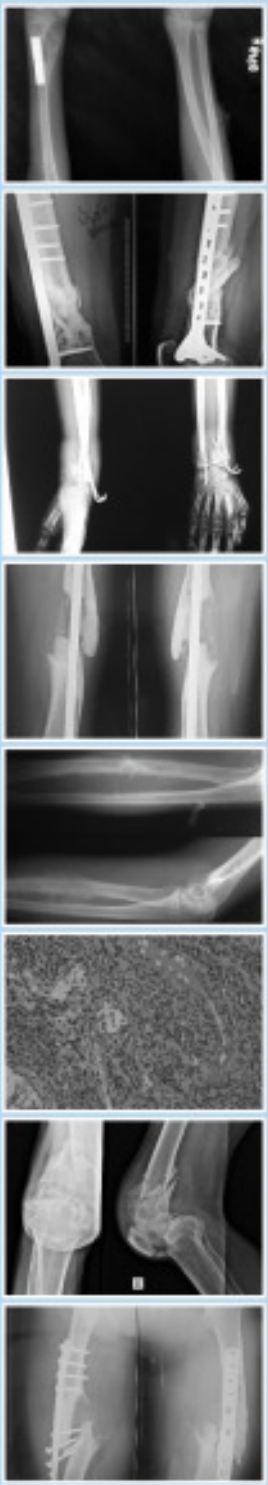

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EDITORIAL

WHAT IS BETTER : BIOMECHANICS OR BIOLOGY

Agrawal A.C.*

Modern trauma is well known for its complexities including high velocity injuries, devascularization of fractured fragments for long distances, open and crushed soft tissues, arterial injury and associated raised systemic inflammatory response. The Orthopaedic surgeon is often in a dilemma as to how to anatomically align the fragments, retain them in this acceptable position till union, preserve vascularity for an early union and avoid stiffness by promoting early movements and function. He is often helped by the industry and engineers by manufacturing newer implants which will have a better hold on bone, will maintain vascularity of bony fragmentsuring application, will have more pull out strength and which will not break even on weight bearing. This often leads to a construct with absolute stability where all biological efforts towards union seize and bone will not unite leading to eventual implant failure. We all have seen the journey from simple compression plates, to Sherman plates, DCP, LCDCP, Recon Plates, LCP and then Precontoured metaphyseal LCP and evolution of fixation by screws too in them.[1]

It is often seen that the Orthopaedics surgeons will hold an X-Ray and discuss treatment options from it. Mostly this is without examining the patient and post operative X-ray will be discussed forImplant sitting, length and direction of screws, position of fractured fragments and limits of acceptability. It is common to find faults with the previous surgery on X-ray where on examination usually there may be good fixation and function and this is because the Orthopaedic surgeon has started to think like an engineer where he knows only mechanical stability or a plastic surgeon who is interested only in cosmesis.[2,3]

But then why does the bone unite Inspite of suboptimal fixation? Has the surgeon turned out lucky or was it his extreme care in the procedure to preserve vascularity by doing an indirect reduction, doing minimal handling of fractured fragments, maintaining soft tissue attachments to bone, preserving periosteal as well as marrow blood supply, doing a stable fixation and at the same time permitting minimal axial motion so that an environment is created which promotes fracture union. The surgeon must have had realistic goals, which maintained the bone length, alignment, vascularity, movements and function and avoided malunion, nonunion and implant failure.[1]

So it is best to have a balance in between Biomechanics and Biology as none can work without the other and finding faults on X-ray are a great distance from actual Orthopaedic practice. I would like to conclude with Wayne Dyer's saying:

"When you judge others, you do not define them, you define yourself."

REFERENCES

1. AAOS Department of Research and Scientific Affairs. AAOS orthopaedic practice in the U.S., 2014. Published 2015.
2. Gallagher TH, Mello MM, Levinson W, et al. Talking with patients about other clinicians' errors. N Engl J Med. 2013;369:1752-1757.
3. Kwon J Y, Miller C P. Orthopaedics in glass houses. Foot and Ankle International ;38(4): 465-466

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ASSESSMENT OF OUTCOMES OF BIOLOGICAL AND CONVENTIONAL PLATING FOR FRACTURES AROUND THE KNEE JOINT IN A TERTIARY CARE HOSPITAL OF RURAL AREA OF MAHARASHTRA

Dulani R.K.* **Sethi M.**** **Singh P.***** **Shrivastava S.******

Key words: Proximal Tibia Fracture, Distal Femur Fracture, Knee joint fracture, Biological plating.

INTRODUCTION

The goal of fracture treatment is to obtain union of the fracture in the most compatible anatomical position which allows maximal and full restoration of the extremity.[1]

Fractures around the knee ie. Distal metaphyseal fractures of femur and tibia have troubled orthopedic surgeons very much because of their common occurrence in present mechanized world. Methods of treatment vary according to type, level of fracture and age of patient and are based on assessment of advantages and disadvantages associated with each.

Distal femoral fractures account for about 7% of all femoral fractures1. Tibial plateau fractures constitute 1% of all fractures and 8% of fractures in the elderly.[2] From 1% to 3% of these fractures are open injuries.[2]

Subcutaneous nature and its precarious blood supply make fractures of tibia more complicated. Hence no single method of treatment could apply to all types of fractures. On the contrary extensive muscle mass and pull make distal femur fractures difficult to reduce.

Limitations of conventional plating became obvious by the late 1980s and efforts were made to develop plating systems and surgical techniques that preserved more of the biological factors contributing to bone healing4.

Minimal invasive percutaneous plate osteosynthesis[3] (MIPPO) appear to be next step in evolution of biological plating. MIPPO is new technique where indirect reduction is achieved without opening fracture site, without disturbing fracture haematoma and by making small skin incision away from fracture site.

Various studies[4] show that this technique, as compare to other methods is better in terms of time taken for fracture healing, hospital stay, complications and functional outcomes. At the same time it requires more technical expertise.

With the above background, the present study was conducted to evaluation of results of biological plating with for fractures around the knee joint as compared to conventional open reduction and plating.

METHODOLOGY

The present was prospective study of proximal tibial and distal femoral metaphyseal fractures with or without intra articular extension treated by biological plating or conventional open reduction and plating at department of orthopaedics, A.V.B.R.H, sawangi, Wardha (Maharashtra), India during study period from 1st august 2008 to 1st October 2010. Patients with following inclusion criteria were included in study Patients with all the fractures around knee joint with or without metaphyseal extension i.e.

1. Proximal tibia and distal femur.
    1. Patients in the age group of 18-60yrs.
    2. All the patients with acute and subacute trauma of less than 2 weeks.
    3. Patients giving consent to undergo the operative procedure.

    Patient with following criteria were excluded

1. Patients in the pediatric age group.

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1. Patients not giving consent for the operative procedure.
2. Patients out of study age group.
3. Severe open fractures i.e compound grade 3b and 3c
4. Avulsion fractures around knee joint.

After initial resuscitation in the emergency, close fractures were splinted and operated at the earliest. Open fractures were thoroughly irrigated and debrided in the emergency room, covered with povidone iodine soaked dressing and splinted. Intravenous antibiotics were started

Detailed history of the patient was recorded and Radiological examination was done to assess the type of fracture and displacement of fragments. 3-D reconstruction x-ray was done for better understanding of fracture pattern. Patients with both close and open fracture were treated with either conventional open reduction and plating or biological plating by conventional plate or locking plates. Fractures were classified according to AO classification. Depending upon the condition of the soft tissue and which tibial condyle is involved, skin incision was placed medially or laterally. Fracture was reduced and held with the help of reduction holding clamp and plate was inserted subcutaneously through the fracture site. Similarly for distal femur fractures trial with MIPPO using lateral incision was given. Intercondylar fragments were first reduced and held with K-wires. Depending upon the fracture anatomy T-buttress. L-buttress, cloverleaf, narrow DCP, hockey stick (both locking as well as non-locking) and if required, 6.5 mm cannulated screws were used in tibial fractures. For distal femoral fractures DCS, non locking condylar buttress, hockey stick both locking as well as non-locking were used. Placement of the plate was checked under the C-ARM in both AP and Lateral profiles. Reduction was done under C-ARM with manual traction and manipulation. Cortical screws were inserted through separate stab incisions. In this study, locking plates, condylar buttress plates, t-butress, l-buttress, and hockey stick plates were used for fixing fractures around the knee. Locking plates were mainly used in patients of older age group with osteoporotic bones and in patients with extensive comminution. Locking plates were also used in patients where MIPPO was done.

Patient were kept non weight bearing for 6 weeks and partial weight bearing was started at six weeks. Assessment of fracture union was assessed on serial x-rays taken at six weeks and monthly there after till fracture union occurs. Full weight bearing was started after clinical and radiological union of fracture. Fracture was considered to be united when the bridging callus was seen in both AP and lateral views.

All the patients were assessed for radiological union, time to partial and full weight bearing, incidence of infection, malunion, delayed union, nonunion, functional assessment using. The Knee injury and Osteoarthritis Outcome Score (KOOS score)[5] and stability of fixation. Preoperative, intraoperative, as well as early and late postoperative complications were analyzed.

Data was compiled in MS Excel and checked for its completeness and correctness. Then it was analyzed.

RESULTS

In the current study, total 23 patients were included. Fracture incidence was more common the age group of 21-30 as they were more exposed to the outdoor activities, incidence being 41%. Males being involved in nearly 90.9% cases. More fractures around knee were in males as they are associated with more outdoor activities (Table 1). Incidence of proximal tibial fractures (59.09%.) is more than distal femur fractures. Around 81.8% of injuries are caused by road traffic accidents. In this study right side (59.09%.) was affected more than the left. Incidence of type A and C fractures of proximal tibia was equal in the study being 27.27%. The incidence of type C fractures of distal femur (31.8%) was much higher than the others indicating high velocity injuries (Table 1).

Table1
Characteristics of Injury and Fracture

Type of Fracture	No.	Percentage
Proximal tibia	13	59.09%
Distal Femur	9	40.91%
Mode of Injury		
RTA	18	81.8%
Assault	2	9.1%
Domestic fall	2	9.1%
Side of Involvement		
Right	13	59.09%
Left	9	40.91%
Fracture classification of proximal tibia		
Type-A	6	
Type-B	1	
Type-C	6	
Fracture classification of femur		
Type-A	2	
Type-B	0	
Type-C	7	

Majority of the surgeries i.e. 54.54% were performed within the first 48hrs of admission. About 59% of surgeries were done with MIPPO and about 31% were done with conventional mode (Table 2).

