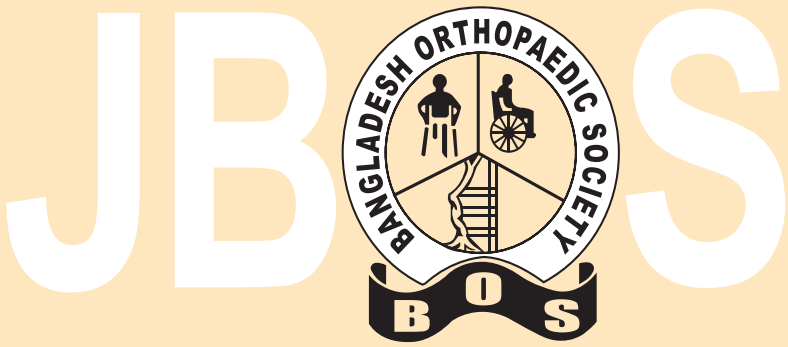


The Journal of Bangladesh Orthopaedic Society

January 2020 **Volume 35 Number 1**

ISSN 1998-6602

The Journal of Bangladesh Orthopaedic Society (JBOS)

Published by



BANGLADESH ORTHOPAEDIC SOCIETY

The Journal of Bangladesh Orthopaedic Society (JBOS)

JOURNAL COMMITTEE 2018 - 2020

Chairman		Prof. Ramdew Ram Kairy
Editor	:	Dr. Md. Golam Sarwar
Associate Editor	:	Dr. Kazi Shamim Uzzaman
Assistant Editor	:	Dr. Mohammad Mahfuzur Rahman Dr. Mohammad Moazzam Hossain
Members	:	Dr. Md. Wahidur Rahman Dr. Monaim Hossen Dr. Md. Jahangir Alam Dr. Maftun Ahmed Dr. Moinuddin Ahmed Choudhury Dr. Md. Rezaul Karim Dr. Md. Mohiuddin

BANGLADESH ORTHOPAEDIC SOCIETY (BOS)

Executive Committee (2018 - 2020)

President	:	Dr. Md. Abdul Gani Mollah
Vice President (Dhaka City)	:	Dr. Monaim Hossen Dr. S.M. Amir Hossain
Vice President (Outside Dhaka City)	:	Dr. A.S.M. Jahangir Chowdhury Titu Dr. Ishtiaque Ul Fattah
Secretary General	:	Dr. Md. Wahidur Rahman
Treasurer	:	Dr. Md. Jahangir Alam
Joint Secretary	:	Dr. A.K.M. Zahiruddin
Publication Secretary	:	Dr. Md. Golam Sarwar
Organizing Secretary	:	Dr. Md. Aminul Haque Pathan (Dhaka) Dr. Md. Mizanur Rahman Chowdhury (Chittagong) Dr. Md. Rezaul Alam (Jewel) (Rajshahi) Dr. Md. Mehedi Newaz (Khulna) Dr. Md. Moniruzzaman Shahin (Barisal) Dr. Shankar Kumar Roy (Sylhet) Dr. Md. Mostafizur Rahman (Suzon) (Rangpur) Dr. Md. Matiur Rahman (Mymenshingh)
Office Secretary	:	Dr. Mohammad Mahfuzur Rahman
Secretary International Affairs	:	Dr. Md. Abdus Sabur
Scientific Secretary	:	Dr. Kazi Shamim Uzzaman
Social Welfare Secretary	:	Dr. Mohammad Khurshed Alam
Members	:	Dr. Kh. Abdul Awal Rizvi Dr. Md. Iqbal Qavi Dr. Ramdew Ram Kairy Dr. M. Amjad Hossain Dr. Md. Anisur Rahman Labu Dr. ABM Golam Faruque Dr. Mohammad Moazzem Hossain Dr. Riad Majid Dr. Moinuddin Ahmed Choudhury Dr. A. M. Fasiul Alam Dr. Molla Mizanur Rahman (Kallol)
Immediate Past President	:	Dr. Md. Abdul Gani Mollah
Immediate Past Secretary General	:	Dr. Syed Shahidul Islam (Shahid)

INFORMATION TO CONTRIBUTORS

The Journal of Bangladesh Orthopaedic Society is published twice in a year in the month of January and July. Articles are received throughout the year in the office of BOS, NITOR, Dhaka. Acknowledgement receipt may be taken from the office. Letter of acceptance will be given on demand after initial scrutiny of the paper by the Journal committee. If any paper is found to be copied, pirated or not a genuine works as claimed by the author, will be discarded automatically without information. Authors are requested to follow the instructions outlined below:-

Preparation of manuscript:

Manuscript should be typed on white A4 size paper with liberal margins and double spacing and on one side of the paper only. Pages are to be numbered consecutively beginning with the title page & not exceeding six (6) pages.

Title page:

The title page should contain the title of the study of investigation and abstract, mentioning basic procedures, main findings, principal conclusions and keywords.

Text:

The text of the article should be divided into introduction, materials & methods, results, discussion and conclusion.

Tables & Illustrations:

Each table or illustration is to be typed on a separate sheet & numbered in roman numbers & attached at the end of the text.

Photographs should be clear, glossy and in black & white preferably. Top of the picture should be indicated by arrow sign (T). Diagrams & graphs are to be drawn by jet black ink or printed by laser printer in white sheet.

References:

References are to be numbered consecutively in the order in which they appear in the text. The form of references should be as per examples below:-

a) References for journal:- References should be written according to the following sequence-authors name, topic, name of the journal with year of publication, volume number, page numbers e.g: Ratliff ABC. Truamatic Separation of the upper femoral epiphysis in Children. J.B.J.S. (Br.) 1968. 5013:57507-70.

When there are seven authors or more the first three names will be listed & then the word 'et. al' to be added.

b) References for Complete books:

Sequence for references are - authors name, name of book, number of edition, Publishers name, Year of Publication, Page e.g: Adams J.C. Outline of Orthopaedic. 9th edition Churchill Livingstone 1981. 347.

c) Reference of articles of Magazines

Sequence of reference are - authors name, name of subject, name of magazine, year & date, Pages e.g: Zachary R.B. Result of nerve suture M. Seddon H.S. Ed. Peripheral Nerve injuries. MRC Special Report Series No. 282. London. 1954 3 5c4-88.

Authors may submit the article composed in Microsoft Word as in the journal format in two columns with pictures and diagrams. 3 copies of printed article to be submitted at Bangladesh Orthopaedic Society office along with soft copy composed in Microsoft Word in a CD or data can be transferred by pendrive or by e-mail. Original copies & digital photos in JPEG format to be attached in a separate folder.

Articles are accepted for Publication on the condition that they are contributed solely to this journal.

Address of Bangladesh Orthopaedic Society Office:
National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR)
Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh.
Tele-Fax: +88 - 02 - 9135734
PABX: +88 - 02 - 9144190-4, Ext-280
Mobile: +88 - 01917-665140
web: www.bosbd.org
e-mail: bos_bdortho@yahoo.com,

FORWARDING LETTER FOR SUBMISSION TO JBOS

Date.....

To

The Editor

Dr. .....

The Journal of Bangladesh Orthopaedic Society (JBOS)

Sub: Submission of manuscript

Dear Sir,

We are submitting our manuscript entitled**,** ..... by, ... [1], ... [2], ... [3], ... [4], ... [5]. for publication in your journal. This article **has not been published or submitted for publication elsewhere.**

We believe that this article may be of value to medical professionals engaged in Orthopaedic Surgery & related subjects/..... We are submitting 3 copies of manuscript along with an electronic version (CD).

We therefore, hope that you would be kind enough to consider our manuscript for publication in your journal **as original / Review article / Case Report**.

Thanks and best regards

(1)

Professor,

Department of ..... BSMMU/NITOR/ Medical College. .....

(2)

Associate Professor,

Department of ..... BSMMU/NITOR/ Medical College. .....

(3)

Assistant Professor

Department of ..... BSMMU/NITOR/ Medical College. .....

(4)

Consultant /...../.....

.....

.....

The Journal of
Bangladesh Orthopaedic Society (JBOS)

Date : .....

To

.....

.....

.....

.....

Subject : Acceptance of the Article for publication

Dear Author

Your article Titled "....." has been accepted for publication by the Editorial Board of the The Journal of Bangladesh Orthopaedic Society (JBOS)

Your article will be published in any of the coming issues.

Thanking you.

……

Editor

The Journal of Bangladesh Orthopaedic Society (JBOS)

THE JOURNAL OF BANGLADESH ORTHOPAEDIC SOCIETY

VOLUME 35 **NUMBER 1** **JANUARY 2020**

CONTENTS

ORIGINAL ARTICLES

- Evaluation of results of fixation of Tibial Plateau Fractures Schatzker Type V & VI by Precontoured Locking Plate with MIPO Technique 1
  Muhammad Eusuf Harun, Shakawat Hossain, Riad Majid, Reza Hossain Khan, Ruhul Amin Mollah, Mohammad Mahfuzur Rahman

- Oral medication versus Intra-articular corticosteroid in the management of frozen shoulder 10
  Mohammad Russel, Md. Ahsan Kabir, Zinat Parveen, Noor E Nahrin, Md Mahbub Ali, Md. Akshad Al Masur, Mst. Fatema Khatun

- Evaluation of treatment of intertrochanteric fracture by Trochanteric Locking Plate in intertrochanteric Kyle III and IV fractures 13
  Mohammad Golam Sagir, M. Muniruzzaman, Md. Aminur Rahman, Md. Mahmud Ullah, Fazle Akber Khan

- Proximal Femoral Locking plate in unstable extracapsular proximal femoral fractures: A retrospective analysis 20
  Md. Kamruzzaman, Shakawat Hossain, Gazi Md. Ruhul Quddus, Md. Nur Alam, Mohammad Mahfuzur Rahman

- Outcome of Single Level Instrumented Posterior lumber interbody fusion (PLIF) Using Corticocancellous Bone Chips and Cages in Spondylolisthesis 24
  Mohammad Mohsin Reza, Md. Shah Alam, Kazi Mohammad Hannanur Rahman, Md. Rashedul Islam, Muhammad Rafiqul Islam, Ripan Gosh, Md. Nahfidul Zannat, Mohammad Awlad Hossain, Md. Iftekharul Alam, Md. Rakibul Hasan

- Chondroblastoma of the Proximal Femur: a retrospective study of 7 cases 31
  Mobinul Hoque, AKM Zahiruddin, Fakrul Amin Khan, Hedayet Hossain Khan, Afrin Akter, Subrata Saha

- Evaluation of The Result of Open Reduction And Internal Fixation of Nonunion of Fracture of Shaft of Humerus by Locking Plate Augmented With Autogenous Cancellous Bone Graft 36
  Md. Omar Faruque, Arun Kumar Sarker, Md. Abdul Halim, Md. Tofayel Hossain, Razib Ahmed, Md. Insanul Alam, Md. Iftekher Irfan

- Role of Proximal Femoral Nail Anterotation in management of unstable intertrochanteric fracture of femur 42
  Das CK, Rahman MA, Ahmed SU, Md. Selim Matbar, Zahra Aziz, Rahman Md. Mostafizur

- Evaluation of Gastrocnemius muscle Island Flap for gain in length of wound coverage around knee and proximal part of leg 48
  Subrata Saha, Md. Abdul Gani Mollah, Md Golam Sarwar, Sajedur Reza Faruquee, Md Sarwar Jahan, Md Asaduzzaman, Mohammad Ruhul Amin Molla, Shadiqur Rahman

- Role of Ponseti's Method In Correction of Club Foot 54
  Md. Nur Alam, Md. Golam Sarwar, Md. Shah Alam, Md. Rezaul Karim, Nadia Mehnaz

Original Article

Evaluation of results of fixation of Tibial Plateau Fractures Schatzker Type V & VI by Precontoured Locking Plate with MIPO Technique

Muhammad Eusuf Harun[1], Shakawat Hossain[1], Riad Majid[2], Reza Hossain Khan[1], Ruhul Amin Mollah[2], Mohammad Mahfuzur Rahman[3]

ABSTRACT

Complex tibial plateau fractures are notoriously difficult to treat. These injuries particularly Schatzker type V & VI are often associated with significant soft tissue injury and poor outcome. Even with advancements in internal fixation principles; anatomic reduction, stable fixation and early movement is needed. Recent advancement of precontoured locking plate with MIPO technique has allowed for a new approach to these difficult fractures. This prospective interventional study was conducted from Jan 2019 to December 2020 at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR). Dhaka. Fourteen (14) patients with ACL and meniscus injuries were treated in the form of arthroscopic reconstruction of ACL by quadruple auto graft of Hamstring Tendon and partial meniscectomy. Accelerated ACL reconstruction rehabilitation protocol was followed. Patients were visited routinely and final outcome evaluation done at 24 weeks. Subjective and objective evaluation were done according to IKDC knee examination form. Lysholm knee scoring scale was used to compare preoperative and postoperative score and to evaluate final outcome. Preoperatively all patients had either grade II or grade III positive Lachman test. Post operatively significant improvement was found, 86% had grade I and only 14% had grade II positive Lachman test. Preoperative Lysholm knee score was 52.64 and postoperative score was 90 that shows significant improvement ($p<0.05$). According to Lysholm knee scoring scale, excellent results (95-100 points) were obtained in 5 (33%) patients, good results (85-94 points) in 8 (53%) patients, fair and poor in 2 patients (7% each). It is concluded that Evaluation of results of Tibial Plateau Fracture Schatzker type V &VI by Precontoured Proximal Tibial Locking plate with MIPO technique is satisfactory

Key words: Tibial plateau fractures, precontoured locking plate, MIPO

INTRODUCTION

Tibial plateau fractures constitute 1% of all fractures. Tibial plateau fracture affecting the knee joint, stability and motion. Bicondylar tibial plateau fractures usually occuring a bimodal age distribution. In young patients, high-energy trauma results in comminuted fractures and severe soft tissue damage, where as in older patients, comminution and soft tissue injury arise mainly from poor bone quality and thin skin[1].

Fixation of Tibial plateau fracture Schatzker type V & VI is challenging because of geographic complexity and compromise of the soft tissue envelope. Treatment goals include preservation of soft tissues, restoration of articular congruity, and correction of anatomic alignment in the lower extremities. Adequate fixation and early achievement of postoperative range of motion are important for a good prognosis and adequate functioning. Buttressing of both the medial and lateral compartments with conventional double plating is the gold standard for managing bicondylar fractures because this may provide sufficient rigid fixation to prevent medial collapse and subsequent varus deformity. However, this may require excessive dissection through injured soft tissue, leading to wound complications or compromised osteosynthesis[4,5,22]. Introduction of advanced instrumentation, such as

1. Junior Consultant, NITOR, Dhaka
2. Assistant Registrar, NITOR, Dhaka
3. Assistant Prfofessor, Department of Orthopaedics, BSMMU, Dhaka

Correspondence: Dr Muhammad Eusuf Harun, Junior Consultant, NITOR, Dhaka.

precontoured locking plate systems, and techniques for internal fixation, such as minimally invasive plate osteosynthesis (MIPO), have changed the nature of treatment for these fractures over the last decade[14]. MIPO, with its key benefit of preserving the intact soft tissue envelope, is the representative biological plate technique. The less invasive stabilization system (LISS) developed by Synthes is representative of locking plates that offer multiple points of fixed-angle contact between the plate and screws, aiming to decrease the tendency toward angular deformity[21].

Precontoured locking plate with MIPO results in high union rates. This technique offers potential biomechanical advantage over other methods by the new generation of plates act as "internal fixators", no direct bone to plate contact ,the load from one fragment to other is completely borne by the implant, minimal soft tissue stripping ,substantially reducing failure of fixation in osteoporotic bones, reducing the risk of a secondary loss of intra-operative reduction by locking with screws to the plate, unicortical fixation ,better preservation of blood supply to the bone,provide stable fixation by creating a fixed angle construct and angular stability and early mobilization[8].

A precontoured locking plate can provide adequate stability for comminuted or osteoporotic plateau fractures and may offer an alternative to additional medial buttressing, thus avoiding further stripping of soft tissue[25,27]. Considering this fact, the current study was designed to evaluate the result of the management of Schatzker type V & VI tibial plateau fracture by precontoured proximal tibial locking plate with MIPO technique[9].

Many different classification systems have been proposed, none with universal acceptance. The system most widely used today is the Schatzker classification; but AO recommended 3D CT based three column classification is most recent[23].

Schatzker Classification:[23]

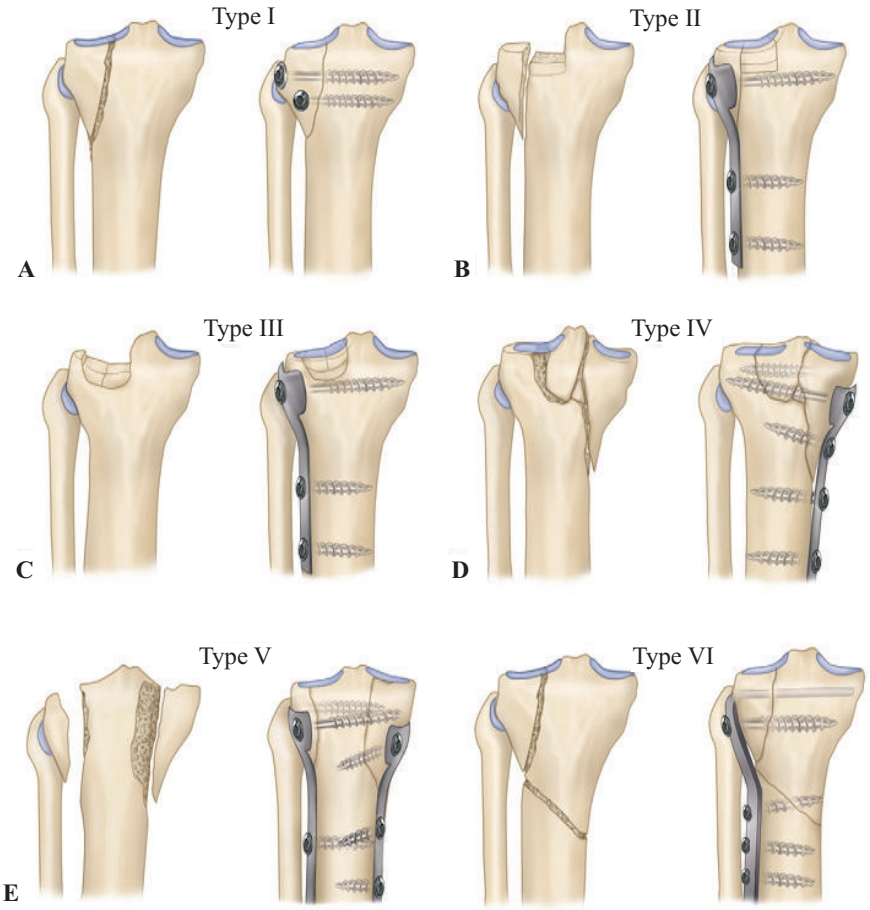


Fig.-1: *Tibial Plateau Fracture, Schatzker Classification (Netter, 1997)*

Three column classification of Tibial plateau:

Most recent classification based on 3D CT Scan -

1. Medial Column
2. Lateral Column
3. Posterior column (medial & lateral part)

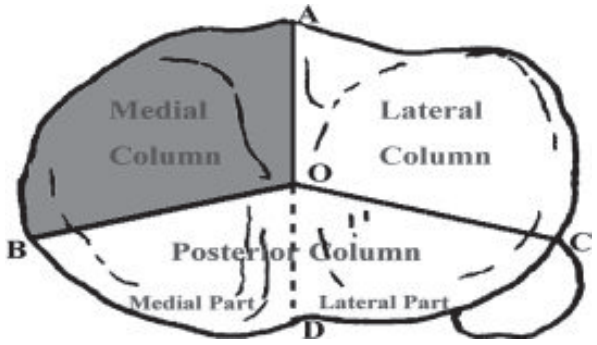


Fig 2: *Three Column Classification*

MATERIALS AND METHOD:

Study design: A prospective observational study.

Place of study: National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka,

Study period: January 2014 to December 2015.

Study sample: Patients with tibial plateau fracture Schatzker type V & VI.

Total 20 patients of tibial plateau fractures Schatzker V & VI fixed by precontoured locking plate with MIPO technique were included in this study. Purposive sampling was done.

Inclusion criteria:

- Patient's age: 20 to 60 years
- Both sexes.
- Schatzker type V & VI tibial plateau fracture
- Presented within 14 days of injury.

Exclusion criteria:

- Other Schatzker types of tibial plateau fracture.
- Fracture with neurovascular injuries, established compartmental syndrome
- Patients below 20 years and above 60 years
- Poly trauma patients.
- Open fracture.

Surgical technique:

a) Anesthesia : Spinal anesthesia

b) Position of patient : Supine

c) Approach : Antero-Lateral MIPO

d) Procedure: Incise the skin over the anterolateral aspect of proximal tibia. Divide the superficial and deep fascia, raise full thickness flaps down to the fascia follow the investing fascia of anterior compartment. Sharply elevate the entire comportment from anterolateral tibial surface. A sub meniscal arthrotomy is performed to see the fracture and depression if needed. To elevated the depression, make a hole in upper tibia and bone graft given, reduction the fracture and hold by temporary K-wire. Fixation of fracture by locking plate by 6.5mm cancellous screws and 5mm cortical screws. Wound was closed in layers after maintaining the hemostasis. A closed suction drain was kept in situ and dressing was given[12].



Fig 3: *Per operative picture*

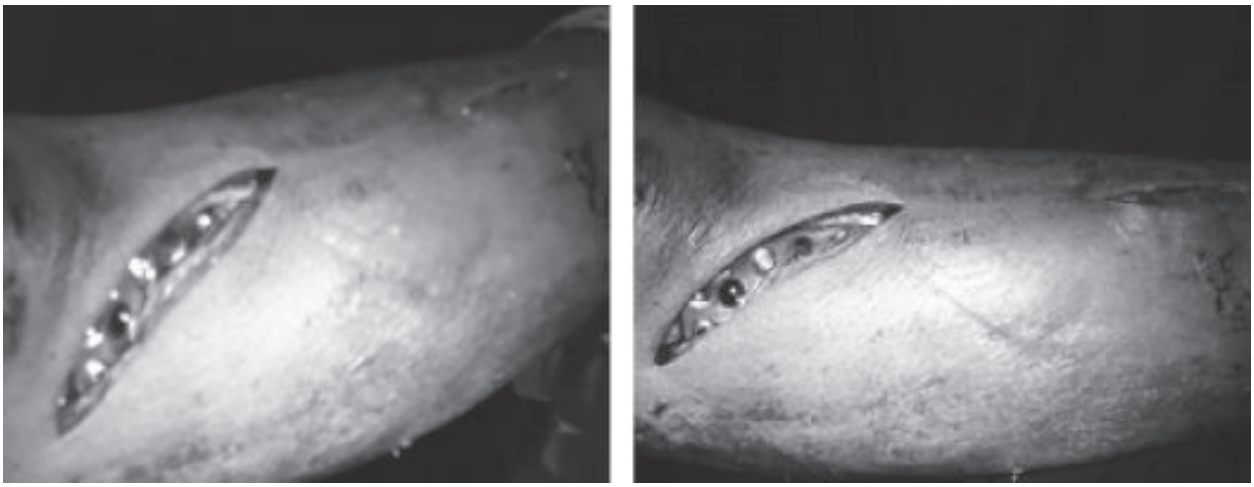


Fig 4: *Per operative picture*

OBSERVATION & RESULTS

All the relevant findings obtained from data analysis are presented in tables and figures. Results were evaluated according to **Rasmussen Functional Grading Criteria** (appendix VII)**.**[20]

Age distribution:

Table 1.1

Distribution of the patients by age (n=20)

Age (years)	Frquency	Percentage
20-30	6	30
31-40	7	35
41-50	3	15
51-60	4	20

Mean age= 39.7 years; range 20-60 years.

The commonest age of patients was 31-40 years, out of 20 patients 7 (35%) were in this group; 20-30 years 6 (30%);51-60 years (20%); 41-50 years (15%).

Sex distribution:

Table 1.2

Distribution of the patients by sex (n=20)

Sex	Number of patients	Percentage
Male	20	100
Female	00	00

All of the patients were male.

Occupation:

Table 1.3

Distribution of the patients by occupation (n=20)

Occupation	Number of patients	Percentage
Driver	01	05
Student	01	05
Teacher	02	10
Advocate	01	05
Businessman	07	35
Service holder	08	40

Out of 20 patients, 8 patients were service holder which includes 40% of total patients.

Cause of injury

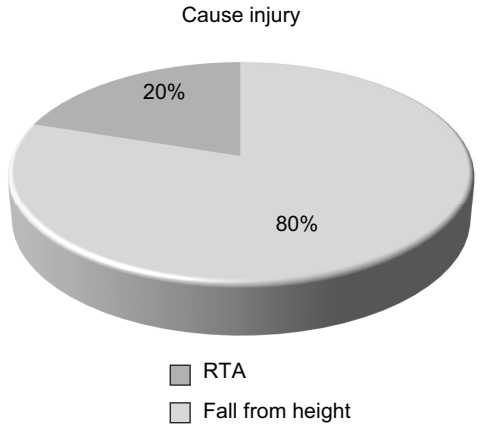


Fig. 5: *Pie chart showing cause of injury*

Out of 20 patients, 16 patients (80%) were affected by RTA, 04 patient (20%) by fall from heigh

Types of injury:

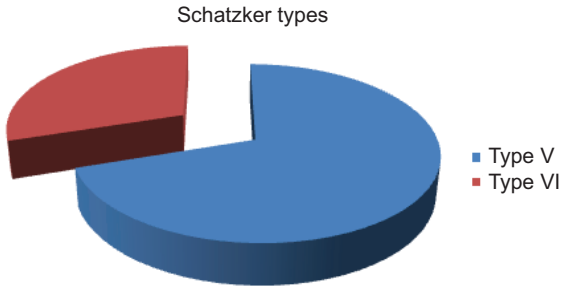


Fig 7: *Pie chart showing type of injury*

Out of 20 patients, 14 patients (70%) were Schatzker Type V and 06 patients (30%) were Schatzker Type VI.

Hospital Stay:

Table 1.4
Hospital stays of the patients (n=20)

Length of stay (week) Mean± SD	No. of Patients	Percentage (%)
≤1 week	6	30
≤2 weeks	8	40
11±4.43		
≤3 weeks	6	30

Mean hospital stay= 11 days; range 6-16 days.

The mean hospital stay was 11 days with SD±4.43; the lowest and the highest stay were 6 and 16 days respectively.

Union Time:

Table 1.5
Distribution of patients by union time (n=20)

Union time (days)	Frequency	Percentage
76-90	12	60
91-105	6	30
106-120	2	10
Mean ±SD	94.30±12.94	

The mean union time of fracture was 94.3 days and the lowest and the highest time were 78 and 112 days respectively.

Follow-up:

20 patients were followed up for at least 4 months, up to a maximum of 6 months, average 3.1±0.71 months.

All patients were advised to attend to OPD at NITOR for follow-up at 2, 4, 6, 12, 16 weeks and at 6 months after operation and then every 3 months interval. Each patient was evaluated both clinically and radiologically. At final follow-up the results were graded as excellent, good, fair or poor according Rasmussen Functional Grading Criteria.

