuses following fracture fixation with/without non union.

The infected foci within the bone are surrounded by a sclerotic, relatively avascular bone covered by a thickened periosteum, scarred muscle and subcutaneous tissue. This avascular envelope of scar tissue leaves systemic antibiotics essentially ineffective. This explains the positive cultures in a majority of our patients even though all patients were receiving broad spectrum antibiotics at the time of sinus tract culture. However, few culture reports were negative in which case either the organism is highly sensitive to the antibiotics or infection is by a fastidious organism like hemolytic *Streptococci* or *Enterococci*. In former situations, the dead bone acts as a foreign body and continues to generate discharge from the wound. Negative sinus tract culture reports have been reported by other researchers too who reported it to have a very low sensitivity, specificity, and positive predictive value.[24–26] we found all the intra-operative specimen cultures to be positive, suggesting it to be a more accurate method to decide an appropriate antibiotic regimen in chronic osteomyelitis post operatively.

Intramedullary infection leading to non-union of the fracture is a known complication of intramedullary nailing; Plating or following Ex-fix.[27] Open fractures have a higher incidence than closed fractures treated with intramedullary nailing.[28, 29] our series we included fifteen patients with Osteomyelitis following fracture fixation by intramedullary nail or Plate or Ex- Fix out of 8 cases were of femur and seven were tibial osteomyelitis.

Use of antibiotic-impregnated cement was first noted by Buchholz and Engelbrecht.[31, 32] a high local concentration of antibiotics and low systemic side effects were the major advantage.[33, 34] Gentamycin has been the most widely used agent followed by vancomycin.[32–35] Use of two antibiotics, namely gentamycin and vancomycin, with bone cement widens the spectrum of activity and also enhances the elution properties of the two antibiotics.[35,36] Klemm was the first to use antibiotic cement beads in cases of osteomyelitis.[37] Cement beads fill the dead space and also allow a high concentration of local antibiotics. The effectiveness of the antibiotic-impregnated cement beads in the control of bone infection is well established. Cement beads have been used for intramedullary infections. However, they offer no mechanical stability, do not fill the dead space completely; not being commercially available in our country and are difficult to remove after 2 weeks.[38] antibiotic cement nail replica can provide stability, is easy to remove, and also provides all the advantages of the cement beads. Use of antibiotic cement nail replica has been first reported by Paley and Herzenberg[13] and later by other authors.[14–16,39] only one study by Thonse and Conway has studied cases of infected non-union with bone defects in 20 patients. They were able to achieve primary union by primary use of antibiotic cement nail replica in only two cases with bone defect, with the remaining cases requiring secondary procedure. They reported infection control in 95% of their cases (n=19). In our study, all patients were cured of Osteomyelitis with no recurrence of discharging sinuses and bony union in non union case.

RESULT

Within two weeks following thorough debridement and insertion of antibiotic cement nail replica pain subsided, discharging sinuses stopped and Lab parameters (e.g. CRP; ESR; TC of WBC) came down to normal level.

The Antibiotic cement nail replica was removed at 6th to 8th week following insertion in another sitting and Intramedullary solid nail fixation was done in the same sitting for non union cases only. The medullary swab during extraction of Antibiotic cement nail replica was sent for culture and sensitivity test which were negative for all cases. The Non union cases progressed to Union within 8 to 12 weeks.

There was no recurrence of discharging sinuses or pain and the lab. Parameters were normal during the whole follow-up period up to 24 weeks.

CONCLUSION

We conclude that this method is highly effective, relatively simple and inexpensive alternative for the treatment of diaphyseal osteomyelitis in adult long bone following fracture fixation.

A multicentric study on bigger sample is recommended for further evaluation of this method.

REFERENCES

1. Toh CL, Jupiter JB. The infected nonunion of the tibia. Clin Orthop Relat Res. 1995;315:176–91
2. Court-Brown CM. Fractures of the tibia and fibula. In: Bucholz RW, Heckman JD, Court-Brown CM, editors. Rockwood and Green's fractures in adults. 6th ed. Lippincott Williams and Wilkins; 2006. pp. 2080–146.
3. Patzakis MJ, Zalavras CG. Chronic posttraumatic osteomyelitis and infected nonunion of the tibia: Current management concepts. J Am Acad Orthop Surg. 2005;13:417–27
4. Beals RK, Bryant RE. The treatment of chronic open osteomyelitis of the tibia in adults. Clin Orthop Relat Res. 2005; 433:212–7.
5. Ueng SW, Chuang DC, Cheng SL, Shih CH. Management of large infected tibial defects with radical debridement and staged double-rib composite free transfer. J Trauma. 1996;40:345–9.
6. Chen CE, Ko JY, Wang JW, Wang CJ. Infection after intramedullary nailing of the femur. J Trauma.2002;55:338–44.
7. Wu CC, Shih CH. Distal tibial nonunion treated by intramedullary reaming with external immobilization. J Orthop Trauma. 1996;10:45–9
8. McKee MD, Yoo DJ, Zdero R, Dupere M, Wild L, Schemitsch EH, et al. Combined single-stage osseous and soft tissue reconstruction of the tibia with the Ilizarov method and tissue transfer. J Orthop Trauma. 2008;22:183–9
9. Maini L, Chadha M, Vishwanath J, Kapoor S, Mehtani A, Dhaon BK. The Ilizarov method in infected nonunion of fractures. Injury. 2000;31:509–17.
10. Song HR, Cho SH, Koo KH, Jeong ST, Park YJ, Ko JH. Tibial bone defects treated by internal bone transport using the Ilizarov method. Int Orthop. 1998;22:293–7.
11. Dendrinos GK, Kontos S, Lyritsis E. Use of the Ilizarov technique for treatment of non-union of the tibia associated with infection. J Bone Joint Surg Am. 1995;77:835–46
12. Cattaneo R, Catagni M, Johnson EE. The treatment of infected nonunions and segmental defects of the tibia by the methods of Ilizarov. Clin Orthop Rel Res. 1992;280:143–52.
13. Paley D, Herzenberg JE. Intramedullary infections treated with antibiotic cement rods: Preliminary results in nine cases. J Orthop Trauma. 2002;16:723–9
14. Qiang Z, Jun PZ, Jie XJ, Hang L, Bing LJ, Cai LF. Use of antibiotic cement rod to treat intramedullary infection after nailing: Preliminary study in 19 patients. Arch Orthop Trauma Surg.2007;127:945–51
15. Madanagopal SG, Seligson D, Roberts CS. The antibiotic cement nail for infection after tibial nailing. Orthopedics. 2004;27:709–12.
16. Thonse R, Conway J. Antibiotic cement-coated interlocking nail for the treatment of infected nonunions and segmental bone defects. J Orthop Trauma. 2007; 21:258–68
17. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones: Retrospective and prospective analyses. J Bone Joint Surg Am.2002;84:682.
18. Cierny G. Classification and treatment of adult osteomyelitis. In: Evarts CM, editor. Surgery of the Musculoskeletal System. Vol. 5. New York: Churchill Livingstone; 1990. p. 4363.
19. Jain AK, Sinha S. Infected nonunion of the long bones. Clin Orthop Relat Res. 2005;431:57–65
20. Motsitsi NS. Management of infected nonunion of long bones: The last decade (1996-2006) Injury.2008; 39: 155–60.
21. Struijs PA, Poolman RW, Bhandari M. Infected nonunion of the long bones. J Orthop Trauma.2007;21:507–11.
22. Shahcheraghi GH, Bayatpoor A. Infected tibial nonunion. Can J Surg. 1994; 37: 209–13
23. Eshima I, Feibel RJ, Louie KW, Lowenberg DW. Combined muscle flap and Ilizarov reconstruction for bone and soft tissue defects. Clin Orthop Relat Res. 1996; 332: 37–51
24. Donati D, Biscaglia R. The use of antibiotic-impregnated cement in infected reconstructions after resection for bone tumours. J Bone Joint Surg Br. 1998;80:1045–50.
25. Zuluaga AF, Galvis W, Jaimes F, Vesga O. Lack of microbiological concordance between bone and non-bone specimens in chronic osteomyelitis: An observational study. BMC Infect Dis. 2002; 16: 2–8
26. Akinyoola AL, Adegbehingbe OO, Aboderin AO. Therapeutic decision in chronic osteomyelitis: Sinus track culture versus intraoperative bone culture. Arch Orthop Trauma Surg. 2009; 129: 449–53

27. Petrisor B, Anderson S, Court-Brown CM. Infection after reamed intramedullary nailing of the tibia: A case series review. J Orthop Trauma. 2005; 19: 437–41.

28. Coles CP, Gross M. Closed tibial shaft fractures: Management and treatment complications: A review of the prospective literature. Can J Surg. 2000; 43: 256–62

29. Joshi D, Ahmed A, Krishna L, Lal Y. Unreamed interlocking nailing in open fractures of tibia. J Orthop Surg (Hong Kong) 2004; 12: 216–21

30. May JW, Jr, Jupiter JB, Weiland AJ, Byrd HS. Clinical classification of post-traumatic tibial osteomyelitis. J Bone Joint Surg Am. 1989; 71: 1422–8

31. Wininger DA, Fass RJ. Antibiotic-impregnated cement and beads for orthopedic infections.Antimicrob Agents Chemother. 1996; 40: 2675–9

32. Buchholz HW, Elson RA, Heinert K. Antibiotic-loaded acrylic cement: Current concepts. Clin Orthop Relat Res. 1984; 190: 96–108.

33. Zalavras CG, Patzakis MJ, Holtom P. Local antibiotic therapy in the treatment of open fractures and osteomyelitis. Clin Orthop Relat Res. 2004; 427: 86–93.

34. Springer BD, Lee GC, Osmon D, Haidukewych GJ, Hanssen AD, Jacofsky DJ. Systemic safety of high-dose antibiotic-loaded cement spacers after resection of an infected total knee arthroplasty. Clin Orthop Relat Res. 2004; 427: 47–51

35. Koo KH, Yang JW, Cho SH, Song HR, Park HB, Ha YC, et al. Impregnation of vancomycin, gentamicin, and cefotaxime in a cement spacer for two-stage cementless reconstruction in infected total hip arthroplasty. J Arthroplasty. 2001; 16: 882–92

36. Gallo J, Kolár M, Florschütz AV, Novotný R, Pantùcek R, Kesselová M. *In vitro* testing of gentamicin-vancomycin loaded bone cement to prevent prosthetic joint infection. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2005;149:153–8

37. Klemm KW. Antibiotic bead chains. Clin Orthop Relat Res. 1993; 295: 63–76

38. Patzakis MJ, Wilkins J, Wiss DA. Infection following intramedullary nailing of long bones: diagnosis and management. Clin Orthop Relat Res. 1986;212:182–91

39. Babhulkar S, Pande K, Babhulkar S. Nonunion of the diaphysis of long bones. Clin Orthop Relat Res. 2005; 431: 50–6.

Surgical Outcome of Post Traumatic Brachial Plexus Injury–Early Experience

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INTRODUCTION:

Number of road traffic accidents r increasing in developing country like in Bangladesh. Motorcycle accidents also increasing in numbers and brachial plexus often injured in this incidence. The brachial plexus is a beautiful, intricate, and complex structure that comprises connection of the spinal nerves to their terminal branches in the upper extremity.

Anatomy: The standard schematic diagram used to describe the brachial plexus uses 5 zones: (1) spinal nerve roots, (2) trunks (3) divisions (4) cords and (5) terminal branches. The C5 to T1 nerve roots typically contribute to the brachial plexus. The C5 to T1 nerve roots tropically contribute to the brachial plexus. The C5 and C6 roots coalesce to form the upper trunk, and the C8 to T1 coalesce to form the lower trunk all three posterior divisions join to form the posterior cord. The anterior division from the upper and middle trunk form the lateral cord, and the anterior division from the lower trunk forms the medial cord. The divcisionbs form cord around the axillary artery and each cord is named based on its relationship to the artery. The lateral cord and the medial cord form the median nerve. The lateral cord terminates into the musculo-ceutenous nerve and the medial cord terminates into the axillary nerve and the radial nerve.

Brachial plexus variations:

The brachial plexus may receive contributions from C4 to T2. A "pre-fixed" plexus as one that receives a contribution from C4. A "post-fixed" plexus as and that receives a substantive contribution T2. The occurrence rate rabge from 15% to 75% and the exact prevalence requires further study.

Localization of a potential lesion:

Dorsal scapular nerve arises quite proximally from C5 and long thoracic nerve arises from nerves roots of C5-C7. Lack of function of either nerve implies a proximally injury a the lived of nerve roots.

Phrenic nerve arises from C3, C4 and C5 diaphramatic paralysis indicates proximal lesion at nerve root level. Upper trunk gives origin to the suprascapular nerve – lost of supra-spinatus and intra spinatus function with deltoid and biceps lesion. As the spinal nerves emerge from the several foramina they receive rami from sympathetic ganglia.

In presence of proximal C8, T1 lesion- presence of Horner"s sign (ptosis, meiosis and anhydrosis)

Surgical Anatomy:

Brachial plexus emerges in the posterior triangle of the neck – bordered by the sternocleidomastoid and trapezius muscles, clavicle and occiput. Omohyoid muscle separates the posterior triangle into a superior omotrapizial trinangle and an inferior omoclavicular triangle. Upper and middle trunks and there divisions generally lie in the omotrapezial triangle, the lower trunk lies in omoclavicular triangle. Spinal accessory nerve emerges posterior to the sterno-cleidomastoid muscle, 2/3 of the way up from the sternum to the mastoid and travels relatively superficially toward the trapizius.

Indication for surgery:

A surgical procedure to reconstruct upper extremity function is indicated in patients with brachial plexus injury when there is no hope for spontaneous recovery. In patients with sharp open injury immediate exploration and repair is indicated – because there is no hope for spontaneous recovery. When there is high suspicion of root avulsion – early exploration and reconstruction is indicated. I operated on my patients 3 to 6 months after their injuries.

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Our priorities for functional reconstruction is as follows:

1.elbow flexion 2.shoulder stability 3.hand sensibility 4.wrist and finger flexion 5.wrist and finger extension 6.intrinsic hand muscle function.

Per operative monitoring is useful for decision making.

Multiple approaches are available – neurolysis, nerve grafts, nerve transfers, free functioning muscles transfers, arthodesis and can be use in various combinations .