Table 2
Variables associated with surgical procedure

Variables	No.	Percentage
Time interval b/t Injury and surgery		
48 hrs.	12	54.54%
upto 5 Days	8	36.36%
> 5 Days	2	9.09%
Surgical procedure		
MIPPO	13	59%
Conventional Plating	9	41%
Associated Injury		
Fracture Patela	2	
Fracture Mandible	2	
Bone Grafting		
Required	3	13.7%
Not Necessary	19	86.3%

Average KOOS for MIPPO being 89 and for conventional plating being 80. Time taken for radiological union was on an average 9 weeks for MIPPO (Figure 1 & 2) and 10weeks for conventional plating (Figure 3 & 4) depicting early radiological union with biological plating (Table 3). Varus Malalignment was one in each MIPPO & conventional (Figure 5). Infection was seen in one patient with conventional plating which was treated by dressing and antibiotics.

Table 3
Surgical outcome of Fracture

Surgical procedure	Koos Score
MIPPO	89
Conventional	80
Surgical outcome	
Surgical Complication	No.
Varus malaingment	2 (1-MIPPO, 1-Conventional)
Fracture collapse	1 (MIPPO)
Infection	1 (Conventional)
Range of Motion	Degree
MIPPO	0-97 Degrees
Conventional	0-122 Degrees
Radiological Union	Weeks
MIPPO	9 weeks
Conventional	11 weeks

Pre-op | Immediate post op | 3 months followup

6 months | Final R.O.M

Fig. 1 : A 22 yr male treated with MIPPO for proximal tibia fracture

DISCUSSION

The internal fixation of fractures has evolved in recent decades with a change of emphasis from mechanical to biological priorities. More flexible fixation should encourage the formation of callus while less precise, indirect reduction will reduce operative trauma. This approach is described as 'biological internal fixation'.[6]

Conventional stable internal fixation with precise reduction usually requires a fairly extensive surgical approach to the bone. This contributes to increasing the necrosis which has been initially produced by the injury, consequently enhancing the risk of delayed healing, infection and possibly refracture. 'Bio-logical' internal fixation avoids the need for precise reduction, especially of the intermediate fragments, and takes advantage of indirect reduction. This principle applies equally to locked nailing, bridge plating, and internal fixator-like devices. Indirect reduction aims only to align the fragments. It avoids exposure of the bone thus reducing the surgical trauma. Flexible fixation is advocated to induce formation of callus and is achieved by using wide bridging of the area of the fracture. Pure splinting without compression results in flexible fixation. The aim is to produce the best biological conditions for healing rather than absolute stability of fixation and this approach has been shown to give early solid union.

Biological internal fixation does not compromise the restoration of early and complete function of the bone, limb and patients, but recognition of the optimum requirements for bone healing now takes precedence, with mechanical stabilisation being less rigid while still allowing painless function and reliable healing. The aim is to reduce the infrequent but possibly severe complications such as sequestration and infection which may be produced by bone necrosis, with less emphasis on avoidance of delayed or nonunion, which is more easily managed.

In our study most of the injuries were caused by road traffic accidents affecting mostly males. In this study, 20 subjects had RTA injuries and 2 falls and 2 assaults. P Kanabar, V Kumar, PJ Owen[8] reported higher incidence of falls in their study. Another study reported that most of the injuries were caused due to road traffic accidents.[7]

Arneson TJ, et al[9] has also observed that the -the main cause of these fractures are high velocity trauma though he pointed out that these fracture can be sustained by minor to moderate trauma in cases of old ladies due to osteoporosis.

This signifies that most of the fractures around the knee are caused by high energy trauma and are associated with severe comminution. Cory Collinge et al[10] had evaluated the results of treatment of complex tibial periarticular fractures using percutaneous technique in seventeen patients and found that twelve patients presented with compound grade-Ill fractures and five with closed fractures.

In patients treated with MIPPO union occurred at an average of 12 weeks and the patients treated with conventional plating the union occurred at an average of 14 weeks. Radiological union of the fracture i.e. characterized by cortical bridging of the fracture in both AP and lateral views of follow up x-rays, was considered as a landmark for union. In our study we explain this with less periosteal stripping, preservation of fracture haematoma and better tissue handling. In our study there was one case in which there were delayed signs of union, a case treated with conventional plating where infection delayed the union for 18 weeks. There were no cases of non-union in the study. K. Kolb et al[8] in their study of 41 patients of distal femur fractures reported three delayed unions, one non-union ie. 7.3% of patients had delayed union and 2.4% had non-union.

P Kanabar, V Kumar, PJ Owen[7] in their study of 17 patients of distal femur fractures with LISS plating reported 1 nonunion and one delayed union.ie.5.8% had delayed union and 5.8% had non-union.

One of the study 11 of MIPPO of proximal tibial fractures in 35 patients reported 2 cases of delayed-union and no cases of non-union. They had 8% of delayed unions among 25 patients that completed study.

Chang-Wug Oh et al[12] in 23 patients did not report any case of non-union although delayed union occoured in 3 patients.ie 13% delayed union rate.

Sanders et al[13] reported 100% union rate in patients with severely comminuted fractures of distal femur.

Similarly Schatzker and Lambert[14] in 1979 obtained 76% to 86% union in patients with fracture of distal femur. Bolhofner[15] reported 100% union in series of prospective study of 57 cases of fracture of distal femur.

Ostrum and Geel[16] obtained 95.7% union rate in a series of 30 patients, operated upon for fracture distal femur.

Chr. Krettek et al[17] (2001) had evaluated a minimally invasive approach for proximal tibial fractures in six patients. The average time to healing was between 12 and 20 weeks postoperatively Cory Collinge et al[10] (2000) had evaluated the results of treatment of complex tibial periarticular fractures using percutaneous technique

in seventeen patients and found that in nine patients with compound fractures, three patients had delayed and three nonunion.

In our study we had 2 cases of varus malalingment and one case of fracture collapse. In one case malalingement occurred in fracture treated with MIPPO and in one case of fracture treated with conventional plating. Both the cases were proximal tibial fractures. The malalingement occoured as a result of improper reduction at time of surgery and early weight bearing. We had a 9% rate of malunion in the study.

One of the study8 on distal femoral fractures fixed with DCS reported malalingement in 12.1% cases. Two patients developed varus and 3 developed valgus malalingment. P Kanabar, V Kumar, PJ Owen[7] reported malunion in 5.8% of cases. The 1 case reported had valgus malalingment. While another study[11] reported malalingment in 4% of cases. Chang-Wug Oh et al[12] reported malalingment in 2 out of 23 cases These malalignments occurred early in the series because of inadequate contouring of the plate before insertion, and not because of secondary loss of fixation. However Mize[18] reported 7.3% of malunion in his series. Similarly Sanders et al[13] and Ostrum[16] et al reported 5.8% and 3% malunion respectively. Bolhofer[15] observed only one malunion in his study of fractures of distal femur.

The one infection that occurred was in case treated with conventional plating of proximal tibia K. Kolb et al8 reported infection in 2 patients out of 41 patients. Their infection rate was 4.8%. P Kanabar, V Kumar, PJ Owen[7] did not report a single infection case in their study. Jackson A. Lee & Stamatios A. Papadakis & Charles Moon & Charalampos G. Zalavras[11] reported infection in 2 cases out of 25 that completed study. Their infection rate was 8%.

In our study there were 2 (9%) case that required reoperative procedures. The one had varus malalingment and the other developed a secondary fracture due to fall. K. Kolb et al[8] had secondary procedures in 5 patients out of 41 patients; 2 with varus malalingment and 3 with valgus malalingment. All the patients required osteotomy with bone grafting. Their percentage of secondary procedures was 12.1%.

P Kanabar, V Kumar, PJ Owen[7] had secondary procedures in 2 patients out of 17 patients. One had refracture due to fall and the other had non union. One of the study[11] had no patient that needed secondary procedure out of 25 patients that followed study. There was no loss of reduction or gross malalingment. Chang-Wug Oh et al[12] had 2 patients that required secondary procedures one due to infection and other due to screw irritation. Their percentage for secondary procedures was 8.6%.

Cory Collinge et al[10] (2000) had evaluated the results of treatment of complex tibial periarticular fractures using percutaneous technique in seventeen patients and found that six fractures united after second procedure and one patient having osteomyelitis required multiple debridement. Chr. Krettek et al[17] (2001) had evaluated a minimally invasive approach for proximal tibial fractures in six patients and one of the patients had revision surgery for deep intraarticular infection.

In our study there were 3 patients that required bone grafting out of total 23 patients i.e. 13.6% patients. 2 patients operated with conventional plating of distal femur required bone grafting as there was extensive communition. The other had a depressed tibial condyle with communition. We obsevered that patients with extensive communition and bone loss conventional plating was preferable as it allowed proper reduction and bone grafting. K. Kolb et al[8] used bone grafting in 5 patients along with corrective osteotomy for malaligments. 2 patients were of varus malalingment and 3 of valgus malalingment. (12.1%). P Kanabar, V Kumar, PJ Owen[7] used bone grafting in 2 patients who had non-union out of 17 patients they evaluated i.e.11.7% of patients. One study[11] did not use bone graft in any of the cases.

Chang-Wug Oh et al[12] from a total of 23 cases all fractures united without using any of the bone grafts. Mize et al[18] stressed on the need of bone grafting in cases of severely communited fractures of femur.He performed bone grafting in 87% of his patients. Sanders et al[13] did bone grafting in about third of their patients. All of them united thereafter. However in a study of 57 patients done by Bolhofer,[15] none of the patient required bone grafting.

Kyle F. Dickson, John Munz[21] (2007) recommended locking plates in large aging population continuing active lifestyles. If used appropriately, locked plating can result in good patient outcomes with recreation of bony architecture and restoration of function. S.L. Ezekiel Tan, Zsolt J. Balogh[22] (2009) stated that locked plating have evolved simultaneously with the minimally invasive techniques, which together provide an elegant safe option for restoring function in well trained, experienced hands.

One of the study[23] while describing the tips and tricks in locking plates concluded that locking plate technology offers improved fixation stability in osteopenic bone and for communited and periarticular fractures. The initial results in series that included a variety of fractures are encouraging, although it is increasingly apparent that failures do occur and the causes of failure should be

examined.

In our study to assess the functional outcome of all the 23 patients we used KOOS score i.e. the knee injury and osteoarthritis outcome score. The score includes pain, symptoms, activities of daily living, sports and recreation, and quality of life. The higher score indicates fewer problems.