5.4 Post-operative complications:

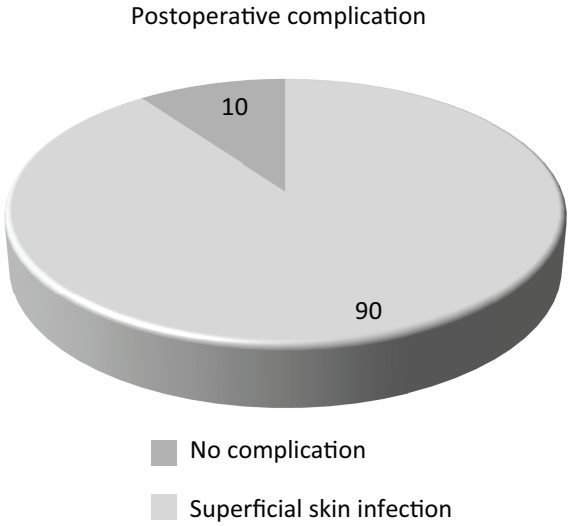


Fig. 8: *Postoperative complications*

In terms of complication, 2 (10%) of the patient's superficial skin infection noticed, 18(90%) cases had no complication.

Radiographic Union Scale for Tibial Fractures (RUST)

Radiographic Criteria (Appendix VI)

Table 1.6
Radiographic Criteria (n=20)

Score per cortex	Frequency	Percentage
1	0	00
2	8	40
3	12	60

The individual cortical scores (anterior, posterior, medial, and lateral) are added to provide an overall RUST value ranging from 4 to 12 for a set of radiographs. Out of 20 cases, 12 cases (60%) showed presence of callus & invisible fracture line and 8 cases (40%) showed presence of callus but visible fracture line. Malunion or nonunion was not found.

Range of motion of the affected knee joint:

Distribution of patients by ROM of affected knee (n=20)

ROM (degrees)	Frequency	Percentage
61-70	1	5
71-80	0	0
81-90	0	0
91-100	8	40
101-110	7	35
111-120	4	20

Mean ROM= 99.3±14.32 degree; range 65-115 degree.

The mean ROM of patients was 99.3p and the lowest and the highest ROM were 65p and 115p respectively.

Functional outcome: Rasmussen Functional Grading Criteria (Appendix VII)

Final clinical outcome:

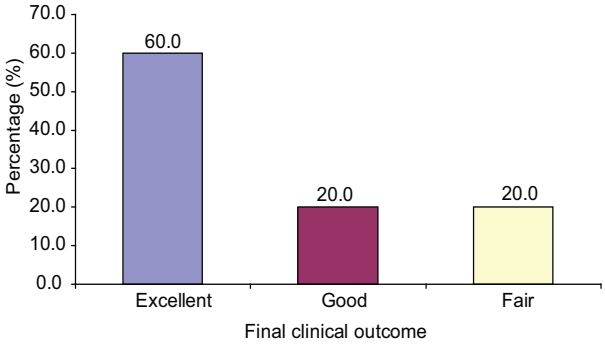


Fig 9: *Bar chart showing final clinical outcome*

Out of 20 patients, 12 patients (60%) showed excellent, 04 patients (20%) showed good and 04 patient (20%) showed fair result.

Satisfactory= Excellent + Good = 80%, Unsatisfactory = Fair = 20%.

Table 1.7

Functional outcome according to Rasmussen Functional Grading Criteria (n=20)

Patient Serial no.	Pain	Walking capacity	Extension lag	Total ROM	Stability	Final Score	Result
1	5	4	6	4	5	24	Good
2	6	6	6	4	6	28	Excellent
3	6	6	6	4	5	27	Excellent
4	6	6	6	4	6	28	Excellent
5	6	6	6	4	6	28	Excellent
6	5	4	6	4	5	24	Good
7	6	6	6	4	6	28	Excellent
8	6	6	6	4	5	27	Excellent
9	4	4	4	2	4	18	Fair
10	5	5	4	3	3	20	Fair
11	5	4	6	4	5	24	Good
12	6	6	6	4	6	28	Excellent
13	6	6	6	4	5	27	Excellent
14	6	6	6	4	6	28	Excellent
15	6	6	6	4	6	28	Excellent
16	5	4	6	4	5	24	Good
17	6	6	6	4	6	28	Excellent
18	6	6	6	4	5	27	Excellent
19	4	4	4	2	4	18	Fair
20	5	5	4	3	3	20	Fair

Highest score was 28, lowest score was 18 and mean score was 25.20±3.65.
In this series 12 excellent, 4 good and 4 fair results achieved in 20 patients.



Fig 10: *Pre operative x-ray AP/Lateral view*



Fig 11: *Post operative x-ray AP/Lateral view*





Discussion

Management of tibial plateau fracture is a challenging problem regarding evaluation of fracture in terms of displacement, location and associated soft tissue injury and their various treatment options particularly for Schatzker type V & VI. Younger or middle-aged patients with high-energy injuries are often have more severe soft tissue injury, sometimes complicated with compartmental syndrome. The second group is elderly, osteoporotic patients, who have a relatively low energy injury such as a simple fall. In schatzker classification no difference was categorized in these two groups. The key point in the management this injury is to recognize the importance of soft tissue component. Where the soft tissue injury is significant, bridging external fixator is advantageous for skeletal and soft tissue stabilization. Definitive fixation is only advisable when soft tissue allow it.[2]

There are several techniques of surgical treatments are known, such as fixation by screws, buttress plate and screws and bone graft, dual plating, external fixators, Ilizarov technique. A recent trend in internal fixation has been a more towards locking plating system with MIPO. The rationale for using this technique includes minimum soft tissue compromise and devascularizement of fracture fragment, minimal disturbance to metaphyseal comminution and hematoma, no need for bone grafting. This procedure includes 2 important components: 1) Anatomical reduction of articular fractures and fixation by open reduction and internal fixation or closed reduction and internal fixation. 2) indirect reduction of metaphyseal & diaphyseal fracture with minimum soft tissue dissection & stabilization with a long percuteneously inserted plate fixed with a limited number of widespread screws.Even though early intervention is advantageous , it is desirable to delay surgery till the soft tissue condition is improved and appearing of wrinkle sign (range: 3 to 8 days) to ensure good local skin condition prior to surgery.[15]

We used Schatzker classification of proximal tibia fracture to evaluate our study. But there is a limitation of that classification as it does not include the fracture of posteromedial or posterior component of proximal tibia and this classification is based on plain radiograph. 3-D CT based classification can overcome this limitation. Most recent classification recommended by AO which gives attention to posteromedial or posterior component of proximal tibia fracture.[16]

This prospective study was carried out during the period from January 2014 to December 2015 at National Institute of Traumatology and Orthopedics Rehabilitation (NITOR), Dhaka, Bangladesh, to find out the results of tibial plateau fracture schatzker type V & VI by precontoured proximal tibial locking plate with MIPO t-echnique. A total of 20 patients were included in th is study. All the patients were treated by this technique, minimum follow up was 4 months and maximum of 6 months. Most common age group in this series were 31-40 years age group (35%) and average age of the patients was 39.7 years. All of the patients were male and road traffic accident was the leading cause of injury (80%). Right side involved in (70%) most of the cases. Most of patients were in Schatzker type V (70%).

Among 20, most of the patients were initially treated by long leg posterior slab and 2 patients were treated by lower tibial skeletal traction to improve condition of soft tissue. Postoperative hospital stay is one of the important parts of this study. Average total duration of hospital stay was 11 days with SD±4.43, ranging from 6 to 26 days. Postoperative hospital stay was average 3 days, range 2 to 4 days. Maximum period of total hospital stay was preoperative waiting for improvement of soft tissue and for getting serial of operation. Total duration of healing (union time) was average 14 weeks, highest 19 weeks and lowest 11 weeks.

In this series postoperative superficial skin infection developed in 2 patients which was controlled by dressing and sensitive antibiotic. When using precontoured locking plate to treat proximal tibia fracture schatzker type V & VI, posteromedial or posterior fragment does not need to fix with buttress plate. Only open reduction and internal fixation with lag screw with washer is sufficient. In the final follow up all the fractures were united well. For union assessment Radiographic Union Scale for Tibial Fractures (RUST) was used. Results were evaluated with Rasmussen Functional Grading Criteria for Evaluation of Final Results after Tibial Plateau Fracture.[20]

Compared with previous studies using MIPO techniques, we successfully using this technique, recorded two patients with superficial skin infection. This method appeared to result in a low rate of wound complications or no nonunion. In addition, functional outcome was good-to-excellent according to the Rasmussen scores.[20]

In our study, the mean Rasmussen functional score was 25.2 (range, 18–28): excellent in 12 patients, good in 4, and fair in 4 patients. Regarding final outcome, out of 20 patients, 16 (80%) had satisfactory (excellent + good), 4 (20%) had unsatisfactory (fair) outcome. It was quite acceptable outcome.

In compared to major comparable study - Evaluation of results of Tibial Plateau fracture Schatzker type V &VI by Precontoured Proximal Tibial Locking plate with MIPO technique had a satisfactory outcome.

Conclusion:

It is concluded that Evaluation of results of Tibial Plateau Fracture Schatzker type V &VI by Precontoured Proximal Tibial Locking plate with MIPO technique is satisfactory

References:

1 Apley AG 1979. Fractures of the tibial plateau. Orthop Clin N Am, vol. 10, pp. 61–74.

2. Barei DP, O'Mara TJ, Taitsman LA, Dunbar RP, Nork SE 2008. Frequency and fracture morphology of the posteromedial fragment in bicondylar tibial plateau fracture patterns. J Orthop Trauma, vol. 22, pp. 176-182.

3. Charles M. Court –Brown 2010. In: Fractures of tibia and fibula. Chapter 52 , Rockwood and Green's "Fractures in Adults", Vol. 2, 6th edition, Lippincott Williams and Wilkins

4 Cole PA, Zlowodzki M, Kregor PJ 2003. Less invasive stabilization system (LISS) for fractures of the proximal tibia: indications, surgical technique and preliminary results of the UMC Clinical Trial. Injury, vol. 34(Suppl. 1), pp. A16-29.

5. Cole, Peter, Zlowodzke, Micheal, Kregor, Philip J 2004. Treatment of proximal tibial fractures using the Less Invasive Stabilisation System: Surgical Experience and Early Clinical results in 77 fractures. Journal of orthopaedic trauma, vol. 18, no. 8, pp. 528-35.

6. Ebraheim NA, Sabry FF, Haman SP 2004. Open reduction and internal fixation of 117 tibial plateau fractures. Orthopedics, vol. 27, pp. 1281–1287.

7 .Egol, Kenneth A, Su, Edward, Tejwani, Nirmal C, Sims, Stephen H, Kummer, Frederick J et al. 2004. Treatment of complex tibial plateau fractures using the less invasive stabilisation system plate: clinical experience and a laboratory comparison with double plating. Journal of trauma injury infection and critical care, vol. 52, no. 2, pp. 340-46.

8 Gosling T, Schandelmaier P, Marti A, Hufner T, Partenheimer A, Krettek C 2004. Less invasive stabilization of complex tibial plateau fractures: a biomechanical evaluation of a unilateral locked screw plate and double plating. J Orthop Trauma, vol. 18, pp. 546-551.

9. Gosling T, Schandelmaier P, Muller M, Hankemeier S, Wagner M, Krettek C 2005. Single lateral locked screw plating of bicondylar tibial plateau fractures. Clin Orthop Relat Res, vol. 439, pp. 207-214.

10. H. M. Ariffin, N. M. Mahdi, S. A. Rhani, A. Baharudin and M. H. Shukur, 2011. "Modified Hybrid Fixator for High Energy Schautzker V and VI Tibial Plateau Fractures," Strategies Trauma Limb Reconstruct, vol. 6, no. 1, pp. 21-26

11. Higgins TF, Kemper D, Klatt J 2009. Incidence and morphology of the posteromedial fragment in bicondylar tibial plateau fractures. J Orthop Trauma, vol. 23, pp. 45-51

12 .Hsieh CH, Huang HT, Liu PC, Lu CC, Chen JC, Lin GT 2010. Anterior approach for posteromedial tibial plateau fractures. Kaohsiung J Med Sci, vol. 26, pp. 130-135.

13. https://www2.aofoundation.org/wps/portal/!ut/p/a1/04, 11.02.2015. Kataria H, Sharma N, Kanojia RK 2007. Small wire external fixation for high-energy tibial plateau fractures.J Orthop Surg (Hong Kong),vol.15,pp.137–143.

14. Kenneth. A. Egol and Kenneth J Koval 2006. In: Fractures of proximal tibia: Chapter 50, Rockwood and Green's "Fractures in Adults", vol. 2, 6th edition, Lippincott Williams and Wilkins.

15. Kulkarni G, Kulkarni M,Kulkarni S, Kulkarni R, Kulkarni V, Shah A. N 2005. Surgical treatment of tibial plateau fractures. J Orthop Trauma, vol. 9, no. 4, pp. 263-272.

16. Luo CF, Sun H, Zhang B, Zeng BF 2010. Three-column fixation for complex tibial plateau fractures. J Orthop Trauma, vol. 24, pp. 683e92.

17. Murray DW, Fitzpatrick R, Rogers K, Pandit H, Beard DJ, Carr AJ, et al. 2007. The use of the Oxford hip and knee scores. J Bone Joint Surg Br, vol. 89, pp. 1010-1014.

18. Musahl V, Tarkin I, Kobbe P, Tzioupis C, Siska PA, Pape HC 2009. New trends and techniques in open reduction and internal fixation offractures of the tibial plateau. J Bone Joint Surg Br, vol. 91, pp. 426-433.

19. Phisitkul P, McKinley TO, Nepola JV, Marsh JL 2007. Complications of locking plate fixation in complex proximal tibia injuries. J Orthop Trauma, vol. 21, pp. 83-91.

20. Rasmussen, 1973. Tibial condylar fractures: impairment of knee joint stability as an indication for surgical treatment. Bone Joint Surg Am, vol. 3. no. 55, pp. 1331-1350.

21. Ricci William 2004. Treatment of complex proximal tibial fractures with LISS; Journal of orthopaedic trauma issue, vol. 18, pp. D-521-527.

22. Rockwood and Green's "Fractures in Adults", 6th edition

23. Schatzker, J, Mcbroom R 1979. The tibia plateau fracture: the Toronto experience 1968-1975. Clinic Orthop, vol. 138, pp. 94-95.

24. Smith WR, Ziram BH, Anglen JO, Stahel PF 2007. Locking plate: tips and tricks. JBJS Am, vol. 89-A, pp. 2297-307.

25. Sommer C.H, Wullschleger M, Walliser M, Bereiter H, Leutenneger, 2004. A experience with locking compression plate in fracture treatment of osteoporotic bones. British journal of surgery, vol. 91, p. 912.

26. Testsutaro S, Shimpei H, Toyohiro, Noribumi K, Keiji S 2005. The treatment result of locking compression plate system in proximal tibial fractures. Central Japan Journal of orthopaedic surgery and traumatology, vol. 48. pp. 187-88.

27. Wagner M 2003. General Principles for technical use of LCP, Injury, vol. 34 Suppl 2, pp. B31-42.

Wagner M, Frenk A, Frigg R, 2004. New concepts of bone fracture treatment and the locking compression plate. Surg Tecnol Int, vol. 12, pp. 271-77.

28. Watson-Jones, R 1955, Fractures and Joint Injuries, 4th edn., Edinburgh: E&S Livingstone Ltd., pp. 672-680.

29. Yoo BJ, Beingessner DM, Barei DP 2010. Stabilization of the posteromedial fragment in bicondylar tibial plateau fractures: a mechanical comparison of locking and nonlocking single and dual plating methods. J Trauma, vol. 69, pp. 148-155.

Original Article

Oral medication versus Intra-articular corticosteroid in the management of frozen shoulder

Mohammad Russel[1], Md. Ahsan Kabir[2], Zinat Parveen[3], Noor E Nahrin[4], Md Mahbub Ali[5], Md. Akshad Al Masur[6], Mst. Fatema Khatun[7]

Abstract :

Frozen shoulder (FS) is a common cause of shoulder pain and limited movement. FS is usually treated by oral medication, local steroid injection, physiotherapy, hydrodistension, arthroscopic or open capsular release. The objective of this study is to evaluate and compare the efficacy of local steroid injection and oral medication treatment along with physiotherapy in idiopathic Frozen shoulder. This prospective interventional study, a total 94 patients were enrolled from outpatient department of combined military hospital (CMH), Bogura. After maintaining inclusion and exclusion criteria patient with frozen shoulder is randomly selected for intervention. Forty four patients (Group A) are selected for local steroid injection and fifty patients (Group B) selected for oral medication along with physiotherapy. They are followed up and the clinical outcomes were documented at first visit (pre-treatment); 3rd, 6th and 24th weeks after treatment.94 patients were enrolled in the study. Patients were divided into 2 groups. 44 patients (Group A) were selected for oral medication and 50 patients (Group B) were selected for local steroid injection along with physiotherapy. 17 patients were dropped-out and finally 77 patients were included in this study in which 38(49.35%) were from group-A and 39 (50.65%) were from group-B. From group-A, 21(55.26%) were male and 17 (44.74%) were female. From group-B 27 (69.23%) patients were male and 12 (30.77%) were female patient. Patients were evaluated for severity of pain and extent of restricted ROM. The clinical outcomes were documented and compared at first visit (pre-treatment); 3rd, 6th and 24th weeks after treatment. Both of the groups showed significant improvement of shoulder function according to shoulder pain and disability index (SPADI).

Keywords: Frozen shoulder, NSAIDs, IA corticosteroid injection, ROM, DM

INTRODUCTION

Frozen shoulder, also known as adhesive capsulitis, is defined as "*a condition of uncertain aetiology, characterised by significant restriction of both active and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorder*"[1]"Frozen shoulder" was first introduced by Codman in 1934 who described it as a painful shoulder condition of insidious onset. It was associated with stiffness and difficulty in sleeping on the affected side. Codman also identified the marked reduction in forward elevation and external rotation that are the hallmarks of the disease.Frozen shoulder can be primary, idiopathic problem or it may be secondary, associated with another systemic illness. Idiopathic frozen shoulder is defined as a self-limiting condition of unknown etiology. A secondary frozen shoulder is associated commonly with diabetes mellitus and may be the first presentation of a diabetic patient.[11] Patients with systemic diseases such as thyroid diseases[12, 13] and Parkinson's disease. [14] are at higher risk.

1. Classified Specialist in Surgery (Orthopaedics), CMHBogura, Associate Professor & HOD of Orthopaedics, AMCBogura.
2. Junior Consultant (Orthopaedics), Chatmohor health complex, Pabna.
3. Assistant Registrar, Department of Orthopaedics, Army Medical College Bogura.
4. IMO, Department of Gynae and Obstetrics, Sir SalimullahMedical College and Mitford Hospital, Dhaka.
5. Associated professor (cc), Department of Gynae and Obstetrics,Army Medical College Bogura.
6. Junior Consultant (Ortho), Chatmohor Health Complex, Pabna
7. MO,250 beded General Hospital, Pabna.

Correspondence: Dr. Mohammad Russel, Classified Specialist in Surgery (Orthopaedics), CMHBogura, Associate Professor & HOD of Orthopaedics, AMCBogura

Secondary frozen shoulder can occur after shoulder injuries or immobilisation (e.g. rotator cuff tendon tear, subacromial impingement, biceps tenosynovitis and calcific tendonitis). These patients develop pain from the shoulder pathology, leading to reduced movement in that shoulder and thus developing frozen shoulder.[15, 16] Some other predisposing factors may be like inactivity, previous disorders of shoulder, cervical spondylitis, coronary artery diseases, pulmonary tuberculosis, chronic obstructive pulmonary disease (COPD), bronchial carcinoma, hyperthyroidism, hemiplegia, brain tumors, epilepsy and Parkinson disease.[17]

This should be resisted to label any patient with a painful stiff shoulder as a case of frozen shoulder. Frozen shoulder is a specific condition that has a natural history of spontaneous resolution and requires a management pathway that is completely different. Ideally frozen shoulder progresses prognostically through three overlapping clinical phases.Painful freezing phase lasts 2-9 months, characterized by pain and stiffness around the shoulder with no history of injury. A nagging constant pain is worse at night, with little response to non-steroidal anti-inflammatory drugs. Adhesive or frozen phase Occurs at 4-12 months where the pain gradually subsides, plateauing of stiffness with equal active and passive ROM (range of motion). Pain is apparent only at the extremes of movement. Gross reduction of glenohumeral movements, with near total obliteration of external rotation is observed. Thawing or resolution phase lasts 5-24 months with spontaneous improvement in the range of movement. Mean duration from onset of frozen shoulder to the greatest resolution is over 30 months. [3, 15, 18]

The physical examination of a patient with frozen shoulder can be uncomfortable, and the patient may need to briefly rest or gently "shake out" the shoulder between maneuvers. The challenges in diagnosing frozen shoulder are differentiating true glenohumeral loss of motion from pain-related guarding, and identifying any concomitant conditions.

MATERIALS AND METHODS

The prospective randomized clinical trial study comparing oral medications with intra-articular steroid injection in the treatment of frozen shoulder conducted during the 18 months period between July 2019 to December 2020 on patients with frozen shoulder. The Ethical Committee of Combined Military Hospital (CMH), Bogura, Bangladesh granted approval for this study. All treatment modalities are explained and informed written consent was obtained from each patient. Diagnostic criteria were painful shoulder coupled with restricted range of motion in all directions. So the patients who presented with shoulder pain and motion limitation in the shoulder joint visited our orthopaedic outpatient department were included. Also for diagnosis of possible secondary causes and as basic laboratory tests, CBC (Complete Blood Count), ESR (Erythrocytes Sedimentation Rate), CRP (C Reactive Protein), urea, creatinine, routine microscopic examination of urine and liver enzymes were checked for all patients. Oral medications were NSAIDs and Oral Steroids. Considering with different response to different types of NSAIDs, they were administered twice daily for all patients. Anti inflammatory dose of Naproxen reached by using 2 tablets of 500 mg daily and then its use is more convenient for the patient. In second group patients underwent single injection of 40 mg triamcinolone at the start of study. The 24 gauge needle was injected between medial head of humerus and 1 centimeter of lateral head of coracoid process and then moved directly to the posterior, superior and lateral position. After 1 week, all patients started home exercise with moving shoulder in 3 directions of flexion (maximum range of 180°), abduction (maximum range of 180°) and taking back by hand and maximum reaching digits to inferior border of scapula. This exercise recommended 3 sessions a day and 15 times at each session.

Selection Criteria:

A. Inclution Criteria:

The inclusion criteria was shoulder pain for more than 2 months; pain aggravation when moving the shoulder joint; significant limitations of passive shoulder motion in more than one plane of the shoulder; age 20 to 70 years; and visual analog scale (VAS) score for pain e"5.

Due to different response to treatment between acute and chronic form of disease, patients with more than 9 months of disease were excluded from the study. Also patients with other proved causes of capsulitis like degenerative diseases, fracture, infection, stroke; history of shoulder joint dislocation or previous shoulder surgery; contraindications to the injection procedure such as local cellulitis, septic arthritis and previous GH joint injection within 6 months were excluded from the study.

A. Exclusion Criteria:

exclusion criteria were active peptic ulcer, history of GI bleeding, history of coagulopathies, myocardial infarction and renal failure. Examining the patients, X-ray was taken for each screened patient.

RESULT:

94 patients were enrolled in the study. Patients were divided into 2 groups. 44 patients (Group A) were selected for oral medication and 50 patients (Group B) were selected for local steroid injection along with physiotherapy. 6 patients from group-A and 11 patients from group-B were dropped-out and finally 77 patients were included in this study in which 38(49.35%) were from group-A and 39 (50.65%) were from group-B. From group-A, 21(55.26%) were male and 17 (44.74%) were female. From group-B 27 (69.23%) patients were male and 12 (30.77%) were female patient. Patients were evaluated for severity of pain and extent of restricted ROM. Pain was assessed according to VAS (Visual Analogue Scale) score. In this study pain is graded between 0–100 levels (no pain to severe pain). ROM (range of motion) was evaluated in 3 directions of flexion, external rotation and abduction. The clinical outcomes were documented at first visit (pre-treatment); 3rd, 6th and 24th weeks after treatment.

CONCLUSION:

Despite its prevalence, Frozen shoulder is a poorly understood shoulder conditions. Its definition, classification, pathophysiology, diagnosis, natural course, treatment, and prognosis remain controversial.[49]

In patients with frozen shoulder, application of both the oral medications and corticosteroid injection show similar efficacy in the long run but single dose of intra-articular corticosteroid injection may be more suitable in comparison to receiving oral medications for months. Physiotherapy adds faster pain relief and earlier improvement of shoulder function and motion. Nearly all Patients usually recover, but may fail to regain their full range of movement.

REFERENCES:

1. Zuckerman JD, Rokito A. Frozen shoulder: a consensus definition. J Shoulder Elbow Surg. 2011;20:322–5.
2. Codman EA (ed) Tendinitis of the short rotators in The Shoulder: Rupture of the supraspinatus tendon and other lesions in or about the subacromial bursa. Boston, MA, Thomas Todd and Co, 1934.
3. Dias R, Cutts S, Massoud S. Frozen shoulder. BMJ. 2005 Dec 17;331(7530):1453-6.
4. Duplay ES: De La Periarthote scapulohumerale. Arch Gen Med 1872;20:513-542.
5. Naviesar JS Adhesive capsulitis of the shoulder. JBJS 1945;27:211-222.
6. van der Windt DA, Koes BW, de Jong BA, Bouter LM. Shoulder disorders in general practice: incidence, patient characteristics, and management. Ann Rheum Dis. 1995;54(12):959-964. doi:10.1136/ard.54.12.959
7. Lundberg BJ. The frozen shoulder. Clinical and radiographical observations. The effect of manipulation under general anesthesia. Structure and glycosaminoglycan content of the joint capsule. Local bone metabolism. Acta Orthop Scand Suppl 1969;119:1-59.
8. Robinson PM, Norris J, Roberts CP. Randomized controlled trial of supervised physiotherapy versus a home exercise program after hydrodilatation for the management of primary frozen shoulder. J Shoulder Elbow Surg. 2017;26(5):757–765.
9. Lee SY, Lee KJ, Kim W, Chung SG. Relationships between capsular stiffness and clinical features in adhesive capsulitis of the shoulder. PM R. 2015; 7(12):1226–1234.
10. Rizk TE, Pinals RS. Frozen shoulder. Semin Arthritis Rheum. 1982 May;11(4):440-52.
11. Pal B, Anderson J, Dick WC, Griffiths ID. Limitation of joint mobility and shoulder capsulitis in insulin- and non-insulin-dependent diabetes mellitus. Br J Rheumatol. 1986;25:147–51.
12. Cakir M, Samanci N, Balci N, Balci MK. Musculoskeletal manifestations in patients with thyroid disease. Clin Endocrinol (Oxf) 2003;59:162–7.
13. Wohlgethan JR. Frozen shoulder in hyperthyroidism. Arthritis Rheum. 1987;30:936–9.
14. Riley D, Lang AE, Blair RD, Birnbaum A, Reid B. Frozen shoulder and other shoulder disturbances in Parkinson's disease. J Neurol Neurosurg Psychiatry. 1989;52:63–6.
15. Chan HBY, Pua PY, How CH. Physical therapy in the management of frozen shoulder. Singapore Med J. 2017 Dec;58(12):685-689.