NUMBER OF PATIENTS:

Total numbers of patients were 10,

8 patients were upper brachial plexus injury involving C5,6,7 and 2 patients were global brachial plexus injury. Nine patients had road traffic accident and one patient had sharp penetrating injury.

RESULTS:

Follow up period is 6 months to 1 year.

8 patients developed satisfactory upper limb function. All of them had upper brachial plexus injuries (C5,6,7 injury). Spinal accessory nerve was transferred to suprascapular nerve to power supraspinatus and infraspinatus muscles is done in 7 patients. Oberlin II transfer is done in 6 patients (fascicule from median nerve is transferred to motor branch of biceps and fascicle from ulnar nerve is transferred to motor branch of brachialis muscle). 6 patients had C5,6 injury with good triceps function but no deltoid power – nerve to long head of triceps was transferred to anterior branch of deltoid muscle in all of them. One patient had sharp penetrating infraclavicular brachial plexus injury involving posterior and lateral cord which was repaired and the result is excellent.

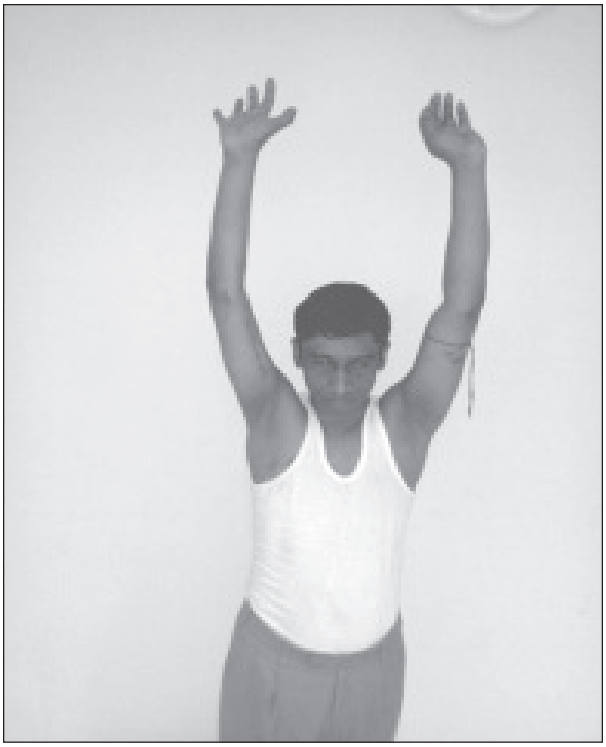


Fig.-1: *Excellent right shoulder abduction and elbow flexion after 8 months of triple nerve transfer.*

Two patients had global brachial plexus injury, spinal accessory nerve was

tranfered to motor branch of biceps and brachialis was done in both of them using sural nerve as inter positional nerve graft. In one patient the result is yet to come.

One patient with global injury has no improvement.

Post operative care:

All patients had immobilized of their operated upper limb for 3 weeks. Restricted passive range of motion is started after 3 weeks. Active physical therapy is resumed thereafter.

DISCUSSION:

Among my patients who have upper brachial plexus injuries developed satisfactory results but in global brachial plexus injury operative plan should be modified. Oberlin II transfer was done in 6 patients- all of them developed good elbow flexion. Nerve to long head of triceps was transferred to anterior branch of axillary nerve – all of them developed good shoulder abduction. Spinal accessory nerve was transferred to suprascapular nerve in 7 patients 6 of them had good shoulder stability.

Two patients had global brachial plexus injury, one has no improvement and another patients result yet to come.

CONCLUSION:

Significant advances have been made in microsurgical management of the injured brachial plexus. Reconstruction of fully functional upper limb in patients who have sustained a brachial plexus injury is still suboptimal, especially for those patients with pen-plexus injuries. Appropriate nerve transfers r gaining acceptance and is still and evolving field.

REFERENCE:

1. Leffert RD. brachial plexus injuries. Churchil Livingstone;1985.p.ix.

2. Herzberg G, Narakas A, Comtet JJ, ET AL. Microsurgical relations of the roots of the brachial plexus. practical applications. Ann Chir Main1985;4:120-133.

3. Biggs MT. Posterior subscapular approach for specific brachial plexus lesions. J Clin Neurosci 2001;8:340-342.

4. Millar RA. Observations upon the arrangement of the axillary artery and brachial plexus. AM J Anat 1939;64:143-163.

5. Ballesteros LE; Remirey LM. Vvariation of the origin of collatiral blanches emerging from the posterior aspect of the brachial plexus. J Brachial plex peripher Nerve inj 2007;2:14.

6. Walsh JE-The anatomy of the brachial plexus. AMJ Medsi 1877;74:387-399.

7. Tubiana R, Thomaine JM, Mckin E.Examination of the Hand and upper limb. 2nd ed. London:Martin Danitz; 1998.P.286-327.

8. Alnot JY, Indications and the therapeutic parspective. In: Alton JY, Narakas A editors. Traumatic brachial plexus injury, 1st ed. Peris: Expantion scientifique Francaise;1996. P.94-109.

9. Chuang DC . nerve transfers in adult brachial plexus injuries: My Methods. Hand Clin 2005; 21:71-78.

10. Davis EN, Chung KC. The Tinal sing : Ahislorical perspective plast R econst surg 2004; 114: 494-499.

12. Narakas A, Bonnard C. Clinical Exaination; In: Alnot JY, Narakas A ,, editors. Traumatic brachial plexus injuries; 1st ed. Paris scientique Franciaise, 1996. P 53-54

Original Article

The Role of Selective Nerve Root Block In The Treatment of Lumbar Radicular Leg Pain

Sharif Ahmed Jonayed[1], Md. Shah Alam[2], Sohely Akter[3], Md. Rezaul Karim[4], Md. Anisur Rahman[4]

ABSTRACT

The objective of this study was to investigate the clinical effectiveness of nerve root block (i.e., periradicular injection of Lidocaine and triamcinolone) for lumbar monoradiculopathy in patients with a mild neurological deficit. We Includded 24 patients (32–74 years) with a minor sensory/motor deficit and an unequivocal MRI finding (18 disc herniations, 6 foraminal stenosis) treated with a selective nerve root block.Seventeen patients (70.84%) had rapid (1–4 days) and substantial regression of pain, four (16.67%) required a repeat injection. 60% of the patients with disc herniation or foraminal stenosis had permanent resolution of pain, so that an operation was avoided over an average of 6 months (2–9 months) follow-up. Nerve root blocks are very effective in the non-operative treatment of minor monoradiculopathy and should be recommended as the initial treatment of choice for this condition.

Keywords: Disc herniation; foraminal stenosis; selective nerve root injection; non-operative treatment; outcome

INTRODUCTION

Since its first description by Mixter and Barr in 1934[1], lumbar disc herniation is one of the few abnormalities in the lumbar spine, were a clear relationship between the morphological alteration and pain seems to exist. While pure mechanical compression was considered previously as a source of sciatica, there is increasing evidence that chemical irritation of the nerve root plays an essential and perhaps even more important role[2,3]. Olmarker et al.[4] have shown in an experimental animal model, that epidural application of autologous nucleus pulposus without compression of the cauda equina leads to a significant drop in the nerve conduction velocity of the cauda equina[4]. Autoimmune responses, microvascular changes and inflammatory reactions are discussed as potential causes of this phenomenon[4-7]. Nucleus pulposus tissue has inflammatory properties, which lead to an intraneural oedema, a very important factor in the pathogenesis of sciatic pain[5]. The negative effect of nucleus pulposus on the nerve root can be significantly reduced by the application of methylprednisolone[8]. The compromising of the nerve conduction velocity by nucleus pulposus tissue seems to be selflimiting. Otani et al.[9] have shown in an animal model, that this effect is most pronounced after seven days and spontaneously normalises within a two month period. These experimental findings may explain, why sciatica has a favourable natural history[10]. Surgery in patients presenting with a radiculopathy with or without minor neurological sensory/motor deficit is only required, if the initial pain cannot be well controlled by non-operative means. Otherwise, surgery is not required because spontaneous recovery can be expected[10,11]. The aim of our study was to investigate whether a selective nerve root block with local application of lidocaine and triamcinolone is an effective option for patients with radicular leg pain.

PATIENTS AND METHODS

From March 2014 to December 2014, 24 patients were treated with selective nerve root blocks at NITOR and private hospital who had an unequivocal morphological imaging finding explaining the radiculopathy.The following inclusion criteria were required: (1) monoradicular leg pain with minor sensory/motor deficit (*MRC* grade >M3), (2) unequivocal morphological correlate at MRI, (3) duration

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of symptoms less then four months. Exclusion criteria were: (1) relevant motor deficit (MRC <M3), (2) Cauda equina syndrome (necessitating immediate surgical decompression), (3) Previous spinal surgery. The follow-up examination was performed at 2,3,6,12 weeks and 6 months interval.

A total of 24 consecutive patients who fulfilled these inclusion criteria were enrolled in the study. Mean age of the patients was 43 years (range 32–74 years). Based on MRI analysis,18 patients had a disc herniation and in 6 patients had a foraminal stenosis was diagnosed as a source of the leg pain (Table 1). According to this analysis, all individuals had a compromised nerve root at the target level explaining the patients symptoms. The average duration of symptoms was 8 weeks (range 3–18 weeks). All patients were referred to our center after intial non-operative therapy (analgesics, physiotherapy) had failed to result in a rapid resolution of pain. According to guidelines in the literature[13], surgery may be undertaken in cases with persistent symptoms when more rapid pain relief and resolution of the actual neurological deficits can be expected, compared to non-operative treatment. The patients were informed that the natural history of such minor sensory/motor deficits is benign and that spontaneous recovery occurs in the vast majority of individuals with time. We offered the patients a selective nerve root block to support nonoperative treatment. None of the individuals expressed a desire to proceed with immediate surgery. Results were assessed by Visual Analogue.Scale (VAS) and Oswestry Disability Index (ODI) of Fairbank. The follow-up period was 6 months (range 2-9 month).

Table 1

Location of disc herniations and foramnal stenosis.

	L3/4	L4/5	L5/S1
Disc herniation	2	9	7
Foraminal stenosis	1	2	3

Technique

The nerve root block was performed under sterile conditions with an image intensifier. We used the technique described by Bogduk et al.[14]. The target point was a "safe triangle" i.e., above the exiting nerve root and below the corresponding pedicle. A spinal needle (22G) was inserted paramedian through the skin and muscles in a craniomedial direction until a bony contact was encountered. This method allows advancing the needle in a safe triangle without contact to the nerve root. After verification of a correct needle positioning under biplanar image intensifier control, 1 ml iopamidol 300 mg was injected until a radiculogram was obtained. Subsequently, 1 ml 2% lidocaine and 1 ml triamcinolone (40 mg) were injected. It should be stressed that this was a peri-radicular and not an intraneural injection. With this technique the nerve roots L3-L5 could be targeted (Fig. 1).

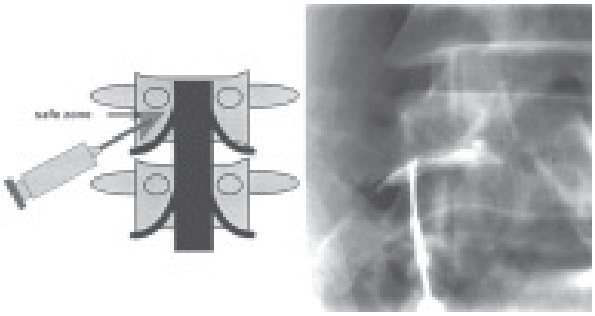


Fig.-1 : *Schematic description of the technique of a selective nerve root block at the level L1-L5 (A). Correct radiculogram of the L5 nerve root after periradicular injection of contrast medium (B).*

To perform a selective nerve root block at the level of S1, a different technique is required. First the image intensifier is positioned perpendicular to the foramen S1. A spinal needle is inserted perpendicular to the surface of the sacrum into the foramen. The correct needle positioning is checked by image intensifier in two planes. After obtaining a correct periradiculogram, 1 ml 2% lidocaine and 1 ml triamcinolone (40 mg) is injected (Fig. 2).

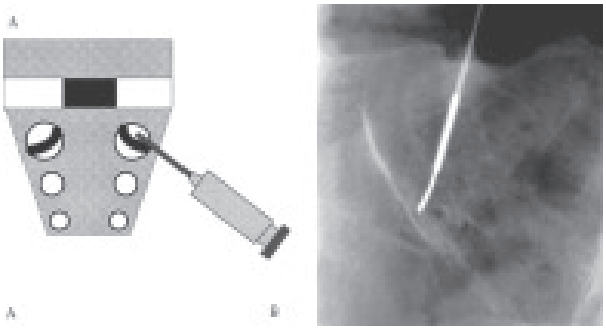


Fig.-2: *Schematic description of the technique of selective nerve root block at the level S1 (A). Correct radiculogram of the S1 nerve root after periradicular injection of contrast medium (B).*

The patients had a clinical surveillance on the ward for about 30 minutes to account for any unexpected side effects. Patients were routinely asked to report the pain reduction on a visual analogue scale 30 minutes after injection. The clinical follow-up was at 2–3, 6 and 12 weeks and 6 months after injection. A successful nerve root block was defined as reduction of the leg pain of more than 60% within the first 4 days. This time interval was chosen because the effect of the steroids is not immediate.