In our study the average score was 85. The patients operated MIPPO had an average score of 89 whereas the patients with conventional plating had an average score of 80. We owe this to the lesser anatomical disturbances enforced on the limb in minimal invasive surgeries and the sturdy construct provided by them.

To date there has been no major study that has used KOOS score as the functional assessment scale. Other scores that have been used in other studies have been the Rasmussen's and the Neer's score. We preferred this score in our study as it uses parameters like pain, symptoms, activities of daily living, sports and recreation and quality of life, all at the same time

CONCLUSION

On the basis of observations the present study conclude that biological plating whether done with locking or nonlocking plates offers better results than conventional plating. We attribute this to less soft tissue dissection, less periosteal stripping and preservation of fracture haematoma. All these factors when combined with a stable fixation give the bone a near anatomical environment to heal and these results in early union and better functional outcome.

REFERENCES

1. Wood GW. General principles of fracture treatment. Campbell's Operative Orthoaedics. 2003:2714.
2. Green DP. Rockwood and Green's fractures in adults. Rockwood CA, Bucholz RW, Heckman JD, Tornetta P, editors. Lippincott Williams & Wilkins; 2010.
3. Thomas A. Russell, An Historical Perspective of the Development of Plate and Screw Fixation and Minimally Invasive Fracture Surgery With a Unified Biological Approach, Techniques in Orthopaedics® 22 (3) :186-190 © 2007 Lippincott Williams & Wilkins, Inc.
4. Int. S.L. Ezekiel Tan, Zsolt J. Balogh, Indications and limitations of locked plating, Injury J. Care Injured 40 (2009) 683-691.
5. Roos EM, Lohmander LS. The Knee injury and Osteoarthritis Outcome Score (KOOS) : from joint injury to osteoarthritis. Health and quality of life outcomes. 2003 Nov 3;1 (1) :64.
6. Stephan M. Perren, jbjs 2000, Evolution of the internal fixation of long bone fractures.
7. P Kanabar, V Kumar, PJ Owen, Less invasive stabilisation system plating for distal femoral fractures, Journal of Orthopaedic Surgery 2007;15 (3) :299-302.
8. K. Kolb et al, The condylar plate for treatment of distal femoral fractures: A long-term follow-up study, j. Injury, April 2009, Pages 440-448.
9. Arneson TJ,.Melton LJ, Lewallen DG, et al. Epidemiology of diaphyseal and distal femoral fractures in Rochester, Minnesota 1965-1984. Clin Orthop 1988;234:188-194
10. Collinge C, Sanders R, DiPasquale T. Treatment of complex tibial periarticular fractures using percutaneous techniques. Clin Orthop. 2000 Jun; (375) : 69-77.
11. Jackson A. Lee & Stamatios A. Papadakis & Charles Moon & Charalampos G. Zalavras, Tibial plateau fractures treated with the less invasive stabilisation system, International Orthopaedics (SICOT) (2007) 31:415-418.
12. Chang-Wug Oh, Jong-Keon Oh, Hee-Soo Kyung, In-Ho Jeon1, Byung-Chul Park, Woo-Kie Min1 and Poong-Taek Kim, Double plating of unstable proximal tibial fractures using minimally invasive percutaneous osteosynthesis technique, Acta Orthopaedica 2006; 77 (3) : 524-530.
13. Roy Sanders, Marc swiontkowski, Nashville, double plating of comminuted and unstable fractures of the distal part of femur. Journal of Bone and Joint Surgcry;vol73-a, No 3, March 1991.
14. Schatzker J, Home G, Waddcll J. The Toronto experience with the supracondylar fracture of the femur 1966-1972. Injury 1974;6:113- 123.
15. Bolhofner BR, Carmen B, Clifford P: The results of open reduction and internal fixation of distal femur fractures using indirect reduction technique. J Orthotop Trauma 10:372, 1996.
16. Ostrum RF, Geel C: Indirect reduction of fracture distal femur without bone graft. J Orthotop Trauma 9:278, 1995
17. Krettek C, Gerkfa T, Miclau T. A minimally invasive medial approach for proximal tibial fractures. Injury. 2001 May; 32 Suppl 1:SA4-13.
18. Mize RD, Bucholz RW, Grogan DP. Surgical treatment of displaced, comminuted fractures of the distal end of the femur. J BoneJoint Surg Am 1982;64:871-879.
19. Olerud S:operative treatment of supracondylar - intercondylar fracture of femur: technique and results in 15 cases, J Bone Joint Surg, 54A:1015, 1972.
20. T. Go¨sling et al, Less Invasive Stabilization of Complex Tibial Plateau Fractures, J Orthop Trauma o Volume 18, Number 8, September 2004.
21. Kyle F. Dickson, 2007, techniques in orthopaedics, Locked Plating: Clinical Indications.
22. S.L. Ezekiel Tan, Zsolt J. Balogh, injury 2009, Indications and limitations of locked plating.
23. Wade R. Smith, Bruce H. Ziran, Jeff O. Anglen and Philip F. Stahel, J Bone Joint Surg Am. 2007;89:2298-2307, Locking Plates: Tips and Tricks.

EVALUATION OF THE OUTCOME OF DISTAL FEMORAL FRACTURE TREATED WITH ANGLED LOCKING PLATE

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ABSTRACT

Management of the distal femoral fracture is the difficult task due to high incidence of complications. Angled locking plate is widely used because of the ease of application and multi-angled locked fixation system provides the stability of the fracture. We conducted the retrospective study of the 26 patients of distal femoral fracture treated with open reduction and internal fixation using angled locking plate. The Functional outcome, evaluated by Sanders et al, was excellent in 25 %, Good in 20 %, fair in 13% and poor in 42%. Range of knee motion was 50-140° (mean 110°). Varus collapse of fracture with implant failure occurred in 2 patients. Knee stiffness was in 6 patients. Valgus malunion was in one case. Infection was found in 2 patients. Comminution either extra articular or intraarticular was associated with poor outcome.

Key words: Distal femoral fracture, angled locking plate, Varus collapse

INTRODUCTION

Distal femoral fracture is defined as the fracture involving the lower end of femur up to 9 cm from the articular surface.[1] Distal femoral fracture constitutes about 1% of all fractures and 4-7% of the femoral fracture, with bimodal occurrence; at young population it results from high energy trauma like road traffic accident or fall from height; and in older age group it results from trivial fall due to the osteoporosis.[2,3] It is difficult fracture to manage in respect of the functional outcome due to the deforming muscle forces. Varus and valgus angulation is caused by adductor and Iliotibial band. Posterior angulation is caused by pull of two heads of gastrocnemius. Shortening in comminuted fracture is the result of pull of quadriceps.[4] Operative treatment is the standard method of treatment for the distal femoral fracture to have better functional outcome.[5] There is high rate of complications like knee stiffness, loss of movement, implant failure and malunion particularly in the comminuted and intraarticular fracture. There are several implant options to treat the fracture. Nowadays angled locking plate is widely used to fix distal femoral fracture because of the ease of application and multi-angled locked fixation providing more stability of the fracture. Plate forms multiple fixed angle construct and act as internal fixator that preserves the periosteal blood supply by avoiding tight plate-bone interface and enable the patients to have rapid return of the knee movement.[6,7,8,9] The purpose of our study is to evaluate the outcome of the distal femoral fracture treated with angled locking plate.

MATERIAL AND METHOD

We conducted the retrospective study of the 26 patients of distal femoral fracture treated with open reduction and internal fixation using angled locking plate from June 2010 to June 2016. Fractures were classified by AO classification as extra articular (type A), partial articular (type B) and complete articular (type C). Type A and C fractures were included in the study requiring angled locking plate for fixation. 14 patients were treated with condylar locking compression plate and 12 patients were treated with distal femoral locking plate. 20 fractures were in the young population (mean age 36 years) and 6 patients were in older population (mean age 62 years). Distal femoral fracture was also found in the polytrauma patients with other associated fractures like acetabulum fracture (one patient), shaft femoral fracture (one patient) and proximal tibia fracture (4 patients). All the patients underwent for surgery in the supine position after the pneumatic tourniquet inflated. Open reduction and internal fixation was done using either a condylar locking compression plate or distal femoral locking plate. Stainless steel implants were used in all the patients. Condylar locking plate was preferred in low lying fracture. In the distal fragment, locked screws were used and in

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the proximal segment combination of locked and unlocked screws were used. During surgery, plate was inserted sub muscularly and extensive periosteal stripping was avoided. Bridge incision is used in most of the cases. Bone graft was added in cases having large gap with comminution. Postoperatively long knee brace was given with advice of intermittent knee mobilization. Stitches were removed in 11 days postoperative. Wait bearing was delayed till union (average union time 16 weeks) and patients were followed up for 6 months to 2 years.

RESULTS

The Functional outcome using Sanders et al criteria[10] was excellent in 25%, Good in 20%, fair in 13% and poor in 42%. Range of knee motion was 50-140° (mean 110°). Varus collapse of fracture with implant failure was in 2 cases. Knee stiffness was in 6 patients; one of them (elderly patient) underwent for implant removal and advised Total knee replacement. Valgus malunion was in one case. Infection was found in 2 patients; one of the two having union of the fracture was

Fig. 1 : Showing postoperative radiograph of distal femoral fracture

Fig. 2 : Showing intraoperative photograph with bridge plating with sub muscular plate insertion

Fig. 3 : Showing 1.5 year old follow up radiograph showing consolidation at fracture site

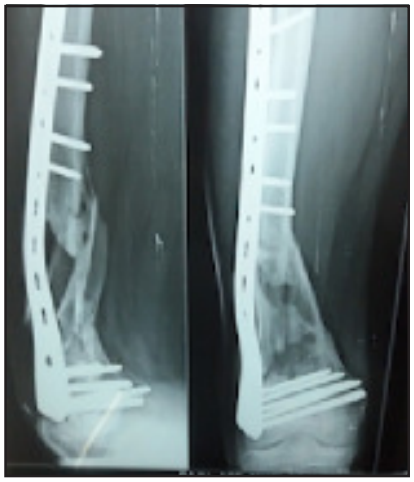

Fig. 4 & 5 : Showing varus collapse with implant failure

treated with implant removal and knee arthrodesis and second with infected nonunion of the fracture was treated with external fixation.

DISCUSSION

Management of distal femoral fracture has the persistent morbidity despite improved fixation method. Angled locking plate is an anatomically pre-contoured fixed angled implant in which locking screws provide rigid fixation and angular stability; thus prevents Varus collapse and conventional screws provide inter-fragmentary compression.[11] In our study, despite using angled locking plate, there were high incidence of poor outcome (42%). Comminution around the fracture site (extraartivular /intraarticular) was thought to be one of the chief determinant of the poor outcome.Varus collapse with implant failure occurred in two cases with extensive medial comminution involving distal shaft.