Original Article

Evaluation of treatment of intertrochanteric fracture by Trochanteric Locking Plate in intertrochanteric Kyle III and IV fractures

Mohammad Golam Sagir[1], M. Muniruzzaman[1], Md. Aminur Rahman[2], Md. Mahmud Ullah[3], Fazle Akber Khan[3]

ABSTRACT

Comminution of the lateral trochanteric wall, postero-medial comminution, reverse oblique fractures, fractures involving comminution of greater trochanter are unstable fractures which had poor results with the regular methods of fixation. The trochanteric locking plate is a new implant that allows angular stability by creating fixed angle block for treatment of complex comminuted proximal femoral fractures. This prospective observational study was conducted to evaluate the functional outcome of unstable intertrochanteric fracture with trochanteric locking plate at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sher-E-Bangla Nagar, Dhaka, Bangladesh over a period of 24 months. Patients diagnosed as unstable (Kyle type III & IV) close intertrochanteric fracture of femur due to trauma were the study population. A total of 20 patients aged above 20 years irrespective of sex were included in the study. The fractures are unstable, closed and less than three weeks and treated by fixation with Trochanteric Locking Plate. Followups were carried out after 6, 12 and 24 weeks of operation. Almost 70% of the patients enjoyed wide range of hip and knee movements and 30% developed some restricted ROM in hip and also in knee. Functional outcome was observed according to Harris Hip Score. The 50% patients had excellent (90-100) score, 35% patients had good (80 – 89),10% had fair (70– 79) and 5% patient had poor (<70) score. The present study concluded that the functional outcome of fixation of unstable intertrochanteric fracture (Kyle type III & IV) of femur with trochanteric locking plate is a feasible alternative and effective method.

Key words: Intertrochanteric fracture, Trochanteric Locking Plate.

Introduction:

intertrochanteric femoral fractures occur in patients older than 70 years old and the commonest cause is fall (about 90%) (Lavelle, 2008). In younger patient these fractures usually result form high energy trauma. These fractures are more common in women than in men by a margin of three to one. More than 50% fractures are unstable. Unstable pattern occur more commonly with increased age and with low bone mineral density. (Babhulkar, 2006). Unstable intertrochanteric fractures are technically much more challenging than stable fractures. A stable reduction of an intertrochanteric fracture requires providing medial and posterior cortical contact between the major proximal and distal fragment to resist varus and posterior displacing forces (Babhulkar, 2006). The choice of implant depends on the degree of instability. Although many fixation 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 proximal femoral locking compression plate (PF-LCP) was introduced about a decade ago as a new implant that allows angular-stable plating for the

1. Assistant Professor (Orthopaedic Surgery), Patuakhali Medical College, Patuakhali.
2. Assistant Professor, CC (Orthopaedic Surgery), Jashore Medical College, Jashore.
3. Registrar, (Orthopaedic Surgery), Sher-E-Bangla Medical College Hospital, Barishal.

Correspondence: Dr. Mohammad Golam Sagir, Assistant Professor (Orthopaedic Surgery), Patuakhali Medical College, Patuakhali.

treatment of complex comminuted and osteoporotic fractures (Zha et al., 2011). Trochanteric Locking Plate provide multi planar points of fixation in the proximal femur to resist rotational stress and optimized fitting for the pre contoured plate design (Smith & Nephew).

MATERIALS AND METHODS:

This prospective, observational study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh from from January 2014 to December 2015 to assess the effectiveness of Trochanteric Locking Plate in the treatment of unstable intertrochanteric fracture (Kyle type III & IV) of femur by clinically and functionally. A total of 20 patients were selected by convenient sampling from the study population. Variables of interest were recorded in a structured data collection form. Followups were carried out after 6, 12 and 24 weeks of operation. Data were processed and analysed using SPSS. Functional outcome was observed according to Harris Hip Score.

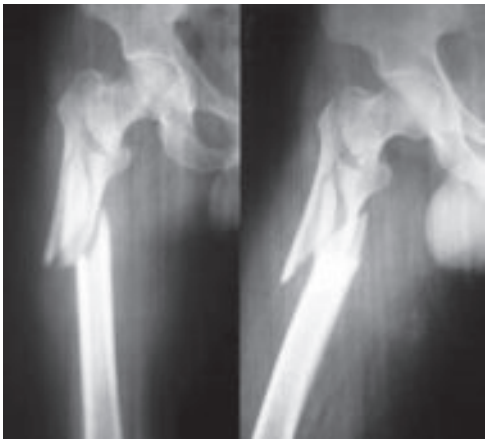


Figure: *Preoperative view of right trochanteric fracture.*



Figure: *Radiograph of right hip 24 weeks after operation.*



Figure: *The patient can stand after 24 week*



Figure: *The patient can sit comfortably after 24 weeks*



Figure: *X-ray of left intertrochanteric fracture.*

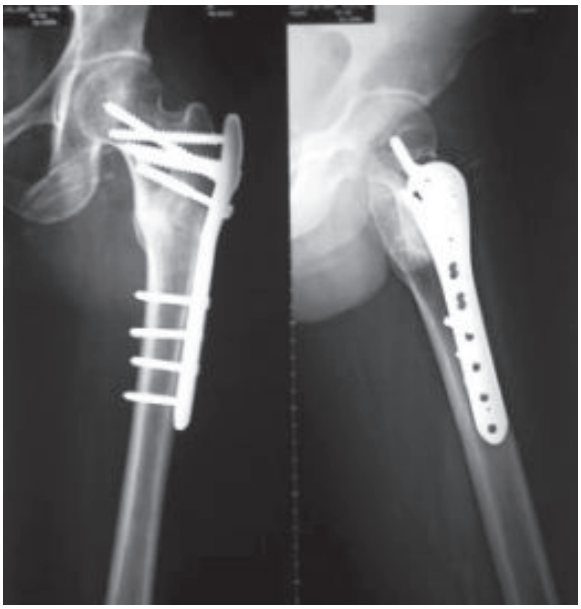


Figure: *Radiograph of left hip 24 weeks after operation.*



Figure: *The patient can stand 24 weeks after operation.*

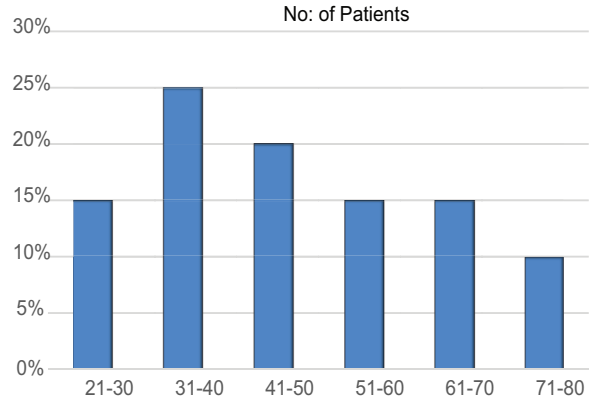


Figure: The patient can sit comfortably after 24 weeks.

RESULTS:

A total of 20 patients with intertrochanteric fractures included in the study to evaluate the outcome of fixation unstable intertrochanteric fracture (Kyle type III & IV) with Trochanteric Locking Plate. The findings of the study obtained from data analyses are documented below.

Age distribution:



Above diagram shows the age distribution of the patients, most of the patients 5(25.0%) were age group of31-40 years and4(20%) were age group of 41- 50 years. Mean±SD age was 51.40 ± 15.96 and ranging from 32 – 50 years.

Sex distribution:

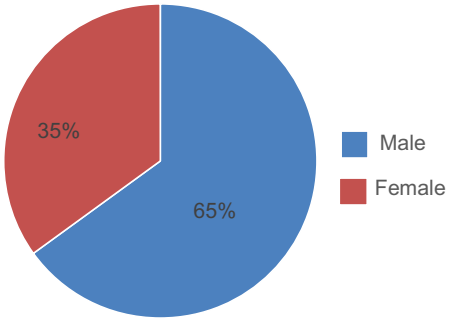
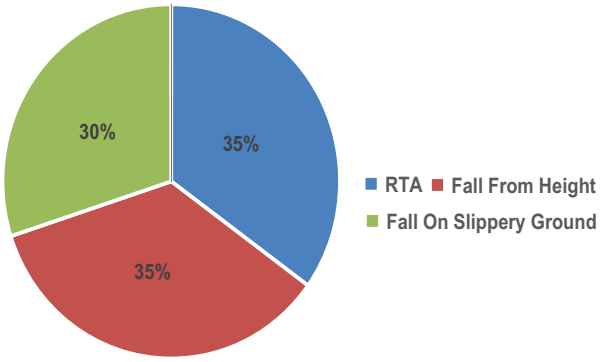


Fig.2: *Pie diagram showing the sex distribution of the patients (n=20)*

Out of 20 cases 13(65%) patients were male and 7(35%) patients were female. The male: female ratio were 1.86:1.00

Mechanism of injury:



Above figure shows the mechanism of injury. Most common 7(35.0%) in each group, cause of injury was combined by RTA and fall from height. The rest group was fall on slippery ground.

Type of fracture:

Table-II

Distribution of the study patients by type of fracture (n =20)

Type of fracture	Frequency	Percentage (%)
Kyle Type III	10	50
Kyle Type IV	10	50
Total	20	100

In our study of 20 unstable intertrochanteric fracture 10(50%) patients were Kyle type III and 10(50%) patients were Kyle type IV.

Pain status:

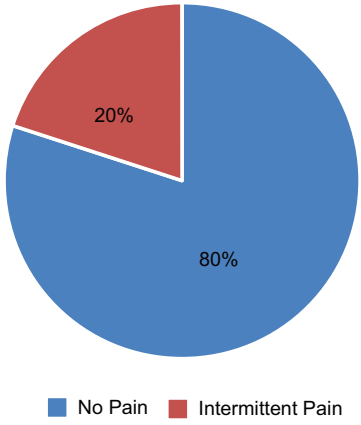


Fig.5: *Pie diagram showing pain status*

Above figure shows the pain status of the study patients, 4(20.0%) patients complaints of intermittent pain.

Weight bearing time:

Table-V

Time at which full Weight bearing achieved (n =20)

Weight bearing time (weeks)	No of Patients	Percentage
14- 16 weeks	14	70
17-18 weeks	04	20
>18 weeks	02	10
Total	20	100

Table shows the time at which full weight bearing achieved. Maximum 14 (0%) patients full weight bear at time 14-16 weeks. Mean full weight bearing time 17±2.4 weeks

SQUATTING:

Table-VII

Status of squatting (n =20)

Squatting	No of Pati+ent	Percentage
Possible	14	70
With difficulties	4	20
Not possible	2	10
Total	20	100

Table showing the status of squatting maximum 14 (70%) patients could squat with ease, 4(20%) patients could with difficulties and 2 (10%) patients could not squat at all.

Walking capacity:

Table-X

Walking capacity (n =20)

Walking capacity	No of Patients	Percentage
Same as before	14	70
Use walking aids	6	30
Total	20	100

Table shows the walking capacity of the patients, maximum 14(70.0%) patient's walking capacity was same as before, 6(30%) patients use walking aids.

DURATION OF RADIOLOGICAL UNION (WEEKS):

Table-VI

Duration of radiological union (weeks) (n =20)

Union (weeks)	No of patient	Percentage
<12weeks	0	0
12- 14 weeks	14	70
18- 20weeks	4	20
Within 24weeks	2	10
Delayed union	0	0
Non union	0	0
Total	20	100

Table shows the duration of radiological union. Most of the fractures 8(40%) were united between21-22 weeks. Mean duration of radiological union was 21.4±1.8 weeks

Complications:

Table-XI

Complication (n =20)

Complications	No of patients	Percentage
SSTI	2	10
Restricted ROM (Hip+Knee)	3	15
Deep infection	0	0
Non union	0	0
Implant failure	1	05
No complications	14	70
Total	20	100

Table showing the complications of the patients, 2 (10%) patients had SSTI, 3 (15%) patients had restricted (hip) ROM, 1(5%) had implant failure (screw cut out) and rest of the patients 14 (70%) had no complications.

HARRIS HIP SCORE:

Table-XII

Functional result assessment by Harris Hip Scoring (n=20)

Harris Hip Score	No of Patients	Percentage
Excellent(90 – 100)	10	50
Good(80 – 89)	07	35
Fair(70- 79)	02	10
Poor(<70)	01	05
Total	20	100

Table showing functional results assessed, by Harris Hip Scoring 10 (50%) patients had excellent outcome, 7(35%) patients had good outcome, 2 (10%) patient had fair and 1 (05%) had poor outcome.

Final outcome:

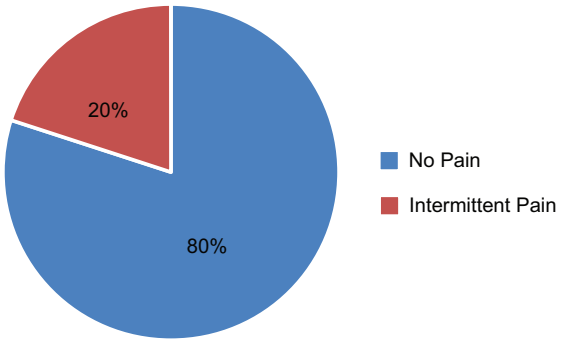


Fig.6: *Pie chart showing final outcome*

Pie diagram showing final outcome of the study. Most of the patients 17(85%) were satisfactory and rest of them 3(15%) patients were unsatisfactory.

Table-XIII

Distribution of the results according to the final outcomes (n=20).

Result	No of Patient	Percentage
Satisfactory(Excellent + Good)	17	85
Unsatisfactory(Fair + Poor)	03	15
Total	20	100

Table showing final outcome of the study. Most of the patients 17(85%) were satisfactory (Excellent + Good) and rest of them 3 (15%) patients were unsatisfactory (Fair +Poor).

DISCUSSION:

Trochanteric Locking Plate is used for unstable intertrochanteric fractures and had fewer complications even in osteoporotic individuals possibly due the angular stable fixation. Out of 20 patients 14 were male and 6 were female with mean age of 55.2 years.

In the study of Zha et al. (2011) shows, mean operation time for unstable intertrochanteric fracture using trochanteric plate (PERI-LOC plate) was 32.6 ± 12.8 minutes. In this study mean operation time for unstable intertrochanteric fracture was 65.75 ± 6.34 minutes may be due to required larger incisions, newer operative techniques of trochanteric plate (PERI-LOC plate) to the operating surgeon and other technical difficulties. All the patients required per-operative blood transfusions may also be related with the above factors.

In this study two patients were suffering from surgical site infection and healed by secondary intention and one patient had implant failure due to screw cut out.

The different movements of hip like flexion, internal rotation, external rotation, adduction and abduction were evaluated at 12 and 24 weeks. All the patients enjoyed wide range of hip movements. But two patients developed certain amount of restricted ROM in hip and ipsilateral knee joints All patients fracture union mean time was 14 weeks (12- 16weeks). One elderly female patient, started weight bearing early and developed proximal migration of the implant and subsequent failure.

In another study mean time to fracture union 98% in 6 months (24 weeks). (Zha et al., (2011). He reported some failure rate as nonunion, breakage of implant and technical complications. In this study all patients had fracture union in 6 months (24 weeks). The reported complication rate of fixation of intertrochanteric unstable fracture with DCS ranges from 3% - 15% (Hasenboehler et al., 2007).

Regarding functional outcome Schatzker and Lambert hip score shown excellent in 8 patients, good in 6 patients, fair in 4 patients and poor in 2 patients.

In this study functional outcome measured by Harris hip score and there were excellent (90-100) in 10 patients, good (80-89) in seven patients and fair (70-79) in two patient and poor (< 70) in one patient. Average Harris hip score 89.25 ± 8.36.

Brett et al., (2006) demonstrated that the trochanteric plate (PF-LCP by Synthese/PERI-LOC plate by Smith and Nephew) offers the surgeon a greater degree of adjustment in plate placement decreasing the common flexion or extension deformity frequently seen with blade plate placement.

The trochanteric locking plate thus fulfills the role of a fixed angle device and achieves the same or greater degree of stability and is ideal in unstable intertrochanteric fractures. It acts as a buttress and prevents excessive fracture collapse. It substitutes for an incompetent lateral cortex. Our results shows minimal varus collapse and one patient had hardware failure. It provides multiplanar fixation of the proximal femur an anatomic contour that allows the implant to be used as reduction aids, complete avoidance of abductor devitalization and the applicability of the all fractures of the proximal femur.

CONCLUSION:

In this study evaluation of treatment of unstable intertrochanteric fracture (Kyle type III & IV) of femur by trochanteric locking plate demonstrated excellent to good results in majority of cases. 70% of cases return to the routine pre injury activities without limitations. In terms of subjective evaluation most of the patients had good to excellent outcome. Locking plate provide stable fixation in unstable intertrochanteric fracture. Respect to the soft tissue during operation & early mobilization due to stable fixation improve final outcome. So, use of trochanteric locking plate to treat the unstable intertrochanteric fractures (Kyle type III & IV) of femur is an effective method.

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, G.C., Chen, Z.L., 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

Proximal Femoral Locking plate in unstable extracapsular proximal femoral fractures: A retrospective analysis

Md. Kamruzzaman[1], Shakawat Hossain[2], Gazi Md. Ruhul Quddus[1], Md. Nur Alam[3], Mohammad Mahfuzur Rahman[4]

Abstract:

Stable trochanteric femur fractures can be treated successfully with conventional implants. However comminuted and unstable inter or subtrochanteric fractures with or without osteoporosis are challenging & prone to complications. The PF-LCP is a new implant that allows angular stability by creating fixed angle block for treatment of complex, comminuted proximal femoral fractures.

We reviewed 30 patients with unstable inter or subtrochanteric fractures, which were stabilized with PF-LCP. Mean age of patient was 65 years, and average operative time was 90 min. Patients were followed up for a period of 3 years (June 2013–June 2016). Patients were examined regularly at 3 weekly interval for signs of union (radiological & clinical), varus collapse (neck-shaft angle), limb shortening, and hardware failure.

All patients showed signs of union at an average of 9 weeks (8–10 weeks), with minimum varus collapse (<10°), & no limb shortening and hardware failure. Results were analysed using IOWA (Larson) hip scoring. Average IOWA hip score was 77.5.

PF-LCP represents a feasible alternative for treatment of unstable inter- or subtrochanteric fractures.

Keywords: Proximal Femoral Locking , unstable, proximal femoral fractures

INTRODUCTION:

Proximal femoral fractures are one of the commonest fractures encountered in orthopaedic trauma practice (about 3 lakh per year[1] with mortality rate of 4.5%–22%).[2]

Extracapsular proximal femoral fractures are those occurring in the region extending from extracapsular basilar neck region to 5 cm below lesser trochanter. Proximal femoral fractures include intertrochanteric and subtrochanteric fractures.3 Stable proximal femoral fractures can be managed with conventional implant with predictable results whereas unstable fractures are challenging, and prone to complications. There is a lack of consensus on the treatment for unstable proximal femoral fractures. Here we report our experience of complex extracapsular proximal femoral fractures with proximal femoral locking plate.

1. Assistant Professor, Ortho Surgery, NITOR, Dhaka
2. Assistant Registrar, Ortho Surgery, NITOR, Dhaka
3. Junior Consultant, Ortho Surgery, NITOR, Dhaka
4. Assistant Prfofessor, Department of Orthopaedics, BSMMU, Dhaka

Correspondence: Dr.Md.Kamruzzaman, Associate professor of pediatrics orthopaedic, NITOR,Dhaka. E-mail: Ztushar2000 @yahoo.com

MATERIALS AND METHODS:

Our study included a total 30 patients (20 males & 10 females) with unstable proximal femoral fractures (AO Type 31A2 & 31A3) [3]who were subjected to management using PF-LCP. The mean age of the patients was 65 years (36–82 years). Extracapsular proximal femoral fractures included both intertrochanteric and subtrochanteric fracture. Intertrochanteric fractures were classified according to Evans, whereas subtrochanteric fractures were classified according to Seinsheimer. Open fracture, Pathological fracture, were excluded from the study. Patients were followed up for a period of 3 years (June 2010–June 2013). Patientswereexamined regularly at 3 weekly interval for signs of union (radiological & clinical), varus collapse (neck-shaft angle), limb shortening, and hardware failure. Patients were allowed non-weight bearing ambulation from day after surgery. Toe-touch weight bearing was started at 3 weeks and full weight being at 8 weeks (subject to union criteria).

All the patients were evaluated for osteoporosis and were given specific scores (1–6) according to the SINGH'S INDEX.[4]

Surgical technique

PF-LCP implant is a limited contact, angular stable plate designed for management of complex proximal femoral fractures.[5] PF-LCP is anatomically pre-contoured to fit the proximal femur. There are separate implants for left and right side. Proximal portion is pre-contoured to fit at greater trochanter.

Surgery is performed with the patient lying supine over operating fracture table. Traction is applied and anatomically satisfactory reduction is achieved preoperatively under fluoroscopic control, in both anteroposterior and lateral views. Lateral approach using a straight incision extending from greater trochanter to 5–10 cm distally, according to fracture configuration, is used.

In cases where anatomically satisfactory reduction was achieved preoperatively the plate was inserted using the less invasive technique, while in others open reduction technique was used. The ultimate plate position and screw position depends upon fracture reduction and placement of guide wires into the femoral head and neck. The fixed-angle wire guides are threaded to the proximal threeholes of the plate, and the plate is approximated to the proximal femur. Next, a guide wire was advanced through the most proximal (95-degree) hole. The correct path of this wire is approximately onecentimetre inferior to the piriformis fossa into the inferior femoral head on the anteroposterior (AP) view, and central in the femoral head on the lateral view. A guide wire is inserted into the next distal (120-degree) hole, and because this is in a different plane than the first hole, the surgeon must visualize its position on the lateral x-ray. The third guide wire, in the 135-degree hole, is then placed, which is in the same plane as the first hole and may alternatively be inserted near the end of the procedure without compromising the stability of the construct. All three guide wires should be in subchondral bone of the femur head before inserting the screws which is confirmed by C-arm in the AP and lateral views. The screw lengths are measured using an indirect device over the guide wires with the wire guides still attached and the appropriate, fully threaded, cannulated screws (7.3 mm for the two proximal holes and 5.0 mm for the third proximal hole) are selected. These cannulated screws are inserted over the guidewires with the guides removed. During distal screws fixation, in subtrochantric fractures first fracture should be reduced, then fix the non-locking screws in compression mode followed by locking screws whereas intertrochantric fracture can be fixed with locking screws. After thecompletion of the fixation, thorough wash of the wound was given with normal saline. Suction drain was inserted at the entry point and wound closed in layers.

Postoperatively patients were put on quadriceps drill and allowed non-weight bearing ambulation day after surgery. Toe-touch weight bearing was started at 3 weeks & full weight bearing at around 8 weeks, subject to union criteria (evidence of sufficient callus in 3 out of 4 cortices on AP and lateral views). Patients were followed up at 3 weekly interval for the first 3 months and looked for signs of union (Clinical & Radiological), varus collapse, limb shortening, and hardware failure

RESULTS:

The median duration of surgery was 80 min (60–130 min). All 30 patients were available for evaluation after 3 years of follow up.

The union rate was 80% (24/30) at 3 months follow up. Average varus collapse was <10° (5–12°). No cases of limb shortening and hardware failure were noted. ROM at knee joint was full in all the cases. However there was one case of greater trochanteric tip avulsion (case-6) in an 80 years old lady at 3 months follow. Patient had associated abductor lurch. She was advised fixation of trochanteric fragment, but refused. Although fracture healed in that case in usual time .This may be due to early full weight bearing by the patient. One patient showed delayed union at 6 month follow up, which was bone grafted. Follow up at 9 month showed full union in that case.

The mean blood-loss was 200 ml. The mean image intensifier time was 5 min and mean length of incision was 10 cm .Postoperatively assessment of the procedure was done using IOWA (Larson) Scoring system.



Figure 1: *Clinical photograph showing sub trochanteric fracture*

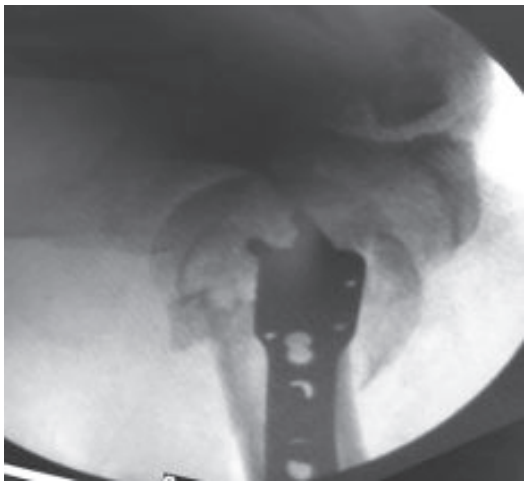


Fig.-2: *Clinical photograph showing position of screws under fluoroscopic control*



Fig.-3: *Clinical photograph showing post oprerative x-ray*



Fig.-4: *Clinical photograph showing Post operative followup x-ray*



Fig.-5: *Clinical photograph showing x-ray after radiological union*

DISCUSSION:

Initial treatment of the proximal femur fractures in the 1800s was mainly non-surgical. The major advances in the treatment of femoral fractures were first seen in 1870 when Hugh Owen Thomas[6] developed the Thomas splint, and advocated immobilization with prolonged bed rest. Surgical management of the hip fractures started gaining interest when the first Bone plate was used in 1886 when Hanmann devised his retrievable bone plate. Lambotte, Lane (1914) Sherman (1912) and Townsend & Gilfillan (1943) played an important role in development of the modern principles of osteosynthesis.[7] The real modern era of internal fixation of hip fractures began with the invention of the triflange nail by Smith Peterson[8] in1925. The invention of sliding compression with a cannulated system of drilling and insertion was invented by Godoy-Moreira and is the precursor of this class of implants in 1938. The desire to increase stability of unstable fracture patterns with valgus osteotomies was popularized by Dimon and Houston,[9] Sarmiento, Harrington in the 1960s 1970s. Cephalomedullary implants are devices inserted with a closed technique and fluoroscopic control with variable femoral length geometry and enhanced proximal geometry to permit fixation with nails or screws into the femoral head. The Grosse-Kempf gamma nail and the Russel-Taylor reconstruction nail were the start of two new classes of intra-medullary devices designed for the hip region. Locked and hybrid compression plates have been applied recently for unstable fractures with only preliminary results so far.

PF-LCP acts as a fixed angle internal fixator device and achieves greater stability compared with DHS/DCS/Angle blade plate while avoiding excessive bone removal. It is also ideal in osteoporotic bones. PF-LCP prevents rotational instability and allows angular stability by creating a fixed angle block for treatment of complex, comminuted proximal femoral fractures. 5 proximal locking screws (5 mm,non-cannulated) provide an angular stable construct independent of bone quality. The varied angle of multiple screw insertions within the complex trabecular zone of the head neck region of proximal femur provides for an optimal mechanical stability. Further 120–135° screws provide calcar stability and maintain neck shaft angle (prevent varus collapse). The use of multiple screws in the head neck area effectively increases the overall cross sectional purchase in this anatomically peculiar area.

Our study has one limitations; it is a case series and not a comparison between two surgical technique in a randomized fashion. But it has two main strengths, first it is a unique study describing a new technique with new implant, second the data analysed here pertain to a specific type of injury; all the fractures were unstable proximal femoral fractures.

CONCLUSIONS:

PF-LCP is an effective implant for unstable proximal femoral fractures (±osteoporosis). PF-LCP provides fixed angle block and provide angular stability with early functional rehabilitation.