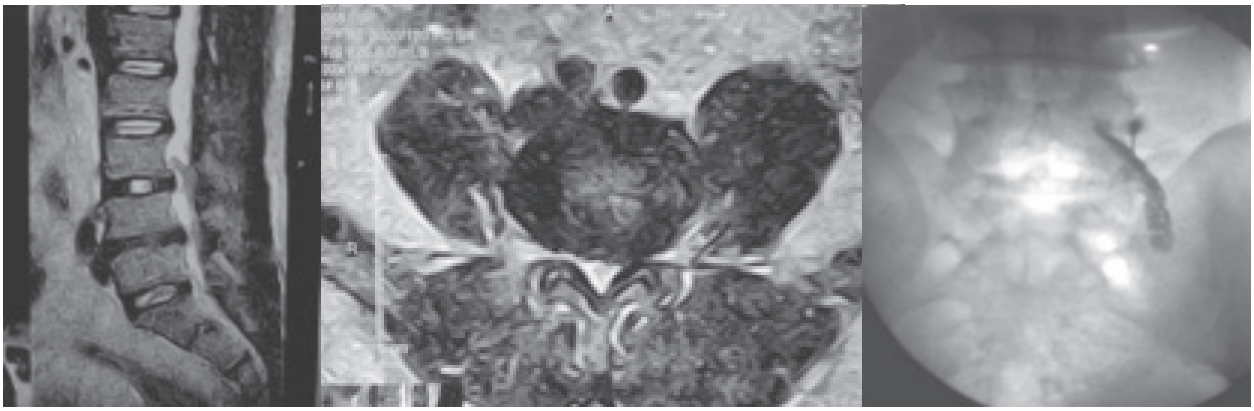


Fig.-3: *Thirty-five-year-old patient with acute onset of severe radicular leg pain with a mild sensory motor deficit of L5 (MRC grade M4). MRI (A and B) shows a disc herniation at the level of L4/5 with sequestration and compression of the nerve root L5. A selective nerve root block of L5 (C) results in a rapid and permanent resolution of the pain within 3 days. At 6 month follow-up, the patient is pain-free and has made a full neurological recovery.*

RESULTS

The average follow-up was 6 months (range, 2–9 months). At 2 to 3 weeks' follow-up, 21 of 24 patients reported successful pain reduction (Fig. 3). In 14 patients, this pain reduction was obtained immediately and in a further 3 patients within 3 days (1 of these patients had a temporary pain increase). In 3 patients, the nerve root block did not show a sufficient pain reduction despite a correct periradiculogram. 4 patients required repeat injection since the first nerve root block did not have the expected success or because the effect was only short-term (less than 1 week). 2 individuals who had an immediate pain relief after the injection but recurrent symptoms had successful surgery with complete relief of the leg pain. There were no complications, in particular no infections, nerve root injuries or bleeding events.

DISCUSSION

Macnab first described selective nerve root blocks in 1971[15]. This infiltration performed with contrast agent and lidocaine aimed to differentiate different sources of leg pain in an equivocal clinical situation[15]. Frequently, it is not possible to exactly localise the compromised nerve root either by clinical neurological examination or by imaging studies. This is particularly true for multilevel nerve root compromise as shown by MRI. There is increasing evidence that there is no close correlation between imaging findings and clinical symptoms[16]. The high incidence of asymptomatic disc herniations recently reported in the literature raises questions about the validity of our morphologically based understanding of pain pathogenesis in this condition[17-20]. These findings stress the importance of an unequivocal concordance of the clinical symptoms and imaging findings as a prerequisite for a successful disc surgery. Numerous studies[21–26] have shown that a nerve root block is helpful in cases were this close correlation is lacking. In the event of a positive response (i.e., resolution of leg pain), the nerve root block allows the diagnosis of the affected nerve root with a sensitivity of 100% in cases with disc protrusions and with a positive predictive value of 75 to 95% in cases of a foraminal stenosis[21,26]. So far, the diagnostic aspect has been the predominant reason for a nerve root block.

A systematic analysis of the therapeutic effect of nerve root blocks has so far not been extensively studied. In a prospective study, Weiner and Fraser[23] investigated the success of nerve root blocks in 30 patients with foraminal and extraforaminal disc herniation. They found an immediate pain reduction in 27 patients, of whom only 3 required surgery because of recurrent leg pain, whilst 2 individuals were lost to follow-up. In total, 22 of 28 patients (79%) had a substantial and permanent pain reduction during a 1–10 year follow-up.

In our study disc protrusions and foraminal stenosis were included as diagnostic groups. Although we anticipated that the therapeutic effect of nerve root blocks would be more pronounced in cases with a discogenic nerve root compression compared to a foraminal (bony) stenosis, we did not find a difference between the 2 groups. While a chemical irritation of the nerve root by disc material is well documented experimentally[4], mechanical compression appears to be the major source in foraminal stenosis. However, foraminal stenosis in elderly patients often persists for a long time before suddenly becoming symptomatic. It remains unclear whether an acute inflammation is the reason for this sudden pain onset. Our

results support the hypothesis of an inflammatory mechanism because 60% of our patients had a rapid and permanent resolution of their leg pain after steroid injections. A more conclusive statement is not possible due to the small numbers and short followup but this deserves further exploration.

Since the study by Henrik Weber in 1982[27], it is well-known, that non-operative (in-hospital bed rest and subsequent physiotherapy) and operative treatment of disc herniations are equally effective after 4 to 10 years. Weber[27] has also shown, that the functional recovery of the nerve root is not superior in the operative group, in those patients presenting with a minor neurological deficit. The main drawback of the non-operative treatment (medication and physiotherapy) is the slow recovery and patients are disabled for a prolonged time period[27]. The effect of epidural steroid injections is still controversial in the literature[28]. Overall, 6 studies indicated that the epidural steroid injection was more effective than the reference treatment and 6 reported it to be no better or worse than the reference treatment[28]. Cuckler et al.[29] treated 73 patients with radicular leg pain either with methylprednisolone acetate and procaine or with physiological saline and did not observe an effect of the steroids after an average of 20 months between both groups. In a more recent study, Carette et al.[30] analysed 158 disc herniation patients with a prospective, placebocontrolled trial (methylprednisolone vs. saline) in terms of outcome. After six weeks, the authors observed a significant improvement in terms of leg pain and sensory deficits but this difference did not achieve statistical significance at three months. The authors concluded that epidural injections of methylprednisolone result in a short term improvement in leg pain and sensory deficits. However, this treatment offers no significant functional benefits at 12 months, nor does it reduce the need for surgery. The drawback of epidural injections is the verification of the correct epidural application of the steroids unless the injection is performed with contrast medium under image intensifier control. On the contrary, a selective nerve root block is always performed under image intensifier control and the correct application to the target nerve root is documented by the injection of contrast medium. Although the steroids applied by the foraminal route can in theory diffuse and involve more than a single nerve root, we did not observe any case reporting a temporary sensory deficit of an adjacent nerve root. This demonstrates the relative selectiveness of the block. With regard to the lack of clinical effectiveness of epidural injections it is important to stress, that the key issue of the local steroid injection is a short-term relief and not a long-term effect because of the benign natural history of this disease[10, 27]. In our study, 21 of 24 patients with a minor neurological deficit and with an unequivocal MRI finding had rapid pain resolution,60% of the patients had permanent resolution of pain.

With regard to an average pain duration of 8 weeks and the presence of a neurological deficit, surgical interventions would have been justifiable in all of these cases. In 60% of the patients a rapid permanent pain resolution occurred, obviating the need for surgery.

Our study is a prospective analysis of patients with radicular leg pain treated by selective nerve root blocks. We clearly acknowledge the limitations of our study because of short study period. Despite that limitation, there is circumstantial evidence, that selective nerve root blocks are an effective and less invasive intervention, and serve as an adjunct to non-operative treatment. In the majority of in-dividuals, a surgical intervention could be pre-vented because of a rapid pain resolution, despite there being a clear indication for surgery. Because a positive treatment effect could be demonstrated by our retrospective analysis, the therapeutic efficacy of a nerve root block deserves further exploration by prospective, randomised doubleblind studies.

CONCLUSION:

The selective nerve root block combined with careful history, physical examination and quality radiolographic studies, is an important tool in the treatment of patients with predominant Lumbar radicular symptoms. It gives acceptable results in lumbar Radicular pain relief largely in patients where surgery is not appropriate for whatever reasons.

REFERENCES

1. Mixter WJ, Barr JS. Rupture of the intervertebral disc with involvement of the spinal canal. N Engl J Med 1934;211:210–5.

2 Rydevik B, Garfin S. Spinal nerve root compression. In: Szabo RM, ed. Nerve Root Compression Syndromes: Diagnosis and Treatment. New York: Slack Medical; 1989. p. 247–61.

3 Olmarker K, Rydevik B. Pathophysiology of sciatica. Orthop Clin North Am 1991;22:223–34.

4 Olmarker K, Rydevik B, Nordborg C. Autologous nucleus pulposus induces neurophysiologic and histologic changes in porcine cauda equina nerve roots. Spine 1993;18: 1425–32.

5 Olmarker K, Blomquist J, Strömberg J, Nannmark U, Thomsen P, Rydevik B. Inflammatogenic properties of nucleus pulposus. Spine 1995;20:665–9.

6 McCarron RF, Wimpee MW, Hudkins PG, Laros GS. The in-flammatory effect of nucleus pulposus. A possible element in the pathogenesis of low-back pain. Spine 1987;12:760–94.

7 Marshall LL, Trethewie ER. Chemical irritation of nerve-root in disc prolapse. Lancet 1973/II:320.

8 Olmarker K, Byrod G, Cornefjord M, Nordborg C, Rydevik B. Effects of methylprednisolone on nucleus pulposus-induced nerve root injury. Spine 1994; 19: 1803–8.

9 Otani K, Arai I, Mao GP, Konno S, Olmarker K, Kikuchi S. Nu-cleus pulposus-induced nerve root injury: relationship between blood flow and motor nerve conduction velocity. Neurosurgery 1999;45:614–9.

10 Saal JA, Saal JS. Nonoperative treatment of herniated lumbar intervertebral disc with radiculopathy. An outcome study. Spine 1989;14:431–7.

11 Cowan NC, Bush K, Katz DE, Gishen P. The natural history of sciatica: a prospective radiological study. Clin Radiol 1992; 46:7–12.

12 Masaryk TJ, Ross JS, Modic MT, Boumphrey F, Bohlman H, Wilber G. High resolution MR imaging of sequestered lumbar intervertebral disks. AJNR Am J Neuroradio 1988;9:351–8.

13 Eismont F, Currier B. Current concepts review. Surgical management of lumbar intervertebral disc disease. J Bone Joint Surg 1989;71A:1266–71.

14 Bogduk N, Aprill C, Derby R, Selective nerve root blocks. In: Wilson DJ, ed. Interventional Radiology of the Muskuloskeletal System. London: Edward Arnold; 1995. p. 122–32.

15 Macnab I. Negative disc exploration. An analysis of the causes of nerve-root involvement in sixty-eight patients. J Bone Joint Surg Am 1971;53:891–903.

16 Boos N, Lander PH. Clinical efficacy of imaging modalities in the diagnosis of low-back pain disorders. Eur Spine J 1996;5: 2–22.

17 Boden SD, Davis DO, Dina TS, Patronas NJ, Wiesel SW. Ab-normal magnetic-resonance scans of the lumbar spine in asymptomatic subjects: a prospective investigation. J Bone Joint Surg 1990;72A:403–8.

18 Boos N, Rieder R, Schade V, Spratt K, Semmer N, Aebi M. 1995 Volvo Award in Clinical Sciences. The diagnostic accuracy of magnetic resonance imaging, work perception and psychosocial factors in identifying symptomatic disc herniations. Spine 1995;20:2613–25.

19 Jensen MC, Brant-Zawadzki MN, Obuchowski N, Modic MT, Malkasian D, Ross JS. Magnetic resonance imaging of the lum-bar spine in people without back pain. N Engl J Med 1994; 331:69–73.

20 Weishaupt D, Zanetti M, Hodler J, Boos N. MR imaging of the lumbar spine: Prevalence of intervertebral disk extrusion and sequestration, nerve root compression, endplate abnormalities and osteoarthritis of the facet joints in asymptomatic volunteers. Radiology 1998;209:6616.

21 Castro WH, van Akkerveeken PF. Der diagnostische Wert der selektiven lumbalen Nervenwurzelblockade. Z Orthop Ihre Grenzgeb 1991;129:374–9.

22 Stanley D, McLaren MI, Euinton HA, Getty CJ. A prospective study of nerve root infiltration in the diagnosis of sciatica. A comparison with radiculography, computed tomography, and operative findings. Spine 1990;15: 540-3.

23 Weiner BK, Fraser RD. Foraminal injection for lateral lumbar disc herniation. J Bone Joint Surg Br 1997;79: 804-7.

24 Dooley JF, McBroom RJ, Taguchi T, Macnab I. Nerve root infiltration in the diagnosis of radicular pain. Spine 1988;13: 79–83.

25 Wilppula E, Jussila P. Spinal nerve block. A diagnostic test in sciatica. Acta Orthop Scand 1977;48:458–60.

26 van Akkerveeken PF. The diagnostic value of nerve root sheath infiltration. Acta Orthop Scand Suppl 1993;251:61–3.

27 Weber H. 1982 Volvo Award in Clinical Sciences. Lumbar disc herniation. A controlled, prospective sudy with ten years of ob-servation. Spine 1982;8:131–40.

28 Koes BW, Scholten RJ, Mens JM, Bouter LM. Efficacy of epidural steroid injections for low-back pain and sciatica: a sys-tematic review of randomized clinical trials. Pain 1995;63: 279–88.

29 Cuckler JM, Bernini PA, Wiesel SW, Booth RE Jr, Rothman RH, Pickens GT. The use of epidural steroids in the treatment of lumbar radicular pain. A prospective, randomized, double-blind study. J Bone Joint Surg Am 1985;67:63–6.

30 Carette S, Leclaire R, Marcoux S, Morin F, Blaise GA, St.-Pierre A, et al. Epidural corticosteroid injections for sciatca due to herniated nucleus pulposus [see comments]. N Engl J Med 1997;336:1634–40.

Original Article

Laparoscopic Cholecystectomy With Spinal Anaesthesia: A Prospective Randomised Study

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Abstract

Laparoscopic cholecystectomy (LC) is conventionally performed under general anesthesia (GA).There are multiple studies which have found spinal anesthesia as a safe alternative. We have conducted this study of LC, performed under spinal anesthesia to its safety and feasibility in comparison with GA.

Fifty patients with symptomatic gallstone disease and American Society of Anesthesiologists grade I or II were randomized to have LC under spinal(n=25) or general(n=25) anesthesia. Intraoperative vitals, postoperative pain, complications and recovery compaired between the 2 groups.

In the SA group six patients(24%) complained of shoulder pain. All the patients(100%) developed per-operative hypotension and bradicardia. None of the patients in the SA group had immediate postoperative pain at operated site. Only 2 patients(8%) had pain score of 4 at the operative site with in eight hours requiring rescue analgesics. One patient had nausea but no vomiting(4%).All the patients(100%) in the GA group had pain at operated site immediately after surgery and their pain score ranged from 4-7, all patients received rescue analgesic before shifting to the ward. Although, the GA group had more patients experiencing postoperative nausea and vomiting it was not statistically significant.