Martin et al in their study of 243 patients with distal femoral fracture treated with locked plate fixation showed non-union in 18% of patients with higher tendency of union in the close injuries. Management of soft tissue with insertion of plate sub muscular reduces the non-union rate.[12]

In our study, we had taken bridge incision in most of cases and avoided extensive periosteal stripping. We added bone graft in cases with extensive comminution.

Working length is the distance of the first screw to the fracture site. Stoffel et al showed in their biomechanical testing that keeping empty of one screw hole on either side of the fracture made the construct twice flexible in both compression and torsion. To avoid fixation failure, longer working length is recommended for simple fracture with small inter-fragmentary gap where one or two holes should be kept empty on each side of fracture to initiate spontaneous fracture healing with callus formation due to micromotion at fracture site. But in comminuted fracture if bone contact was not present at the fracture site, a longer working length result in earlier failure in dynamic load testing. For fracture with a large gap due to comminution, innermost screw is placed near to the fracture as close as possible.[13] Longer length of plate is recommended to have at least 5 screw proximally with screw density less than 60%.[14,15] In our study, adequate working length and longer plate was used to fix the fracture.

Maintenance of distal femoral alignment in sagittal and coronal plane is the crucial for the function of the limb. Zehntner et al concluded in the study of 59 patients with supracondylar -intercondylar fractures of the femur that restoration of the alignment in coronal plane was more difficult than the restoration of the sagittal plane and rotation; and the angulation difference of less than 5 degrees in any plane provided the satisfactory functional outcome.[16] In our study, sagittal angulation was restored with keeping pillow below the knee. Coronal angulation and rotation was restored with keeping the limb in the alignment.

CONCLUSION

Poor outcome is usually associated with comminution (extraarticular /intraarticular) of the distal femoral fracture, even after treated with angled locking plate. In such fracture, additional medial column support may be warranted.

Limitation of study: A large sample size is needed to draw significant conclusion.

REFERENCES

1. Chapter 186 Fracture of the distal femur.Magu NK;Text book of orthopaedics & trauma.Vol 3, 3rd edition, 2016 Jaipee Brothers Medical publication.
2. Kolmert L, Wulff K.Epidemiology and treatment of distal femoral fractures in adults.Acta Orthop Scand. 1982 Dec;53 (6) :957-62. Court-Brown CM, Caesar B. Epidemiology of adult fractures: a review. Injury. 2006; 37:691-697.
3. Martinet O, Cordey J, Harder Y, Maier A, Buhler M, Barraud GE. The epidemiology of fractures of the distal femur. Injury. 2000;31 (Suppl 3) :C62-C63.
4. Vaibhav B, Smit S, Gaurav S.Distal femoral fracture:complications and How to avoid them? Trauma International. Vol.2 Issue 1. 2016 PP 24-27.
5. Jahangir AA, Cross WW, Schmidt AH. Current management of distal femoral fractures. Current Orthopaedic Practice. 2010; 21:193-197.
6. Perren SM. Evolution of the internal fixation of long bone fractures. The scientific basis of biological internal fixation: choosing a new balance between stability and biology. J Bone Joint Surg Br 2002; 84 :1093-.
7. Bolhofner BR, Carmen B, Clifford P. The results of open reduction and internal fixation of distal femur fractures using a biologic (indirect) reduction technique. J Orthop Trauma. 1996; 10:372-377.
8. Gwathmey FW Jr, Jones-Quaidoo SM, Kahler D, Hurwitz S, Cui Q. Distal femoral fractures: current concepts. J Am Acad Orthop Surg. 2010; 18:597-607.
9. Kubiak EN, Fulkerson E, Strauss E, Egol KA. The evolution of locked plates. J Bone Joint Surg Am. 2006;88 (Suppl 4) :189-200.
10. Sanders R, Swiontkowski M, Rosen H, Helfet D. Double-plating of comminuted, unstable fractures of the distal part of the femur. J Bone Joint Surg Am 1991; 73 :341-346.

11. Haidukewych GJ, Ricci W. Locked plating in orthopaedic trauma: a clinical update. J Am Acad Orthop Surg 2008; 16 :347-355.

12. Martin FH, Clifford BJ, Debra LS, Paul T, Scott JKClinical outcomes of locked plating of distal femoral fractures in a retrospective cohort J Orthop Surg Res.2013; 8: 43.

13. Stoffel K, Dieter U, Stachowiak G, Gachter A, Kuster MS. Biomechanical testing of the LCP-how can stability in locked internal fixators be controlled? Injury. 2003;34 (Suppl 2) :B11-B19

14. Smith WR, Ziran BH, Anglen JO, Stahel PF. Locking plates: tips and tricks. J Bone Joint Surg Am. 2007;89:2298-2307.

15. Ricci WM, Streubel PN, Morshed S, Collinge C, Nork SE, Gardner MJ. Risk factors for failure of locked plate fixation of distal femur fractures: an analysis of 335 cases. J Orthop Trauma.2014 Feb;28 (2) :83-9.

16. Zehntner MK, Marchesi DG, Burch H, Ganz R. Alignment of supracondylar/intercondylar fractures of the femur after internal fixation by AO/ASIF technique. J Orthop Trauma. 1992; 6:318-326.

COMPARISON OF THE FUNCTIONAL OUTCOME AND COMPLICATIONS OF INTRAMEDULLARY NAILING THROUGH ANTEROGRADE AND RETROGRADE TECHNIQUE IN DISPLACED MIDCLAVICULAR FRACTURES

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ABSTRACT

Aims: The aim of this prospective study was to evaluate the effectiveness of intramedullary nailing in displaced midclavicular fracture and to compare the functional outcome and complications of intramedullary nailing through anterograde and retrograde technique.

Settings and Design: Prospective study.

Methods and Material: This prospective comparative study was conducted at the tertiary center between October 2013 to September 2015 after being approved by the local ethical committee. Total 33 patients ranging between 18 to 60 years of age included in this study. They were randomized into two groups to be treated by intramedullary nail either through anterograde or through retrograde technique. Clinical and radiological assessments performed at 3rd week and 6th week and 3rd, 6th, and 12th month postoperatively. Outcomes and complications compared to one year of follow-up in both groups.

Results: No significant difference found in between two groups regards to functional outcome after fracture union. Though lower blood loss, less duration of hospital stay, and better cosmetic appearance noted in the nailing group done via anterograde method. Constant shoulder scores were same between the two groups after six months of follow-up. Infection and revision surgery (non union) rates were more in nailing done through retrograde method group, and this difference is significant.

Conclusions: Functional outcome remain same in intramedullary nailing done through anterograde or retrograde technique, however, infection and complications were more in nailing done through retrograde method. Intramedullary nailing done through anterograde method is advantageous concerning better cosmetically appeared scars.

Key-words: Clavicle, intramedullary nailing, anterograde, retrograde.

INTRODUCTION

Fracture of clavicle accounts for approximately 3.2% of all the fractures and about 35% of all injuries of shoulder girdle.[1] About 80% of fractures involved the middle 3rd region and about 50% are displaced. The mean age of patients sustaining clavicular fracture is about 33 years, and males are more commonly involved.[2,3] Most common mechanism of injury is a fall or direct blow to shoulder leading to axial compressive force. Displaced midclavicular fractures were treated conservatively because early reports suggesting that non-union are very rare and mal-union are without any functional deficit and for radiographic interest only.[4,5,6] Clavicle keeps upper limb away from torso for efficient function so work as 'strut'. However recent studies concern about higher rates of delayed union, shoulder weakness, residual pain and deficits and terminally affected movements associated with non-operative treatment. Internal plate fixation and intramedullary nailing are essential operative techniques. Either technique provides superior functional results compared to the conventional method. In recently reported randomized studies regarding significant lower non-union, a new union, residual pain and deficits, the clavicular length maintained which is very crucial regarding the functional outcome of terminally affected movements. However, prospective RCT comparing these practical techniques for displaced midclavicular fractures were lacking.[4,7,8] The aim of this study was designed to examine the effectiveness of intramedullary nailing in displaced midclavicular fractures through anterograde and retrograde technique and comparison of functional outcome and complications of two standard operative procedure.

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SUBJECTS AND METHODS

This prospective comparative study to compare functional outcome and complications of displaced midclavicular fractures treated by intramedullary nailing either through anterograde or through retrograde method. Between October 2013 to September 2015 a total of 40 unilateral displaced midclavicular fractures were admitted, 33 patients included in this study along with one-year follow-up protocol. Intramedullary nailing included tense elastic nail and Rush pin used in 15 patients via anterograde technique and 18 patients through retrograde technique. Patients randomized into two groups by alternate (one by one) methods. Robinson classification treasured in choosing therapy as well as it is prognostically significant.

INCLUSION CRITERIA

1. Complete displacement.
2. Age between 18 to 60 years.
3. Unilateral clavicular fracture.
4. Marked shortening of the clavicle (<2 cms).
5. Angulation>30.
6. Fractures less than two weeks of duration.

EXCLUSION CRITERIA

1. Age below 18 and above 60 years.
2. Undisplaced fractures.
3. Bilateral clavicular fractures.
4. Severe commination.
5. Former surgery to shoulder.
6. Multi trauma patients.
7. Former chronic illness of shoulder.
8. Nonunion and malunion.
9. Pathological or open fractures.
10. Neurovascular injury.

OPERATIVE PROCEDURE

INTRAMEDULLARY NAILING THROUGH RETROGRADE TECHNIQUE

The patient positioned in 'beach chair position after giving general anesthesia with one folded towel in between shoulder blades. Through Image intensifier 45 degree caudal and cephalad orthogonal views can be obtained. Entire upper limbs from the base of neck to hand were prepared and draped. A transverse incision about 2 to 3 cm made over clavicle centering over the fracture site. Subcutaneous tissue and platysma were divided, and dissection was carried out down to fracture site. The osseous ends freed from surrounding tissue. Fracture end was freshened. Towel clip was used to elevate the ends of fracture. Appropriate size drill attached to T handle and medullary canal drilled and tapped. Lateral fragment was elevated through incision and medullary canal drilled through same size drill. Under fluoroscopic control drill was passed through posterolateral cortex of clavicle. Drill was removed from lateral fragment and medullary canal tapped. Now intramedullary nail was passed through previously drilled hole in posteromedial cortex. Once pin exits through clavicle, its tip can be felt subcutaneously and a small incision was made over palpable tip. T handle attached through pin. The pin was retracted laterally and advanced to medial end after fracture reduction. Incision site closed in layers, and a sterile dressing was applied.