REFERENCES:

1. Ehmke L.W., Fitzpatrick D.C., Krieg J.C. Lag screws for hip fracture fixation: evaluation of migration resistance under simulated walking. J Orthop Res. 2005;23:1329–1335.
2. Dobbs R.E., Parvizi J., Lewallen D.G. Perioperative morbidity and 30-day mortality after intertrochanteric hip fractures treated by internal fixation or arthroplasty. J Arthroplasty. 2005;20(8):963–966.
3. Rockwood and green's fractures in adults, vol. 2, 7th ed. *Intertrochanteric Fractures*. Thomas A Russell. Page 1597–1600.
4. Koot V.C.M., Kesselaer S.M.M.J., Clevers G.J., DeHooge P., Weits T. Evaluation of the singh index for measuring osteoporosis. J Bone Joint Surg [Br] 1996;78-B:831–838.
5. Hasenboehler Erik A., Agudelo Juan F., Morgan Steven J., Smith Wade R., Hak David J., Stahel Philip F. Treatment of complex proximal femoral fractures with proximal femur locking compression plate. Orthopaedics. August 2007;30(8)
6. Hugh Owen Thomas, quoted by Rockwood CA, Green DP. *Fracture in Adults*, 4th ed., vol. 2, 1972–73.
7. Townsend Kenneth, Gilfillan Charles. A new type of bone plate and screws.SurgGynecol Obstet. 1943;77:595–597.
8. Smith Peterson M. Treatment of neck of femur by internal fixation. SurgGynecol Obstet. 1937;64:287.
9. Dimon J.H.J.C. Unstable intertrochanteric fractures of the hip. J Bone Joint Surg Am. 1967;49(3):440–450.
10. Medoff R.M. A new device for the fixation of unstable pertrochanteric fractures of the hip. J Bone Joint Surg Am. 1991;73(8):1192–1199.
11. Knobe Mathias, GradlGertraud, burger Andreasladen, TarkinIvans S., PapeHanschristoph. February 2013. Clinical Orthopaedics and Related Research. 11999-013-2834-9.
12. Sharma V., Babhulkar S., Babhulkar S. Role of gamma nail in management of pertrochanteric fractures of femur. Indian J Orthop. 2008;42:212–2
13. Simpson A.H., Varty K., Dodd C.A. Sliding hip screws: modes of failure. Injury. 1989;20:227–231.
14. Nungu K.S., Olerud C., Rehnberg L. Treatment of subtrochanteric fractures with the AO dynamic condylar screw. Injury. 1993;24:90–92.
15. OzkayaUfuk, BilgiliFuat, KilicAyhan, Parmaksizoglu AtillaSancar, KabukcuogluYavuz. Minimally invasive management of unstable proximal femoral extracapsular fractures using reverse LISS femoral locking plates. Hip Int. 2009;19(2):141–147.

Original Article

Outcome of Single Level Instrumented Posterior lumber interbody fusion (PLIF) Using Corticocancellous Bone Chips and Cages in Spondylolisthesis

Mohammad Mohsin Reza[1], Md. Shah Alam[2], Kazi Mohammad Hannanur Rahman[3], Md. Rashedul Islam[4], Muhammad Rafiqul Islam[5], Ripan Gosh[1], Md. Nahfidul Zannat[6], Mohammad Awlad Hossain[7], Md. Iftekharul Alam[8], Md. Rakibul Hasan[3]

Abstract

A Posterior Lumbar Interbody Fusion (PLIF) procedure allows the surgeon to insert bone graft and cage into the disc space from a unilateral approach. By using cage, restoration of disc height and indirectly foraminal height can occur. Pedicle screws and rods give immediate stability.This prospective observational study was conducted in the National Institute of Traumatology Orthopedic and Rehabilitation from July 2015 to June 2017. All spondylolisthetic patients of both sexes age above 18 years were included in this study. A total number of 20 patients were enrolled as per inclusion and exclusion criteria. Surgery was done by posterior lumbar interbody fusion using cage, bone graft and stabilization by pedicle screws and rods. Preoperative and postoperative pain status was recorded by self-evaluated Visual Analog Score (VAS) and disability by Oswestry Disability Index (ODI). Radiologically preoperative and post-operative disc height, foraminal height, angle of total lumbar lordosis and slip reduction, preoperative pelvic parameters (Pelvic tilt, pelvic incidence, sacral slope) were measured in standing lateral films. Hackenberg criteria were used for assessment of bony fusion. The overall functional outcome was assessed by Macnab's criteria.Total number of patients were 20 where male was 5(25.0%) and female found 15(75.0%) and mean age group was 43.8±9.7 years. Twelve patients (60%) had spondylolisthesis at L4/L5 level and 8(40%) patients had at L5/S1 level. Regarding clinical assessment, the ODI percentage has been decreased from 58.2±1.6 to 18.2±.4, VAS for back pain has come down from 7.0±0.46 to 2.25±0.55 and VAS for leg pain has come down from 6.6±0.51 to 1.3±0.46 six months after surgery. According to Macnab criteria the overall functional outcome was, 18(90%) found excellent and only 2(100%) found good. Regarding radiological variables of the of the study patients, pre-operatively, mean slip angle was found 15.1±1.2-degree, total lumbar angle 21.0±3.0 degree and mean measurement of slip 31.4%±2.3%. Six months after surgery, mean slip angle 7.6±1.1-degree, total lumbar angle 21.0±3.0 degree and mean measurement of slip was 12.7%±1.0%. There was significant increase in disc space height and foraminal height post-operatively (p value< 0.05). Fusion rate was 100% according to Hackenberg criteria. This study conclude that spondylolisthesis lumbar spine can be treated with posterior lumbar interbody fusion and spinal stabilization.

Key words: Posterior Lumbar Interbody Fusion(PLIF), Spondylolisthesis.

1. Junior consultant (Ortho), National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh
2. Professor & Head, Dept. of Orthopaedics, DMCH, Dhaka
3. Assistant professor of Orthopaedics, NITOR, Dhaka
4. Asst. surgeon, Orthopaedic Surgery, NITOR, Dhaka
5. Assistant professor of Orthopaedic Surgery, Netrokona Medical College, Dhaka
6. Clinical Assistant (Ortho), NITOR, Dhaka
7. Senior consultant (Ortho), NITOR, Dhaka
8. Registrar (Ortho), NITOR, Dhaka

Correspondence: Dr. Mohammad Mohsin Reza ,Junior consultant, NITOR, Dhaka, Bangladesh, E-mail: rezamohsinss28@gmail.com

INTRODUCTION

Herbiniaux, a Belgian obstetrician, noted a bony prominence in front of sacram that caused problems in delivery generally is credited with having first described Spondylolisthesis. The term spondylolisthesis was used by Kilian in 1854 is derived from Greek spondylos, meaning 'vertebra' and olisthenein meaning 'to slip'. Spondylolisthesis is defined as anterior or posterior slipping of one segment of spine on the next lower segment[1]. In 1989, Wiltse and Rothman separated the post-surgical type from the pathologic type producing 6 different classifications that is congenital, isthmic, degenerative, traumatic, pathologic and post-surgical, which is the common form used today.[2]Compression of spinal nerve roots by lumbar spinal stenosis (LSS) in spondylolisthesis is a major clinical problem associated with intermittent claudication, pain, numbness, and lack of normal sensitivity. Such compression has been shown to induce neurophysiologic dysfunction, degeneration, and reduced blood flow in nerve roots in animal models and human as well. Reduced blood flow in nerve roots induces neurogenic intermittent claudication.[3-8]

The prevalence of spondylolisthesis and spondylolysis in general population is 6%.[9-13] Among them, in 85%-90% cases conservative therapies may be helpful, and 10-15% will fail conservative therapy requiring surgical intervention.[14-16] Controlled clinical studies comparing conservative and surgical treatment are rare and there are few reports on long-term results. The outcome of those studies favors surgical management over conservative treatment.[17]The most widely used surgical techniques are all based on the principles of decompression and fusion, with or without instrumentation.[18-20] Lumbar spinal fusion has been established as an effective treatment modality for proper patients with low back and leg pain suffering from degenerative lumbar spinal disorder. Numerous efforts have been undertaken to fulfill the aim of spinal fusion procedure, which is a solid arthrodesis of unstable segment finally relieving patients from pain and restoring their global spinal function. Among various techniques introduced so far, posterior lumbar interbody fusion (PLIF) with instrumentation is considered as one of most solid and biomechanically sound methods for fusion.[21-25]Several procedures have been described for interbody fusion with or without instrumentation: posterior lumbar interbody fusion (PLIF), anterior lumbar interbody fusion (ALIF), circumferential 360º fusion (front and back) and more recently, the transforaminal lumbar interbody fusion (TLIF)**.**[26]A posterior lumbar interbody fusion (PLIF) has the advantages of spinal canal decompression, anterior column reconstruction, decompression of foraminal stenosis, and reduction of the sagittal slips from a single posterior approach. The PLIF using double cage has been a standard practice till recently. However, there are many studies now with PLIF using single cages with comparable results and lesser complications.[27-29]

Degenerative spondylolisthesis is a common condition which occurs most frequently in the lower lumbar spine, most commonly at the level of L4/L5. The extent of the slip is usually graded using the Meyerding classification with grades I and II representing up to 25% and 50% displacement respectively. These are referred to as low-grade slips. The initial management of the condition is non-operative. However, should this fail surgical intervention is then considered.Posterolateral Fusion (PLF) and Posterior Lumbar Interbody Fusion (PLIF) are procedures that can be undertaken for the surgical management of degenerative low-grade spondylolisthesis. Although there is tentative evidence in the literature that PLIF provides an increased fusion rate and therefore an improvement in symptomology.[25]During the last decade, posterior lumbar interbody fusion (PLIF) has been widely used in arthrodesis for segmental instability of the lumbar spine. With additional instrumentation and posterolateral fusion, the overall fusion rate has been high, ranging from 96% to 100%, and the clinical success has been satisfactory as reported in the literature.In practice, several kinds of bone grafts have been used for interbody fusion. Autologous iliac bone graft is a suitable choice with good biological healing ability but may cause considerable donor-site morbidity, such as local pain, increased operation time and blood loss, and infection. Local lamina bone and facet joint autograft obtained from the decompression procedure are also good sources of bone grafts in PLIF and have the advantage of not increasing morbidity.[30]Posterior lumbar interbody fusion (PLIF) with cages can be combined with decompression of the spinal canal and with instrumented posterolateral fusion (IPLF) with pedicle screws, through a single posterior incision.Aim of the presented study was to evaluate whether the PLIF with cage and instrumentation is effective regarding clinical and functional outcome, fusion rate, structural restoration and complications in treatment of spondylolisthesis.

MATERIALS AND METHODS

Study design: Prospective observational study.

Place of Study: The study was conducted in the Department of Orthopedics, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh.

Study period: From July 2015 to June 2017.

Study population: Patients with post traumatic subtrochanteric fractures of femur within three weeks of incidence were the study population, those who are admitted in NITOR.

Sample size and sampling technique: A total of 20 patients who met the following selection criteria were selected by convenient sampling from the study population.

Inclusion criteria: Patients with following characteristics were eligible for study

- Age between 18-65 years of both sexes.
- Symptomatic spondylolisthesis confirmed by X-ray & MRI
- Radiology proven instability
- Severe low back or leg pain or both
- Failure of 3 month of conservative treatment.
- Skeletal maturity.
- Progressive neurological deficit

Exclusion criteria: Patients with following characteristics were excluded from the study

- Severe systemic disease
- Spondylolisthesis due to neoplastic condition
- Spondylolisthesis due to traumatic condition
- Spondylolisthesis due to infective condition

Surgical Technique:

Anesthesia: General anesthesia.

Patient Positioning and Preparation

First, adequate relief of intraabdominal pressure reduces epidural venous pressure and decrease intraoperative bleeding. Second, several positioning frames exist that allow for varying amounts of lumbar lordosis.

Surgical approach

The posterior approach to the lumbar spine is through a posterior midline incision. This midline skin incision followed by fascial exposures. The posterior approach provides access to all of the posterior spinal elements by means of a single longitudinal midline fascial incision. Direct exposure of the spinous process, laminae, and facets at all levels can be achieved. In addition, further lateral dissection and retraction of the paraspinal musculature can also reach the transverse processes.

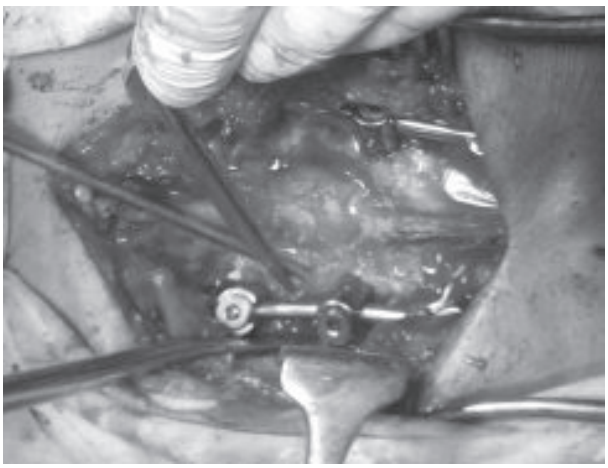


Fig.-1: *Decompression and instrumentation*

PARASPINAL MUSCLES

Trans-pedicular screw instrumentation

Although many pedicle screw systems exist, they all share a similar screw insertion technique. Intraoperative fluoroscopy using anteroposterior and lateral images may be of significant value to identify the direction of the pedicles. Oblique imaging can be helpful to follow insertion directly along the axis of the pedicle. Surgical exposure of the base of the transverse process is mandatory for pedicle screw insertion. The mammillary process, pars interarticularis, and the transverse process are important landmarks for the screw insertion point. Intersection method used for screw insertion. Pedicle screws inserted at adjacent two vertebra, sometimes one above or below can be included.

Spinal fusion procedures

After pedicle screw insertion by using the intersection landmark, articular processes of both facet joints are resected and the disc is exposed in the neuroforamen. Care should be taken to coagulate the epidural veins running superior to the pedicle into the neuroforamen before incising the disc. The disc is subtotally resected using rongeurs, shavers and curettes. While proceeding with the disc removal the disc space is progressively distracted via the contralateraly inserted rod. After scraping of the endplates the anterior part of the disc space is packed with autologous bone chips taken from the resected part of lamina and facet. A curved cage specially designed for the PLIF technique is filled with bone chips and inserted into the posterior or central part of the disc space.

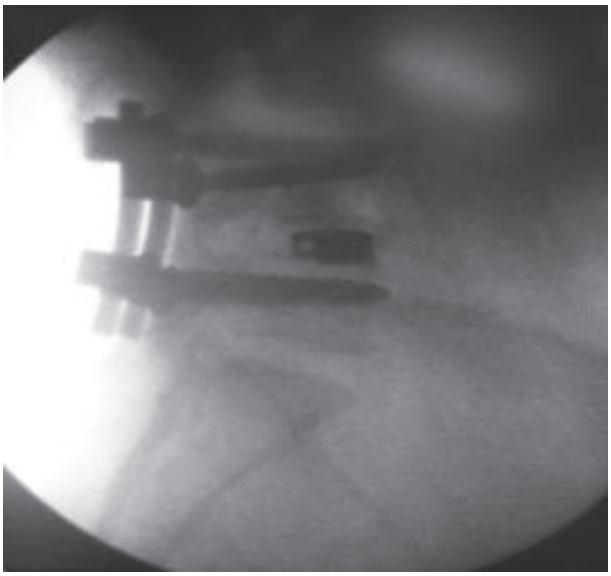


Fig.-2: *Peroperative C-arm view*

The shape of the cage and the 40° angle of the introducer enable a controlled cage positioning. Finally, both rods are mounted under slight compression. The remaining posterior elements are decorticated and bone ships are placed to achieve a posteromedial spondylodesis. If a decompression of the spinal canal is required this is done before resecting the disc. In cases of unilateral nerve root compression, the resection of the facet joint is done on this side. In cases of isthmic spondylolisthesis with bilateral nerve root compression and mobile lamina a complete laminectomy is performed to allow sufficient nerve root decompression and to use the lamina as bone graft. (Hackenberg, et al., 2005)

Postoperative management and follow-up

Immediate postoperatively management involves local wound care and mobilization of the patient. Generally, the patient is fitted for a lumbosacral orthosis. Following discharge, the patient is encouraged to increase activity gradually while maintaining lifting, bending, and squatting restrictions. Physical therapy is implemented on an out-patient basis to provide a structured exercise program. Part-time sedentary work is allowed at 4 to 6 weeks. After 3 months the orthosis is discontinued and the patient is allowed to return to full time employment with light to moderate activity. Full heavy labor and vigorous activities may resume 6 months after surgery.

RESULTS

The present study has been undertaken in NITOR from July 2015 to June 2017 to evaluate the clinical outcomes of posterior lumbar interbody fusion (PLIF) using cage combined with decompression and stabilization of lumbar spine for spondylolisthesis

A total 20 patients satisfying the inclusion and exclusion criteria were selected for this study. The youngest patient in our series was 30 years and oldest was 65 years. Out of 20 patients more male 5(25%) were affected than female 15(75%).Outcome of the operation was compared according to the modified Macnab criteria of the study patients, 18(90%) was found excellent in final follow up and only 2(10.0%) found good.

Table-I

Results on post-operative functional outcome by Macnab criteria

Post-operative Modified Macnab criteria	Number	Percentage
Excellent	18	90.0
Good	2	10.0
Fair	0	0.0
Poor	0	0.0

DISCUSSION

In present study, out of 20 patients, 3(15.0%) was 30-34 years old, 4(20.0%) was 35-39 years old, 2(10.0%) was 40-44 years old, 6(30.0%) was 45-49 years old and 5(25.0%) was above 50 years. The mean age was 43.8±9.7 years and the lowest and highest ages were 30 and 65 years respectively. Male was found in 5(25.0%) cases and female was found in 15(75.0%) cases. Akamaru et al. reported in a related study mean age 59.4±12.3 years and male 37.5% male and 62.5% female. In this series improvement of pain status measured by Visual Analog Score (VAS) is, back pain improvement from (07.0±0.46 to 02.25±0.55) and leg pain improvement from (06.6±0.51 to 01.3±0.47), p value of both of which is <0.05 which is statistically significant. In initial series of Yan, et al., the improvement of VAS score of back pain was (07.18 ± 01.09 to 01.84 ± 0.91) and leg pain improvement was (06.88 ± 01.21 to 01.34 ± 0.97) both of which is comparable to this study. In this series improvement of disability measured by Oswetry Disability Index (ODI%) is (58.2±01.6 to 18.2± 4.4) after 6 months of follow-up, here also p value is<0.05 which is statistically significant. In the study of Hackenberg, et al., it was showed that, in 54 patient series Oswetry Disability Index (ODI %) was 60.00 ± 01.21 pre-operatively and 17.09± 0.97 after 6 months of follow-up, which is comparable to this study.[37]According to Audat , et al., excellent outcome had

been observed around 70% cases in PLIF by using Macnabcriteria, which was also comparable to this study where excellent outcome is 90% and 10% is good. The overall satisfactory clinical outcome was not measured by the same criteria in different literaturesbut even then, the overall outcome had also been similar.[33]Interbody cages are used to restore the disc height, foraminal height and stabilize the affected segment.[36] These parameters have significant correlation regarding structural restoration and maintenance of stability (Osman , et al., 1997). From this study a significant increase of disc and foraminal height as well as neurological improvement.This study revealed a significant ($P < 0.05$) rise of mean disc height from 07.6±1.1 to 12.2±1.7mm. The mean foraminal height (MFH) increase was recorded from 13.0±0.8 to 14.7±0.93mm, which was also significant ($P < 0.05$). In (Sakeb & Ahsan, 2013), of mean disc height (MDH) raised from 07.76 ± 02.77 to 12.24 ± 01.89 mm and mean foraminal height (MFH) increase was recorded from 13.30 ± 1.55 to 17.50 ± 01.87 mm in their 26-patient series, which is comparable to this study. We were able to achieve $10.4^0 \pm 0.70^0$ improvement of lumbar lordotic angles, that were comparable (Sakeb & Ahsan, 2013) where improvement of lumbar lordotic angles were 05.70°±0.75°.The correction of forward slip restores sagittal alignment and physiological transmission of weight. Inadequate restoration and abnormal lordosis are the primary predisposing factor for adjacent segment degeneration results in chronic low back pain.[38] The percentage of correction of slip in this study had been significant ($P < 0.05$) from 15.1±1.6% to 7.6±1.2%. Interbody fusion with cage has been well accepted for its superior fusion results.[39]In our study, the PI in the spondylolisthesis group was higher than that in the normal group (69.6° and 47.5°, respectively, p<0.01), the SS in the spondylolisthesis group was higher than in the normal group (53.3° and 40.5°, respectively, p<0.01) and the PT in the spondylolisthesis group was higher than in the normal group (16.6° and 11.6°, respectively, p<0.01). These results were in accord with the other reported results. Labell et al. concluded that the SS of the spondylolisthesis group was higher than that of the normal group was supported by our results. The pelvic incidence was suggested by Duval-Beaupere et al. to be an anatomical parameter that is correlated with such positional parameters as the sacral slope and pelvic tilt. Therefore, as the PI is increased, the PT and SS will be increased. Generally, the normal range of the PT is very narrow from 10 to 15 degrees, so if the PI is increased, the SS will be increased relatively much more than the PT and it will be the cause of increasing lordosis. If the lordosis is increased, there will be a large load to the posterior complex that will produce a spondylolysis and possible progression of spondylolisthesis. Progression of spondylolisthesis displaces the center of gravity of the pelvis anteriorly, which increases the PT and decreases the SS to compensate.

Placement of autografts anteriorly and impacted before the introduction of cage in all the cases of PLIF with a theoretical background of anterior column load transmission (80%) and enhancement of fusion (Kuslich, et al., 2000). The biomechanical concept of "fusion stability" is assessed postoperatively to determine the achievement of stability of fusion area and biomechanically stable spine is achieved only when solid fusion is achieved.[40] Development of pseudarthrosis is one of the most common (range, 05-45%) complications of interbody fusion. In this study, we have achieved 100% fusion rate by usingHackenberg criteria which is comparable to (Mehta et al., 2011) where Pseud arthrosis was present in two (2.60%) patients in their series. In terms of complications, 10% of the patients developed minor complications in current series. Yuan et al. (1994) reported 1% implant failure rate like screw breakage, screw back up, screw loosening and rod slippage in his large multicentre studies and Dantas et al. reported the implant failure in his series of 5%. Devkota et al. reported the implant failure was four (5.55%). The wound infection rate in this study was 2 cases (10%), which was superficial and treated with regular dressing and intravenous antibiotics. Dantas et al. reported 6.6% of infection in his study on PLIF group and reported wound complications rate was 0.6% to 5% [19,20], which was comparable with our result. The criteria used to analyse the overall outcome was proposed by Macnab criteria which is based on relief of back and leg pain, return of employment, restriction of physical activities and use of analgesics for lumbar spine fusion. In this series 18 patients (90%) got excellent results, 2 (10.0%) belonged to the good results. Stauffer got 81% good results with satisfactory clinical outcome which is comparable with our results. Similar study done by Azad AK (2016) reported 80% excellent results with satisfactory clinical outcome and Tasmeem MR (2016) reported 80% excellent results. To conclude, Posterior Lumbar Interbody Fusion (PLIF) method is effective in relieving symptoms, achieving stability and fusion and lesser complication rates in surgical management of spondylolisthesis.

CONCLUSION:

From the above study result, we can say that PLIF is a cost effective, reasonably easy procedure for the management of spondylolisthesis by enhancing

neurological recovery reduction of pain and make the patients able to return to work comfortably.

REFERENCES:

1. Ching-Hsiao Yu, Chen-Ti Wang, Po-Quang Chen, 2008. Instrumented Posterior Lumbar Interbody Fusion in Adult Spondylolisthesis. *Clin OrthopRelat Res*, vol. 466(12), pp. 3034–3043.
2. Hagg, O., Fritzell, P. & Nordwall, A., 2006. Sexual function in men and women after anterior surgery for chronic low back pain. *European Spine Journal,* Volume 15, pp. 677-682.
3. Moller, H., Sundin, A. & Hedlund, R., 2000. Symptoms, Signs and Functional Disability in Adult Spondylolisthesis. *Spine,* 25(6), pp. 683-689.
4. Sakeb, N. & Ahsan, K., 2013. Comparison of the early results of transforaminal lumbar interbody fusion and posterior lumbar interbody fusion in symptomatic lumbar instability.. *Indian Journal Orthopedics.,* May-June, 47(3), pp. 255-263.
5. Vaz G, Roussouly P, Berthonnaud E, Dimnet J (2002) Sagittal morphology and equilibrium of pelvis and spine. *Eur Spine J* 1(11):80–87.
6. Wiltse, L. L. & Winter, R. B., 1983. Terminology and measurement of spondylolisthesis. *Journal of Bone Joint Surgery ,* Jul, 65(6), pp. 768-772.
7. Phan, K., Mobbs, R.J. & Rao, P. J., 2015. Foraminal Height Measurement Technique. *Journal of Spine Surgery,* 1(1), pp. 35-43.
8. Tang, S. & Xu, W., 2012. Does Disc Space Height of Fused Segment Affect Adjacent Disc Degeneration in Anterior Lumbar Interbody Fusion?A radiological Study. *Iran Red Cresent Medical Journal,* Volume 14, pp. 139-145.
9. Trouillier, H. et al., 2006. Posterior Lumbar Interbody Fusion with cages and Local Bonegraft in the Treatment of Spinal Stenosis. *Acta Orthopaedica Belgica,* Volume 72, pp. 460-466.
10. Wang, S.-T.et al., 2006. Comparison of two interbody fusion cages for posterior lumbar interbody fusion in a cadaveric model. *International Orthopedics,* Aug, 30(4), pp. 299-304.
11. Kalichman, L. & Hunter, D. J., 2008. Diagnosis and conservative management of degenerative lumbar spondylolisthesis. *European Spinal Journal,* Volume 17, pp. 327-335.
12. Hayes, M. A., Howard, T. C., Gruel, C. R. & Kopta, J. A., 1989. Roentgenographic Evaluation of Lumbar Spine Flexion-Extension in Asymptomatic Individuals. *Spine,* 3 November, Volume 14, pp. 327-331.
13. Berthonnaud E, Dimnet J, Roussouly P et al 2005. Analysis of the sagittal balance of the spine and pelvis using shape and orientation parameters. *J Spinal Disord Tech* 18:40–47
14. Etimadifer, M. R., Hadi, A. & Masouleh, M. F., 2016. Posterolateral instrumented fusion with and without transforaminal lumbar interbody fusion for the treatment of adult isthmic spondylolisthesis: A randomized clinical trial with 2-year follow-up. *Journal fo craniovertebral Junction & Spine,* Jan-Mar, 7(1), pp. 43-49.
15. Kuslich, S. D. et al., 2000. Four-Year Follow-up Results of Lumbar Spine Arthrodesis Using the Bagby and Kuslich Lumbar Fusion Cage.. *SPINE,* Volume 20, p. 2656–2662.
16. Rajnics P, Templier A, Skalli W, Lavaste F, Illes T. The association of sagittal spinal and pelvic parameters in asymptomatic persons and patients with isthmic spondylolisthesis. J Spinal Disord Tech. 2002;15:24–30.
17. Yan, D., Pei, F.-x., Li, . J. & Soo, C.I, 2008. Comparative study of PILF and TLIF treatment in adult degenerative spondylolisthesis.. *European Spine Journal.,* Octeber, 17(10), pp. 1311-1316.
18. Mehta , V. A. et al., 2011. Trans-foraminal versus posterior lumbar interbody fusion: comparison of surgical morbidity.. *Neurological Research,* 33(1), pp. 38-42.
19. Reynolds, R. A. K. et al., 2013. Postoperative Pain Management after Spinal Fusion Surgery: An Analysis of the Efficacy of Continuous Infusion of Local Anesthetics. *Global Spine Journal,* March, 3(1), pp. 7-14.
20. Roussouly P, Gollogly S, Noseda O, Berthonnaud E, Dimnet J (2006) The vertical projection of the sum of the ground reactive forces of a standing patient is not the same as the C7 plumb line: a radiographic study of the sagittal alignment of 153 asymptomatic volunteers. *Spine* 31(11):E320–E325
21. Ohtori, S., Yamashita, M., Murata, Y., Eguchi, Y., Aoki, Y., Ataka, H., Hirayama, J. et al., 2012. Conservative and Surgical Treatment Improves Pain and Ankle-Brachial Index in patient with Lumbar Spinal Stenosis. *Yonsei Medical Journal,* 17 September, 54(4), pp. 999-1005.
22. Rousseau, M. A., Lazennec, J. Y., Bass, E. C. & Saillant, G., 2005. Predictor of Outcomesafter Posterior Decompression and Fusion in Degenerative Spondylolisthesis. *European Spine Journal,* Volume 14, pp. 55-60.
23. Ohtori, S. et al., 2012. Conservative and Surgical Treatment Improves Pain and Ankle-Brachial Index in patient with Lumbar Spinal Stenosis. *Yonsei Medical Journal,* 17 September, 54(4), pp. 999-1005.
24. Klemme, W. R. et al., 2001. Lumbar Sagittal Contour After Posterior Interbody Fusion.Threaded Devices Alone

Versus Vertical Cages Plus Posterior Instrumentation.. *SPINE,* March, 26(5), pp. 534-537.