Spinal anesthesia is feasible, safe and cost effective for elective LC.

Keywords: Cholecystectomy, Gallstone disease, Laparoscopic cholecystectomy, Laparoscopy, Regional anesthesia, Spinal anesthesia

INTRODUCTION

Laparoscopic cholecystectomy (LC) has become the gold standard for the surgical treatment of symptomatic cholelithiasis and has gained worldwide acceptance[1]. It is minimally invasive procedure with a significantly shorter hospital stay and a quicker convalescence compaired with the classical open cholecystectomy[2].

LC is conventionally done under general anesthesia(GA) and may be associated with postoperative pain and nausea and vomiting(PONV). Rogers et al., published a meta-analysis showing that the use of neuroaxial techniques for a variety of surgical procedures resulted in a decrease in mortality, venous thromboembolism, myocardial infarction, and several other complications[3]. Regional anaesthesia techniques have been used for performing LC as an alternative to GA. It has been used as a routine technique for otherwise healthy patients. Spinal anesthesia (SA) is a commonly used anaesthetic technique that has a very good safety profile. SA has several advantages over GA, like reduced postoperative pain, nausea,vomiting and smooth post anesthesia recovery period, as the patient is awake and oriented at the end of the procedure. There are multiple reports that have been published regarding the feasibility of SA for LC in patients fit for GA[4-10].

The aim of this prospective, randomized study was to evaluate the efficacy, safety and advantages of conducting LC under SA in comparison to GA.

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MATERIALS AND METHODS

A randomized controlled clinical trial was conducted in the department of surgery 250 bed Chittagong General Hospital and different clinics for a period of 2 years from January 2012 to December 2013 in order to see the efficacy, safety and advantages of conducting LC under SA in comparison to GA. 50 patients were included in the study. The inclusion criteria were all patient of both sexes 20-65 yrs of age with American Society of Anaesthesiologists Grade I and II admitted with uncomplicated symptomatic cholelithiasis. Acute cholecystitis, pancreatitis, cholangitis, previous upper abdominal surgery, pregnancy and contraindication for spinal anaesthesia were excluded from the study.

Informed consent was taken from all patients before enrollment into the study. After detailed preoperative evaluation and preparation for surgery patients were randomly allocated into 2 arms of the trial, control group (GA group) and Experimental group(SA group).Every alternate patient was enrolled in each group. Both groups received standard 4 port laparoscopic procedure. On arrival in the preoperative room the patients non-invasive blood pressure (NIBP),oxygen saturation (Spo2) and heart rate(HR) were recorded. Intravenous cannulation was done with an 18G catheter inserted in forearm and patients received 500 ml of ringer's lactate solution, 10 mg of metoclopramide, 50mg of ranitidine hydrochloride. All patients received prophylactic preoperative antibiotic ceftriaxone 1 gm iv.

In the SA group SA was performed with the patient in sitting position. After infiltration with 2% lidocaine, a 26 gauge lumber puncture was done in L2-L3 intervertebral space.4 ml of hyperbaric bupivacaine (0.5%) and 15 micrograms(mcg) of Fentanyl were injected intrathecally. The patient was then placed in the supine position with 10o head down for 10 min. The sensory level of T4 dermatome level was accepted as to allow LC. As soon as the sensory block level reached T4 dermatome level, the surgery was started. HR, NIBP, SpO2 were measured and recorded at 5 minute intervals during the surgery. In all 25 cases blood pressure(BP) fall down and patients having bradicardia. BP was managed by fluid load and 10 mg of Ephedrine iv bolus and if needed repetation done. Bradycardia was managed by 0.6mg atropine iv. When the patient settle, diazepam 10 mg and fentanyl 80 mcg given iv slowly for sedation and prevention of intraoperative shoulder pain.

In the GA group , patients received the standard protocol of 250 Bed Chittagong General hospital.

The intraoperative incidents like right shoulder pain, hypotension, nausea and/or vomiting were recorded. Postoperative pain was assessed regularly using a visual analog scale from 0-10,with 10 being most severe, for 24 hr. Intramuscular Nalbuphine Hydrochloride 20mg was used as rescue analgesic and the total dose administered during first 24h postoperatively was recorded.500mg of Paracetamol was given orally every 8 hours. Patients were discharge after 24 h. Followup of the patients was performed at 4th POD, at the end of first and fourth postoperative week.

Standarized protocol was strictly followed for patients allocation and prescribed case record form(CRF) was used for collection of data.

STATISTICAL ANALYSIS

Statistical analysis was done by student t-test and Chi-square test were performed for nonparametric values and corresponding p-value was computed using SPSS (Statistical Package for the social Sciences) (software version 17) for windows and p-value <0.05 was considered statistically significant.

RESULTS

The study was conducted between January 2012 till December 2013.A total number of 50 patients were included in the study.

In both the groups,all the procedures were completed laparoscopically, and there were no conversion to open cholecystectomy. Both the groups had similar demographic profile. In the SA group, 15 patients were females and 10 patients were males.The mean age was 45+/-11.73[Table-I].In the SA group nine patients had diabetes mellitus which was well controlled and five patients were hypertensives. The GA group had 8 males and 17 females, their mean age was 47.84+/-10.49. Seven patients were well controlled diabetics and six patients were hypertensives on treatment.

In the SA group six patients (24%) complained of shoulder pain. In all 25 patients(100%) developed per-operative hypotension and bradicardia. BP was managed by fluid load and 10 mg of Ephedrine iv bolus and if needed repetation done. Bradycardia was managed by 0.6mg atropine iv. None of the patients in the SA group had immediate postoperative pain at operated site. Only two(8%) patients had pain score of 4 at the operative site within eight hours requiring rescue analgesics. One patient had nausea(4%) which subsided with ondensetron 4 mg iv but no vomiting.[table-II]

All the patients(100%) in the GA group had pain at the operated site immediately after completion of operation and their pain score ranged from 4-7, all the patients received rescue analgesics before shifting to the ward[table-III].Although, the GA group had more patients experiencing postoperative nausea and vomiting, it was not statistically significant. Two patients in the SA group needed catheterization .None of the patient had postoperative infections or headache[table-IV] .

Table-I

Demographics of patients in both group studied

	SA Group	GA Group	P-value
Age(years)Mean+/-standard deviation	45+/-11.73	47.84+/-10.49	0.383
Gender(n%)Male(36%)	10	8	0.391
Female(74%)	15	17	
Age in years	61.95+/-7.78	64.44+/-10.22	0.383

SA:Spinal anesthesia GA:General Anesthesia

Table-II

Spinal Anesthesia group intraoperative events.

Shoulder pain	6	24%
Hypotension	25	100%
Nausea intraoperatively	1	1%
Vomiting	0	
Immediate post op.pain	0	

Table-III

Pain scores

VAS+/-SD	SA group(n=25)	GA group(n=25)	p-value
Immediate post op. period	0	5+/-1.16	<0.001
1 hour post op.	0	4.48+/-1.31	<0.001
2 hour post op.	0	3.76+/-1.34	<0.001
4 hour post op.	0.45+/-1.35	4.16+/-1.22	<0.001
8 hours post op.	3.55+/-0.90	4.92+/-1.38	<0.001
24 hour post op.	3.80+/-0.97	3.48+/-0.94	0.28

SA: Spinal Anesthesia GA: General anesthesia

Table-IV

Postoperative complication

VAS+/- SD	SA group(n=25)	GA group(n=25)	p-value
Postoperative nausea & vomiting	4	7	0.49
Postoperative spinal headache	0	0	-
Urinary retention	2	0	0.48
Wound sepsis	0	0	-

SA:Spinal Anesthesia , GA: General Anesthesia

DISCUSSION

The anesthetic technique of choice for laparoscopic procedures is GA.Recent studies indicate regional anesthesia for LC is safe,economical and has good postoperative pain control. But there are concerns associated with SA like raised intraabdominal pressure resulting in regurgitation of gastric content. There is also a concern of hypotension and bradycardia during laparoscopic procedures done under SA due to the effect of reduced venous return peripheral vasodilatation due to SA and also consequent to increased intraabdominal pressure and reversed Trendelenburg position[11,12]

In our study, we had hypotension in all 25 cases (100%) we could be correct it with fluid load and vasopressor boluses. Sinha et al.,[8] noted an incidence of hypotension as 20.5% in their series.Tzovaras et al., found that intraoperative hypotension is a well known adverse effect of spinal anesthesia it was easily managed and did not affect the planned procedure[5].

Although, recent studies have shown that laparoscopy in patients with regional anesthesia may be tolerated well, shoulder tip pain can be a significant intraoperative problem. The reported incidence for intraoperative right-shoulder pain in previous studies requiring iv fentanyl administration ranged from 10-55.2%[6-10].Referred pain to right shoulder is probably due to irritation of diaphragm by the CO2 pneumoperitonium[13]. In our study, six patients(24%) complained of shoulder pain but none of them required conversion to GA. Hamad et al., reported intraoperative right shoulder pain 10% which was similar to our study[4], but Tzovaras et al., encountered right shoulder pain in 10 patients(20%)[5]. Sinha et al., reported intraoperative right-shoulder pain in 12.3% patients but none of them required conversion to GA[8]. Yusek et al., reported an incidence of intraoperative right-shoulder pain in 50%; it was severe enough to necessitate anaesthetic conversion in three patients (10.3%) and in five patients (17.2%), additional spraying of the diaphragm with 2% lidocaine solution was required for control of the pain[6]. Patients in the SA group had lower pain scores in the first 24 h, but after that the level of postoperative pain was similar in both groups. The additional analgesics requirement was in the GA group was more than double that of the SA group in first 24h in our study. Earlier studies have reported that LC done under SA results in significantly less early postoperative pain and analgesic requirement compared to that performed under GA[1,7].

The reduced pain in the SA group may be due to a persistent neuroaxial blockade by SA[14].

Although, the incidence of PONV was not significant between both the groups the GA group had more patients with PONV compared to SA group. Bessa et al., study had 22.2% of the GA group having PONV compared to only 6.9% of patients in the SA group. Postoperative urinary retention requiring catheterization was seen in two patients in the SA group. This is known to be related to regional anesthesia with rates of upto 20% in some series[15].

LIMITATION

The main limitation of this study would be the small number of the cases and it will be tried to continue on the trial in further research protocols involving patients who are high risk for GA.

CONCLUSION

This study confirms the feasibility, safety and cost effectiveness of spinal anaesthesia for elective laparoscopic cholecystectomy.The patients outcomes are similar in both techniques this makes SA a cost effective option in developing countries.

REFERENCES

1. Bessa SS, Katri KM, Abdel-Salam WN, El-Kayal SA, Tawfik TA. Spinal versus general anesthesia for day-case laparoscopic cholecystectomy: A prospective randomized study.J Laparoendosc Adv Surg Tech.2012;22:550-55.
2. Kesus F, de Jong JAF, Gooszen HG, van Laarhovan CJHM. Laparoscopic versus open cholecystectomy for patients with symptomatic cholecystolithiasis. Cochrane Database Syst Rev.2006;4:CD006231.
3. Rodgers A, Walker N, Schug S, Mckee H, van Zundert A, Dage D et al. Reduction of postoperative mortality and morbidity with epidural or spinal anesthesia: results from an overview of randomized trials.BMJ.2000;321:1493-97.
4. Hamad MA, Ibrahim El-Khattary OA. Laparoscopic cholecystectomy under spinal anesthesia with nitrious oxide pneumoperitoneum: A feasibility study. Surg Endosc.2003;17:1426-28.
5. Tzovaras G, Fafoulakis F, Pratsas K, Georgopouloun S, Stamatiou G, Hatzitheofilou C. Laparoscopic cholecystectomy under spinal anesthesia. A pilot study. Surg Endosc 2006;20:580-82.
6. Yuksek YN, Akat AZ, Gozalan U, Dagler G, Yasar Pala Y,Canturk M, et al. Laparoscopic cholecystectomy under spinal anesthesia.Am J Sur.2008;195:533-36.
7. Tzovaras G, Fafoulakis F, Pratsas K, Georgopouloun S, Stamatiou G, Hatzitheofilou C. Spinal vs. general anesthesia for laparoscopic cholecystectomy.Interim analysis of a controlled, randomized trial.Arch Surg.2008;143:497-501.
8. Sinha R, Gurwara AK, Gupta SC. Laparoscopic cholecystectomy under spinal anesthesia:A study of 3492 patients. Laparoendosc Adv Surg Tech A.2009;19:323-27.
9. Tiwari S,Chauhan A, Chaterjee P, Alam MT. Laparoscopic cholecystectomy under spinal anesthesia:A prospective randomized study .J Min Access Surg.2013;9:65-71.
10. Goyal S, Sinha S. Laparoscopic cholecystectomy under spinal anesthesia with low-pressure Pneumoperitoneum-Prospective study of 150 cases. Arch Clin Exp Surg.2012;1(4):224-28.

11. Gutt CN,Oniu T, Mehrabi A, Schemmer P, Kashfi A, Kraus T, et al. Circulatory and respiratory complications of carbon dioxide insufflation.Dig Surg.2004;21:95-105.

12. Hirvonen EA, Poikolainen EO, Paakkonen ME, Nuutinen LS. The adverse haemodynamic effects of anesthesia, head-up tilt, carbondioxide pneumoperitoneum during laparoscopic cholecystectomy. Surg Endosc.2004;14: 272-77.

13. Sarli L, Costi R, Sansebastiano G, Trivelli M,Roncoroni L. Prospective randomized trial of low-pressure pneumoperitoneum for reduction of shoulder-tip pain following laparoscopy.Br J Surg.2000;87:1161-65.

14. Gurusamy KS, Samraj K, Davidson BR. Low-pressure versus standard pressure pneumoperitoneum in laparoscopic cholecystectomy. Cochrane Database Syst rev.2009;(2):CD006930.

15. Jensen P, Mikkelsen T, Kehlet H. Postherniorrhaphy urinary retention: effect of local, regional and general anesthesia: a review. Reg Anesth pain med.2002; 27: 612-17.