INTRAMEDULLARY NAILING THROUGH ANTEROGRADE TECHNIQUE

After giving general anesthesia, patients positioned in a supine position. The nailing technique described by Jubel et.al. A small skin incision of approximately 1 to 1.5cm posterolateral to sternoclavicular joint. Fluorographic images were taken in 45degree cephalad and 45 degree caudal direction to provide the picture in two planes 90 degrees apart. Cortex was opened using sharp awl pointed posterolaterally and at 30 degrees to coronal planes, angulated in line with the clavicle. Single tense elastic nail or Rush pin varying from 2 cm to 3.5 cm depending upon the width of bone inserted under fluorographic control. Closed reduction performed using two pointed reduction clamps percutaneously. Tense elastic nail or rush pin passed through medial fragment in reduced retypes, Image intensifier should use for precise maneuvering of nailing to avoid the dorsolateral cortex perforation. The fracture ends were compressed, and the nail cut and bent close to the skin. Dissected tissue closed in layers. The postoperative sling applied to all the patients, pendulum range motion exercise advocated as soon as pain allowed. Active range of shoulder movement training promoted after 2 to 3 weeks postoperatively. Patients were encouraged to resume activities of daily living around six weeks postoperatively. Heavy work and athletic activities allowed after 12 weeks postoperatively. All patients were examined and reviewed on OPD basis during their follow-up visits. Clinical and radiological assessments were done on every visit. Constant shoulder score was used to assess functional

outcomes based on objective and subjective criteria. Secondary outcome included like operative time, incision length, blood loss, and hospital stay. Pain on visual analog scale on 1st Postoperative day documented for each patient. Complications were recorded and compared between the two standard procedures. Complexity includes nonunion, malunion, neurovascular injury, wound infection, implant migration, implant failure, hardware prominence and cosmetic aspect. Implant removal was routinely done in all the cases after fracture union.

RESULTS

At the end of this prospective study a total 33 patients were analyzed who completed at least one year of complete follow-up and as per inclusion criteria. We had 15 patients operated through anterograde technique and 18 patients operated through retrograde technique. (Table 1). In the anterograde group (1), we had 5 (33.33%), female patients, whereas there were 5 (27.77%) female patients in the retrograde group (2). Statistically, there was no significant difference between two groups on gender (p=0.398). Mean age of patients in Group I (31.79±11.05 years) was slightly higher as compared to that of patients in Group II (28.88±7.89 years) but the difference between two groups was not significant statistically (p=0.223) (Table 2). In both the groups, the majority had involvement of right side. Left side was involved in 36.4% of Group I and 39.4% of Group II patients. Statistically, this difference did not account for a significant difference (p=0.800). Mean injury time was 3.61±3.28 days in Group I as compared to 3.64±2.76 days in Group II. Statistically, this difference between two groups was not significant (p=0.968). But mean duration of hospital stay, as well as mean amount of blood loss, was higher in Group II (2.36±1.03 days and 55.30±16.77 ml) as compared to that in Group I (1.64±0.78 days and 05.30±02.77 ml) and this difference was significant statistically (p<0.05). The mean length of incision was smaller in Group I (1.10±0.2cm) as compared to that in Group II (4.38±0.75 cm). For both these parameters, the difference between two groups was significant (p<0.001). Mean pain score was higher in Group II (3.33±1.47) as compared to that in Group I (2.91±1.42) yet this difference was not significant (p=0.238) (Table 3) Time taken for union ranged from 3 to 11 months with a mean value of 5.91±1.89 months. Union time was slightly longer in Group II (6.00±2.41 months) as compared to Group I (5.82±1.89 months), but the difference between two groups was not significant statistically (p=0.701) (Table 4, Table 5).

Table 1
Group wise distribution of cases

SN	Group	Description	No. of cases	Percentage
1.	I	Patients managed with intramedullary nail through anterograde technique.	15	45.45
2.	II	Patients managed with intramedullary nails through retrograde technique.	18	54.54

Table 2
Demographic Profile of the Patients

SN	Parameter	Group I		Group II		Statistical Significance	
1.	Mean Age±SD (Range) in years	31.79±11.05 (18-64)		28.88±7.89 (20-46)		t=1.231; p=0.223	
2.	Gender	No.	%	No.	%	χ^2	'p'
	Male	10	66.67	17	72.23	0.713	0.398
	Female	5	33.33	5	27.77		

Table 3
Perioperative Evaluation

SN	Parameter	Group I		Group II		Statistical Significance	
		No.	%	No.	%	χ2	'p'
1.	Implant used	15	100	18	100	66	<0.001
		Mean	SD	Mean	SD	't'	'p'
2.	Time taken during procedure (min)	64.03	10.74	40.09	8.35	10.109	<0.001
3.	Length of incision (cm)	1.10	0.75	4.38	0.75	26.370	<0.001
4.	Pain (VAS)	3.33	1.47	2.91	1.42	1.191	0.238
5.	Hospital stay (days)	1.64	.78	2.36	1.03	3.238	0.002
6.	Average blood loss (ml)	5.30	2.77	55.30	16.77	9.851	<0.001

Table 4
Postoperative Complications and Follow up Findings

SN	Parameter	Group I (n=15)		Group II (n=18)		Statistical Significance	
		No.	%	No.	%	$\chi 2$	'p'
1.	Infection	1	3.0	1	3.0	0.000	1
2.	Wound dehiscence	0	0	0	0	0	0
3.	Non-union	0	0	1	5.5	1.015	0.314
4.	Delayed union	0	0	1	5.5	1.015	0.314
5.	Symptomatic malunion	1	6.6	2	11	0.349	0.555
6.	Major revision	0	0	1	5.5	1.015	0.314
7.	Hypertrophic scar	0	0	2	11	0.115	0.723

Table 5
Final Functional Outcome

SN	Final Outcome	Group I (n=15)		Group II (n=18)	
		No.	%	No.	%
1.	Excellent	9	60.0	10	55.5
2.	Good	3	20.0	4	22.2
3.	Fair	3	20.0	2	11.1
4.	Poor	0	00.0	2	11.1

DISCUSSION

Traditionally Displaced midclavicular fractures had been managed nonoperatively. NEER & ROWER found minuscule incidence of nonunion (0.1% & 0.8% respectively) in their studies in 1960 and recommended conservative treatment for clavicular fractures.[9,10,11] Although these results never been reproduced by anyone. Recent studies have shown higher nonunion rates in nonoperatively treated patients is approximately 5%. Recent studies also show poorer functional outcome in displaced midclavicular fractures that treated traditionally when compared to surgically treated patients. Also, the best treatment for displaced midclavicular fractures remains unclear and becomes a topic of debate. But the current recommendation for Displaced midclavicular fractures treatment is by operative fixation. Many authors advocate plate fixation as a standard operative procedure for Displaced midclavicular fractures. Plate fixation choice included 3.5 mm, dynamic compression plates, anatomically pre-contoured locking plates.[12,13] Locking reconstruction plates applied either anterosuperiorly or anteroinferior and fixed by three screws on either side of the fracture. Recent emerging mode of fixation is intramedullary nailing fixation either by anterograde or by retrograde technique. Biomechanically nailing is weak regarding better rotation control of fragments during early movement of the shoulder and thus allows the primary union. Patients can be allowed full range of motion as soon as soft tissue healing occurs.The disadvantage of plating includes damage to the supraclavicular nerve, slight higher infection rates, more soft tissue stripping and significant refracture after plates removal. The advantage of intramedullary nailing is less soft tissue trauma and enhanced bone healing.[5,6,14,15] The Higher advantage of intramedullary nailing is ease in implant removal and lesser scar in cosmetically conscious patients. In our study, constant shoulder scores were same in both groups treated either anterograde or retrograde techinque. No significant difference of standardized shoulder scores found between the two group after six months of follow-up period. Complications like infection and non union is significantly higher in retrograde group as compared to anterograde group (p value<0.05).

The limiting factor of our study is small sample size and study done at a single center. Longer RCT are needed at the various center to evaluate the outcomes and complications further. What we can conclude from our study is that both technique of intramedullary nailing is the equally alternative method for treating Displaced midclavicular fractures as for as functional outcome is concerned. Complications like infection and non union is higher in retrograde technique. Though from our study we recommended use of minimally invasive anterograde intramedullary nailing in Displaced midclavicular fractures in light of better cosmetic result in cosmetically conscious patients.

Conflict of Interest: Nil

REFERENCES

1. Sullivan JE. Injuries about the shulder joint in children, exclusive of fractures of the clavicle. Ann Surg [Internet]. 1938;107 (4) :594-601. Available from: http://dx.doi.org/10.1097/00000658-193804000-00014
2. Egol K, Koval KJ, Zuckerman JD. Handbook of Fractures [Internet]. Lippincott Williams & Wilkins; 2012. 816 p. Available from: http://books.google.co.in/books/about/Handbook_of_Fractures.html?hl=&id=pHZj29fRfLAC
3. Sethi MK, Alex Jahangir A, Obremskey WT. Orthopedic Traumatology: An Evidence-Based Approach [Internet]. Springer Science & Business Media; 2012. 454 p. Available from: https://market.android.com/details?id=book-DaEPkuoUYq8C

4. Plakogiannis C. A-0169The operative treatment for delayed union and non-union of midshaft clavicular fractures. Internal fixation and early mobilisation. J Hand Surg Eur Vol [Internet]. 2007;32:110-110. Available from: http://dx.doi.org/10.1016/j.jhse.2007.02.200

5. Tubby AH. A Clinical Lecture on Delayed Union, Non-Union and Mal-Union of Fractures: Delivered at Westminster Hospital. BMJ [Internet]. 1901;2 (2136) :1649-54. Available from: http://dx.doi.org/10.1136/bmj.2.2136.1649

6. Kohli S, Vishwakarma N, Chauhan S, Salgotra K. Non-union Clavicular Fractures Treated With Anatomical Locking Plate. Annals of International medical and Dental Research [Internet]. 2017;3 (2). Available from: http://dx.doi.org/10.21276/aimdr.2017.3.2.or2

7. Parsons J, Marcer N. Osteopathy: Models for Diagnosis, Treatment and Practice [Internet]. Elsevier Health Sciences; 2006. 341 p. Available from: http://books.google.co.in/books/about/Osteopathy. html?hl = &id = u9SPCZ7HoIEC