25. Khaldoun El-Abed and MJ Barakat MO 2014. The Surgical Management of Low Grade Single Level Adult Degenerative Spondylolisthesis: Posterolateral Fusion versus Posterior Lumbar Interbody Fusion. *J OrthopRheumatol*, vol. 1(1), pp. 1-4.

26. Umehara , S. et al., 2000. The biomechanical effect of postoperative hypolordosis in instrumented lumbar fusion on instrumented and adjacent spinal segments.. *Spine (Phila Pa 1976),* 1 July, 25(13), pp. 1617-1624.

27. Yuan HA, Garfin SR, Dickman CA, Mardjetko SM 1994. A historical cohort of pedicle screw fixation in thoracic, lumbar and sacral spinal fusions. *Spine*, vol. 19, pp. 2279-96.

28. Warner WC, Sawyer JR, Kelly DM. (2013). In: Scoliosis and Kyphosis. Campbells Operative Orthopaedics, S. Terry Canale, James H, Beaty (editors), vol. 2. pp. 1739-1740.

29. Labelle H, Roussouly P, Berthonnaud E, et al. Spondylolisthesis, pelvic incidence, and spinopelvic balance: a correlation study. *Spine* (Phila Pa 1976) 2004;29:2049–2054.

30. Gelb , D. et al., 1995. An analysis of sagittal spinal alignment in 100 asymptomatic middle and older aged volunteers. *Spine (Phila Pa 1976).,* 15 Jun, 20(12), pp. 1351-1358.

31. Chad D. Cole, Todd D, McCall Meic, H Schmidt, Andrew T. Dailey 2009. Comparison of low back fusion techniques: transforaminal lumbar interbody fusion (TLIF) or posterior lumbar interbody fusion (PLIF) approaches. *Curr Rev Musculoskelet Med.* vol. 2, pp. 118–126.

32. Kalichman, L. et al., 2009. Spondylolysis and spondylolisthesis: prevalence and association with low back pain in the adult community-based population. *Spine,* 34(2), p. 199.

33. Khoo LT, Palmer S, Laich DT, et al. 2002. Minimally invasive percutaneous posterior lumbar interbody fusion. *Neurosurgery*, vol. 51, pp. S166–81

34. Fujiwara , A. et al., 2000. The relationship between disc degeneration, facet joint osteoarthritis, and stability of the degenerative lumbar spine.. *Journal of Spinal Disorder. ,* Octeber, 13(5), pp. 444-450.

35. Humphreys, S. C. et al., 2001. Comparison of Posterior and Transforaminal Approaches to Lumbar Interbody Fusion. *Spine,* 26(5), pp. 567-571.

36. Cole, C. D., McCall, T. D., Schmidt, M. H. & Dailey, A. T., 2009. Comparison of low back fusion techniques:transforaminal lumbar interbody fusion(TLIF)or posterior lumbar interbody fusion(PLIF) approaches. *Current Review in Musculoskeletal Medicine,* Volume 2, pp. 118-126.

37. Jeong, H.-Y., You, J.-W., Sohn, H.-M. & Park, S.-H., 2013. Radiological Evaluation of Degeneration in Isthmic and Degenerative spondylolisthesis. *Asian Spine Journal,* 10 Jan, Volume 1, pp. 25-33.

38. Macnab, I., 1971. Negative Disc Exploration. An Analysis of The Cause Of Nerve Root Involvement in Sixty-Eight Patient. *Journal of Bone Joint Surgery ,* July, 53(5), pp. 891-903.

39. Tan, G., Goss, P., Thorpe & Williams, R., 2007. CT-Based Classification of Long Spinal Allograft Fusion. *European Spine Journal,* Volume 16, pp. 1875-1881.

40. Walsh, T. L., Hanscom, B., Lurie, J. D. & Weinstein, . J. N., 2003. Is a Condition-Specific Instrument for Patients withLow Back Pain/Leg Symptoms Really Necessary?The Responsiveness of the Oswestry Disability Index, MODEMS,and the SF-36. *Spine(Phila Pa 1976),* 28(6), pp. 607-615.

41. Audat, Z., Moutasem , O., Yousef , K. & Mohammad , B., 2012. Comparison of clinical and radiological results of posterolateral fusion, posterior lumbar interbody fusion and transforaminal lumbar interbody fusion techniques in the treatment of degenerative lumbar spine.. *Singapore Medical Journal.,* March, 53(3), pp. 183-187.

Original Article

Chondroblastoma of the Proximal Femur: a retrospective study of 7 cases

Mobinul Hoque[1], AKM Zahiruddin[2], Fakrul Amin Khan[3], Hedayet Hossain Khan[4], Afrin Akter[5], Subrata Saha[6]

Abstract

Chondroblastoma is a rare and benign, cartilaginous bone tumour affecting adolescents and young adults. The lesion arises from epiphysis or apophysis usually of a long bone. The aim of this study is to report clinical and radiological outcome following operative treatment of chondroblastoma of the proximal femur and asses functional outcome by the Musculoskeletal Tumour Society (MSTS) Rating scale for the lower extremity. This is a retrospective study which includes 7 patients radiologically and histologically diagnosed as having Chondroblastoma involving proximal femur from 2012 to 2019. The most common site of proximal femoral involvement was the greater trochanter 5 out of 7 patients (71.4%) and their mean age was 22.6yrs.Only 2 out of 7 patients had femoral head involvement (28.6%) and mean age was 16.5yrs. All cases of the greater trochanter lesion were curetted, chemical cauterization with 5% phenol done and bone graft was added to fill the osseous defect. 2 cases of femoral head involvement were curetted and bone graft applied. Only 1 case (femoral head lesion) had recurrence after 1 year. The mean follow- up period for the patients was 5.6yrs and average MSTS score on last visit was 22. Chondroblastoma is a rare, benign bone tumor. In cases of proximal femoral involvement, the greater trochanter lesion is more compared to femoral head. Young adults suffer from greater trochanter lesion whereas adolescents suffer from femoral head lesions. Males are more affected than females. The first line aggressive mode of treatment in the form of intralesional curettage, chemical cauterization with 5% phenol and application of bone graft (auto and or allograft) can effectively lower recurrence rate, restore mechanical strength and provide early rehabilitation of the patient.

Key words: Chondroblastoma, Proximal femur, retrospective.

INTRODUCTION

Chondroblastoma of bone is rare, benign bonetumors and represents only 1-2% of all primary bone tumors (Strong et al., 2010). It typically occurs in patients 10 to 25 years old, with a 2:1 male predominance (Heck Jr.and Toy, 2020). These cartilaginous tumors are found in epiphysis or apophysis of long bones. 18% of the cases involve proximal femur while most common being proximal tibia (20%) and proximal humerus (19%) (Laitinen et al., 2019).

Patients usually complaints of pain and local tenderness at the time of presentation, followed by swelling and limitation of joint movement (Suneja et al., 2005).

The surgical option for Chondroblastoma include extended intralesional curettage with autogenous or allogenic bone grafts or bone cements (Laitinen et al., 2019). Phenol can be used as a local adjuvant (Zekry et al., 2019).

Local recurrence rate varies considerably but is reported to be ranging from 10-20% (Lin et al., 2005). The aim of this study is to report the clinical, radiological and functional outcome following operative treatment of

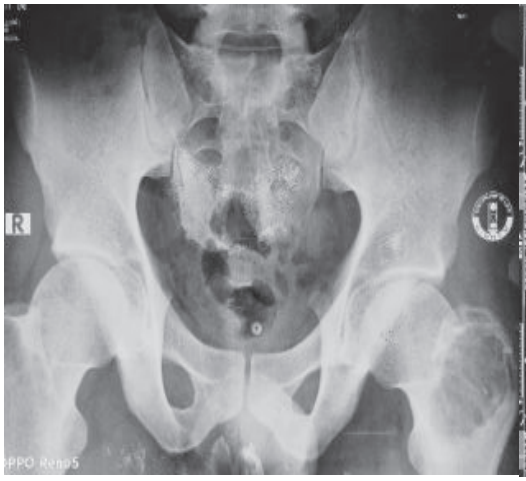
1. Medical Officer, Orthopaedic Surgery, National Institute of Traumatology &Orthopaedic Rehabilitation (NITOR), Sher-e-Bangla Nagor, Dhaka.
2. Professor, Orthopaedic Surgery, National Institute of Traumatology &Orthopaedic Rehabilitation (NITOR), Sher-e-Bangla Nagor, Dhaka.
3. Professor and Head of the department , Orthopaedic Surgery, Dhaka Medical College Hospital, Dhaka
4. Hedayet Hossain Khan, Ex-Associate Professor, Orthopaedic Surgery, Sir Salimullah Medical College Hospital, Mitford, Dhaka.
5. Assistant Surgeon, DGHS, Mohakhali, Dhaka.
6. Assistant Registrar, NITOR, Dhaka

Correspondence to: Dr. Mobinul Hoque, Medical Officer, Orthopaedic Surgery, National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Sher-e-Bangla Nagar, Dhaka. email: mobinulhoque30@gmail.com Cell: 01956595643

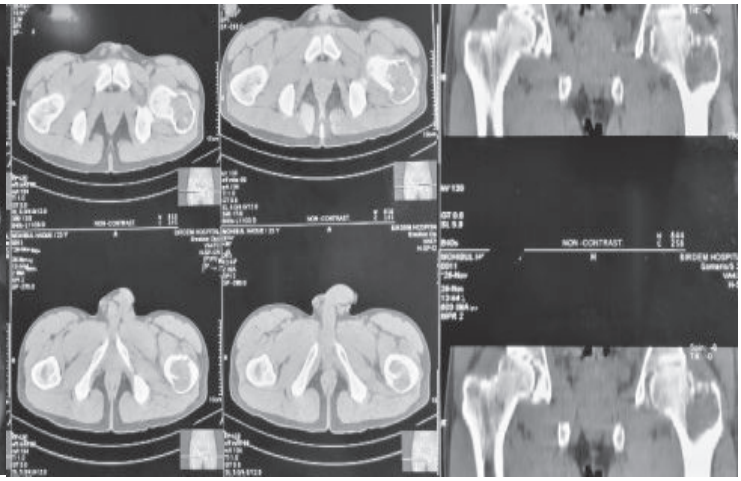
Chondroblastoma by means of extended intralesional curettage, chemical cauterization by 5% phenol followed by implantation of autogenic or allogenic bone graft.

MATERIALS AND METHODS

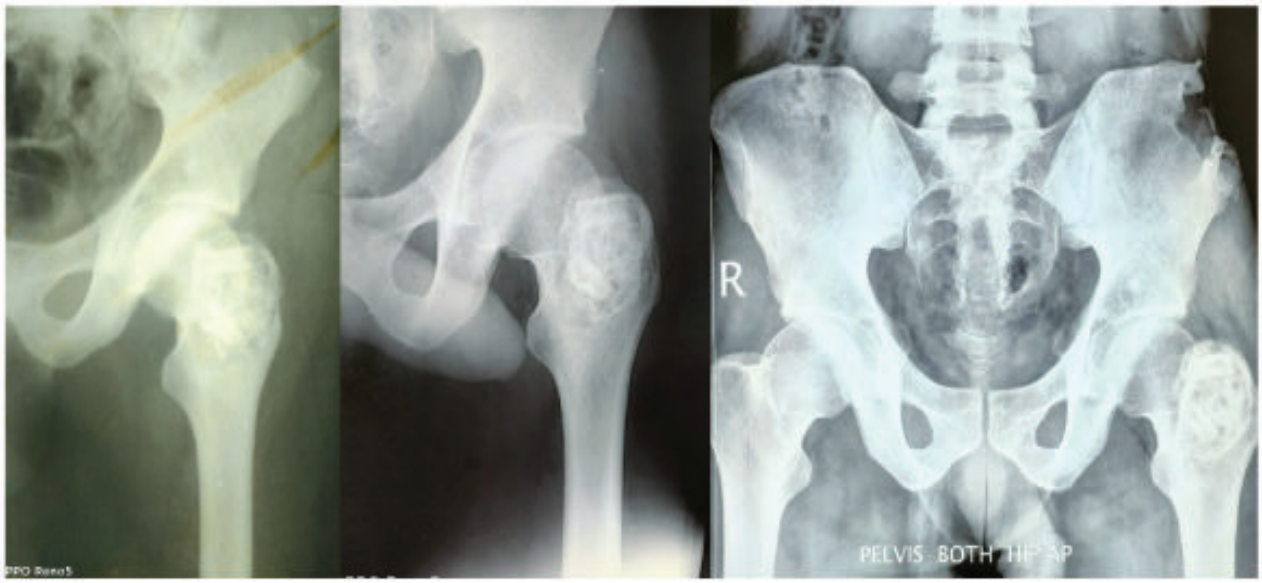
7 patientswith Chondroblastoma between 2012 and 2019 were included in this study. Diagnosis was made based on radiological and histological criteria. 5 patients with greater trochanter involvement underwent extended intralesional curettage through a lateral approach, chemical cauterization with 5% phenol. Out of 5, 3 patients received autogenous cortico-cancellous bone graft from iliac crest and fibula while 2 patients received bone allograft. Bone cement was not applied in any case. 2 patients who had femoral head involvement underwent intralesional curettage with autogenous iliac bone graft. The mean follow- up period was 5.6yrs. Radiographs were takes 3 monthly for 1st year, 6 monthly for 2nd and 3rd year and yearly thereafter.



Preop. X-ray: Lytic lesion Greater trochanter (left)



CT scan: Axial and Coronal section: Greater trochanter lesion(left).



(a) 1st postop (b) After 3 months (c) After 1 year

X-rays after intra-lesional curettage and autogenous bone graft (harvested from iliac crest and fibula)



Follow up X-ray after 6 years: Graft union and absence of Lytic lesion

RESULT

The data of the patient is shown in Table 1. There were 5 male and 2 female patients. Their average age was 20.9yrs. Pain at the site of the lesion was the main symptom and average duration of symptom was 12.1yrs. 5 out of 7 patients (71.4%) had greater trochanter involvement and 2 (28.6%) had femoral head involvement. The average age of the patients with greater trochanter lesion was 22.6yrs. while the average age of patients with femoral head involvement was 16.5yrs.

Recurrence was seen in a female patient aged 17yrs with femoral head lesion after 1 yr. There was appearance of pain at the operated site and radiology revealed lytic lesion. She was re-operated with curettage and autogenous iliac

Table I

Patient Data

Patient	Age(yrs.)	Sex	Duration of symptom (months)	Site of proximal Femur	Treatment	Recurrence	MSTS score	Follow-up period(yrs.)
1	22	M	12	Gr. Trochanter	Curettage+ bone auto graft	None	28	7
2	25	M	16	Gr. Trochanter	Curettage + bone auto graft	None	28	8
3	23	M	10	Gr. Trochanter	Curettage + Bone allograft	None	20	6
4	20	M	10	Gr. Trochanter	Curettage + Bone autograft	None	24	5
5	23	F	7	Gr. Trochanter	Curettage + bone allograft	None	20	6
6	16	M	14	Femoral head	Curettage + bone autograft	None	19	4
7	17	F	16	Femoral head	Curettage + bone autograft	Yes	17	3
	Mean 20.9yrs		Mean 12.1 months				Mean: 22	Mean: 5.6yrs

Table II

The Musculoskeletal Tumor Society (MSTS) Rating Scale for lower extremity (Hapa et al., 2016 and Suneja et al., 2005.)

Score	Pain	Function	Emotional	Supports	Walking	Gait	Final patient score of Functional Evaluation
5	No pain	No restriction	Enthused	None	Unlimited	Normal	
4	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	
3	Modest/ Non-disabling	Recreational restriction	Satisfied	Brace	Limited	Minor cosmetic	
2	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	
1	Moderate disabling	Partial restriction	Accepts	One cane or crutch	Inside only	Major cosmetic	
0	Severe disabling	Total restriction	Dislikes	Two canes or crutches	Not independent	Major handicap	
Pt. score							

bone graft. Subsequent follow-up and radiology showed no further evidence of recurrence. The mean MSTS rating scale score was 24yrs till last follow-up. The average follow-up duration for the patients was 5.6yrs.

Discussion

Chondroblastoma is a primary locally aggressive bone tumor with an incidence of 1-2% of all primary bone tumors (Springfield et al., 1985). Zekry et al. (2019) showed mean age of presentation was 20.8yrs and in our study, it was 20.9yrs. Occurrence was observed more in young adults(71.4%) than adolescents (28.6%) which coincides with the study carried out by Hapa et al. (2016)- young adults being 72.7% and adolescents being 27.3%.

The male to female ratio in this study is 2.5: 1 which is in accordance with the study done by Laitinen et al. (2019) which showed sex predilection to be 2.3:1. Suneja et al. (2005) had higher sex ratio of male: female which was 3:1. The average duration of symptoms varies from literature to literature. In this study it is 12.1 months.

Greater trochanter involvement occurred in 71.4% cases while 28.6% cases had femoral head lesion. The mean age of patients with greater trochanter lesion was 22.6yrs whereas the mean age for femoral head lesions was 16.5yrs. Laitinen et al. (2019) in his study, found that,56% had greater trochanter lesion and 44% had femoral head lesion. He also calculated that mean age is statistically lower in tumor located in femoral compared to greater trochanter (19.5yrs compared to 13.9yrs; p -value= 0.004).

Springfield et al. (1985), Ramappaet al. (2000) and Suneja et al. (2005) reported local recurrence after treatment ranges from 10% to 35%. In our study, it was 14.3% (1out of 7), which is in accordance with the literature. The mean Musculoskeletal Tumor Society rating scale score was 22yrs in this study while it was 21yrsin the study conducted by Hapa et al. (2016).

ConclusionIt can be concluded from the study that Chondroblastoma of the proximal femur is rare and first line aggressive treatment in the form of extended intralesional curettage, chemical cauterization with 5% phenol and application of bone graft can prevent recurrence and provide good functional outcome.

Limitations

The study has limitations as it is retrospective with a limited number of patients.So study with large sample size is needed in future for an acceptable statistical analysis.

Funding: No funding sources.

Conflict of interest:

The authors disclose and confirm no conflict of interest.

REFERENCES

1. Atalar H, Basarir K, Yildiz Y, et al. Management of chondroblastoma: retrospective review of 28 patients. J Orthop Sci 2007; 4: 334-340.
2. Dahlin DC and Ivins JC. Benign chondroblastoma. A study of 125 cases. Cancer 1972; 30(2): 401-413.
3. Davis AM, Wright JG, Williams JI, Bombardier C, Griffin A, Bell RS. Development of a measure of physical function for patients with bone and soft tissue sarcoma. Qual Life Res. 1996; 5(5): 508-16.
4. De MattosCB, Angsanuntsukh C, Arkader A, Dormans JP. Chondroblastoma and chondromyxoid fibroma. J Am Acad Ortho Surg 2013; 4: 225-233.
5. Enneking WF. A system of staging musculoskeletal neoplasms. Clin Orthop 1986; 204: 9-24.
6. Hapa O, Karakasli A, Demirkiran ND, Akdeniz O, Havitcioglu H. Operative treatment of chondroblastoma: a study of 11 cases. Acta Orthop. Belg., 2016, 82, 68-71.
7. Heck Jr. RK and Toy PC, 2020. Benign/ Aggressive Tumors of Bone. In Azar FM, Canale ST and Beauty JH, eds.Campbells Operative Orthopaedics. 14th ed. Elsevier. Ch. 26 pp. 988.
8. Iwata S, Uehara K, Ogura K, Akiyama T, Shinoda Y, Yonemoto T, Kawai A. Reliability and validity of a Japanese-language and culturally adapted version of the Musculoskeletal TumourSociety Scoring System for the lower extremity. Clin OrthopRelat Res. 2016; 474: 2044-2052.
9. Laitinen MK, Stevenson JD, Evans S, Abudu A, Sumathi V, Jeys LM, Parry MC. Chondroblastoma in pelvis and extremities - a single centre study of 177 cases. Journal of Bone Oncology 17(2019). 100248.
10. Lee SH, Kim DJ, Oh JH, Han HS, Yoo KH, Kim HS. Validation of a functional evaluation system in patients with musculoskeletal tumours. Clin OrthopRelat Res. 2003; 411: 217-226.
11. Lehner B, Witte D, Weiss S. Clinical and radiological long-term results after operative treatment of chondroblastoma. Arch Orthop Trauma Surg 2011; 1:45-52.
12. Leilei Xu, Xinhua Li, Zhou Wang, JinXiong and Shoufeng Wang. Functional evaluation for patients with lower extremity sarcoma: application of the Chinese version of Musculoskeletal Tumour Society Scoring system. Health and Quality of Life Outcomes 2017; 15:107.

13. Lin PP, Thenappan A, Deaver MT, et al. Treatment and prognosis of chondroblastoma; Clin OrthopRelat Res 2005, 438: 103-109.

14. Mashhour MA and Abdel Rahman M. Lower recurrence rate in chondroblastoma using extended curettage and cryosurgery. Int Orthop 2014; 5: 1019- 1024.

15. Masui F, Ushigome S, Kamitani K, et al. Chondroblastoma: a study of 11 cases. Eur J Surg Oncol 2002; 28: 869-874.

16. Ramappa A, Lee F, Tang P, et al. Chondroblastoma of bone Surg 2000; 82A: 1140.

17. Sailhan F, Chotel F, Parot R. Chondroblastoma of bone in a paediatric population. J Bone Joint Surg 2009; 91(9): 2159-2168.

18. Springfield DS, Capanna R, Gherlinzoni F, Picci P, Campanacci M. Chondroblastoma. A review of seventy cases. J Bone Joint Surg Am 1985; 67: 748-755.

19. Strong DP, Grimer RJ, Carter SR, Tillman RM, Abudu A. Chondroblastoma of the femoral head: management and outcome. Int. Orthop 2010; 3: 413-417.

20. Suneja R, Grimer RJ, Belthur M, et al. Chondroblastoma of bone: long term results and functional outcome after intralesional curettage. J Bone Joint Surg 2005: 87(7): 974-978.

21. Zekry KM, Yamamoto N, Hayashi K, et al. Surgical treatment of chondroblastoma using extended intralesional curettage with phenol as a local adjuvant. Journal of Orthopaedic Surgery 2019; 27(3): 1-7.

Original Article

Evaluation of The Result of Open Reduction And Internal Fixation of Nonunion of Fracture of Shaft of Humerus by Locking Plate Augmented With Autogenous Cancellous Bone Graft

Md. Omar Faruque[1], Arun Kumar Sarker[2], Md. Abdul Halim[1], Md. Tofayel Hossain[3], Razib Ahmed[1], Md. Insanul Alam[4], Md. Iftekher Irfan[5]

Abstract

Although the great majority of the fractures of the humeral shaft heal uneventually when treated nonoperatively, nonunion is not a rare condition. The prevalence of nonunion as a complication of both nonoperative and operative treatment has been reported to be as high as 13%. Open reduction and internal fixation by locking plate combined with autogenous cancellous bone grafting can result in reliable healing of these humeral nonunions with excellent functional outcome. To assess locking compression plating with autogenous cancellous bone graftingas an effective modality of treatment for non-union of humeral shaft fracture. This prospective observational study was conducted from July 2014 to June 2016 at NITOR. 15 patients with non-united humeral shaft fractures weretreated by open reduction and internal fixation by locking plate with autogenous cancellous bone graft. Detailed clinical conditions of all patients, duration of operation, technical difficulty with the implant, hospital stay period were recorded. Patients were followed up at 3rd weeks, 6th Weeks, 12th weeks and then 3 monthly upto 6 months.The patients were evaluated clinically and radiologically for outcomes. The progresses of healing as well as occurrence of complications were recorded. The modified Constant and Murley score of functional assessment was used to document shoulder and elbow function at final follow up.Mean age of the study patients was 36.13±8.68 years, range 20 to 50 years. Maximum patients were male 12(80.0%) and 3(20.0%) patients were female.Atrophic nonunion was found in 13(86.7%) patients and hypertropic in 2(13.3%) patients. Radiological evaluation of fracture site union showed that 4(26.7%) cases united within 12-15 weeks and 11(73.3%) cases united within 16-18 weeks. The mean union time was 15.87±1.41 weeks. Only 1(6.7%) patient had wound infection and 2(13.3%) patients had shoulder stiffness. Functional outcome was satisfactory (excellent plus good) in 13(86.6%) cases and unsatisfactory (fair plus poor) in 2 case (13.3%). Open reduction and internal fixation by locking plate and autogenous cancellous bone grafting of humeral shaft nonunions resulted in 100% union rate and mostly excellent or good functional outcome without significant morbidity.

Keywords: Nonunion, Locking Plate, Bone graft.

INTRODUCTION

The humerus is a long bone connecting two important joints of upper limb which has a wide range of movement having very little bony stability in shoulder joint and distal elbow joint which is a uniaxial hinge joint. It is an unpaired bone, the shaft of which is totally covered by a thicker layer of soft tissue. Approximately 10% of all long bone fractures occur in the humerus. Fracture of the humeral shaft is commonly encountered by the orthopaedic surgeons, accounting for approximately 30% of all humeral fractures (Ward et al., 1998).

1. Jr. Consultant, NITOR, Dhaka.
2. Assistant professor, NITOR, Dhaka.
3. Associate Professor, NITOR, Dhaka.
4. Asstt. Prof., Medical college for women and hospital, Uttara, Dhaka.
5. Medical Officer, NIOR, Dhaka

Correspondence: Dr. Omar Faruque, Jr. Consultant, NITOR, Dhaka. Email: omar.mmc36@gmail.com

Both younger andelder people suffer fromthese fractures. The mechanism of injury is mainly direct trauma, motor vehicle accident, fall from height, direct blow and penetrating injury like bullet or sharp object causing transverse or comminuted fractures. Indirect trauma due to fall on out stretched hand, twisting injuries or even violent muscle contraction results spiral or oblique fracture. Treatment of these injuries continue to evolve as advances are made in both non-operative & operative management (Cole et al., 2010 and Swanson and Gustilo, 1993).

Most of the humeral shaft fracture heals with closed method without surgicalintervention, in certain circumstances when this fracture fails to unite in expected period of time (4-6 months after injury) and then it is called delayed union or non-union (Zuckerman andKoval, 1996).

The middle third of the bone is the most vulnerable in relation to delayed or non-union. This is because, the main nutrient artery enters the bone very constantly at the junction of the middle & lower thirds or in the lower part of the middle third and the foramina of entry are concentrated in a small area of the distal half of the middle third of the shaft on the medial side of the bone (Carroll, 1963).