Evaluation of Results of Open Reduction and Internal Fixation by Reconstruction Plate in Closed Intra-Articular Calcaneal Fracture

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ABSTRACT:

We Studied 19 patient with intra-articular calcaneal fracture managed by open reduction and internal fixation by reconstraction plate in NITOR, over a period of 2 years between January 2010 and December 2011.According to Marylamd Foot Score, after 5 to 18 Month Follow-up the result were 5. 26% Excellent 73.68%Good, 10.53% Fair and 10.53% Poor .78.94% Was satisfactory (Excellent and Good) and 21.06% was unsatisfactory (Fair and poor) result .5.26% of the patients returned to Routine pre-injury activities, 73.68% of the patients pre-injury activities with mile limitation and 10.53% patients had changed their job.Wound dehiscence,superficial wound necrosis subtalar arthrities were the Commonest Complication in our study, Surgical treatment with open reductions and internal fixation of intra-articular fracture of the calcancus Sanders type II and III is the best treatment by recostruction plate for achieving good clinical result. This study emphasizes the clinical success and lead to satisfactory result by open reduction and internal fixation by reconstruction plate in the management of displaced intra-articular fracture of Calcancus.

INTRODUCTION

Background of the study:

Fractures of the calcaneus were rare in prehistoric times. These fractures did not become frequent in Europe until the development of tall buildings, such as monsteries, castles and churches. Even after that this injury was exceedingly rare up to the advent of the Industrial Revolution. Since then, motor vehicle accidents and falls from height have become relatively commonplace (Wells C. 1976)

The calcaneus is the most commonly fractured tarsal bone and accounts for about 2% of all fractures (Sanders R. et al.,2006). Calcaneus fractures comprise 60% of all major tarsal injuries of the foot with the majority resulting from falls from height . Since the mechanism of injury is axial loading, 10% of calcaneal fractures are associated with thoracic or lumber spine compression fracture and more than 20% are associated with other injuries of the lower extremities (Roger LF., 1992).

The calcaneus acts as a weight-bearing base of the foot as well as a lever arm for the muscles that allow the push-off which occurs with forceful gait (Lowery RBW et al. 1996).

The calcaneus articulates with the talus through three facets: posterior, middle and anterior. The largest of these is the posterior which transmits a significant portion of the body weight concentrated to a small area, creating large forces over the small domelike articular surface.

The mechanism of injury is usually through axial loading of the calcaneus, causing a blow-out of the lateral wall of the calcaneus and fracture through the posterior facet with various degrees of comminution.

The sustentaculum tali usually remains properly aligned with the talus, which provides a reference for reduction of the posterior facet during surgery.

Calcaneal fractures are the result of high energy impact, with mechanism of injury including falls from height and

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motor vehicle accidents. As such they tend to be the more common in young labourers who work on scaffolding, bridges and ladders.

Calcaneal fractures have characteristic appearances based on the mechanism of injury and are devided into two major groups, intraarticular and extraarticular. Most calcaneal fractures (70% - 75%) are intraarticular and result from axial loading that produces shear and compression fracture lines (Sanders R. 2000). Extraarticular fractures account for about 25% - 30% of calcaneal fractures and include all fractures that do not involve the posterior facet.

Ninety percent of calcaneal fractures occur in males between 41 and 45 years of age, with most occurring in industrial workers, and their morbidity and loss of working capacity are considerably high. The economic importance of this injury is highly significant in that 20% of patients may be totally incapacitated for up to 3 years and partially impaired for up to 5 years after injury (Kitako HB et al. 1994). Therefore, their management is extremely important. The management of calcaneal fractures was first described by Essex-Lopresti, and since then their conservative or surgical approaches have been recommended (Ebrahem N. A. et al. 2000).

MATERIALS AND METHODS

Study design

This prospective interventional study was undertaken to evaluate the result of open reduction and internal fixation of closed intraarticular fracture of the calcaneus by reconstruction plate.

The present study is a quasi experimental type.

Place of study

The study was undertaken at the National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh.

Study period

January 2010 to December 2011.

Study population

All patients attending at emregency and out-patient department in NITOR.

Study sample

Patients with intraarticular calcaneal fracture.

Sample size

The sample size was determined using following formula.

$n = (Z2 \times p \times q)/d2$, where

Z= Standard normal deviate = 1.96 corresponding to 95% of Cl

P=Anticipated proportion, taken as 50%, i.e. 0.5

$q = (1-p) = 0.5$

d = allowable error (here 10% of 'p') = 0.05

Therefore, the required sample size, $n = (1.962 \times 0.5 \times 0.5)/(0.05)2 = 384$.

Due to time limitation and financial constraint only 22 cases were selected during study period but out of them 20 cases were feasible to be included in the study, remaining 2 cases were lost during follow up.

Sampling technique

Purposive sampling (non randomized) according to availability of the patients and strictly considering the inclusion and exclusion criteria.

Inclusion criteria:

1. Close fracture.
2. Displaced intraarticular fracture, Sanders' type II and type III.
3. Unilateral involvement.
4. Fracture duration less than 3 weeks were included

Exclusion criteria:

1. Age > 60 years
2. Calcaneus fracture associated with spinal inury or lower limb long bone fracture.
3. Peripheral vuscular diseases.
4. Pathological fracture
5. Patients who were unfit for surgical treatment.

Surgical Technique

With informed and written consent, under spinal anesthesia, the tourniquet is inflated to 350mm Hg after exsaanguination. Painting and drapping are done. The operation is performed by placing the patient in lateral decubitus position. The foot centered at the end of the table so that the surgeon can move with ease around the foot to perform the procedure.

The calcaneum is approached through an extensile right angle lateral incision with full thickness flap.7,61.65

An L-shaped (Rt side) or J-shaped (Lt side)surgical incision is made posteriorly and inferiorly to the lateral malleolus. The vertical branch of the incision lies between the Achilles tendon and the sural nerve, the horizontal branch lies at

the limit between the plantar and the dorsal skin extending to the base of the fifth metatarsal. Fig-2

The incision is made down to the bone in order to make a cutaneous – subcutaneous flap that includes the peroneal tendons. This full-thickness flap is created by a subperiosteal dissection of all tissue of the lateral wall of the calcaneus . The calcaneofibular ligament is taken with the flap. Similarly, when the peroneal tendons are found they are left in their sheath except where they cross the peroneal tubercle. Here the cartilaginous "Pulley" is dissected of the calcaneus on order to leave the tendon sheath intact.

This flap is developed anteriorly to expose the posterior subtalar joint.

The subtalar joint is opened and the fractures of the lateral calcaneal wall are dissected in order to expose the fractured and depressed articular fragments.

The full-thickness flap is then retracted using the "no touch" technique & three kirschner wires: one up the fibular shaft, one in the talar neck, and one in the cuboid.

A short schanz pin is inserted into the posteroinferior corner of the calcaneus to achieve reduction and to regain the length and axis , This completes the lateral approach.

Post-operative Care

Operative limb was elevated and closed suction drainage was done for 24 to 48 hours until drainage was less than 25 ml per 8 hours. After removal of drain patient was allowed to walk by using axillary crutches.

The short leg splint was removed at 3 to 5 days postoperatively. If the wound margin showed uncomplicated healing and the wound was sealed, early active movement of the ankle and subtalar joint was started.

A removable short leg splint was used to prevent development of equinus deformity.

Patient was discharged at the end of 4th or 5th postoperative day and advised to return at the end of second week for intermittent stitch removal to prevent wound dehiscence.

Patient was advised to return again at the end of 3rd week for removal of remaining stitches and to return at 6 weeks interval for a radiographic and clinical examination.

Patients who developed wound dehiscence, routinely foot bath and dressing were done. Wound was healed in second intention.

Partial weight bearing is allowed after 6th week and full weight bearing after radiological union of fracture, usually at the 12 weeks.

OBSERVATION AND RESULTS:

The present study was carried out between January 2010 to December 2011 at NITOR and clinic on Dhaka city. Total 21 patients of Sanders' type I, type II and type III intraarticular fracture of calcaneus were selected but 1 patient was lost during follow up. The purpose of the study was to evaluate the outcome of treatment. All the patients after clinical examination and investigation were treated with open reduction and internal fixation by reconstruction plate and followed up from 7 to 17 months. All the relevant findings obtained from data analysis are presented in tables and figures.

Presentation of patients

Table-I

Presentation of patients (n=20)

Total number of patients	20
Male	16
Female	4
Mean age	36 years
Average length of follow up	11 months

Age distribution:

Table – 2. Age distribution of the patients (n=20)

Mean age= (36+11.15) years; range=(21-70) years

The mean age of patients was 36+11.15 years and the lowest and the highest ages were 22 and 60 years respectively.

Occupation

Table-IV

Occupation of the patients

Occupation	Number of patients	Percentage
Labourer	15	75
Service holder	1	5
House wife	2	10
Student	1	5

Out of 19 patients, 15 patients were labourer which includes 75% of total patients.

Mechanism of injury

Table - VI, Distribution of patients by mechanism of injury

Out of 19 patients, 14 patients were affected by fall from height and 5 patients by RTA.

Type of fracture

Out of 19 patients, 10 patients were Sanders' type II, 7 patients were type III and 2 patients were type IV.

Follow up

Table -11, Distribution of post operative follow up period in months.

All the 19 patients were follow up for at least 7 months, up to a maximum of 17 months, average 11 months. Duration of postoperative hospital stay in this series was 3 to 10 days, average 5 days.

All patients were advised to attend for follow up at 6th, 12th, 18th week up to a minimum 7 months. Each patient was evaluated both clinically and radiologically. At final follow up the results were designed as excellent, good, fair or poor according to Maryland Foot Score.

Complications :

Table 12. Incidence of complications

In term of complication, 1 (5%) of the patients developed loss of sensation along the lateral border of the foot and wound dehiscence, 1 (5%) developed superficial wound necrosis, 4 (20%) developed wound dehiscence, 1 (5%) developed reflex sympathetic dystrophy and 1 (5%) developed subtalar arthritis.

Functional assessment – Activity level.

Table 13. Distribution of patient by activity level (n=20)
5 % of the patient returned to routine preinjury activities, 70 % of patients to preinjury activities with mild limitation and 15% to preinjury activities with moderate limitation and 10 % unable to perform routine activities.

Final clinical outcome

Table 15

Outcome of patients based on Maryland foot Score.

Maryland Foot Score criteria	Frequency	Percentage
Excellent	1	5
Good	14	70
Fair	3	15
Poor	2	10
Satisfactory (Excellent+Good)	15	75
Unsatisfactory (Fair+Good)	5	25

Test of significance – Confidence interval

In this study it is found that 75% satisfactory results among 20 patients of closed intraarticular calcaneal fracture fixation by reconstraction plate. If this procedure put in total population then satisfactory result will be found in following confidence interval (at 95% level).



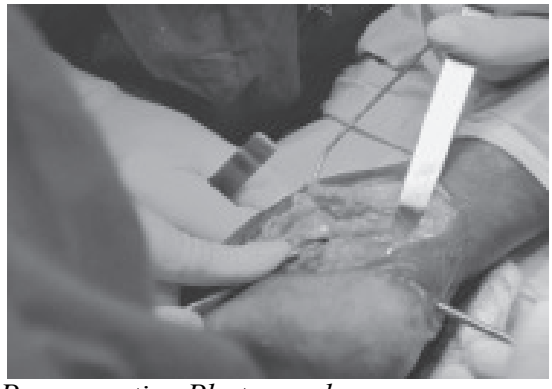
Photograph of Final Follow-up



Photograph of Final Follow-up



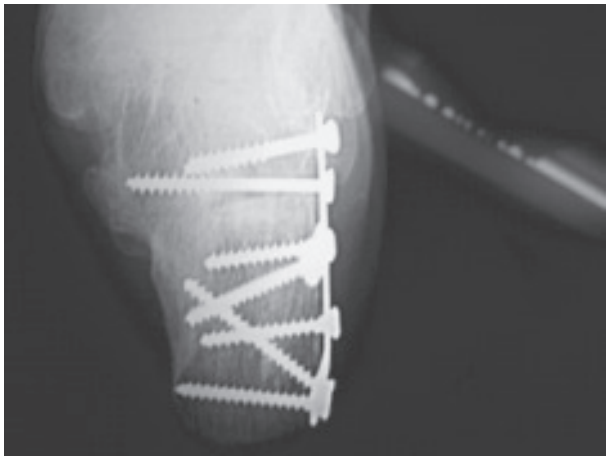
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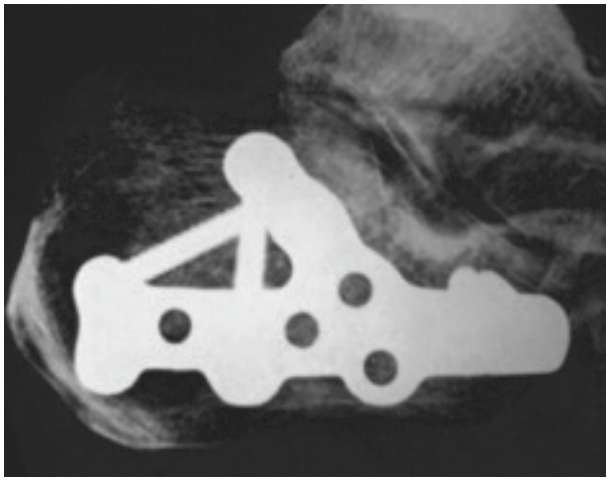
Per-operative Photograph



Per-operative Photograph



Post-operative X-ray axial view



Post-operative X-ray lateral view

DISCUSSION

Calcaneal fractures constitute only 2% of all fractures. The most frequently broken heel bone is the calcaneus and intraarticular fractures occupy a large proportion (60%-70%) of calcaneal fractures leading to significant disabilities. Since most the patient are actively working men, the resultant loss in work force and cost effectiveness have a direct impact on socioeconomic life.