8. Hill CE. Is intramedullary nailing more effective than non-operative treatment in adults with displaced middle-third clavicle fractures? J Orthop Traumatol [Internet]. 2014;15 (3) :155-64. Available from: http://dx.doi.org/10.1007/s10195-014-0299-6

9. Almajali A, Alzaben R, Alahmar MR. The out Come of Conservative Treatment of Displaced Midclavicular Fractures in Adolescent, Experience at King Hussein Medical Center. Journal of the Royal Medical Services [Internet]. 2016;23 (2) :34-8. Available from: http://dx.doi.org/10.12816/0027103

10. Karibasappa A G KAG, Karibasappa A G Karibasappa A, Professor A, Orthopaedics D of, Rc SA, Davangere, et al. Surgical Versus Conservative Treatment in The Management of Displaced Mid Shaft Clavicular Fractures: A Clinical Study. J Appl Sci Res [Internet]. 2012;3 (2) : 343-6. Available from: http://dx.doi.org/10.15373/22778179/feb2014/110

11. Sling Compared With Plate Osteosynthesis for Treatment of Displaced Midshaft Clavicular Fractures: A Randomized Clinical Trial. Orthopedics [Internet]. 2012;35 (11) :961-2. Available from: http://dx.doi.org/10.3928/01477447-20121023-09

12. Ebnezar J. Chapter-06 Fracture Clavicle and Injuries around the Shoulder. In: Essentials of Orthopaedics for Physiotherapists [Internet]. 2003. p. 80-9. Available from: http://dx.doi.org/10.5005/jp/books/10292_6

13. Torrens C, Corrales M, Vilà G, Santana F, Cáceres E. Functional and Quality-of-Life Results of Displaced and Nondisplaced Proximal Humeral Fractures Treated Conservatively. J Orthop Trauma [Internet]. 2011;25 (10) :581-7. Available from: http://dx.doi.org/10.1097/bot.0b013e318210ed2f

14. Brinker MR. Review of Orthopaedic Trauma [Internet]. Lippincott Williams & Wilkins; 2013. 608 p. Available from: http://books.google.co.in/books/about/Review_ of_ Orthopaedic_Trauma.html?hl=&id=IdKxBuUJmV0C

15. Weber EC, Vilensky JA, Carmichael SW, Lee KS. Netter's Concise Radiologic Anatomy [Internet]. Elsevier Health Sciences; 2011. 512 p. Available from: http://books.google.co.in/books/about/Netter_s_Concise_Radiologic_Anatomy.html?hl=&id=r2rsC7ebMYYC

ROLE OF DXA IN DIAGNOSIS AND ASSESSMENT OF FRACTURE RISK IN OSTEOPOROTIC PATIENTS

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ABSTRACT

Introduction: Osteoporosis is a global problem occurring in every geographic area and affecting 150 million men and women worldwide. According to a WHO committee, osteoporosis operationally defined as a bone density that falls 2.5 standard deviations (SD) below the mean for young healthy adults of the same race and gender also referred to as T-score of -2.5. Dual-energy X-ray absorptiometry (DXA) scans to measure bone mineral density (BMD) at the spine and hip have an important role in the evaluation of individuals at risk of osteoporosis. DXA allows accurate diagnosis of osteoporosis, estimation of fracture risk and monitoring of patients undergoing treatment.

FRAX (Singapore FRAX model) is a computer-based algorithm that employs bone density, age, and some clinical risk factors to help patients and their doctors predict the likelihood of having a fracture in the next ten years.

Objective: This prospective randomized study attempts to evaluate the influence of FRAX score in calculating fracture risk in osteoporotic men and women. It also aims to examine the effect of clinical risk factors and femoral neck T-score on BMD.

Method: FRAX tool (Singapore FRAX model) is used to assess fracture risk utilizing T-score after knowing CRF's from 400 men and women drawn from the general population aged more than 40 years.

Results: Out of 400 individuals 220 were found to have osteopenia with T-score between -1 to -2.5. The calculated FRAX score shows >3% chance of hip fracture in 33.64% individuals and >20% chance of other major osteoporotic fracture in 4.09% people.

Conclusion: Low BMD and low T- Score has demonstrated in our study as a significant predictor of future fracture risk both in men and women. Osteopenia patients can be treated prophylactically to prevent osteoporosis in future. We have also evaluated from this study the potential clinical risk factors related to osteoporosis. Thus, identification of people at risk of osteoporosis by population-based screening programs and implementation of preventive strategies are the measures to improve health-related quality of life and reduce the personal and economic burden of osteoporosis.

Keywords: Osteopenia, bone mineral density, FRAX.

INTRODUCTION

Osteoporosis is a global health problem which affecting more than 150 million men and women worldwide. Ethnicity and race are well-known determinants of skeletal health and bone mineral density. Osteoporosis ranks as one of the five costliest diseases of aging. It causes a reduction in the bone mass and change in the bone structure, both of which eventually result in reduced bone strength and increased the propensity to fractures.[1,2,3]

Osteoporosis widely recognized as an important public health problem because of the significant morbidity, mortality and associated complications like fractures of the hip, spine, forearm and other skeletal sites.[4,5,6] Dual-energy X-ray absorptiometry (DXA) is a means of measuring bone mineral density (BMD), which is widely used and thoroughly studied technology. The DXA scan used to measure bone mineral density (BMD) at the spine and hip have an important role in the evaluation and follow-up of individuals at risk of osteoporosis. It helps clinicians advise patients about the appropriate use of anti-fracture management. Compared with alternative bone densitometry techniques, hip and spine DXA examinations have some advantages that include a consensus that BMD results can be interpreted

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using the World Health Organization T-score definition of osteoporosis, a proven ability to predict fracture risk, proven effectiveness at targeting anti-fracture therapies, and capacity to monitor response to treatment.[7,8,9,10] FRAX is a computer-based algorithm that employs bone density, age, and some clinical risk factors in predicting the likelihood of having a fracture in the next ten years.[11,12,13]

MATERIAL AND METHOD

This study conducted at the Department of Orthopedics in Sarojini Naidu Medical College, Agra. Patients fall under risk of osteopenia selected randomly from urban and rural areas. Data collected from patients include name, age, gender, height, weight, activity level, menopause, history of DM/HTN, smoking, alcohol, medications (steroids), joint problems, bone related complaints, thyroid disorders and any other risk factor for osteoporosis. At the end of the study, a total of 400 patients had included. All participants completed a questionnaire about any metabolic bone disease, any infection, and tumors. Subjects excluded if they had at least one of the conditions mentioned above. Anthropometry measurements Height and weight were measured while subjects were standing, wearing light clothing and no shoes. Body mass index was calculated as the ratio of weight (in kilograms) by height (in meters squared). The bone mass assessment was done by DXA scan. This device assesses bone marrow density (g/cm2) of hip and lumbar spine. T-score is the difference between the measured BMD and the mean value of young adults, expressed in standard deviations (SD) for an average population of the same gender and ethnicity. Patients who were found to be osteopenic with calculated T score between -1 to < -2.5 were subjected to Fracture risk assessment tool. The aim of FRAX is to provide an evaluation tool for the prediction of fractures in men and women with the use of clinical risk factors with or without femoral neck bone mineral density. FRAX is used to assess 10years probability of a major osteoporotic fracture.

RESULTS

Among the total of 400 patients, 140 (35%) were osteoporotic, and 220 (55%) were osteopenic with hip T score between -1 to -2.5 (Table 1, Table 2). The osteopenic patients subjected to FRAX tool for evaluating fracture risk. We found that 10 years probability of hip fracture is < 3% in 146 (66.36%) cases and > 3% in 74 (33.64%) cases (Table 3). The 10 years probability of major osteoporotic fracture is < 20% in 211 (95.91%) cases & > 20% in 9 (4.09%) cases (Table 4).

Table 1
Age wise Distribution of Hip T score

Age Groups (Years)	Hip T score > -1	-1 to -2.5	< -2.5	Total
41-50	15	53	21	89
51-60	20	110	56	186
61-70	3	47	38	88
> 70	2	10	25	37
Total	**40**	**220**	**140**	**400**
%	**10**	**55**	**35**	**100**

Table 2
Sex wise Distribution of Osteoporosis

Sex	Total	Osteoporotic	%
Male	40	17	42.5
Female	360	123	34.17

Table 3
10 years Probability of Hip Fracture by FRAX Score

Age group	10 yrs probability of hip fracture < 3%	>3%
41-50	17	4
51-60	23	33
61-70	5	33
> 70	2	23
Total	**47**	**93**
%	**33.57**	**66.43**

Table 4
10 years probability of Major Osteoporotic Fracture by FRAX Score

Age group	10 yrs probability of major fracture < 20%	>20%
41-50	21	0
51-60	50	6
61-70	34	4
> 70	17	6
Total	**122**	**18**
%	**87.14**	**12.86**

DISCUSSION

Osteoporosis means literally "porous bone", and characterized by a reduction in bone mineral density to a level below what required for mechanical support. In clinical practice, BMD measurements are widely used to diagnose osteoporosis and analysis in bone mass are commonly used as a surrogate for fracture risk.[14,15] The BMD values (in g/cm^2) not used for diagnosing osteoporosis. Instead, a working group of the WHO proposed to define osteoporosis by the T-score.[16,17] In a previous study, X-ray examination of the vertebral column was done for diagnosis of osteoporosis, whereas in the present study, dual energy X-ray absorptiometry (DXA) was used to assess bone mineral density in lumbar spine and femur. Dual energy X-ray absorptiometry (DXA) measurements are good predictors of fracture risk. The average radiation exposure for DXA is 1 to 3 rad per scan.[1,14,18] In our study we used DXA scan for the diagnosis of osteopenia that is supported by Rizzoli R et al. In our study among 400 selected patients 140 (35%) were osteoporotic, and 220 (55%) were osteopenic which is comparable to the study by Marwaha RK, et al. Bone health in healthy Indian population aged 50 years and above, found osteoporosis was present in 35.1% of subjects (M-24.6%, F-42.5%) and osteopenia in 49.5% (M-54.3%, F-44.9%) 19.[19,20,21] In our study, we used FRAX tool for the assessment of fracture risk in osteopenic patients, which is also supported by other studies. We found that 10 years probability of hip fracture is < 3% in 146 (66.36%) cases and > 3% in 74 (33.64%) cases and 10 years probability of major osteoporotic fracture is < 20% in 211 (95.91%) cases and > 20% in 9 (4.09%) cases by FRAX score assessment.