Various risk factors that may predispose patients to nonunion include obesity, osteoporosis, alcoholism, smoking, poor bone quality, andscar tissue. Many methods of treatment have been described with various degrees of success. The rates of healing of humeral nonunions by traditional means of internal fixation with bone graft range from 70% to 92%, although in cases of infection, poorly vascularized beds, and open, segmental, or severely comminuted fractures, secondary bony healing may still be compromised (King et al., 2007).

Muller and Thomas (1979) stated that operative treatment is usually indicated for non-union, poly trauma patients, bilateral humeral shaft fractures, floating elbow, fractures with neurovascular complications, segmental fractures, radial nerve palsy after manipulation, pathological fracture, failure to obtain or maintain acceptable alignment after closed reduction, associated injury or patient conditions precluding closedmanagement, failure to conservative treatment (Swanson and Gustilo, 1993 and Crenshaw, 2003).

Unfortunately not all the fractures of the humeral shaft in the adults unite in a specific time and ifnot given appropriatetreatment,the fracture can go on to state of established non-union. When this stage of indolence is reached with sclerosis of the bone ends and mature fibrous tissues laid down between the fragments, treatment becomes more difficult. It is then necessary not only to refresh the bone surfaces but also immobilize them as rigidly as possible, which cannot be done by simple plaster cast and not even by a shoulder Spica (Swanson and Gustilo, 1993).

Banquet et al. (1989) reported successful union in 24 of 25(96%) aseptic non union of the humerus. Rosen (1990) reported 97% healing rate with one surgical procedure in 32 humeral non unions treated with dynamic plate and screws.Two series have reported excellent results for treatment of humeral non union with compression plating combined with cancellous bone grafting.

Treatment of delayed union, malunionand nonunion is a challenge to the orthopaedic surgeons. Apart from restoration of alignment and stable fixation, in many cases adjunctive measures such as bone-grafting or use of bone-graft substitutes are of paramount importance. Bone-graft materials usually have one or more components: an osteoconductive matrix, which acts asscaffold to new bone growth; osteoinductive proteins, which support mitogenesis of undifferentiated cells;and osteogenic cells, which are capable of forming bone in the appropriate environment. Autologous boneremains the "gold standard" for stimulating bone repair and regeneration, but its availability may belimited and the procedure to harvest the material is associated with complications (Nandi et al., 2010).

A recent trend in internal fixation has been a more towards locking compression plating system. With locking compression plating system the locking screws are locked with plate which stabilizes the screws and gives better rigid fixation. The friction between the plate and bone is less thatprovides less disturbance of periosteal blood supply (Larson and Rizzo, 2007).

Locking the screws to the plate mechanically recreates a point of cortical bone contact which may be useful in poor cancellous bone of proximal humerus. Locking compression plates(LCP) also have a preconfigured shape & screw direction which may reduce hardware complications. Early clinical results using the locking-humerus plates have been promising (Fankhause et al., 2005).

Poor bone quality increases the technical difficulty and complications of operative treatment of nonunions and delayed unions of the diaphyseal humerus in older patients. Locking compression plates provide stable fixation of poor quality bone in patients with delayed union or non-union of the humerus; successful union &

restoration of function are achieved in most patients (Ring et al., 2004).

Both experimental and clinical studies with early locking compression plates have shown a lower rate of infection with locking system compared with the standard dynamic compression plate. Locking compression plate gives more stability and chance of implant failure is less (Koval et al., 1997).

Locking compression plate (LCP) is a useful implant in the presence of poor bone quality due to disuse osteoporosis, stress shielding from the previous plate, enlarged screw holes of previous loose screws, cortical thinning due to a loose intramedullary nail and segmental bone defect due to nonunion (Kumar et al., 2013).

The present study is a prospective follow up study of evaluating outcome of the use of locking compression plate (LCP) with autogenous cancellous bone graftin osteosynthesisof humeraldiaphyseal nonunion following previous failed conservative treatment.

MATERIAL & METHODS

This was a prospective observational study conducted in National Institute of Traumatology & Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh during the period July 2014 to June 2016. Fifteen patients were selected by purposive sampling according to the inclusion &exclusion criteria. Inclusion criteriawere Non-union (more than 6 months old) of humeral shaft fracture, patients of 18 years and above,Both sexes & Non-union following conservative treatment. Exclusion criteria were Recent fracture, Infected non-union, Non-union following operative treatment.,Pathological fracture.

After explaining the purpose of the study, informed written consent was taken and data were collected using a structured questionnaire. All patients were assessed before operation from history, physical examinations and necessary investigations and declared fit by anaesthetists considering all ethical issues.

Surgical procedure: With all aseptic precautions exploration, freshening of fracture fragments,open reduction and internal fixation was achieved with a standard LCP by anterior Henry approach or posterior approach (for distal third). Autogenous cancellous bone graft (from iliac crest) was placed in and around the fracture site. Follow up were taken accordingly.

RESULTS

Mean age of the study patients was 36.13±8.68 years, range 20 to 50 years. Maximum patients were male 12(80.0%) and 3(20.0%) patients were female.Mode of injury were found road traffic accident 8(53.3%) cases, fall from height 5(33.3%) cases and physical assault 2(13.3%) cases. Right side was injured in 9(60.0%) patients and left side in 6(40.0%) patients. Atrophic nonunion was found in 13(86.7%) patients andhypertropic in 2(13.3%) patients. Mean duration of injury of the patients was 9.73±2.63 months. Mean duration of hospital stay of the patients postoperativelywas 4.80±0.78 days. Radiological evaluation of fracture site union showed that 4(26.7%) cases united within 12-15 weeks and 11(73.3%) cases united within 16-18 weeks. The mean union time was 15.87±1.41 weeks. Only 1(6.7%) patient had wound infection and 2(13.3%) patients had shoulder stiffness. Functional outcome was satisfactory (excellent plus good) in 13(86.6%) cases and unsatisfactory (fair plus poor) in 2 case (13.3%).



Fig.-1: *Locking plate was placed in humerus.*



Fig.-2: *Bone graft was placed in fracture site.*

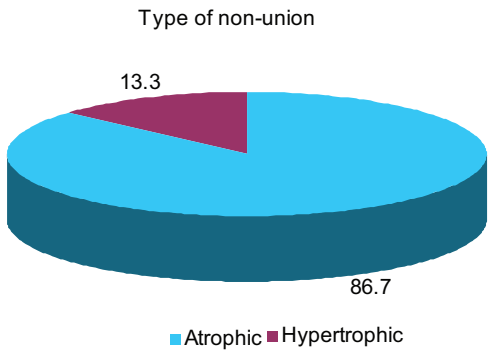


Fig.-3: *Pie diagram showing the type of non-union of the study patients*

In the present series, atrophic nonunion was found in 13(86.7%) patients and hypertropic nonunion in 2(13.3%) patients. The results are shown in Figure-III.

Table-I

Distribution of the patients by Post-Operative complications (n = 15)

Complications	Number of finger	Percentage (%)
Wound infection	1	6.7
Shoulder stiffness	2	13.3
Elbow stiffness	0	00
Implant failure	0	0.0
No complication	12	80.0
Total	15	100.0

Out of 15 cases, only 1(6.7%) patient had wound infection, 2(13.3%) patients had shoulder stiffness and rest of the patients 12(80.0%) had no complications. Results are shown in Table-VIII.

Table-II

Final outcome (n = 15)

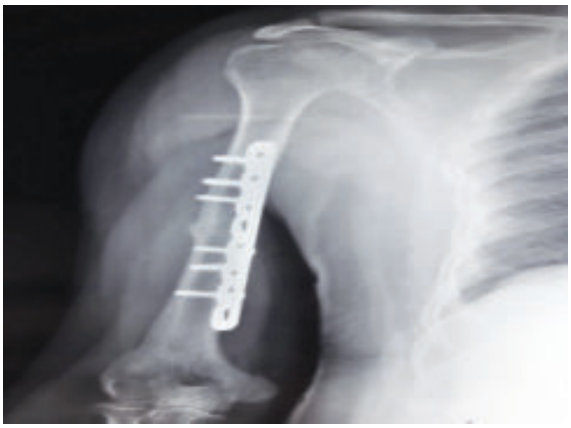
Functional outcome	Clinical outcome	Number of patients	Percentage (%)
Satisfactory	Excellent	5	33.3
	Good	8	53.3
Unsatisfactory	Fair	2	13.3
	Poor	0	0
Total		15	100.0

Z = 2.077, p-value = 0.04. The result is significant at p <0.05.

Table-II shows that functional outcome was satisfactory (excellent plus good) in 13(86.6%) cases and unsatisfactory (fair plus poor) in 2 case (13.3%).



Preoperative X-ray



6 weeks after operation



12 weeks after operation



Final outcome after 6 months (Excellent functional outcome)

CONCLUSION

Based on the results shown above it is concluded that treatment for the nonunion of the humeral shaft fracture by locking plate and screws augmented with autogenous cancellous bone grafting is an effective modality and is especially recommended in osteoporotic bones and elderly patients with compromised bone quality. Humeral diaphyseal nonunion treated with locking plate and autogenous cancellous bone graft method yielded a high percentage of healing with good functional results and minimal complications.

REFERENCES:

1. Al-Sayyad, M.J., 2014. Functional outcome after surgical plating for humeral shaft nonunion. *Egyptian Orthopedic Journal*, vol. 49, pp. 267-72.
2. Carroll, S.E., 1963. A study of the nutrient foramina of the humeral diaphysis. *The Journal of Bone and Joint Surgery*, vol. 45 B, pp. 179-81.
3. Changulani, M., Jain, U.K., Keswani, T., 2007. Comparison of the use of the humerus intramedullary nail and dynamic compression plate for the management of diaphyseal fractures of the humerus. A randomised controlled study. *International Orthopaedics*, vol. 31, pp. 391-95.
4. Cole, A., Pavlou, P., Warwick, D., 2010. Injuries of the shoulder, upper arm and elbow. In: L. Solomon, D. Warwick, S. Nayagam, eds. *Apley's System of orthopaedics and fractures*. 9 th edition. London: Hodder Arnold, pp. 748-52.
5. Crenshaw, A.H., 2003. Fractures of the shoulder, arm and forearm. In: S.T. Canale, ed. *Campbell's Operative Orthopaedics*. Vol. 3, 10th edition. Philadelphia: Mosby, pp. 3004-13.
6. Freeland, A.E,. Lumber, K.T., 2005. Biomechanics and biology of plate fixation of distal humerus fractures. *Hand Clinics,* vol. 21, pp. 329-39.
7. Frigg, R., 2003. Development of the locking compression plate. *Injury*, vol. 34 (Suppl2), pp. 6-10.
8. Healy, W.L., White, G.M., Mick, C.A., 1987. Nonunion of the humeral shaft. *ClinicalOrlhopaedics and Related Research*, vol. 219, pp. 206-13.
9. Hsu, T.L., Chiu, F.Y., Chen, C.M., Chen, T.H., 2005. Treatment of Nonunion of Humeral Shaft Fracture with Dynamic Compression plate and Cancellous Bone Graft. *Journal of Chinese Medical Association*, vol. 68, pp. 73-76.

10. Hunt, S.B., Buckley, R.E., 2013. Locking plates: A current concepts of review of technique and indications for use. *Acta Chirurgiae ET TraumatologiaeCechoslovaca*, vol. 80, pp. 185-91.

11. Khadka, P.B., 2005. *Treatment of nonunion of humeral shaft fracture by antegrade intramedullary interlocking nail with autogenous cancellous bone grafting*. Thesis (MS). Dhaka University.

12. King, A.R., Moran, S.L., Steinmann, S.P., 2007. Humeral nonunion. *Hand Clinics*, vol. 23, pp. 449-56.

13. Klenerman, L., 1966. Fractures of the shaft of the humerus. *The Journal of Bone and Joint Surgery*, vol. 48-B, pp. 105-11.

14. Kontakis, G.M., Tosounidis, T., Pagkalos, J., 2007. Humeral diaphyseal aseptic non-unions: An algorithm of management. *Injury*, vol. 38, pp. 39-49.

15. Koval, K.J., Hoehl, J.J., Kununer, F.J., 1997. Distal femoral fixation: A biomechanical comparison of the standard condylar buttress plate, a locked buttress plate and 95-blade plate. *Journal of Orthopaedic Trauma,* vol. 11, pp. 521¬24.

16. Kui, L.X., Haiqiang, W., Yiyong, W., Ziziang, W., 2008. Treatment of nonunions of humeral fractures with interlocking intramedullary nailing. *Chinese Journal of Traumatology*, vol. 11, pp. 335-40.

17. Kumar, M.N., Raindranath, V.P., Raishankar, M.R., 2013. Outcome of locking compression plates in humeral shaft nonunions. *Indian Journal of Orthopaedics*, vol. 47, pp. 150–55.

18. La Velle, D.G., 1998. Delayed and nonunion of fractures. In: S.T. Canale, J.H. Beaty, eds.*Campbell's operative orthopaedics*, vol. 3. 11th ed. Philadelphia: Elsevier Mosby, pp. 2579¬629.

19. Laing, P.G., 1956. The arterial supply of the adult humerus. *The Journal of Bone and Joint Surgery*, vol. 38-1, pp. 1105-116.

20. Larson, A.N., Rizzo, M., 2007. Locking plate technology and its applications in upper extremity fracture care. *Hand Clinics*, vol. 23, pp. 269-78.

21. Malek, A., 2013. *Evaluation of the result of locking compression plate for the treatment of non-united humeral shaft fracture augmented with autogenous cancellous bone graft*. Thesis (MS). University of Dhaka.

22. Micic, I., Mladenovic, D., Golubovic, Z., Abbasher, N., Kralejic, S., Stojiljkovic, P., 2006. Treatment of the humeral shaft nonunion. *Acta FacultatisMedicaeNaissenis*, vol. 23, pp. 319-43.

Original Article

Role of Proximal Femoral Nail Anterotation in management of unstable intertrochanteric fracture of femur

Das CK[1], Rahman MA[1], Ahmed SU[1], Md. Selim Matbar[2], Zahra Aziz[3], Rahman Md. Mostafizur[4]

Abstract

The intramedullary fixation of unstable trochanteric fracture has steadily increased with good evidence of stable fixation and early ambulation. The aim of this study is to evaluate the management of pertrochanteric fracture of the femur using proximal femoral nail antirotation (PFNA). Sixty patients of unstable pertrochanteric fractures were treated by closed reduction and internal fixation by proximal femoral nail antirotation from July 2015 to June 2017. Four patients were lost to follow-ups. The remaining 56 patients were followed for a mean period of 2 years. The results were evaluated by assessing the patients regarding their clinical and functional outcome at follow up as per kyle's criteria Peroperative failure to proximal head neck blade fixation (n-1), jamming of nail (n=2) and post operative lateral migration of head neck blade (n=1) and fracture related infection (n=1) were complications observed. End results were excellent in 46.34%; good in 36.58%, fair is 14.64% and poor in 2.43%. Proximal Femoral Nail Antirotation is the biomechanically and biologically suitable implant for the management of pertrochanteric fracture of the femur.

Key words: Proximal Femoral Nail Anterotation, Pertrochanteric fracture.

INTRODUCTION

Development of antegrade intramedullary nail progressed through various design. Initially it was called Halifax nail after the place where Dr Subash Halder[1] developed it. A group of surgeons from Strasbourg[2] changed the name of the nail to a Universal one Gamma nail as the shape resembled the Greek latter. Various authors have reported same result in the management of intertrochanteric fracture with the use of proximal femoral nailing (PFN) or Dynamic Hip Screw (DHS)[12] but the nails scored better in unstable trochanteric fracture.

Proximal femoral nail Anterotation (PFN-A) is a versatile implant for fixation of unstable intertrochanteric fracture of femur. The PFN-A was developed by AO/ASIF group as alternate to the PFN with a special helical blade with 5^0 valgus angle, flat lateral surface and smaller proximal diameter 15.5 mm. Several other companies also developed a longer version of the nail. The helical blade allows improved purchase in the femoral head by radial compaction of the cancellous bone around the blade during insertion. It improved purchase in osteoporotic bone has been determined biomechanically and prevents bone loss that occur during drilling and insertion of standard sliding screw. The helical head neck blade has its advantages of fixation stability, anterotation and ant-varus collapse. Strauss et al[12]. reported that fixation of the femoral head with a helical blade is biomechanically superior to sliding hip screw. The PFN-A has a small distal shaft diameter resulting in lower stress concentration in the tip than in the Gamma nail. Though intertrochanteric fracture has treated in the past by a variety of fixation devices, the present study carried out by managing this fracture by proximal nail Anterotation.

METHODS AND MATERIALS:

Sixty patients suffering from inter trochanteric fracture (AO classification 31A2 and 31A3) were treated by PFN-

1. Professor, Department of Orthopaedic Surgery, Chattogram Medical College Hospital, Chattogram, Bangladesh.
2. Assistant Professor, Patukhali Medical College
3. Associate Professor Biochemistry, NITOR, Dhaka
4. Assistant Professor & Head, Department of Maxillofacial Surgery, NITOR, Dhaka

Correspondence: Dr. Das CK, Professor, Department of Orthopaedic Surgery, Chattogram Medical College Hospital, Chattogram, Bangladesh.

A from July 2015 to June 2017. Informed written consent obtained from patients with pertrochanteric fracture who admitted to the department of orthopedic surgery at Chattogram medical college hospital. Subsequently they managed by PFN A during the study period the study excluded patients with combination of trochanteric fracture with ipsilateral shaft fractures, poly trauma patients, age below 4^{Th} and above 8^{th} decade. These patients were evaluated postoperatively at regular interval at first month, third months, six months and annually. All the patients were evaluated for peroperative parameters like duration of screening time in seconds, operating time in minutes, blood loss in milliliters smoothness of the procedure, possible intraoperative complications like malreduction or failure of reduction, jamming of nail, iatrogenic fracture shaft of femur. Screening time meant the time during which a particular fracture was screening under image intensifier during surgery. In the present study, the smoothness of the operation categorized as easy and difficult in anatomical reduction. Technique of closed or mini open reduction and the opinions of the operating surgeons taken into account to label the surgery as easy or difficult.

Postoperatively they evaluated for malunion, delayed union, nail breakage, osteonecrosis of head of femur, osteoarthritic changes of hip joint, general and local complications and any revision surgery required. In addition, they evaluated for date out of bed to chair, state of ambulation, ambulatory status at discharge, requirement of ambulatory assistant device, weight-bearing status at discharge and length of hospital stay. Radiographic assessments of fracture fragment position, head neck blade position (TAD), neck alignment and extent of fracture healing were made. Overall outcome were assessed and categorizing the results as excellent, good, fair and poor using Kyle's criteria[5] (Table-I).

Clinical outcome (Kyle et al)

Excellent	No or minimal limp No pain hip joint
Good	Full ROM hip joint
Fair	Mild limp Mild occasional pain
Poor	Full ROM Limp up to moderate Moderate pain using two stick Limited ROM Wheel chair bound Pain at any position Non ambulatory

OPERATIVE PROCEDURE:

After proper preoperative assessment and spinal anesthesia patient was taken to the traction table for fracture reduction by image intensifier. Usually a senior and a junior surgeon and two residents were participated in the operation.

For reduction of unstable intertrochanteric fracture the normal leg was flexed and internally rotated. The fractured limb was adducted and Torso wind swept and unobstructed for image intensifier. The anterior and medial reduction was done by lever technique (from James Carr) and "Joy stick" for proximal fragment stabilization. Spiral pattern were stabilized using circlage wiring. Reduction was verified by image intensifier. Tip of greater trochanter was identified by palpation and a 5 cm incision was given at the intersecting point made by horizontal line from anterior superior iliac spine (ASIS) to vertical extension line from trochanter tip.

Incision was deepened through fascia lata splitting the abductor muscle. The entry site was opened up with a cannulated curved awl and a guide wire passes into the medullary cavity. Riming was done 1 mm increment upto 10-12 cm with the help of flexible reamer in order to accommodate the proximal end of the nail. The trochanteric region was reamed upto 17 mm according fracture geometry irrespective of distal diameter chosen. Short PFN-A was used in 56 cases and long PFN-A was used in 4 cases because of osteoporosis. Nail of chosen size mounted on introducer Jig. Nail was then passed manually with rocking motion without using hammer. Leg was abducted after the insertion of nail. The incision was made over the skin overlying the lateral cortex in the line with slot proximal jig for introduction of the Helical Blade. A guide pin was passed through the guide sleeve across the lateral cortex into the posterior inferior cortex-center or central central Cleveland zone of femoral head under image intensifier. Then after reaming of femoral neck approximate size of helical blade was introduced over the head neck blade guide pin deep into the subchondral region maintaining the TAD. Full length reaming of head neck fragment was judged considering bone quality. Distal locking screw applied after releasing the traction.

Postoperative patient was closely observed for vital parameters, soakage of dressing, antibiotic prophylaxis using ceftriaxone and amikacin for 48 hours postoperatively. Wound inspection was done on 1^{st}

postoperative day. On 1st postoperative patients were made to sit up in bed and chest physiotherapy was started. Active Knee bending and static quadriceps exercise was also started. Weight bearing with walker or crutch was encouraged. All A2 fractures at the end of first week and A3 fracture at the end of third week were allowed full weight bearing with walker followed by squatting 6-8 weeks, cross legged sitting 8-12 weeks and full activity was permitted by 16 weeks.

Statistical Analysis:

Statistical analysis was performed using SPSS statistical package, version 15 foe windows. Quantitive variables were analyzed using the student's t-test and categorical variables were analyzed by the Fisher's extract test. The level of statistical significance was set at a two- sided *P*-value of 0.05.

RESULTS

The study involved 60 cases of unstable A2/A3 intertrochanteric femoral fracture of either sex. Four were lost to follow-up before 1 year after the injury and excluded for the study. The remaining 56 patients were followed up for a period of 2 years. There were 40 men and 16 women. All patients were from 4th to 8th decade of life. Trochanteric fracture was classified according to AO classification. 31A2, 31A3 fracture [A2 (n=36), A3 (n=20)]. Mean age for A2 fracture was 53 ±5.66 years, while mean age for A3 fracture was 59.7 ± 7.03 years out of total 56 patients. Out of total 56 patients, 29 patients were suffered from high energy trauma while 27 suffered from low energy trauma. It was observed from the result that high energy trauma was significant statistically (n^2 = 18.19; p=<0.001) in causation of 31A3 fractures as compared to 31A2 fracture. 56 Patients of trochanteric fractures underwent operative intervention resulted in satisfactory outcome. The mean duration of hospital stay was 14 ± 0.72 days/ Mean screening time was 31 minutes (28-39 mins.).

Out of total 56 pertrochanteric fracture 6 were found to be in difficult category [31A2 (n=4); 31A3 (n=2)] while the rest were easy. The mean operative time for this fracture was 60 minutes (ranges from 45 to 90 mins). The average blood loss during the surgery was 400 ml. Regarding post operative mobilization all patients were shifted from bed to chair in 1st POD. Full weight bearing was started by the end of first week in A2 patients (n=36, 64.5%). In A3 (n=20, 35.6) full weight bearing was delayed till the end of third week. This decision was taken considering the stability of nail bone construct and as per direction by operating surgeons. The stability of the nail bone construct was assessed depending on comminution of posteromedial cortex, reverse oblique fracture, ability to achieve anatomic or anatomic reduction and adequacy of fixation. During peroperative period time there was jamming of nail (n=1, 1.78%) and failed proximal blade fixation (n=1, 1.78%). Jamming of nail was corrected by extracting the nail passing the nail with lesser diameter and proximal missed head neck blade was revised using image intensifier. Reducing the proximal posterior sagging fragment with temporary wire & k wire. There was no complication like drill breakage, iatrogenic fracture shaft of femur. Post operatively one patient (n=1, 1.78%) suffered from superficial wound infection and one patient (n=1, 1.78%) from bed sore, one (n=1, 1.78%) lateral migration of head neck blade but no cases of superior cut out of head neck blade. This was not corrected as it was accepted by the patient and fracture was consolidated. There was no incidence of implant breakage or symptomatic removal of hardware. All fractures achieved union by a mean period of eight weeks.

The end results were found to be Excellent in 46.34% , Good in 36.58%, Fair in 14.64% and poor in 2.43% of patients (Table II). There was no statistically significant difference (n^2= 5.61; p=0.05) between A2 and A3 fractures in term of end results with the use of PFN-A at follow up of 2 years .The fractures had healed in all the patients and no further treatment was required.

Table-II

End results

	Excellent	Good	Fair	Poor
31A2 fractures	14	17	05	0
31A3 fractures	12	4	3	1

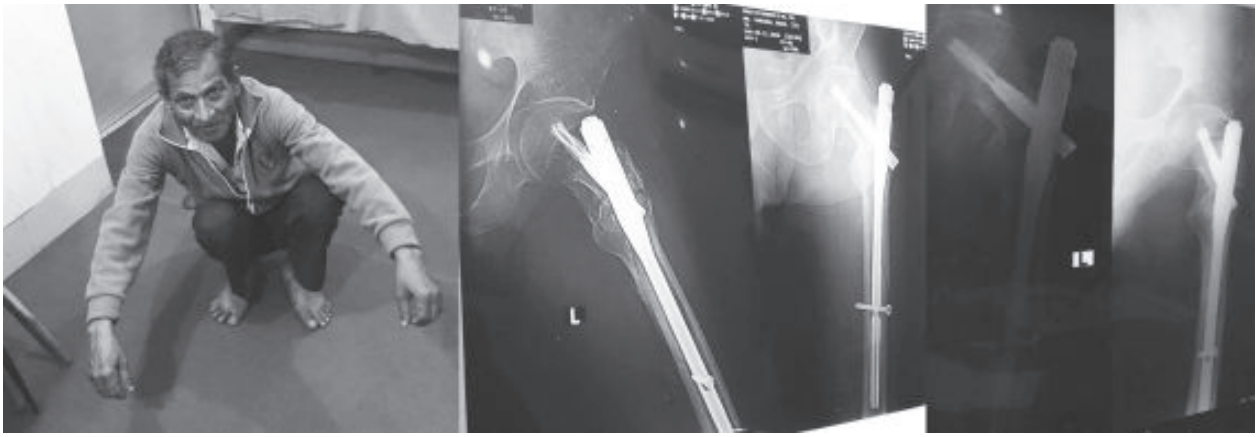
CASE 1:





- The patient walk with single crutch
- 6 weeks later
- 12 weeks later shows consolidation of fracture.

CASE 2:



- 60 year old man sustained an AO type A3.2 trans-trochanteric fracture
- Stabilized with closed PFNA
- 6 weeks later, patients squats
- 12 weeks later shows consolidation of fracture.

DISCUSSION

Intertrochanteric fractures are one of the most commonly suffered fractures by patients of different age groups. The available published literature in this regard has shown these fractures being treated by a variety of devices like nail plate devices, Dynamic Hip Screws (DHS) and medullary devices like Gamma nail, PFN. The PFNA has developed with improved biomechanics by AO/ASIF group as an alternative to the Gamma nail and seems to be associated with lower incidence of complications.

The preoperative screening time as reported by Leung[4] for the pertrochanteric fracture was identical to the screening time in this study and was lesser than his screening time for pertrochanteric fractures treated by DHS. Operating time in this study was a mean period of 60 minute in all fracture (range 45-90). This was almost identical to operation time for fractures treated by Gamma Nail by Leung.

The blood loss during operative procedure by patient in this study was comparable to other studies[31]. Peroperative complications like jamming of nail, failed proximal head neck blade fixation, post operative infections, superior cut out of head neck blade and iatrogenic fracture of femur were found to be less in this study than that reported in other studies [3, 11, 13.]