Surgical treatment of displaced calcaneal fractures is an established surgical standard. Accurate anatomic reduction and osteosynthesis is major importance. The restoration of the tension of the plantar fascia by reconstruction of Bohler's angle and hindfoot length is important for the biomechanics of the foot. Anatomical and biomechanical studies refer to the important role of the posterior joint facet which has to be stablised to reconstruct the subtalar joint. The selected implant should be able to neutralize the forces resulting from the Achilles tendon and maintain reduction of the fragments until bony consolidation. Most plates used for calcaneal fractures have a small number holes and do not allow for significant moulding because of their thickness. In this situation, the screws have to be inserted in the fractured zone of the lateral wall, specially in the comminuted fractures. This sometimes can lead to insufficient mechanical resistant of the implant. We noted practical advantages to the use of reconstruction plate. It is almost always possible to insert the screw in a good cortical area of the lateral calcaneal wall and so improve the mechanical endurance of the implant and the plate exerts a compression effect when screws are being tightened, thus reducing the width of the posterior tuberosity.

The aim of surgical management' is to maintain the smoothness of the displaced articular surfaces and to re-cover the normal weight-bearing position of the calcaneus with a sound stabilisation which allows earlier mobiliza-tion of the subtalar joint. For that reason, it is believed that maintenance of height of the calcaneus prevents arthrosis of the ankle. In addition, a normal gait is established by restoring the length of the heel and subtalar stiffness, and pain is obviated by ensuring smoothness of the articular facets. Timing of the op-eration and choice of incision are also important factors. Many authors recommend that the operation should be done within 5-10 days after the injury. It was stated that intervention within 5 days after the trauma might lead to problems with wound healing due to the presence of ex-cessive edema, and also intervention after the 10th post-traumatic day might pose difficulties for proper anatomic reduction.

In our series, the time in-terval between injury and the operation was 1—10 days (mean 6 days). Apart from these patients, especially in cases_of excessive oedema, we delayed the operation for approximately 5-6 days after the trauma.

We rated 8 and 11 cases as excellent and good (77% in total), respectively. We obtained 4 fair and 2 poor results for patients with inadequate anatomic reduction. The achievement of anatomic reduction and stable os-teosynthesis are relatively important factors for better functional outcomes and the patients' full recovery. In our series, 13 patients returned to their work 2 years after the operation. However, 4 patients took 3 years to regain their full working capacity. Two patients with poor outcomes could not return to their previous job and were only able to work in a half-sitting position.

Notwithstanding their relatively minor prevalance among all types of fractures, the management of calcaneal frac-tures deserves considerable attention because of the extent of the loss of work and serious morbidities. The key to success in the management of displaced intraarticular fractures is the achievement of anatomic reduction, and maintenance and preservation of the reduction with stable osteosynthesis. Given the results in the literature and our own experience in this series, we are convinced that only a surgical approach can lead to satisfactory results in the management of displaced intraarticular fractures of the calcaneus.

CONCLUSION:

The management of calcaneal fractures deserves considerable attention because of the extent of the loss of work and serious morbidities. The key to success in the management of displaced intra-articular fractures is the achievement of anatomic reduction, and maintenance and preservation of the reduction with stable osteosynthesis. Surgical treatment with open reduction and internal fixation of intra-articular fractures of the calcaneus of Sanders type II and III is the best treatment by reconstruction plate for achieving good clinical results. In this study, short term follow-up showed good functional results with a high percentage of patients returning to their previous occupation. Given the results in the literature and in this series, it is established that only a surgical approach can lead to satisfactory results in the management of displaced intra-articular fractures of the calcaneus.

REFERENCES

1. Abidi NA, Dhawan S, Gruen GS, Vogt MT, Conti SF. Wound-healing risk factors after open reduction and internal fixation of calcaneal fractures. Foot Ankle Int. 1998;19:856-861.
2. Bernischke S. K, and Sangeorzan B. J: Extensive intraarticular fractures of the foot. Surgical management of the calcaneal fractures. Clin Orthop 1993; 292: 128-134.
3. Bezes, H.; Massart, P.; Delvaux, D.; Fourquet, J. P.; and Tazi, F.: The operative treatment of intraarticular calcaneal fractures. Indications, technique, and results in 257 cases. Clin. Orthop., 290: 55-59,1993.
4. Bohler, L.: Diagnosis, pathology, and treatment of fractures of the os calcis . J. Bone and Joint Surg, 13: 75-89, Jan. 1931. Buckley, R. E., and Meek, R. N.: Comparison of open versus closed reduction of intraarticular calcaneal fractures: a matched cohort in workmen . J. Orthop. Trauma. 6: 216-222,1992
5. Bajammal S, Tornetta P 3rd, Sanders D, Bhandari M. Displaced intra-articular calcaneal fractures. J Orthop Trauma. 2005;19(5):360-4.
6. Ebraheim NA, Elgafy H, Sabry FF, Tao S (2000) Calcaneus fractures with subluxation of the posterior facet. A surgical indication. Clin Orthop 377: 210-216.Carr JB,
7. Hamilton JJ,Bear LS. Experimental intraarticular calcaneal fracture: anatomic basis for a new classification. Foot and ankle 1989;10:81-87..
8. Carr, J. B.: Mechanism and pathoanatomy of the intraarticular calcaneal fracture. Clin. Orthop., 290: 36-40, 1993.
9. Crosby, L. A., and Fitzgibbons, T.: Computerized tomography scanning of acute intra-articular fractures of the calcaneus: a new classification system. J. Bone and Joint Surg., 72-A: 852-859, July 1990.
10. Crosby, L. A., and Fitzgibbons, T. C.: Intraarticular calcaneal fractures. Results of closed treatment. Clin. Orthop., 290: 47-54, 1993.
11. Crosby, L. A., and Fitzgibbons, T. C.: Open reduction and internal fixation of type II intraarticular calcaneus fractures. Foot and Ankle Internat., 17: 253-258, 1996.
12. Eastwood D. M. Phipp L. : Intraarticular fracture of the calcaneus: why such controversy? 1997;28;247-249.
13. Eastwood, D. M.; Gregg, P. J.; and Atkins, R. M.: Intra-articular fractures of the calcaneus. Part I: Pathological anatomy and classification. J. Bone amd Joint Surg., 75-B(2): 183-188, 1993.
14. Eastwood, D. M.; Langkamer, V. G.: and Atkins. R. M.: Intra-articular fractures of the calcaneus. Part II: Open reduction and internal fixation by the extended lateral transcalcaneal approach. J. Bone and Joint Surg., 75-B(2): 189-195, 1993.
15. Essex-Lopresti, P.: The mechanism, reduction technique, and results in fractures of the os calcis. British J. Surg. 1952; 39: 395-419.
16. Fernandez, D. L., and Koella, C.: Combined percutaneous and "minimal" internal fixation for displaced articular fractures of the calcaneus. Clin. Orthop., 290: 108-116, 1993.

17. Folk JW, Starr AJ, Early JS. Early wound complications of operative treatment of calcaneus fractures: analysis of 190 fractures. J Orthop Trauma. 1999;13:369-372.

18. Gould, N.: Lateral approach to the os calcis. Foot and Ankle, 4: 218-220, 1984.

19. Hutchinson, F., III, and Huebner, M. K.: Treatment of os calcis fractures by open reduction and internal fixation. Foot and Ankle Internat., 15: 225-232, 1994.

20. Kitaoka HB, Schaap EJ, Chao EY, An KN (1994) Displaced intraarticular fractures of the calcaneus treated non-operatively. J Bone and Joint Surg AM 76: 1531-1540.

21. Lin PP, Roe S, Kay M, Abrams CF, Jones A (1998) Placement of screws in the sustentaculum tali. Clin Orthop 352: 194-201.

22. Laughlin, R. T.; Carson, J.G.; and Calhoun, J. H.: Displaced intra-articular calcaneus fractures treated with the Galveston plate. Foot and Ankle Internat., 17: 71-78, 1996.

23. Letournel, E.: Open reduction and internal fixation of calcaneal fractures. In Topics in Orthopedic Surgery, PP. 173-192. Edited by P. Spiegel. Baltimore, University Park Press, 1984.

24. Levin, L. S., and Nunley, J. A.: The management of soft-tissue problems associated with calcaneal fractures. Clin. Orthop., 290: 151-156, 1993.

25. McLaughlin, H. L.: Treatment of late complications after os calcis fractures. Clin. Orthop., 30: 111-115, 1963.

26. Myerson, M., and Quill, G. E., Jr.: Late complications of fractures of the calcaneus. J. Bone and Joint Surg., 75-A: 331-341, March 1993.

27. O'Farrell, D. A.: O'Byrne, J. M.; McCabe, J. P.; and Stephens, M. M.: Fractures of the os calcis: improved results with internal fixation. Injury, 24: 263-265, 1993.

28. Palmer, I.: The mechanism and treatment of fractures of the calcaneus. Open reduction with the use of cancellous grafts. J. Bone and Joint Surg, 30-A: 2-8, Jan. 1948.

29. Richter M, Gosling T, Zech S, et al. A comparison of plates with and without locking screws in a calcaneal fracture model. Foot Ankle Int. 2005;26(4):309-19.

30. Redfern DJ, Oliveira ML, Campbell JT, Belkoff SM. A biomechanical comparison of locking and nonlocking plates for the fixation of calcaneal fractures. Foot Ankle Int. 2006;27(3):196-201.

31. Rammelt S, Gavlik JM, Zwipp H (2001) Historical and current treatment of calcaneal fractures. J. Bone and Joint Surg Am 83-A(9): 1438-1440.

32. Sanders R.: Radiological evaluation and CT classification of calcaneal fractures. In Disorders of the Foot and Ankle, edited by M. Jahss. Vol. 3, pp. 2326-2354. Philadelphia, W.B. Saunders, 1990,

33. Sanders, R.; Fortin, P.; Dipasqale, T.; and Walling, A.: Operative treatment in 120 displaced intraarticular calcaneal fractures. Results using a prognostic computed tomography scan classification. Clin. Orthop., 290: 87-95, 1993.

34. Sanders, R., and Gregory, P.: Operative treatment of intraarticular fractures of the calcaneus. Orthop. Clin. North America, 26: 203-214, 1995.

35. Soeur, R., and Remy, R.: Fractures of the calcaneus with displacement of the thalamic portion. J. Bone and Joint Surg., 57-B940: 413-421, 1975.

36. Song, K. S.; Kang, C. H.; Min, B. W.; and Sohn, G. J.: Preoperative and postoperative evaluation of intra-articular fractures of the calcaneus based on computed tomography scanning. J. Orthop. Trauma, 11: 435-440, 1997.

37. Squires B, Allen PE, Livingstone J, Atkins RM. Fractures of the tuberosity of the calcaneus. J. Bone and Joint Surg Br 2001; 83:55-61.

38. Stephenson, J. R.: Displaced fractures of the os calcis involving the subtalar joint: the key role of the superomedial fragment. Foot and Ankle, 4. 91-101, 1983.

39. Stoffel K, Booth G, Rohrl SM, Kuster M. A comparison of conventional versus locking plates in intraarticular calcaneus fractures: A biomechanical study in human cadavers. Clin Biomech (Bristol, Avon). 2007; 22(1): 100-5.

40. Thordarson, D. B., and Krieger, L.E.: Operative vs. nonoperative treatment of intraarticular fractures of the calcaneus: a prospective randomized trial. Foot and Ankle Internat., 17: 2-9, 1996.

41. Tornetta, P., III: Open reduction and internal fixation of calcaneus using minifragment plates. J. Orthop. Trauma, 10: 63-67, 1996.

42. Walde TA, Sauer B, Degreif J, Walde HJ. Closed reduction and percutaneous Kirschner wire fixation for the treatment of dislocated calcaneal fractures: surgical technique, complications, clinical and radiological results after 2-10 years. Arch Orthop Trauma Surg. 2008;128:585-591.

43. Zwipp H, Rammelt S, Barthel S. Calcaneal fractures: open reduction and internal fixation (ORIF). Injury. 2004;35(Suppl2): SB46-SB54.

Original Article

Occupational Hazards in Anaesthesia

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ABSTRACT

Of all the specialities of medical science Anaesthesia deserves and demand an equal even more importance in comparison with many other branches of medical science. Hazards may occur in every occupational place. But hazards that is more potential in Anaesthesia because an Anaesthesiologist always has to stay close with patients mouth and has to handle blood, fluid, secretions, saliva and has to work with syringe, needle, drug ampoules, machines and instruments and always in an environment of various volatile anaesthetic gases. An Anaesthesiologist always has to deal the mood of a patient before introduction of anaesthesia and sometime has to face and tolerate biting, scratching, Crying and non co-operation of paediatric and psychological imbalanced patients also. An Anaesthesiologist always in tension either there will be a difficult intubation or failed block or complication in an obese patient or other with co-existing diseases. Pre-operative pre-anaesthesia visit to the patient must be made compulsory both in the Government and private hospitals and clinics. It will alleviate the patients anxiety and tension of operations and anaesthesia. At the same time the Anaesthesiologist will get the chance to be known to the patients. Anaesthesiologist can also make a plan of anaesthesia and make a protective measure for himself before the schedule of operation. There should be provision of risk allowance for anaesthesia practitioners as they are always subjected to tension and hazards of operation theater.

INTRODUCTION:

Newer developments and advancement in anaesthesiology, surgical and medical fields have widened the functional scope of anaesthesiologist thus increasing his professional responsibilities and obligation.[1] An anaesthesiologist always faces different hazards during their practice. The operating room[2] in which anaesthesiologists spend most of their time, is regarded as an unhealthy workplace due to the potential risk it offers. However the health of anaesthesiologist is affected to a great extent by ever increasing professional and social burden both at workplace and in the personal life, with continuous physical & mental stress, anesthetist may suffer in various types of problem. So it is our duty to aware our self and to demonstrate it to the general people about the importance of Anesthesia.

OCCUPATIONAL HAZARDS:

Occupational environment[3] is meant the sum of external conditions and influences which prevail at the place of work and which have a bearing on the health of working population. A hazard may be defined as an unexpected, unplanned occurrence which may involve injury that may cause death, Damage, Disruption, Distortion, Disable. "Occupational hazards" are the hazards those occure in the course of employment**.**

BACKGROUND:

Anaesthesiologist[4] who spend more time in operating rooms than any other groups of physician are responsible for protecting unconscious patient from a multitude of possible dangers during surgery. As a result the anaesthesiologist is primarily responsible for ensuring the proper function of operating rooms medical gases, environment factors (e.g. temperature, humidity, ventilation and noise) and electric safety. Diethyl ether[5] is flammable. Highly volatile liquid which is flammable in air and explosive in oxygen. It is no longer used. Other flammable anaesthetic agents ethylchloride, ethelene, chloroform, Cyclopropane are no longer used. In past decades, static discharge were a feared source of ignition in an operating room fill with flammable anaesthetic vapors. Humidity at least 50%

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decreases likelihood of static discharges with the modern inflammable anaesthetic agent is safe in this aspect.