CONCLUSIONS

In summary, low BMD and low T-Score has demonstrated in our study as a significant predictor of future fracture risk both in men and women. Osteopenia patients can be treated prophylactically to prevent osteoporosis in future. We have also evaluated from this study the potential clinical risk factors related to osteoporosis. This study also demonstrates the utility of DEX scan in screening for osteopenia and osteoporosis due to its cost effectiveness, low X-ray dose, immediate results and no clothing restrictions. The FRAX score is assessed using international FRAX scoring system establishing that patients with low T-score are at greater risk of hip fracture and other major osteoporotic fracture in future. In our study among 400, 220 osteopenic were subjected to FRAX showing that 10 years probability of hip fracture is < 3% in 146 (66.36%) cases and > 3% in 74 (33.64%) cases. The 10 years probability of major osteoporotic fracture is < 20% in 211 (95.91%) cases & > 20% in 9 (4.09%) cases. Thus identification of people at risk of osteoporosis by population-based screening programs and implementation of preventive strategies are the measures to improve health-related quality of life and reduce the personal and economic burden of osteoporosis.

REFERENCES

1. Bartl R, Frisch B. Osteoporosis: Diagnosis, Prevention, Therapy. Springer Science & Business Media; 2009. 321 p.
2. WHO Global Report on Falls Prevention in Older Age. World Health Organization; 2008. 47 p.
3. Meeta. Postmenopausal Osteoporosis: Basic and Clinical Concepts. JAYPEE BROTHERS PUBLISHERS; 2013. 281 p.
4. Rubin C, Pope M, Chris Fritton J, Magnusson M, Hansson T, McLeod K. Transmissibility of 15-Hertz to 35-Hertz Vibrations to the Human Hip and Lumbar Spine: Determining the Physiologic Feasibility of Delivering Low-Level Anabolic Mechanical Stimuli to Skeletal Regions at Greatest Risk of Fracture Because of Osteoporosis. Spine. 2003;28 (23) :2621-7.
5. Orwoll ES, Bilezikian JP, Vanderschueren D. Osteoporosis in Men: The Effects of Gender on Skeletal Health. Academic Press; 2009. 741 p.
6. Chase JA. Spine Fractures Associated with Osteoporosis. Orthop Nurs. 1985;4 (3) :31-4.
7. Daly RM, Petit MA. Optimizing Bone Mass and Strength: The Role of Physical Activity and Nutrition During Growth. Karger Medical and Scientific Publishers; 2007. 162 p.
8. Morgan SL, Kiebzak GM. Long-Term vs. Short-Term Precision Measurement of Dual-Energy X-Ray Absorptiometry (DXA) Scans and the Impact of Interpreting Change in Bone Mineral Density (BMD) At Follow-Up. J Clin Densitom. 2010;13 (1) :136.
9. Kim E-H, Kim H-S, Dong K-R, Park Y-S, Chung W-K, Cho J-H. A study on the effects of a calcium drug on the bone mineral density (BMD) by using dual-energy X-ray Absorptiometry (DXA). J Korean Phys Soc. 2012;61 (11) :1889-97.
10. Diaz Curiel M, Botella B, Garcés MV, Ruiz Moreno M, Turbi´ C. Bone mineral density in children and adolescents measured by dual-energy X-ray absorptiometry (DXA). Bone. 2001;29 (3) :300.
11. Lou Bonnick S, Lewis LA. Bone Densitometry for Technologists. Springer Science & Business Media; 2012. 421 p.
12. Stathopoulos? I, Trovas G, Lampropoulou-Adamidou K, Zafeiris C, Tournis S, Katsalira A, et al. Application of FRAX algorithm in a sample of Greek male population - A preliminary study. Bone. 2012;50:S137.
13. Michieli R. General Practitioner and FRAX? (computer-

based algorithm). Clin Cases Miner Bone Metab [Internet]. 2014; Available from: http://dx.doi.org/10.11138/ccmbm/2014.11.2.120

14. Javier R-M, Theulin A, Chatelus E, Gottenberg J-E, Sibilia J. Assessment of clinical risk factors of osteoporosis, bone mineral density and fracture prevalence in systemic sclerosis. Bone. 2011;48:S199.
15. Burr DB. Bone Biomechanics and Bone Quality: Effects of Pharmaceutical Agents Used to Treat Osteoporosis. Clin Rev Bone Miner Metab. 2016;14 (3) :197-217.
16. Frost ML, Blake GM, Fogelman I. Can the WHO Criteria for Diagnosing Osteoporosis be Applied to Calcaneal Quantitative Ultrasound? Osteoporos Int. 2000;11 (4) :321-30.
17. Wan H, Yang D, Shen J. Comparison between SOS of quantitative ultrasound and BMD measured by DXA in diagnosing osteoporosis. Bone. 2008;43:S91.
18. Linna JM. How to Prevent and Manage Common Orthopedic Problems. Booklocker.Com Incorporated; 2010. 135 p.
19. Marwaha RK, Tandon N, Garg MK, Kanwar R, Narang A, Sastry A, et al. Bone health in healthy Indian population aged 50 years and above. Osteoporos Int. 2011 Nov;22 (11) :2829-36.
20. Marwaha R, Tandon N, Bhadra K, Mahalle N, Garg MK. Relationship of lipid parameters with bone mineral density in Indian population. Indian J Endocrinol Metab. 2014;18 (3) :325.
21. Rizzoli R, Bonjour J-P. Determinants of Peak Bone Mass Acquisition. In: Osteoporosis. 2009. p. 1-22.

SINGLE BONE FOREARM IN POST TRAUMATIC AND POST INFECTIVE COMPLICATED FOREARM

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INTRODUCTION

The first single bone forearm was performed in 1921 by Hey Groves.[1] Single bone forearm can be performed for bone loss following trauma, infection, tumours of distal radius, radial club hand and also for forearm instability.[2,3,4,5,6,7,8,9,10,11]

Although this procedure results in loss of supination and pronation but patient can still move the wrist and elbow and have a normal looking forearm. If the epiphysis in a child can be saved then growth of the forearm also may be possible. We are reporting a case of post-traumatic and post-infective forearm in a child in whom the procedure was used as a last resort for limb salvage.

CASE REPORT

A 14 year old boy fell on his left outstretched hand and developed Salter and Harris Grade II injury of his left distal Radius and lower end ulna which was fixed at some local hospital by open reduction and "K" wire fixation. (Figure 1) The patient developed infection followed by a chronic discharging sinus and sequestration of his distal radius. (Figure 2) The patient was treated by a two stage surgery where, in the first stage the sequestrum was removed and the gap in Radius was bridges by antibiotic impregnated bone cement and in the second stage following wound healing single bone forearm was constructed. At 3 months the single bone ulna to radial distal epiphysis fusion was complete and patient was able to do activities of daily living. (Figure 3).

DISCUSSION

Single bone forearm is considered useful as a last resort in post traumatic and post infective bone loss including segmental bone loss.[12,13] The complications cited include nonunion, impingement, pain and

Fig. 1 : Open distal radius ulna epiphyseal injury treated by "K" wire fixation.

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Fig. 2 : Chronic osteomyelitis of distal Radius and subluxation of distal radio-ulnar joint.

Fig. 3 : Single bone forearm with strong union.

shortening, restriction of motion and infection. Poor results can be due to infection, previous trauma, severe nerve injury and multiple surgeries also.[3] Although the French technique of bone grafting also could be used in this case but would have required a lot of bone graft and time for union. Single bone forearm saved the child by an unnecessary procedure as well as the cost and time of healing. We recommend the procedure in these situations.

REFERENCES

1. Hey Groves EW. On modern methods of treating fractures. 2nd ed. Bristol: John Wright and Sons Ltd, 1921: 320. ?
2. Maurice E. Castle. One-Bone Forearm. J Bone Joint Surg Am. 1974; 56 (6) :1223-1227. ?
3. Peterson CA, Maki S, Wood MB. Clinical results of the one-bone forearm. J Hand Surg Am. 1995; ?20 (4) :609-18. ?
4. Sidney M J, Abdo B, Eliseo VD, Randall WC, et al. Complications Following One-Bone Forearm Surgery ?for Posttraumatic Forearm and Distal Radioulnar Joint Instability. The Journal of Hand Surgery 2013; ?38 (5) : 976-982. ?
5. Izhar UH. The production of a one-bone forearm as a salvage procedure after haematogenous ?osteomyelitis - A case report. J Bone and Joint Surg [Br] 1982; 64 (4) : 454-5 ?
6. Kitano K, Tada K. One-Bone Forearm Procedure for Partial Defect of the Ulna. J Pediatric Orthop ?1985; 5 (3) : 261-387. ?
7. Arai K, Toh S, Yasumura M, Okamoto Y, et al. One-bone forearm formation using vascularized fibula ?graft for massive bone defect of the forearm with infection: case report. J Reconstr Microsurg. 2001; ?17 (3) :151-5. ?
8. Jitendra NP, Rajeeb B. Monoaxial distraction of ulna to second metacarpal followed by single bone ?forearm in massive post infective radial bone loss. Indian Journal of Orthopaedics 2012; 46 (6) :685-9. ?
9. Radovan M, Goran T, Marko K, Cedomir V, et al. Forearm Reconstruction after Loss of Radius:Case ?Report., Srp Arh Celok Lek. 2013; 141 (1-2) :100-103. ?
10. Murray RA. The one-bone forearm. A Reconstructive Procedure. J Bone Joint Surg Am, 1955; 37 (2) :366-?370. ?
11. Jesse BJ, Diego LF, Scott L, Robert WW. Reconstruction of Posttraumatic Disorders of the Forearm. J ?Bone Joint Surg Am. 2009; 91:2730-2739. ?
12. Lee SJ, Jazrawi LM, Ong BC, Raskin KB. Long-term follow-up of the one-bone forearm procedure. ?American Journal of Orthopedics 2000; 29 (12) :969-972. ?
13. Krishna R K, Aradhana TR, Srikantha KS, Preetham N. Management of bone defect in forearm by creating one bone forearm- A case Report. Indian Journal of Orthopaedic Surgery. 2015;1 (1) : 79-81.

BILATERAL SCAPHOID FRACTURE: A CASE REPORT

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ABSTRACT

The scaphoid is the most prominent of carpal bone in the first row and most frequently fractured of all the carpal bones account for 50-70%.Bilateral simultaneous scaphoid fractures are uncommon, with very few cases reported in the literature.

CASE REPORT

A 17 year old male presented in our hospital with history of fall on outstretched hand while catching a ball. Patient sustained injury to both his wrists. Physical examination showed tenderness present in anatomical snuff box on both side along with scaphoid tubercle on volar side with limitation of movements at the wrist. Xray revealed fracture bilateral scaphoid with fracture through waist of scaphoid on one side while near distal pole on other side. Patient was managed conservatively and bilateral cast given in glass holding position.