This was because the nail used in this study was proximal femoral nail anterotation rather than gamma nail. In the present study the result regarding post operative weight bearing were comparable to the result by Mereddy et al. [13] and Simmuermacher et al.[14] who observed the restoration of the prefracture activity level approximately 56-80% of patients treated with PFN-A. In contrast, several studies showed that the use of a DHS led to about 40-50% restoration of the prefracture level of activity[5, 17, 19].

There was incidence of early wound infection in one patient which was much less than the study by Leung. Fracture of the femoral shaft at the tip of the nail is a known complication associated with the use of intramedullary nail is the treatment of proximal femoral fracture[35]. Such complication was absent in the study with PFNA.

Reported incidence rate of revision surgery in the DHS group was 7.7% and in Gamma nail was 5.7% while in PFNA was 1.78%. This good outcome could be due to the use of proximal femoral nail Anterotation and good experience of the surgeons. The study did not schedule a large number of patients and larger sample size is needed in order to decide which is the ideal implant for the treatment of these fractures.

CONCLUSION:

The use of PFNA in the treatment of unstable trochanteric femoral fracture is biomechanically and biologically superior and a positive effect in the speed of restoration of walking. The PFNA is a suitable minimally invasive implant in expert hands for the unstable trochanteric femoral fracture.

CONFLICTS OF INTEREST

The authors had no conflicts of interest to declare in relation to this article.

REFERENCES

1. Halder SC. The Gamma nail for peritrochanteric fractures. J Bone Joint Surg Br. 1992;74:340-4.Clawson DK. Trochanteric fractures treated by the sliding screw plate fixation method. J Trauma. 1964;27:737-52.
2. Kempf I, Grosse A, Tanglang G, Favreul E, Gamma nail in the treatment of closed trochanteric fractures, results and indications apropos of 121 cases, Rev Chir Orthop Reparatrice Appar Mot 1993;79:29-40.
3. Leung KS, So WS, Shen WY, Hui PW. Gamma nails and dynamic hip screws for peritrochanteric fractures. A randomised prospective study in elderly patients. J Bone Joint Surg Br. 1992;74:345-51.
4. Leung KS, Chen CM, So WS, Santo K, Lai CH, Machaisavariya B. et *al* Multicenter trial of Modified Gamma nail in East Asia. Clin Orthop Relat Res 1996;323:146-54.
5. Kyle RF, Gustilo RB, Premer RF. Analysis of six hundred and twenty-two intertrochanteric hip fractures. J Bone Joint Surg Am. 1979;61:216-21.
6. Arnaout A, Beya B, Delplace J, Vial D, Lecestre P, osteosynthesis of fractures of the trochanteric region using the Gamma Nail, apropos of 76 reviewed cases. Acta orthop Belg(Belgium)1993;59:30-9.
7. Clavert PT. The Gamma Nail a significant advance or a passing fashion. J Bone Joint Surg Br 1992;74:329-31.
8. Chevally F, Gaamba D. Gamma nail in Pertrochanteric and subtrochanteric fractures: Clinical results of a series of 63 consecutive cases. J Orthop Trauma (United States) 1997;11:412-5.
9. Forthomme JP, Costenoble V, Docquier J. Treatment of trochanteric fracture fractures of the femur using the Gamma Nail (apropos of a series of 92 cases). Acta Orthop Belg(Belgium)1993;59:22-9.
10. Landolt M. Comparison and presentation of technique and results of the Gamma Nail and Dynamin Hip Screw. Helv Chir Acta (Switzerland) 1993;59:965-9.

11. Lindsey RW, Teal P, Probe RA, Rhoads D, Danvenport S, Schauder K. Early experience with the Gamma Interlocking Nail for pertrochanteric fractures of the proximal femur. J Trauma 1993;31:1649-58.

12. Aune AK, Ekeland A, Odegaard B, Alho A. Gamma nail vs compression screw for trochanteric femoral fractures: 15 reoperations in a prospective, randomized study of 378 patients. Acta Orthop Scand 1994;65:127-30.

13. Bridle SH, Patel AD, Bircher M, Calvert PT. Fixation of intertrochanteric fractures of the femur. A randomised prospective comparison of the gamma nail and the dynamic hip screw. J Bone Joint Surg Br. 1991;73:330-4.

14. Goldhagen PR, O'Coonor DR, Schwarze D, Schwartz E. A prospective comparative study of the compression hip screw and the Gamma Nail. J Orthop Trauma(United States) 1994;8:367-72.

15. Radford PJ, Needoff M, Webb JK. A prospective randomised comparison of the dynamic hip screw and the gamma locking nail. J Bone Joint Surg Br. 1993; 75:789-93.

16. Miedel R, Ponzer S, Tornkvist H, Söderqvist A, Tidermark J. The standard Gamma Nail or the Medoff Sliding Plate for unstable trochanteric and subtrochanteric fractures. A randomized controlled trial. J Bone Joint Surg Br 2005;87:68-75.

17. Sadowski C, Lübbeke A, Saudan M, Riand N, Stern R, Hoffmeyer P. Treatment of reverse oblique and transverse intertrochanteric fractures with use of an intramedullary nail or a 95 degree screw plate: A prospective randomized study. J Bone Joint Surg Am 2002:372-81.

18. Nobuyuki S, Fuminori F, Masato Y, Hiroya S, Hidenori M. A comparison of Gamma nail and comparison hip screw for pertrochanteric fractures. Centran Jpn J Orthop Surg Traumatol.2004;47:947-8.

19. Kukla C, Heinz T, Gaebler C, Heinze G, Vecsei V. The standard Gamma nail: A critical analysis of 1,000 cases. J Trauma 2001;51:77-83.

20. Pajarinen J, Lindahl J, Michelsson O, *et al*: Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail. A randomised study comparing post-operative rehabilitation. *J Bone Joint Surg Br* 2005; **87:** 76 – 81.

21. Simmermacher RK, Bosch AM, van der Werken C: The AO/ASIF-proximal femoral nail (PFN): a new device for the treatment of unstable proximal femoral fracture. *Injury* 1999; **30:** 327 – 332.

22. Strauss E, Frank J, Lee J, *et al*: Helical blade versus sliding hip screw for treatment of unstable intertrochanteric hip fractures: a biomechanical evaluation. *Injury* 2006; **37:** 984 – 989.

Original Article

Evaluation of Gastrocnemius muscle Island Flap for gain in length of wound coverage around knee and proximal part of leg

Subrata Saha[1], Md. Abdul Gani Mollah[2], Md Golam Sarwar[3], Sajedur Reza Faruquee[4], Md Sarwar Jahan[5], Md Asaduzzaman[1], Mohammad Ruhul Amin Molla[1], Shadiqur Rahman[1]

Abstract

The relatively circulatory disadvantage of the leg and subcutaneous nature of the bone makes the tibia vulnerable to certain unique problems like delayed union and non union of fractures as well as chronic osteomyelitis of tibia. Muscle flaps, musculocutaneous flap by virtue of their intrinsic blood supply and mouldable nature fills in the irregular cavities of the wound and eliminate dead space. This study has been designed to evaluate gain in length of gastrocnemius muscle island flap for coverage of wound around knee and proximal part of leg. This prospective observational study was conducted at NITOR, Dhaka, from September 2017 to March 2019. Patients with open fracture tibia G-IIIB with soft tissue defect around knee, upper and middle one third were study population. Total 32 patients aging between 12 to 70 years were included in the study. Follow up on 5th POD, 14th POD & 28th POD was done. The mean age was 31.75±14.75 years with a male predominance (87.5%). Location of the soft tissue defect were upper third (40.6%), upper and middle third (34.4%). 62.5% were operated during chronic phase of injury. The average length of medial head of the gastrocnemius muscle before division of proximal attachment was seen 19.5 cm. The average length of medial head of the gastrocnemius muscle after division of proximal attachment was seen 23.8 cm. The average gain in length of the medial head of the gastrocnemius muscle was 4.56 cm. Total flap necrosis occurred in 6.3% and needed further intervention. 28.13% had some minor complication and 65.6% had no complication. 15 (46.9%) had wounds ranging from 51 to 100 cm^2 covered by island gastrocnemius muscle flap.Majority of patient (75.0%) stayed in hospital between 31-60 days. 30(93.73%) of the patients had excellent to good outcome. The main disadvantage was that the volume of the distal part of the muscle was small and sometimes unable to provide enough coverage for large defects. The present study showed the use of the islanded gastrocnemiusmuscle flap has proven to be effective in the management of soft tissue defects extending from the lower third of thigh to the upper two thirds of the leg due to increased gain in length.

Key words: Gastrocnemiusmuscle flap, Coverage knee, proximal part of leg, result.

INTRODUCTION:

The management of open Tibial fractures is a challenge for both Orthopedic and plastic surgeons; they have been usually treated with decortications of the exposed bone and skin grafting on the granulation tissue bed thus formed or coverage by fasciocutaneous flaps such as cross-leg flap. The fact undoubtedly supported by an increase in vascularity imparted by the flaps. Bone healing in fractures in an ischemic soft tissue envelope does not begin until neovascularization is seen in the muscle layer[1].

In our country severe lower limb injuries are initially managed by wound debridement and fracture

1. Asst Reg, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka
2. Professor & Director, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka
3. Professor, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka
4. Associate Professor, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka
5. Consultant, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), DhakaCorrespondence : Dr. Subrata Saha, Assistant Registrar, NITOR, Dhaka, Bangladesh, Email- subratadmch59@gmail.com

Correspondence: Dr. Subrata Saha, Asst Reg, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka

immobilization by external fixator with subsequent for management of soft tissue defects. This delay in wound coverage and stabilization by external fixators often leads to bone necrosis and death and pin tract infection which enhances chronic osteomyelitis and nonunion[2].

Displaced fractures deprive the bone of its endosteal blood supply and when this is associated with compounding, the periosteal blood supply is also further damaged. This is an important cause of delayed union and non union of fractures as well as chronic osteomyelitis of tibia. Muscle flaps, by virtue of their intrinsic blood supply and mouldable nature, fills in the irregularities of the wound and create an envelope of vascular tissue, and are regarded as an ideal solution for such defects[3]. Introduction of transposed muscle flap by Ralph Ger in 1970 was a major breakthrough for compound fractures of the lower limb[4,5] found that muscles were associated with faster healing of the fracture site compared with skin and fascia.

Since its introduction, the gastrocnemius muscle flap has been appreciated for its reliable blood supply, its easy harvest, reasonable arc of rotation, and wide use to cover defects in the distal thigh, the knee, popliteal area, and the upper third of the leg.

Raising the medial head of the gastrocnemius solely on its pedicle is a safe way if increasing its arc of rotation and also adding valuable length for defects that involve even the middle third of the tibia[6].This would spare the harvesting of a second ankle flexor such as the soleus and prevent disruption of the lymphatico-venous pump mechanism and also decrease the deformity of the extremity[4]. Each head of the gastrocnemius receives an individual sural artery arising from the popliteal artery accompanied by the motor (tibial) nerve, both of which are constant in position and supply, so both the heads can be safely raised on its own neurovascular pedicle[6].

The arc of the medial head of the gastrocnemius island flap has been shown to be suitable for providing soft-tissue coverage of the proximal two thirds of the tibia, the entire knee and popliteal fossa, and the distal aspect of the thigh[7]. The medial rather than the lateral head of the gastrocnemius muscle is the most commonly used due to its larger size, better mobility, and thus easily conforms to defects of different size and shape.

This study attempts to evaluate the benefit of dividing both the distal and proximal attachments of the medial head of the gastrocnemius and raising it as an island flap based on its vascular pedicle. The length gained in the radius of the arc of rotation was significant (p=0.000, a maximum of 7 cm was gained in 4(12.5%) cases with an average gain of 4.56 cm, which concurs with findings of others[6].

The use of the island gastrocnemius muscle flap to the distal and middle femur has not been well studied. Its use to reach femur defects 21 and 26 cm above the joint line was achieved by taking advantage of the favorable location of the vascular pedicle above the joint line and the individual length of the medial head of the gastrocnemius muscle belly[8] with some additional modifications.

MATERIALS & METHODS:

After obtaining the institutional review board (IRB) approval the gastrocnemius muscle island flap population details were prospectively obtained from Patients that were admitted in different unit of NITOR with diagnosed as open fracture tibia and fibula G-IIIB with soft tissue defect involving proximal part of leg and around knee. It was conducted according to the principles of the World Medical Association Declaration of Helsinki. After collecting the demographic data of the patients, the coverage of the deficit was evaluated, the donor site morbidity, complications in the defect site as well as in the donor site.

The inclusion criteria for the present study were the following: soft tissue defects on proximal part of leg, around the knee joint & lower thigh region**.** Total 32 patients met the inclusion criteria,the mean age was 31.75±14.75 years with a male predominance (87.5%). Most of the cases were either student (25%) or motor vehicle driver (21.9%). MVA was the main cause of soft tissue loss (84.4%). Location of the soft tissue defect were upper third (40.6%), upper and middle third (34.4%). 62.5% were operated during chronic phase of injury. The average gain in length of the medial head of the gastrocnemius muscle was 4.53 cm range (2 – 7 cm).

All the patients were treated with initial resuscitation; surgical debridement of the wound followed by fracture stabilization wherever indicated or limb immobilization by long leg posterior cast. After second or third look debridement, as indicated and control of infection definitive surgery was done to resurface the soft tissue defect(s), in this case with gastrocnemius island flap (medial head).

Surgical procedure:

The medial gastrocnemius flap muscle originates from the medial epicondyle of the femur and inserts into the

calcaneus to form the Achilles tendon. Muscle is only present at the upper one-third of the calf and it can only be used for knee defects and soft tissue defects of the upper one-third of lower leg[9].

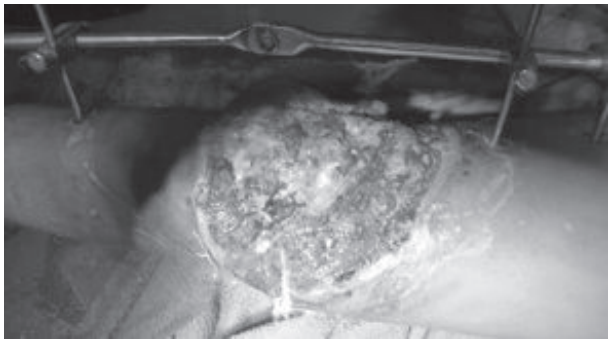


Fig .-1 *Exposed knee with external fixator in situ*

The patient was placed in supine position with the knee slightly flexed if possible (i.e if the limb was without any external fixators) and the limb was elevated on the posterior calcaneus with a sandbag. It was then prepped and draped. The contralateral limb was draped and kept out of the operating field. An initial measurement of the defect(s) was taken with a ruler, the greatest length and the greatest breadth was recorded in cm. The wound was excised removing any and all devitalized tissues which may include skin, subcutaneous tissues, muscle and bone.



Fig.-2: *Gastrocnemius muscle after detachment of distal attachment*

The wound was measured again to asses and confirm our initial operative plan. Skin was incised in a pyramidal fashion, with the truncated apex being the medial margin of the wound, the two arms of the pyramid are lines drawn from the proximal and distal end of the medial margin of the wound, one to the popliteal fossa and the other to a point between the tendo Achilles and the medial margin of the tibia 6-7cm proximal to the medial malleolus, the base being the wide area below these two lines.

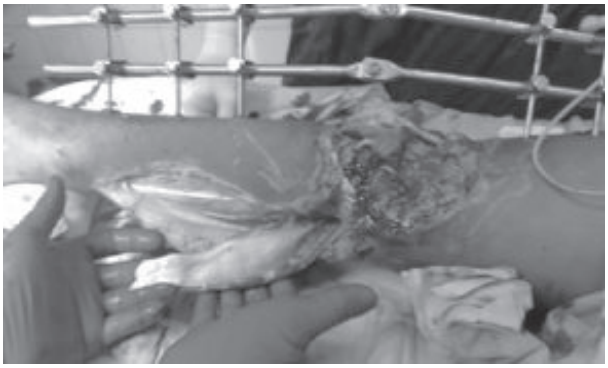


Fig.-3: *Gastrocnemius muscle island flap*

The incision was deepened down to and included the deep fascia of the leg and a triangular flap was raised medially. The medial reflection of the skin allows it to behave like a fasciocutaneous flap with a wide base. This incision also allows us adequate exposure to include the soleus muscle if and when required.

The medial gastrocnemius thus exposed was inspected for any signs of trauma, such as haematoma, lacerations or necrosis. If the muscle was found to be viable, dissection was started by identifying a plane between the gastrocnemius and soleus muscle. The plane was opened up by sharp and blunt dissection. The whole length of the medial gastrocnemius was separated from the underlying soleus, from the origin down to its insertion into the tendoachilles.



Fig 4: *After Flap Inset*

The length of the muscle was measured from origin at the medial femoral condyle to its insertion into the tendoachilles (LB). The insertion was cut sharply leaving a 1cm to 1.5 cm of tendon cuff of tendon, which facilitated in holding the stitches during anchoring of the muscle.

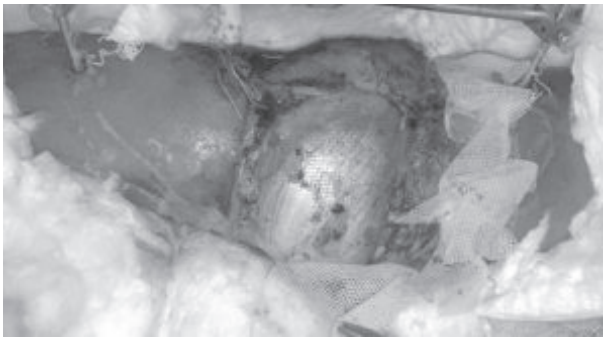


Fig .-5: *Follow up at 1st POD*

Next, the median raphe was identified by observing the directions of the muscle fibres and the presence of the fibrous septum in the midline, a finger was used to identify the junction between the two heads of the muscle within the popliteal fossa. The muscle was now separated from all its attachments except its origin. The muscle is rotated into the wound and the distance from the tip of the muscle to the wound margin is measured and marked. The next step was to clearly identify the vascular pedicle seen to enter the deep surface of the muscle 4-5 cm from its origin in the popliteal fossa a plane was created between the pedicle and the muscle using sharp and blunt dissection, thus separating the two, and the index finger was inserted in this plane, next the origin was cut from the femoral condyle by the help of a diathermy.

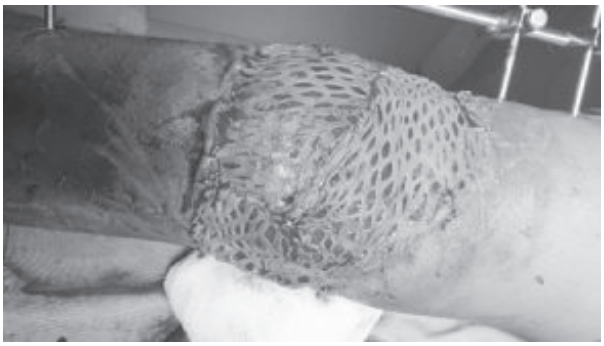


Fig.-6: *Flap area coverage by skin graft at 5th POD*

Now the muscle was completely free of all its attachments and was islanded on its neurovascular pedicle. Another measurement was taken from the femoral condyle to the distal end of the muscle which was kept in firm traction with forceps along its long axis (LA). Extreme caution has to be practiced near the pedicle so as not to jeopardize the vessel wall. At this point the distal cut end of the muscle was also measured and recorded. The flap thus raised was rotated into position and the effective gain in length of the flap was obtained by measuring the excursion of the flap along the defect and its ability to reduce the gap between the tip of the flap and the wound margin recorded earlier.

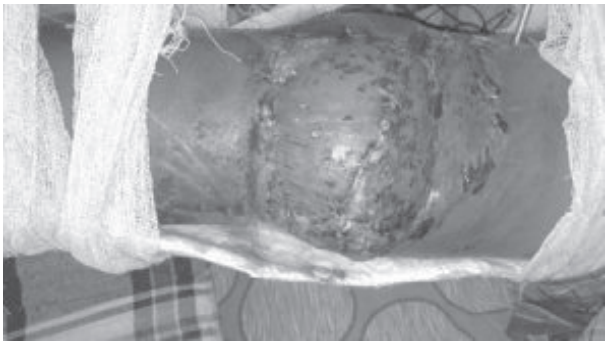


Fig.-7: *Follow up at 1 month*

The flap was anchored with absorbable suture. The flap was thus secured. The wound was closed in layers with or without a drain in situ. We grafted the muscle with meshed split skin on the same day or usually on or after the 3rdPOD.

RESULTS

The mean age was 31.75±14.75 years with a male predominance (87.5%). Most of the cases were either student (25%) or motor vehicle driver (21.9%). MVA was the main cause of soft tissue loss (84.4%). Location of the soft tissue defect were upper third (40.6%), upper and middle third (34.4%). 62.5% were operated during chronic phase of injury. The average length of medial head of the gastrocnemius muscle before division of proximal attachment was seen 19.5 cm. The average length of medial head of the gastrocnemius muscle after division of proximal attachment was seen 23.8 cm. The average gain in length of the medial head of the gastrocnemius muscle was 4.56 cm. Total flap necrosis occurred in 6.3% and needed further intervention. 28.13% had some minor complication and 65.6% had no complication. 15 (46.9%) had wounds ranging from 51 to 100 cm^2 covered by island gastrocnemius muscle flap.Majority of patient (75.0%) stayed in hospital between 31-60 days. 30(93.73%) of the patients had excellent to good outcome.

DISCUSSION

The age of the patients in this study varied from 12 years to 70 years with an average of 32 years, 28 (87.5%) patients were male and 4 (12.5%) were female. 62 % of the patients were in the 21 – 55 years age group indicating that the younger and thus the earning members of the family were

mostly involved in this sort of trauma. This result is nearer to a study carried out by[10] where age group varied from 20 to 40 years with a mean age of 26 years. This age incidence is similar with the study carried out by[11] where mean age was 32 years.

In this study the leg was grossly divided into three parts and out of the total 32 limbs, 13(46.88%) had defects in the upper third, 11(34.4%) had defects involving the upper and middle third, 4(12.5%) had defects in the middle third only and 4 (12.5%) had a defect in the lower femur. Wounds as high as 26 cm from the knee joint line[12] to wounds in the middle third of the tibia are reported to have been covered successfully by medial gastrocnemius island flap[6].

In this study none of the wounds were covered during the acute phase of the injury as described byBurd[13]. 20 (62.5%) were operated during the chronic phase of the injury, and 12 (37.5%) in the sub acute phase. This delay allowed the edema to subside and enabled to plan a definite surgical procedure most likely to succeed. This was a very important factor considering the socioeconomic status of the patients admitted to the government hospital.

The length covered by the medial head of the gastrocnemius muscle before division of its proximal attachment was seen to be 19.5 cm range (15 – 22 cm). Length covered by the medial head of the gastrocnemius muscle after division of its proximal attachment is as follows; 2(6.25%) patients had lengths in the range of 18 – 21 cm, 11(34.38%) patients had length in the range of 21 – 24 cm, 18 patients were in the range of 24 – 27 cm, and there was only 01 (3.13%) patient in the range of 27 – 30 cm. Average length after division of the attachment was seen to be 23.84 cm range (19 – 27 cm). The average gain in length of the medial head of the gastrocnemius muscle was 4.53 cm range (2 – 7 cm).

The size of the wounds varied from 23 cm^2 to156 cm^2, average of 82.75 cm^2. It was seen that a minimum of 31.3% of the defect was covered by medial head of gastrocnemius muscle flap while 46.9 % was covered by the gastrocnemius muscle island flap. Wounds greater than 120 cm^2 usually required a second flap for complete coverage, but it also depended on the location of the wound relative to the knee joint line.

Out of the 32 patients, 2(6.3%) had major complications, 9(28.1%) had minor complication and 21(65.6%) had no complication. Major complications include total or partial flap necrosis. They were treated by another flap to fill the defect. Minor complications include mild infection, haematoma and wound dehiscence. Infection was controlled by dressing and antibiotic according to C/S. Haematoma was treated by evacuation and wound dehiscence was treated by regular dressing. This figure is not different from other study where total of 95 muscle flap transposition were done and only five case of muscle flap necrosis was found. However they found 31 cases of major and minor complication.

CONCLUSION

The technique of the gastrocnemius island flap in general is simple and safe. The operation can be done in a short time without interfering with the blood flow of the major vessels of the leg. The flaps reconstructions were performed in busy orthopaedic institution under optimal environment and with adequate medical supplies. Gain in length of the gastrocnemius muscle flap (medial head) after division of its proximal attachment from the medial femoral condyle was quite significant in most cases. It is to be effective in the management of soft tissue defects extending from the lower third of thigh, to the upper two thirds of the leg, because of the flap's reliable and constant vascular pedicle.

Declaration of Competing Interest :

All the authors declare no conflict of interest.

REFERENCES

1. Saddawi-Konefka, D, Kim, HM Chung, KC, 2008, 'A Systematic Review of Outcomes and Complications of Reconstruction and Amputation for Type IIIB and IIIC Fractures of the Tibia', *Plastic and Reconstructive Surgery*, vol.122, no.6, pp. 1796 – 805.

2. Gopal, S, Majumder, S, Batchelor, AGB, knight, SL, De Boer, P, Smith, RM, 2000, 'Fix And Flap: The Radical Orthopaedic And Plastic Treatment Of Severe Open Fractures Of The Tibia', *The Journal Of Bone And Joint Surgery*, vol. 82, no.7, pp. 959 – 66.

3. Khan, AH, Ahmad, QG, 2003, 'Gastrocnemius muscle flaps for coverage of knee and upper tibial defects', *Indian Journal of Orthopaedics*, vol. 37, pp.1.

4. Daigeler, A, Drucke D, Tatar, K, Homann, HH, Goertz, O, Tilkorn, D, Lehnhardt, M, Steinau, HU, 2009, 'The Pedicled Gastrocnemius Muscle Flap: A Review of 218 Cases', *Plastic and Reconstructive Surgery*, vol. 123, no.1, pp. 250 – 57.

5. Harry, L, Chan, JK-K, Williams, G, Nanchahal, J, 2012, 'Soft tissue reconstruction of open fractures of the lower limb: muscle versus fasciocutaneous flaps', Plastic and Reconstructive Surgery, vol. 130, no. 2, pp. 280-95.

6. Le Nen, D, HU, W, Liot, M, Moineau, G Gerard, R, 2007, 'Gastrocnemiusmedialflaps', *InteractSurg*, 1, pp. 1 – 10.

7. Mathes, SJ Nahai, F, 1997, 'Reconstructive Surgery, Principles, Anatomy and Technique', *U.S.A: Churchill Livngstone Inc*, Vol. 2, pp. 1391 – 418.

8. Whitney, TM, Heckler, FR, White, MJ, 1995, 'Gastrocnemius Muscle Transposition to the Femur: How high can you go?' *Annals of Plastic Surgery*, vol.34, no.4, pp.512 – 7.

9. Kilic A, Denney B, de la Torre J. Reconstruction of knee defects using pedicled gastrocnemius muscle flap with split-thickness skin grafting: a single surgeon's experience with 21 patients. J Knee Surg 2019;32:463–7. doi:10.1055/s-0038-1653965.

10. Eshaque, AKM, Saleh, MQA, Awal, MA, Nahar, N, 2001," Management of exposed tiba and fibula by soleus flap with locally made AO external fixator", *Bangladesh Orthopaedic Society*, vol. 19, no. 2, pp. 1-6.