DESCRIPTION:

Hazard can be broadly classified into following categories[6]:

a) Biological hazards

b) Mechanical hazards

c) chemical hazards

d) Physical hazards

e) Personal hazards

(a) Biological hazards in anaesthesia[7]:

Occupational exposure to a range of pathogens represents a serious risk to anaesthetists. The risk of transmission of blood borne pathogens such as human immunodeficiency virus (HIV) and hepatitis B and C are well known, but occupational exposure also includes airborne pathogens such as tubercolosis. For anaesthetists the most likely source of an occupational exposure is self-inoculation from a needle during the insertion and suturing of intervascular catheters, the injection of intradermal anaesthesia or resheathing of used needles. Transmission may also occur after exposure to body fluid, pericardial fluid, plural fluid, synovial fluid, infected tissues and organs, exudative fluid from burns or skin lesions, vaginal secretions.

(b) Mechanical hazards in anaesthesia[8]:

These are not common hazards in routine anaesthesia practice but nevertheless can be potential source of injury and harm to the anesthesiologist at the workplace. These can range from simple collisions with equipment and objects to crushing, cutting, fracture, abrasions and puncture.

(c) Chemical hazards in anaesthesia[9]:

Inhalation of smoke and vapour generated by the use of surgical diathermy and lasers represent a potential hazard to anaesthetists. Surgical masks do not filter toxic gases nor trap particles <0.5 μm in diameter. Chemicals (e.g. toluene, styrene, carbon disulphide) have been identified in diathermy smoke and can cause corneal irritation, dermatitis, renal and hepatic toxicity and affect the central nervous system. Waste anesthetic[10] gases include both nitrous oxide and halogenated anesthetics such as halothane, enflurane, desflurane, sevoflurane have been implicated in various harmful biological effects. Metabolites of halogenated anaesthetics can potentially cause hepatic, renal, and pulmonary toxicity and decreased psychomotor efficiency on chronic exposure. Though, it is claimed about the teratogenic effects of anaesthetic gases cause congenital abnormalities in the newborn as well as a higher rate of spontaneous abortion among female anesthesiologists but nothing conclusive has been established as yet. The Oxygen enriched atmosphere of operation theatre along with presence of inflammable substance and ignition sources such as diathermy and lasers are potential factors that can cause fire or explosion in the operation theatre. Latex allergy[11] is one of the common allergies observed in the latex containing surgical gloves. It can occur as contact dermatitis.

(d) Physical hazards[12]:

These hazards can be from various sources. Such as noise pollution of various alarms and monitoring gadgets, sounds of cautery and harmonic vibrations of various equipment and suction apparatus, bright lights, electrical hazards from various electrical and electronic appliances and temperature changes in the operation theater. Both the ionizing (from C. Arm, portable X-Ray) and non-ionizing[13] radiation has been implicated as the potential hazard to the anaesthesiology at their workplace, the anaesthesiologist is exposed to radiation six times more than other personals. Repeated episodes may lead to cumulative exposure with potentially adverse health effects. Non-ionizing radiation from lasers may cause burn to the cornea and retina, destruction of macula or optic nerve and cataract formation. Orthopaedic and soft tissue injuries[14] – Abrasions, lacerations and cut injuries from glass are common during the snapping of drug ampoule, wrong positioning during airway securing and administration of neuroaxial anaesthesia is harmful for the back muscles and can potentially lead to disc problems in certain high risk individuals.

(e) Personal hazards[15]:

i) **Drug abuse and addiction–** multiple risk factors, individual susceptibility, long monotonus working hours, fatigable work shifts, personal problems in the family and marital discord, easy availability of the sedative narcotics and potent psychoactive drugs predispose the anaesthesiologsts to substance abuse that can prove harmful not only to himself but can be devastating for the patient as well. Some anesthetist may develop addiction in halothane.

ii) Stress and burn out[16]: A higher levels of stress included over work, nature of duties especially night shifts, disturbances of natural sleep cycle, additional

administrative responsibilities besides heavy clinical schedule, family problems, financial problems, litigation problem etc. stress "burnout" is the end result of taking too much stress for a long time leading to mental and physical exhaustion and ultimately resulting in mental and physical breakdown and a tendency to commit suicide. Stress may course hypertension, diabetics mellitus, ischemic heart disease, mental depression etc.

ii) **Exhaustion and fatigue[17]–** Stress can lead to fatigue which can be mental, physical or emotional, can lead to impaired decision making can cause accidents while driving. Metabolic consequences though rare but are associated with fatigue and include hypoglycaemia, hypovolemia, ill health, gastritis, coronary artery diseases and high propensity for drug abuse.

Recommendation:

- Anesthetist always should have mentality to protect himself from the hazards of anaesthesia.
- Gloves[18] must worn during induction of Anaesthesia, performance of venepuncture or insertion of any intravascular cannula and during insertion or removal of airways and tracheal tubes. Use of gloves and other barriers during contact with open wounds and body fluids frequent hand washing.
- Cuts or abrasions[19] on the anaesthetists hands should be covered with a waterproof dressing. An anaesthetist with considerable skin lessions, such as eczema, chopping or several scratches particularly at risk of being infected.
- If a needlestick[20] injury or contamination of a cut or abrasion occurs, bleeding should be encouraged and the skin washed thoroughly with soap and water.
- Needle precautions[21] including no recapping and immediate disposal of contaminated needles.
- Anaesthetist must wear lead apron with thyroid shields and stay with a distance from the source of radiation.
- Anaesthetist should introduce anaesthesia with a calm and cool mind.
- Exhausted Anaesthetist should not perform Anaesthesia.
- Anaesthetist should check proper investigations of the patient specially tuberculosis, HBS_{Ag} and HIV for suspected patient.
- Every Anaesthetist should check himself for function of liver, Kidney, heart and metabolic disorders every year.

CONCLUSION:

Anaesthesia is a work of tension and risk. An anaesthetist must know the operation theatre environment and should careful about every corner of the operation theatre. He or she not only maintain the safety of anaesthesia machine but also be cautous about safety of electricity, diathermy and radiation. All responsibilities of the patient go on anaesthetist and always needs maintenance of strong mental stability to outcome a good recovery of the patient. An anaesthetist always face multiple occupational hazards from small needle prick, cut injury, abrasion to inhalation of anaesthetic gases and explosion. An anaesthetist always should maintain a cool mind for giving a safe anaesthesia. Srilonkan anaesthesiologist Deepthi Attygalle Says- "An anaesthetist should have three eyes, four hands, a rotating neck, a small stomach and double bladder". So, we can think that an anaesthetist always live in anxiety and pain and sometimes suffer from different mental and physical diseases. We must have to realize that an anaesthetist should take proper diet, rest and recreation for the sake of the patient. "Among this unhappy world is the administrator of anaesthetics and he/she should cover himself in every way possible."

REFERENCES:

01. Website www.aerouline.org/article.asp risk and safety concrus in anesthesiology practice: The present perspective.
02. Website www.sciencedirect.com/..../S0034709413 occupational hazards and diseases related to the practice of Anaesthesiology.
03. Preventive and social Medicine by K. park twentieth edition, Chapter-16, Page-708
04. Clinical Anaesthisiology
    By G.Edward Morgan, 4th Edition, Chapter-2, Page-18
05. Textbook of Smith Alkinson
    Page-162, Chapter-13, 4th Edition
06. Risk and Safety Concerns in anaesthesiology practice; The present perspective www.aeronline.org/article.asp
07. Website Occupational hazards of anesthesia CEACEP-Oxford journals Ceaccp.oxfordjournals.org/6/5/182.full
08. Risk and Safety Concerns in anaesthesiology practice; The present perspective www.aeronline.org/article.asp
09. Occupational hazards of anaesthesia CEACE- Oxford journals Caecap.oxfordjournals.org/—/6/5/182.

10-17. Risk and Safety Concerns in anaesthesiology practice; The present perspective www.aeronline.org/article.asp

18-20. Textbook of Smith Atkinson, Page-162, Chapter-33, 4th Edition, Page-412.

21. Lees synopsis of Anaesthesia, eleventh edition, Chapter-19, Page-358.

Case Report

Frequency of Spinal Tuberculosis in National Tuberculosis Control Clinic

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Abstract:

To find out the frequency and age distribution of patient suffering from spinal tuberculosis in Bangladesh. A cross sectional study was carried out in National Tuberculosis control clinic, Shymoli, Dhaka from January 2009 to December 2010. Patient who are diagnosed clinically as spinal tuberculosis were included in this study. Purposive type of non-probability sampling method was followed and questionnaire was developed for collection of data for this study. The age range of this study was between 1.5 months to 68 years. The highest number of patient in this series 11(36.66%) belong to age group 1-10 years and the 2nd peak, 7 (23.33%) were in age group 51-60 years. In this study 16 (53%) patient were male and 14 (47%) were female and the most frequent involvement was in thoracic spine 13(43.33%) and next common involvement was in thoraco-lumbar spine which was 10(33.33%). of total patients. Most frequent presentation were with complaints of back pain and weight loss . About.48.6%, of total patient had complaints of back pain and 43.2% had suffered from weight loss. / Only 8.1%. were presented with low grade fever .Further multi-center, randomized study should be conducted with large sample size. We can conclude that children and elderly people are the most frequent victim of spinal tuberculosis, involving thoracic and throraco-lumbar spine most commonly and presenting with back pain and weight loss. Further multicenter, randomized study should be conducted with large sample size.

Key words: Tuberculosis, spinal.

INTRODUCTION:

Tuberculosis is a deadly disease affecting many people in the world and spinal tuberculosis is a destructive form of tuberculosis which accounts for approximately half of all cases of musculoskeletal tuberculosis.[28] Evidences of spinal tuberculosis have been found in Egyptian mummies dating back to 3400 BC1. [2] Tuberculosis was a leading cause of mortality in the beginning of the twentieth century.[3] Improvement in the socio-economic status led to a major decline in its prevalence..Malnutrition, poor sanitation, and exanthematous fever are the factors contributing to the spread of the disease. [4] The commonest causative organism for spinal tuberculosis is Mycobacterium tuberculosis. The dorsal spine is involved in half the cases of spinal tuberculosis.[6] A minimum time lag of 2 to 3 years is present between the development of primary focus and manifestation of the disease in the spine. [7] Destruction of vertebral bodies compromises the nutrition of the intervertebral disc and leads to progressive disc destruction and vertebral collapse.[8] The clinical features of tuberculosis of the spine include insidious onset of localised pain in the spine. This is usually accompanied by fever, malaise, anorexia and weight loss. Clumsiness in walking and weakness in lower limbs may be present.[9] There may be evidences of associated extra-skeletal tuberculosis like cough, expectoration, lymphadenopathy, diarrhoea and abdominal distension. Presence of hoarseness, dysphagia, respiratory stridor or torticollis indicates cervical involvement. [10] Physical examination of the spine reveals localized tenderness and

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Para vertebral muscle spasm. A kyphotic deformity due to prominence of spinous process may be evident due to collapse and anterior wedging of vertebral bodies. [11] Tuberculous necrotic material from the cervical spine may collect in the form of a cold abscess or as discharging sinus. The presence of a sinus in the back with a thin watery discharge is a strong evidence of tuberculous involvement of the posterior arch of vertebral bodies. [12]Radiographs are the first line of investigations to substantiate or refute a clinical diagnosis of tuberculosis of the spine. The earliest signs are narrowing of the joint space and loss of definition of the paradiscal margin of vertebral bodies. [13] The wide availability of CT scanning and MR scanning has increased the use of these modalities in the management of tuberculosis of the spine. A positive Mantoux test can be observed, one to three months after infection. Technetium (Tc) - 99 m bone scan showed increased uptake in 63 per cent patients with active tuberculosis in the series reported Acid-fast bacilli may be demonstrated on smear examination. [14] The high prevalence of tuberculosis precludes the need of histopathological diagnosis prior to starting chemotherapy. [15] The scientific basis for the clinical management of spinal tuberculosis has been well established by the British Medical Research Council group and Hong Kong surgeons. Antitubercular chemotherapeutic agents are the mainstay of management, with chemotherapy for 12 months preferred to shorter courses. The standard is a combination of isoniazid, rifampin, and pyrazinamide, with or without ethambutol. [16] Patients who present late with deformity are candidates for anterior debridement and stabilization with corrective instrumentation. Posterior instrumented stabilization to prevent kyphosis in early spinal tuberculosis is indicated, however, only when anterior and posterior elements of the spine are involved, particularly in children.[17] It is concluded that spinal tuberculosis without unsightly kyphosis and neurologic symptoms is a medical, rather than a surgical, condition. Surgery should be reserved for those patients who have advanced tuberculosis with unacceptable complications such as paraplegia and or deformity.[18] This study was done to find out the frequency of spinal tuberculosis in National Tuberculosis Control Clinic, Dhaka.

METHODS

A cross sectional study was carried out in National Tuberculosis control clinic, Shymoli, Dhaka from January 2009 to December 2010. Patients who are diagnosed clinically as spinal tuberculosis irrespective of age and sex, socio-economic status were included in this study. Purposive type of non-probability sampling method was followed in this study. For diagnosis, complete blood count, x-ray chest, FNAC (Fine needle aspiration cytology) and MRI was done and for treatment purpose, National Tuberculosis control guideline as category I, II and III was followed as per indication.

RESULTS

Table 1

Distribution of patient by age

Age in years	No of patients	% of total patient
0-10 yr	11	36.66%
11-20 yr	01	3.33%
21-30yr	06	20%
31-40yr	01	3.33%
41-50yr	02	6.66%
51-60 yr	07	23.33%
above 60yr	01	3.33%

Age range of the patient in this series was between 1.5 months to 68 years. 11(36.66%) patient belong to age group 1-10years which is the most frequently involved age group. The 2nd peak 7(23.33%) patient was in the age group 51-60 years.

Table I1

Showed the sex distribution of the patient

	No of patient	% of patient
Male	16	53%
Female	14	47%

- Regarding the sex distribution , this study showed that 16 (53%) patient were male and 14 (47%) were female. Male are slightly predominantly affected by spinal tuberculosis than female.