11. Fisher, MD, Gustilo, RB, Varecka, T F, 2001, "The timing of flap coverage, bone grafting and intramedullary nailing in patients who have a fracture of the tibial shaft with extensive soft tissue injury", *Bone and joint surgery*, vol.73, no. A, pp 1316-1321

12. Alam, M, Lawlor, C O'donnell, M, 2007, 'Versatility of the Gastrocnemius Muscle Flap: How High Can You Reach?', *Plastic and Reconstructive Surgery*, vol.120, no.7, pp. 2129 – 30.

13. Burd, HS, Spicer, TE, Cierny, G, 1995, 'Management of Open Tibial Fractures', *Plastic and Reconstructive Surgery*, vol.76, no.5, pp.719 – 28.

14. Busse, JW, Jacobs, CL, Swiontowski, MF, Bosse, MJ, Bhandari M, 2007, 'Complex Limb Salvage or Early Amputation for Severe Lower-Limb Injury', *Journal Ortho Trauma*, vol.21, no.1, pp.70 – 76.

Original Article

Role of Ponseti's Method In Correction of Club Foot

Md. Nur Alam[1], Md. Golam Sarwar[2], Md. Shah Alam[3], Md. Rezaul Karim[4], Nadia Mehnaz[5]

Abstract

The present study for evaluation of treatment of CTEV by ponseti technique wasconducted in department of orthopaedics, lugansk state medical university, lugansk,ukraine.the subjects included in the study were forty-two patients (sixty-five feet) presenting with idiopathic CTEV attending orthopedicsOPD from October 2007 to September 2009 treated by ponseti method. In present series there were two differences which were noted against the original procedure described by ponseti. This setting also provided most congenial and aseptic environment while doingtenotomy. Most of the children were below 6 week of age. The youngest patient in the series was of 3 days, while oldest was of 60 weeks. The mean age of initial presentation was of11.57 weeks of age. Male predominated the series consisting about sixty-two% of the population. The male to female ratio in the series was 1.6: 1. twenty-three (55%) patients were having bilateral involvement, however right-side was found to be more commonly involved (58%) in unilateral cases when compared to left (42%). approximately 17% of the patients were having positive family history. foot was classified into supple type, if manual reduction was possible and rigid type, where manual reduction was impossible. by this method 68% fect were rated as supple and 32% as rigid, at time of initial presentation. Majority (88%) of patient in our series had taken no treatment. 12% of the patients were treated with a cast before initial presentation no patient had any corrective surgery before presentation, the deformity was classified, according to the pirani scoring system into 3 groups. Majority of the patients (48%) were having pretreatment pirani score between 3.0-4.5. overall mean pirani score for all patients was 4.43, severity of clubfoot was detected by pirani scoring system at initial presentation and at weekly follow-up. All patients were treated by the same procedure, on comparing pirani score with age at presentation it was found that patients presenting Carly after birth were having mild or moderate deformity belonging to Group I and group II, while patients presenting late were having more severe deformity belonging to group ii and Group III (p = <.0003). The more severe the initial deformity, the more casts were required to obtain correction. Average duration of plaster cast application was 8.3 weeks. Minimum duration of plaster cast application was five weeks, maximum being twelve weeks. 76.2% of patient under treatment showed good compliance, 6 relapses were seen in noncompliance group. The mean duration of follow-up was 7.3 months (range, two to fourteen months). There were 19 complications among all the castings performed, constituting 29% of total feet. Overall 92.3% of the patients showed satisfactory results. the above observations clearly showed that age at initial presentation (p=0.0015), mobility of foot (p=0.0003) and pirani score at presentation (p=0.0084)has a direct bearing on final results. thus the present study reveals that ponseti technique for treatment of clubfoot is simple, effective, noninvasive, non-operative and economical procedure, which is suitable in indian subcontinent because of its less expansive in socioeconomic poor set-up.

Keywords: Ponsetis, Club Foot, Ponseti Technique.

1. Consultant (Ortho & Spine Surgery), National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh
2. Professor (Ortho Surgery), National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh
3. Professor & Head of the Department (Orthopaedic & Spine Surgery), Dhaka Medical College, Dhaka, Bangladesh
4. Associate Professor (Ortho & Spine Surgery), National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh
5. Medical Officer, GOD, B.G Press, Tejgaon, Dhaka, Bangladesh

Correspondence: Dr. Nur Alam, Consultant (Ortho & Spine Surgery), National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh

INTRODUCTION

"clubfoot", "piede torto", "pie zambo", "pie bot", "pesequinovaro congenito","klumpfus" are worldwide synonyms for congenital talipes equinovarus, a complex birthdeformity of the foot that is difficult to correct. The deformity has four components: equinus,hind foot varus, forefoot adductus, and cavus[1-5]. The incidence of congenital talipesequinovarus is approximately one in 1000 live births and is more common in boys. Bilateraldeformities occur in 50 % of patients. There is commonly a family incidence of talipes but thelikelihood of further children in the family being affected remains approximately 3:100. Whenone parent is affected with clubfoot, there is a 3% to 4% chance that the offspring will also beaffected. However, when both parents are affected, the offspring have a 30% chance ofdeveloping clubfoot[1,6]. Clubfoot is not an embryonic malformation. Normally developing foot turns into aclubfoot during the second trimester of pregnancy. Clubfoot is rarely detected withultrasonography before the 16th week of gestation. Therefore, like developmental hip dysplasiaand idiopathic scoliosis, clubfoot is a developmental deformation[6]. Understanding the path mechanics and treating successfully clubfoot has always been anunsolved mystery for modern medicine. Probably every conceivable form of treatment has beenrecommended by someone at some time. There has been much repetition, as certain procedureshave been tried and reported over the years and recommended to be condemned later. Most orthopaedic surgeons have agreed that the initial treatment of a clubfoot should benonsurgical and start as soon as possible after birth [7–12]. A variety of manipulations, splinting,strapping, bracing, and casting techniques have been advocated in an attempt to achievecorrection of the deformity [7,9,10,13-18]. Although some success with nonsurgical treatmenthas been reported in the literature, results have often been less than optimal, with partial corrections, recurrence, and other complications[8,19-22]. This has led to a trend toward surgical intervention, usually within the first year of life[12,15,17,23,24]. However, surgicaltreatment also carries significant risks, and the potential for complications is great. Although generally well tolerated into late adolescence and early adulthood, many patients with clubfoottreated with surgical correction tend to develop feet that are stiff, painful, and weak [18,25,26]. In 1950, ignacio ponseti, md, at the University of Iowa, developed a method of treatingclubfoot by serial manipulation, a specific technique of cast application, and a possible percutaneous achilles tenotomy. The clinical correction achieved by using this method has produced a functional, plantigrade foot without requiring posteromedial release in 85% to 90%of cases [2,27,28].cooper and dietz[29], in a review of the cases of forty-five patients who had been treated by ponseti technique and followed for a mean of thirty years, found that, with use of painand functional limitation as the outcome criteria, thirty-five patients (78%) achieved an excellentor good outcomehigher number of patients coming to our center from nearby districts, the unsatisfactoryresults associated with complete soft tissue releases at ten to fifteen years of follow-up,[30,31] and good to excellent results by ponseti technique reported by many authors [20, 29,31-32] encouraged us to study the subject.

MATERIALS QND METHODS

The present study of 42 cases with 65 feet was carried out in department of orthopedics, regional hospital, lugansk state medical university, lugansk, ukraine.Selection/ diagnostic criteria for clubfoot:The subjects included in the study were consecutive patients presenting with CTEVattending orthopedic OPD from October 2007 to September 2009. All those cases which had other ante descent causes such as arthrogryposis multiplex congenita, spina bifida, cerebral palsy.poliomyelitisetc were excluded from this study. Patients included in study were having all classical clubfoot deformities and on passive dorsiflexion patients were unable to touch dorsum of foot to shin of lower leg bellow:

History:Demographics: Demographic data (name, age, sex and date of birth of the child, educational level, and income of the parents etc) were obtained from the parents during their visits.Children were evaluated and graded for severity of clubfoot by pirani severity scoringsystem[6,33,34], which registers the deformity of six different components of the clubfoot. It is comprising of two scores mid foot score and hind foot score, scoring six components of club foot viz. Curvature of lateral border of foot [CLB]. Medial crease [MC], Lateral part of the head of the Talus [LHT], posterior crease [PC], empty heel [Eh], rigidequinus [RE]. Each Component Is Given A Score Of 0.0.5. Or 1.0.

Follow Up: after the last cast was removed and once all deformities were corrected, the patients weregiven foot abduction brace (fab). Patients were evaluated every 15 days until the age of sixmonths, and then every month after initial completion of treatment to encourage parental compliance to fab and to evaluate maintenance of correction.

Observation

The present study was carried out in department of orthopaedics, lugansk state medical university, lugansk,

ukraine. The subjects included in the study were consecutive patients presenting with idiopathic CTEV attending orthopaedic OPD from October 2007 to September 2009. in total there were forty-two children (sixty-five feet) presented with idiopathic clubfoot deformity, treated by ponseti technique.

Table – 1

Distribution of Patients in Different Age Groups.

S.N.	Age (In Weeks	No. Of Patients	Percentage
1.	0-6 Weeks	25	59.5%
2.	7-12 Weeks	4	9.5%
3.	13-18 Weeks	4	9.5%
4.	19-24 Weeks	2	4.8%
5.	25-30 Weeks	3	7.2%
6.	31-36 Weeks	0	0%
7.	> 36 Weeks	4	9.5%
8.	Total	42	100%
Mean: 11.57 Wks		Mode: 1 Median: 4	S.D.: 14.79

Most of the children were below 6 week of age. The youngest patient in the series was of 3 days, while oldest was of 60 weeks. Treatment was initiated at a mean of 11.57 weeks of age (range, 0.5 to 60 weeks). Treatment was begun at less than three months of age in twenty-nine patients (69%). In only four patients treatment was initiated at more than thirty-six weeks of age.

Table-II

Sex Incidence.

S.N.	Sex	No. Of Patients	Percentage
1.	Male	26	62%
2.	Female	16	38%
3.	Total	42	100%

Male predominated the series consisting about sixty-two% of the population. The male to female ratio in the series was 1.6: 1.

Table-III

Involvement of Foot.

S.N.	Involvement	No. of Patients	Percentage
1.	Unilateral	19	45%
2.	Bilateral	23	55%
3.	Total	42	100%

Of the forty-two patients, nineteen (45%) had unilateral and twenty-three (55%) had bilateral involvement.

Table-IV

Showing Side Involvement.

S.N.	Side	Male	Female	Total	Percentage
1.	Right	7	4	11	26%
2.	Left	5	3	8	19%
3.	Bilateral	14	9	23	55%
4.	Total	26	16	42	100%

Twenty-three (55%) patients were having bilateral involvement, however right side was found to be more commonly involved (58%) in unilateral cases when compared to left (42%).

Table –V

Mobility of Foot.

S.N.	Foot	No. of Foot	Percentage
1.	Supple	44	68%
2.	Rigid	21	32%
3.	Total	65	100

Foot was classified into supple type, if manual reduction was possible; and rigid type, where manual reduction was impossible. By this method 68% feet were rated as supple and 32% as rigid, at time of initial presentation. When mobility of clubfoot was compared with age at presentation it was found that in majority of patients presenting at early age foot was supple. While in those presenting late rigid variety of foot was more common. p = <.0001, extremely statistically significant.

Table –VI

Mobility of Foot with Sex Incidence.

S.N.	Foot	Male	%	Female	%	No. Of Foot	%
1.	Supple	28	70%	16	64%	44	68%
2.	Rigid	12	30%	9	36%	21	32%
3.	Total	40	100%	25	100%	65	100%

P=0.6, Not Statistically Significant

On comparing mobility of foot with sex incidence no significant difference was found. 70% of males and 64% female were having supple foot while 30% of male and 6% of female were having rigid foot.

Table-VII

Mobility of Foot with Different Groups.

Sn	Group	Supple		Rigid		Total	
		Foot	%	Foot	%	Foot	%
1	I	7	100%	0	0%	7	100%
2	II	27	87%	4	13%	31	100%
3	III	10	37%	17	63%	27	100%
4	Total	44	63%	21	37%	65	100%
Mean Pirani Score		3.96		5.40		4.43	

P=<0001

When mobility of feet was analysed with respect to different pirani score groups.it was found that majority of foot in Group I and II were belonging to supple variety of feet and in group iii majority of feet were belonging to rigid variety of feet (p = <.0001). It was also found that mean pirani score of supple and rigid feet were 3.96 and 5.40 respectively.

Table-VIII

Duration of Follow Up.

S.N.	Months	No. of Patients	Percentage
1.	<3 Months	5	12%
2.	4-6 Months	10	24%
3.	7-9 Months	18	43%
4.	10-12 Months	7	16%
5.	>12 Months	2	5%
6.	Total	42	100%
Mean: 7.3 Months		Mode: 8	Median:8

In the present study the minimum duration of follow up was of 2 months and longest was of 14 month. The mean duration of follow-up was 7.3 months.

Table-IX

Complications.

S.N.	Complication	No. of Feet	Percentage
1.	Cast Saw Injury	4	21%
2.	Abrasions	5	26%
3.	Cast Intolerance/Removal	4	21%
4.	Erythema	3	16%
5.	Toes Swelling	2	11%
6.	Blister	1	5%
7.	Total	19	100%

There were 19 complications among all the castings performed, constituting 29%of total feet. Majority of complications were minor abrasions (26%) seen in young neonates that may be due to soft skin. in some patients (21%) having marked equinus downward slippage of the cast was noticed. no infections, skin necrosis, neurovascular compromise, or bleeding were observed even in post tenotomy period.

Table-X

Results of Treatment at Final Follow-Up.

S.N.	Result	Number	Percentage
1.	Good	54	83%
2.	Fair	6	9.3%
3.	Poor	5	7.7%
4.	Total	65	100%

Patients were labeled as having a good result if pirani score is 1.5 points or betteror if all deformities get corrected by ponseti technique alone at final follow up. If additional surgical procedures such as tendon lengthening through an open approach or aposterior release of the ankle and subtalar joint was done to get correction it was classified as fair result. However if ponseti technique failed to give complete correction of foot even once, such patients were kept under poor result. In present study about 83%of patients showed good results and about 9.3% had fair results and 7.7% of patient's had poor results showing failure with ponseti technique. Overall 92.3% of the patients showed satisfactory results.

DISCUSSION

A clinical study on one of the most common congenital deformity of foot i.e. in total there were forty-two children (sixty-five feet) treated by ponseti technique. All those

cases which had other ante descent causes such as arthrogryposis multiplex congenita, spina bifida, cerebral palsy, poliomyelitis etc. were excluded from this study. In present series there were two differences which were noted against the original procedure described by ponseti [2,6]. Children were crying inspite of handling them gently, delicately and in spite of keeping mother aside them. Children were crying even with slightest of touch. However this discrepancy did not made any difference in overall results achieved in our study. Another difference was that, we prefer to perform the tenotomy in the operating room with the patient under general anesthesia, which allowed optimal analgesia topatients. This setting also provided most congenial and aseptic environment while doingtenotomy and it also helped in deciding on table if slight extended release was required. this approach differs from that of ponseti (2) and others,[32,33,35] who preferred the achilles tenotomy in the OPD clinic with a topical and/ or local anesthetic. However the mean age of initial presentation was 11.57 weeks, which is higher than median age of study because of 4 cases (95%) who reported quite lateie, after 36 weeks of birth as against the median age of initial presentation. the youngest patient in the series was of 3 days, while oldest was of 60 weeks. the mean age at initial presentation of 1157 weeks is in agreement with age incidence observed by dobbs et al.[37] by reported clubfeet in 51 patients at mean age of 12 weeks, at initial presentation. while in the study of 70 patients by leaves and ponseti[27], the mean age was 69 weeks at initial presentation. A mean age of 10.8weeks was reported by Lehman et al.[38] in a series of 30 patients treated by ponset technique. However herzenberg et al.[26] reported a study of 27 patients in which all the patients presented within 3 month of age. in the present study on comparing mobility of feet, presenting at age less than 3 months of age with those presenting at more than 3 month of age, p = <.0001 was obtained. As the showed that in only 53% of cases tenotomy was required where age of initial presentation was below 6 weeks, whereas tenotomy was required in 75% of cases, those presented after 36 weeks of age. The above observations clearly showed that presenting age at initial presentation has a direct bearing on quality (mobility) of foot, pirani score, and the need of tenotomy and final results. Males were found to be more commonly affected with clubfoot than females. In the present study sixty-two percent patients (twenty-six patients) treated were males and thirty-eight percent (sixteen patients) were females. The male to female ratio was 1.6:1. Similar observation of sex incidence has been reported by dobbs et al. [38] in which 63% out of 51 patients were male. In study by morcuende et al[35] 68% out of157 patients were male. laaveg and ponseti[27] had reported that 68.6% patients were male and 31.4% were female. A high preponderance of male sex was observed by turbo (1) and kite (14) who reported 71.36% male and 28.63% females and 70 percent males and 30 percent females respectively. Bilateral involvement was more common in most reported series [1,8,14.29,34]. In the present study 55% patients had bilateral and 45% patients had unilateral involvement. Similar observations regarding bilateral occurrence have been recorded by turco,[1] and cooper et al[29] in 57% and 58% patients respectively. A high preponderance of 68% bilateral involvement was noted by dobbs et al[34]. In the present study mobility of foot was classified into supple type, if manual reduction was possible; and rigid type, where manual reduction was impossible. By this method 68% feet were rated as supple and 32% as rigid at time of initial presentation. When mobility of clubfoot was compared with age at presentation it was found that in majority of patients presenting at early age foot was supple. While in those presenting late rigid variety of foot was more common. Majority of the feet (48%) were having pretreatment pirani score between 3.0-4.5. we preferred to perform the tenotomy in the operating room with the patient under general anesthesia, which allowed optimal analgesia to the patient. this approach differs from that of ponseti[2] and others[32, 33,35] who prefer that the achilles tenotomy be done in the clinic with a topical and/or local anesthetic. After the tenotomy, an additional cast was applied and left in place for three weeks to allow for healing of the tendon. in the present study, in Group-I with a score of 1.5 to 2.5 points only two feet (29%) required percutaneous achilles tenotomy, in Group-II with score of 3 to 4.5 points 18 feet (58%) underwent percutaneous tenotomy, while in Group-III with score of 5 points twenty-one feet (78%) required tenotomy. on the other hand Lehman et al[39] required as low as 25 (55%) tenotomies in 45 clubfeet in 30 patients. Dobbs et al[38] and moreuende et al[33] both reported tenotomy in 86% of cases. While high preponderance of percutaneous tenotomy was observed in study of Laaveg and Ponseti[27] and Herzenberg et al[36], requiringtenotomy in 93% and 91% of cases respectively. In the present study, when feet that scored > 5 (Group III) on pirani score were compared to feet that scored < 4.5 (Group I + Group II) for need of tenotomy. A two-tailed p value equal to 0.0383 was obtained by conventional criteria, this difference is considered to be statistically significant.In the present study 15 (36%) patients were follow-up for 4-6 months, 18 (43%) patients were followed to 6-9 months, 7 (16%) patients were followed to 10-12 months and 2 (5%) patients

were followed to more than a year. In this study the minimum follow-up was of 2 months and longest was of 14 month. The mean duration of follow-up was7.3 months. this is less when compared with studies conducted out by Laaveg and Ponseti[27] who followed the patients to ten to twenty-seven years after treatment and cooper et al[29] which reported result after thirty years of follow-up. There were 19 complications among all the castings performed, constituting 29% of total feet. In some patients (21%) having marked equines downward slippage of the cast was noticed. no infections, skin necrosis, neurovascular compromise, or bleeding were observed even in post tenotomy period. However no such serious bleeding was recorded in the present study. Overall 92.3% of the patients showed satisfactory results.similarly Lehman et al[39] also noted that 84% of the feet showed good results, 5% fair and 11% poor when treated by ponseti technique. Ippolito et al[31] studied long term results treated with ponseti technique and reported 37% excellent 41% good, 12% fair and 10% poor results. Herzenberg et al[36] a comparative study of ponseti versus traditional method of casting reported that ponscti group required pmstr in only 3% of the cases, while in control group 94% of the cases required pmstr. In study by Morcuende et al[33] clubfoot correction was obtained in 98% of the patients treated by ponseti technique. The major concern in the operative treatment of congenital clubfoot is functional outcome. In patients presenting within first three month of age, 93% of the feet had showed good results compared to those presenting after 36 weeks who showed good results in only 50% of feet. however a very statistically significant $p = 0.0015$ was obtained, when final results, were compared with patients presenting at age less than 3 months of age to those presenting at more than 3 month of age. In particular, patients treated over the age of 6 month appear to have an increased probability of poor results. Although the number of patients in this study is small, our results and those of ponseti suggests that the importance of maintaining correction with the foot abduction brace is paramount tosuccessful treatment.

CONCLUSIONS

In overall results achieved in our study. Another difference was that, we prefer to perform the tenotomy in the operating room with the patient under general anesthesia, which allowed optimal analgesia to thepatient. This setting also provided most congenial and aseptic environment while doing tenotomy. on comparing mobility of clubfoot with age at presentation it was found that in patients presenting at early age foot was supple and in those presenting late nigid variety of foot was more common(''0001). Thus the present study reveals that ponseti technique for treatment of clubfoot is simple, effective, noninvasive, non-operative and economical procedure, which is suitable in indian subcontinent because of its less expansive in socioeconomic poor set-up.

REFERENCES:

1. Turco V J. Clubfoot. New York: Churchill Livingstone: 1981.
2. Ponseti IV. Congenital Clubfoot. Fundamentals of treatment. New York: OxfordUniversity Press: 1996.
3. Simon GW, Sarrafian S. The microsurgical dissection of a stillborn fetal clubfoot.ClinOrthop. 1983: 173:275.
4. McKay DW. New concept of and approach to clubfoot treatment section -principles and morbid anatomy. J PediatrOrthop. 1982: 2:347-356.
5. Irani RN. Sherman MS. The pathological anatomy of clubfoot. J Bone Joint Surg.1963: 45A:45-52.
6. Staheli L. Clubfoot: Ponset Management. 2nd Ed. Global HELP publication: 2005.
7. Kite JH. The Clubfoot. Philadelphia: Grune& Stratton; 1964.
8. Ponseti IV. Smoley EN. Congenital clubfoot: the results of treatment. J Bone JointSurg. 1963: 45A:261-275.
9. Ikeda K. Conservative treatment of idiopathic clubfoot. J PediatrOrthop. 1992:12:217-223.
10. Bensahel H, Guillaume A. Czukonyi Z, Desgrippes Y. Results of physical therapy foridiopathic clubfoot: a long-term follow-up study. J PediatrOrthop. 1990:10:189-192.
11. DeValentine SJ, Blakeslee TJ. Congenital talipesequinovarus. In Foot and AnkleDisorders in Children, edited by SJ De Valentine. New York: Churchill Livingstone;1992.
12. Blakeslee TJ. Congenital idiopathic talipesequinovarus (clubfoot). Current conceptsClinPodiatr Med Surg. 1997; 14:9-56.
13. Scarpa A. A memoir on the congenital club feet of children, and the mode ofcorrecting that deformity. 1818 ClinOrthop. 1994; 308:4-7.
14. Kite JH. Non-operative treatment of congenital clubfoot ClinOrthop. 1972; 84.29-38
15. McKay DW. New concept of and approach to clubfoot treatment section IIcorrection of the clubfoot. J PediatrOrthop. 1983; 3:10–21.
16. Simons GW. The Clubfoot: The Present and a View of the Future. New York:Springer Verlag: 1994.

17. Turco VJ. Resistant congenital clubfoot: one-stage posteromedial release withinternal fixation: a follow-up report of a fifteen-year experience. J Bone Joint Surg[Am] 1979; 61:805-14.

18. Nutt JJ. Diseases and Deformities of the Foot. EB Treat, New York: 1915.

19. Aronson J, Puskarich CL. Deformity and disability from treated clubfoot. J PediatrOrthop. 1990; 10:109-119.

20. Karski T, Wosko I. Experience in the conservative treatment of congenital clubfoot in newborns and infants. J PediatrOrthop. 1989; 9:134-136.

21. Wesely MS, Barenfeld PA, Barrett N. Complications of the treatment of clubfoot.ClinOrthop. 1972; 84:93-96.

22. Miller JH, Bernstein SM. The roentgenographic appearance of the "correctedclubfoot." Foot Ankle. 1986; 6:177-183.

23. Crawford AH, Marxen JL, Osterfeld DL. The Cincinnati incision: a comprehensiveapproach for surgical procedures of the foot and ankle in childhood. J Bone JointSurg. 1982; 64A:1355-1358.

24. Carroll NC, Gross RH. Operative management of clubfoot Orthopedics. 1990:13:1285 1296.

25. Applington JP. Riddle CD. Avascular necrosis of the body of the talus after combinedmedial and lateral release of congenital clubfoot. South Med J. 1976; 69:1037–1038.

26. Haasbeek JF. Wright JG. A comparison of the long-term results of posterior andcomprehensive release in the treatment of clubfoot. J PediatrOrthop. 1997; 17:29-35.

27. Laaveg SJ, Ponseti IV. Long-term results of treatment of congenital clubfoot. J BoneJoint Surg [Am]. 1980; 62:23-31.

28. Ponseti IV. Current concepts review: Treatment of congenital clubfoot. J Bone JointSurg [Am] 1992; 74:448-54.

29. Cooper DM, Dietz FR. Treatment of idiopathic clubfoot: a thirty-year follow-up note.J Bone Joint Surg [Am] 1995; 77:1477-89.

30. Hutchins PM, Foster BK, Paterson DC, Cole EA. Long-term results of early surgicalrelease in clubfeet. J Bone Joint Surg [Br] 1985; 67:791-9.

31. Ippolito, E.; Farsetti, P.; Caterini, R.; Tudisco, C.: "Long term Comparative Results inPatients with Congenital Clubfoot Treated with Two Different Protocols." J Bone &Joint Surg 2003; 85A (7):1286-1294.

32. Colburn M, Williams M. Evaluation of the treatment of idiopathic clubfoot by usingthe Ponseti method. J Foot Ankle Surg. 2003; 42(5):259-67.

33. Pirani S, Outerbridge H. Moran M, Sawatsky B. A method of evaluating the virgin club foot with substantial interobserver reliability. Presented at the annual meeting of pediatric orthopaedic society of North America, Miami, 1995.

34. Flynn JM, Donohoe M. Mackenzie WG. An independent assessment of two clubfoot-classification systems. J PediatrOrthop 1998, 18:323-327.

35. Morcuende, JA, Dolan, LA, Dietz FR, MD, Ponseti, IV. Radical Reduction in theRate of Extensive Corrective Surgery for Clubfoot Using the Ponseti Method JPediatrOrthop 2003; 23(6):780-7.

36. Herzenberg JE, Radler C. Bor N. Ponseti Versus Traditional Methods of casting forIdiopathic Clubfoot. J PediatrOrthop 2002; 22(4):517-521.

37. Dobbs MB. Rudzki JR, Purcell DB, Walton T. Porter KR. Gumett CA. Factorspredictive of outcome after use of the Ponseli method for the treatment of idiopathicclubfeet. J Bone Joint Surg Am 2004; 86-A (1):22-7.

38. Dobbs MB, Gorden JE, Walton T. Schoenecker PL. Blecding complicatons lollowing percutancous tendoachililes tenotomy in the treatment of clubroot deformity. J Pediatr Orthop 2004; 24(4): 353-357.

39. Lehman WB, Mohaideen A. Madan S, Scher DM. Van Bosse HJ, lannacone. Bazzi JS, Feldman DS. A method for the early evaluation of the Ponseti (lowa) technique for the treatment of idiopathic clubfoot. J Pediatr Orthop B 2003, 12(2):133-40.