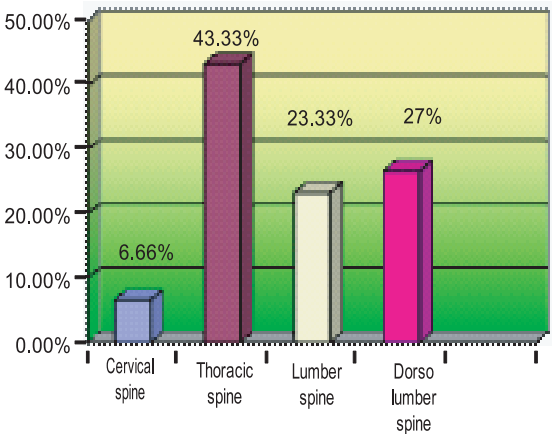


Fig.-1: *Distribution of the patients by level of involvement of spine*

The most frequent involvement is in thoracic spine 13(43.33%) and involvement of thoraco-lumbar spine is 8(27%). was the next frequent. 7(23.33%) patient were suffering from lumbar spine involvement and only 2(6.66%) had cervical spine tuberculosis.

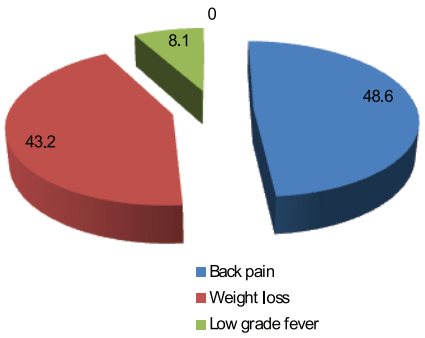


Fig.-3: *Distribution of the patients by complaints*

Majority (48.60%,) of the patients in the present study had presented with back pain and, 43.2% had been suffering from weight loss .and only 8.1% patients had low grade fever as initial presentation.

DISCUSSION

In this series thirty patient who are diagnosed as spinal tuberculosis were included.The age range of the patient in this study was between 1.5 months to 68 years. The majority 11(36.66%) belong to age group 1-10 year which is comparable to other studies [27] Infant and young children are more prone than older children and adult to develop spinal tuberculosis . Tuberculosis in children is a public health problem of special significance because it is a marker of recent transmission of tuberculosis.[27] Infant and young children are more likely than adult to develop life threatening form of tuberculosis In the present study the 2nd peak, 7 (23.33%) is at age group 51-60 year. This signifies that spinal tuberculosis also affects elderly people more commonly than adult . Spinal tuberculosis account for half all cases of musculoskeletal tuberculosis [28]The exact incidence of spinal tuberculosis in most part of the world including Bangladesh are not known. But in countries with high burden of pulmonary tuberculosis incidence of spinal tuberculosis is expected to proportionately high. Approximately 10% of the patient with extrapulmonary tuberculosis have skeletal involvement and spine is the most common skeletal site affected [28] The incidence of spinal tuberculosis is increasing in developed countries and that increase is likely due to impairment of immune system by the human immunodeficiency virus leading to reactivation of latent infection and a likelihood of progression to active disease.[1,28]. In this study 16 (53%) patient were male and 14 (47%) were female, showing that male are slightly more prone to develop spinal tuberculosis. The most frequently involved area is thoracic spine 13(43.33%) and the next frequent site of involvement is thoracolumbar spine which is 8(27%) Spinal tuberculosis commonly affect thoracolumbar spine and the next frequenrt site of involvement is lumber spine[27] Majority of the patient in the present study presented with back pain(48.6%) similar to other studies [19,2021], About 43.2%patient had weight loss at the time of presentation reflecting that the patient with spinal tuberculosis has generally late presentation for management.. The effects of spinal tuberculosis were devastating. Spinal tuberculosis can cause destruction of verterbrae, spinal deformity, and parapleg **T**uberculosis of spine is an aggressive form of tuberculosis. Delay in establishing diagnosis and management causes spinal cord compression and spinal deformity .A high degree of clinical suspicion is required if patient present with back pain along with constitutional symptoms even in the absence of neurological symptom and signs.

REFERENCES

1. Dass B, Puet T A and Watanakunakorn C. Tuberculosis of the spine (Pott's disease) presenting as 'compression fractures.' *Spinal Cord* 2002; 40: 604- 608
2. Fancourt GJ, Ebden P, Garner P. Bone tuberculosis: results and experience in Leicestershire. Br J Dis Chest 2006; 80: 265-272.
3. Davies PD, Humphries MJ, Byfied SP. Bone and Joint Tuberculosis. A survey of notifications in England and Wales, J Bone Joint Surg (Br) 2004, 66: 326- 330.
4. Hayes AJ, Choksey M, Barnes N, Sparrow OCE, Spinal tuberculosis in eveloped countries; difficulties in diagnosis. J R Coll Surg Edinb 2006; 41: 192-196.
5. Janssens JP, De Haller R. Spinal uberculosis in a developed country. A review of 26 cases with special emphasis on abscesses and neurologic complications, Clin Orthop 2010; 257: 67-75.
6. Cotton A, Flipo RM, Drouot MH. Spinal tuberculosis: Study of the radiological aspects of 82 cases. J Radiol 2006; 77: 419-426.
7. Munoz Fernandez S, Cardenal A, Balsa A. Rheumatic manifestations in 556 patients with human immunodeficiency virus infection. Semin Arthritis Rheum 2001; 21: 30- 39.
8. Vassilopoulos D, Chalasani P, Jurado RL. Musculoskeletal infetions in patients with human

immunodeficiency Virus Infection edicine (Baltimore) 2007; 76: 284- 294.

9. Leibert E, Schluger NW, Bonk S, Rom WN. Spinal tuberculosis in patients with human immunodeficiency virus infection: clinical presentation, therapy and outcome. Tuber Lung Dis 2006; 77: 329-334.

10. Brashear HR, Rendleman DA. Pott's paraplegia. South Med J 2008; 71: 379.

11. Friedman B. Chemotherapy of tuberculosis of the spine. J Bone Joint Surg (Am) 2006, 48, 451-474.

12. Dobson J. Tuberculosis of the spine. An analysis of the results of conservative treatment factors influencing prognosis. J Bone Joint Surg (Br) 2001, 33, 517-531.. Pertuiset E, Johann B, Liote F. Spinal uberculosis in adults. A study of 103 ases in a developed country, 2009; 78: 309-320.

14. Azzam NI, Tammawy M. Tuberculous spondylitis in adults: diagnosis and treatment. Br J Neurosurg 2008; 2: 85- 91.

15. Perronne C, Saba J, Behloul Z. Pyogenic and tuberculosis spondylodiskitis (vertebral

osteomylitis) in 80 adult patients. Clin Infect Dis 2004; 19: 746-750.

16. Jain R, Sawhney S, Berry M. Computed tomography of tuberculosis: patterns of bone destruction. Clin Radiol 2003; 47: 196-199.

17. Nussbaum ES, Rockwold GL, Bergman TA. Spinal tuberculosis: A diagnostic and management challenge. Neurosurg 2005; 83: 243-247. Lindhal S, Nymann RS, Brismar J. Imaging of tuberculosis. IV. Spinal manifestations in 63 patients. Acta Radiol 2006; 37: 506-511.

19. Naim-ur-Rahman. Atypical forms of spinal tuberculosis. J Bone Joint Surg 2010, 62, 162-165.

20. Monaghan D, Gupta A, Barrington NA. Case report: tuberculosis of spine, an unusual presentation. Clin Radiol 2001; 43: 360-362.

21. Weaver P, Lifeso RM. The radiological diagnosis of tuberculosis of adult spine, Skel Radiol 2004; 12: 178-186. Ridley N, Shaikh MI, Remedios D. Radiology of skeletal tuberculosis. Orthopedics 2008; 21: 1213-1220.23. Desai SS. Early diagnosis of spinal tuberculosis by MRI, J Bone Joint Surg (Br) 2004, 76: 863-869.

24. Ahmadi J, Bajaj A, Destian S. Spinal tuberculosis: atypical observations at MR imaging. Radiology 2003; 189: 489-493.

25. Rezai AR, Lee M, Cooper PR. Modern management of spinal tuberculosis. Neurosurgery 2005; 36: 87-97.

26. Moon MS. Tuberculosis of the spine. Controversies and a new challenge Spine 2007, 22, 30-39

27. Kanabar P. Tuberculosis of lumbar spine.IJO, vol39;issue 2:81-89 . Garg RK, Somvashi DS. Spinal tuberculosis; A review. J spinal cord med,sep 2011;440-454 doc 101179/2045772311Y000000023

Principles of Medical Ethics

Md. Golam Sarwar

The medical profession has long subscribed to a body of ethical statements developed primarily for the benefit to the patient. As a member of this profession, a physician must recognize responsibility to patients first and foremost, as well as to society, to other health professionals, and to self. The following principles adopted by the American Medical Association. Principles are as following:

1. A physician shall be dedicated to providing competent medical care, with compassion and respect for human dignity and rights.
2. A physician shall uphold the standards of professionalism, be honest in all professional interactions, or not engaging in fraud or deception, to appropriate entities.
3. A physician shall respect the law and also recognize a responsibility to seek changes in those requirements which are contrary to the best interests of the patient.
4. A physician shall respect the rights of the patients, colleagues, and other health professionals, and safeguard patient confidences and privacy within the constraints of the law.
5. A physician shall continue to study, apply, and advance scientific knowledge, maintain a commitment to medical education, make relevant information available to patients, colleagues, and the public, obtain consultation, and use the talents of other health professionals when indicated.
6. A physician shall, in the provision of appropriate patient care, except in emergencies, be free to choose whom to serve, with whom to associate, and the environment in which to provide medical care.
7. A physician shall recognize a responsibility to participate in activities contributing to the improvement of the community and the betterment of public health.
8. A physician shall, while caring for a patient, regard responsibility to the patient as paramount.
9. A physician shall support access to medical care for all people. (adopted June 1957; revised June 1980; revised June 2001)

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The practice of medicine has changed in ways that highlight the relevance of ethical issues. Medical science can intervene in ways that were not previously possible; patients are better informed; limitation is more common; physicians have to be aware of the cost implications of their treatment for society; they have to juggle obligations to the hospital, the health region and the government.

Ethics deals with right and wrong conduct, with what we ought to do and what we should refrain from doing.

Medical ethics concerns how to handle moral problems arising out of the care of patients; often clinical decisions must consider more than just the patient's medical condition.

Ethics is not only discipline that deals with these issues; the law and theology also prescribe certain behaviors. Law is concerned with rules enacted by a certain society and that have effect within geographical boundaries.

Evolving bases for ethical reasoning

Beware of a distinction between ethical arguments that are based on set principles, which is called "principlism" and arguments of a more flexible nature in which the circumstances of a case influence the decision (casuistry) or case-based argument.

The four Traditional Pillar of Medical Ethics

There are four basic principles of medical ethics. Each addresses a value that arises in interactions between providers and patients. The principles address the issue of fairness, honesty, and respect for fellow human beings.

Autonomy :

Respect for autonomy of the patient. Autonomy refers to the capacity to think, decide and act on one's own free initiative. Physicians and family members therefore should help the patient come to their decision by providing full information, even if it appears medically wrong. This principle simply means that an informed, competent adult patient can refuse or accept treatments, drugs, and surgeries according to their wishes. And these decisions must be respected by everyone, even if those decisions are not in the best interest of the patient.

Beneficence :

Promoting what is best for the patient. The definition of 'what is best' may drive from the health professional's judgment or the patient's wishes; these are generally in agreement, may diverse. What is good for one patient may not be good for another, so each situation should be consider individually. Beneficence implies consideration of patients pain, their physical and mental sufferings; the risk of disability and death; and their quality of life.

Non-maleficence:

'Do no harm' is the bedrock of medical ethics. In every situation, health care providers should avoid causing harm to their patients. The most treatments involve some degree of risk or have side-effects, so their principle reminds us to ponder the possibility of doing harm, especially when you can not cure.

Justice:

Resources are limited; you can't cure everybody and so priorities must be set. In allocating care, the justice principle holds that patients in similar situations should have access to the same care, and that in allocating resources to one group we should assess the impact to this choice on others. In other words, you should try to be as fair as possible when offering treatment to patients and allocating scarce medical resources.

Finally, the health care provider must consider four main areas when evaluating justice; fair distribution of scarce resources, competing needs, rights and obligations, and potential conflicts with established legislation.

Related principles:

Confidentiality: confidentiality forms a cornerstone of the doctor-patient relationship; it implies respecting the patient's privacy, encouraging them to seek care and preventing discrimination on the basis of their medical condition. In order to protect the trust between doctor and patient, the physician should not release personal medical information without the patient's consent. Like other ethical duties, however, confidentiality is not absolute. It can be necessary to override privacy in the interests of public health, as in contact tracing for partners of a patient with sexually transmitted disease.

A patient's relative gives you information on the patient but asks you not to reveal where the information came from.

Disclosure: for the patient to be informed and to make informed choices, the doctor must disclose information that is materially relevant to the patient's understanding of their condition, their treatment options and likely outcomes.

Informed consent: follows from the principle of patient autonomy, and consent is required before you may provide care. "no medical intervention done for any purpose-whether diagnostic, investigational, cosmetic, or therapeutic- should take place unless the patient has consented to it" informed consent also serves as a significant protection to you against possible litigation.

Consent may be given verbally, but a consent form provides evidence of consent. It is not contract, however, and the patient can withdraw consent at any time. For routine procedure such as blood pressure check, consent may be implied if the patient comes voluntarily to the doctor's office for a check-up.

PUTTING IT INTO PRACTICE:

Several groups have proposed frameworks that help you to address the ethical aspects of a difficult situation in a systematic manner.

Herbert's book (page 20) suggests the following steps in reaching an ethical decision:

1. Describe the case simply but with the pertinent facts
2. Specify the ethical dilemma
3. What alternatives do you have ?
4. List the key considerations: Autonomy; Beneficence; Justice; Context (situational factors such as your own feelings,your peers, the law)
5. Propose a resolution
6. Review this choice critically: formulate it as a general maxim and review its plausibility
7. Do the right thing !