DISCUSSION

Scaphoid fractures are among the most common hand injuries at all ages. Carpal fracture account for 6% of all fractures, with scaphoid being more commonly injured.[1] Fractures to the scaphoid most commonly occur following a fall onto outstretched hand with associated wrist hyperextension. Scaphoid fractures are often occult and medical providers should have a high suspicion for any patient with reported wrist pain following trauma. If patient complain pain on provocative tests but xray continue to be normal consider MRI.[2,3,4] Scaphoid fractures have been subdivided into acute fracture, delayed fracture and the scaphoid non-union. The acute fractures will heal 90% of times if recognised early and properly immobilised. Below elbow cast is recommended in glass holding position for immobilisation of fracture for 6 weeks, regular follow up is required with serial x-rays to

Fig. 1 : Xray showing bilateral scaphoid fracture on anteroposterior view

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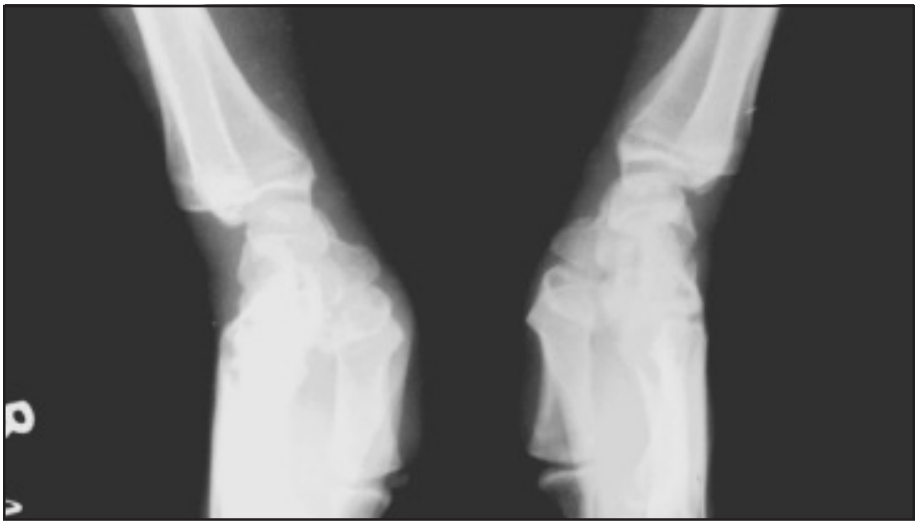

Fig. 2 : Xray lateral view showing bilateral scaphoid

see the union at fracture site. If suspected non union is there at fracture site then we can consider for ORIF.[5,6]

CONCLUSION

Although recent opinions tend to favour internal fixation for bilateral simultaneous fracture of the scaphoid bones to avoid prolonged cast immobilisation and loss of man hour at work, they can be treated successfully with conservative cast immobilisation with comparatively early return to full activity.

REFERENCES

1. Larsen CF, Brondum V et al. Epidemiology of scaphoid fractures in odense, Denmark. Acta Orthop 1992;63:216-18.
2. Freeland P. Scaphoid tubercle tenderness: a better indicator of scaphoid fracture. Arch Emg. Med 1989;6:46-50.
3. Dacruz D, Bodiwala G et al. The suspected fracture of scaphoid: a rational approach to diagnosis 1988;19:149-152.
4. Breitenseher M et al. Radiographically occult scaphoid fractures: value of MR imaging in detection. Radiology 1997;203:245-250.
5. Soto-Hall R, Halderman K. Treatment of fracture of carpal scaphoid. JBJS 16;822.
6. Adolfsson L et al. Screw fixation versus cast immobilisation for undisplaced scaphoid waist fracture. Journal of hand surgery 2001;26:192-195.

BILATERAL CLAVICULAR FRACTURE : A CASE REPORT

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ABSTRACT

Bilateral clavicular fractures are uncommonly reported in the literature with the incidence being less than 0.5% of all the clavicular fractures. Bilateral clavicular fractures are caused either by high energy transfer of compression forces across both shoulder girdles or by direct trauma to one clavicle followed by that to other clavicle. We report a case of traumatic bilateral clavicle fracture with mode of injury due to compression across shoulder girdle. Bilateral clavicular fractures should be actively sought by every trauma team with proper clinical examination and chest radiographs including both shoulder joint.

CASE REPORT

A 18 year old male was crushed inside an auto rickshaw when hit by a truck, presented to our hospital with pain, swelling and bony instability over both the midclavicular regions. He was unable to move both of his shoulder girdles due to pain.The patient had a history of a short period of unconsciousness followed by one episode of vomiting. His GCS score was normal when brought to the hospital after few hours of injury. CT scan was found to be normal. Xray chest with bilateral shoulders revealed displaced midclavicular fractures on both sides. He had no neurovascular injury in any of his upper limb. Patient was treated conservatively and clavicular brace was applied Figure 1.

DISCUSSION

Clavicular fractures are common injuries in all age groups.1 They account for 2% to 5% of all the fractures

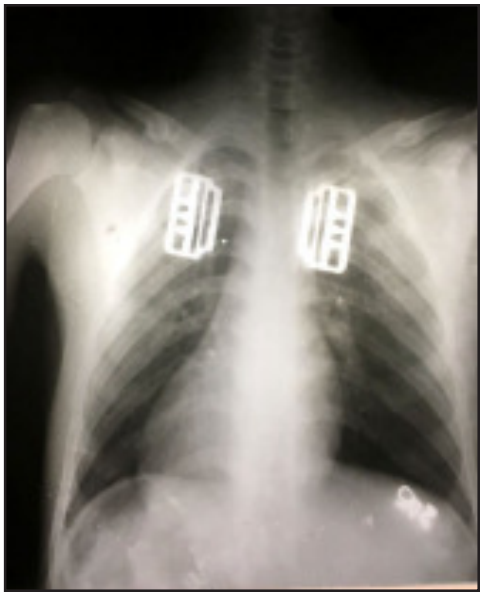

Fig. 1 : Showing chest xray with bilateral mid clavicular fracture treated by brace

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with incidence in children being >10%.[2,3] Althogh unilateral clavicle fractures are commonly encountered, bilateral clavicle fractures have been reported extremely rarely in literature. The incidence of bilateral involvement is <0.5% of all clavicle fractures.[4,5] Conservative management has been the preferred treatment modality for most of the clavicle fractures because of high complication rates reported after surgical treatment.[6,7,8] The mechanism of sustaining bilateral clavicle fractures is different from that of unilateral clavicle fracture. They are often caused by compressive force across the shoulder girdles, direct blow to both shoulder girdles or an indirect blow such as fall onto the shoulder. Bilateral clavicle fractures are usually associated with high energy trauma and therefore are associated with other concomitant injuries.

In the case described above mode of trauma was a high energy transfer of forces across the shoulder joint, due to crushing inside an auto rickshaw when hit by a truck. The patient had associated minor head injury followed by uneventful recovery. The patient was treated conservatively with a clavicular brace.

CONCLUSION

Bilateral clavicle fractures are uncommonly reported in literature. The trauma team should be more vigilant, especially in high energy trauma cases to detect and treat such injuries.

REFERENCES

1. Nowak J, Holgersson M, Larsson S. Sequelae from clavicular fractures are common; a prospective study of 222 patients. Acta Orthop. 2005;76 (4) :496-502.
2. Postacchim F, Gumina S, De Santis P, Albo F. Epidemiology of clavicle fractures. J Shoulder Elbow Surg. 2002;11 (5) : 452-56.
3. Nordqvist A, Petersson C. The incidence of fractures of clavicle. Clin Orthop Relat Res. 1994 (300) :127-32.
4. Devendra L, Kavin K, Vijay S. Bilateral clavicular fractures; A report of three cases.J Clin Diagn Res. 2016 Jun;10 (6) :01-03.
5. Puranik G, Gillham N. Bilateral fractured clavicles with multiple rib fractures. Emerg Med J. 2007;24 (9) :675.
6. Norwak J, Mallmin H, Larsson S. The aetiology and epidemiology of clavicular fractures. A prospective study during a two year period in Uppsala, Sweden. Injury. 2003;31 (5) :353-58.
7. Throckmorton T, Kuhn J. Fractures of the medial end of clavicle. J Shoulder Elbow Surg. 2007;16 (1) :49-54.
8. Rowe CR: An atlas of anatomy and treatment of midclavicular fractures. Clin Orthop Relat Res. 1968;58:29-42.

SINGLE BONE FOREARM FOR LIMB SALVAGE FOLLOWING EXCISION OF EWING'S SARCOMA FROM THE RADIUS DIAPHYSIS

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INTRODUCTION

Single bone forearm has been used by us as a last salvage procedure to treat a large segmental defect of radius following excision of an Ewing's sarcoma of the radius diaphysis. The procedure was performed by fusion of the proximal two thirds of the ulna with the distal shaft of the radius. In the process the ulna united with the distal radius and additional strength of the construct could be achieved by ulnar distal fragment getting union at this site too as an effort of nature towards salvage efforts. In this procedure although forearm pronation and supination were lost, but elbow and wrist movements were preserved and the patient could do strong work.

CASE REPORT

A 14 year old male patient developed a swelling of his left forearm. X-ray of the forearm showed an extracompartmental diaphyseal bone tumour with multiple lamellar and speculated reaction. (Figure 1) His MRI confirmed an extra-compartmental radial malignant bone tumour and pre-operativeradionuclide scanning was negative for metastasis. An open incisional biopsy was done and the histopathology report was Ewing's Sarcoma. The patient did not want an above elbow amputation and hence was planned for excision and single bone forearm surgery. The patient was given 3 cycles of neoadjuvant chemotherapy following which excision of the radial diaphysis was done in a radicle manner. (Figure 2) The ulna was cut at the level of distal radial stump and single bone forearm surgery was performed. The fixation was done with a 3.5 mm dynamic compression plating. 6 months later it was found that the reconstruction had solid union and the distal ulnar stump had also united well with remodeling. (Figure 3) This patient was given continued adjuvant chemotherapy and survived for 5 years after surgery without any local recurrence although he had several metastasis one by one for which he was treated with repeated radiotherapy and chemptherapy protocols.

Fig. 1 : X-ray of the forearm showing an extracompartmental diaphyseal bone tumour with multiple lamellar and speculated reaction.

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Fig. 2 : Radical excision of radius diaphysis along with biopsy tract.

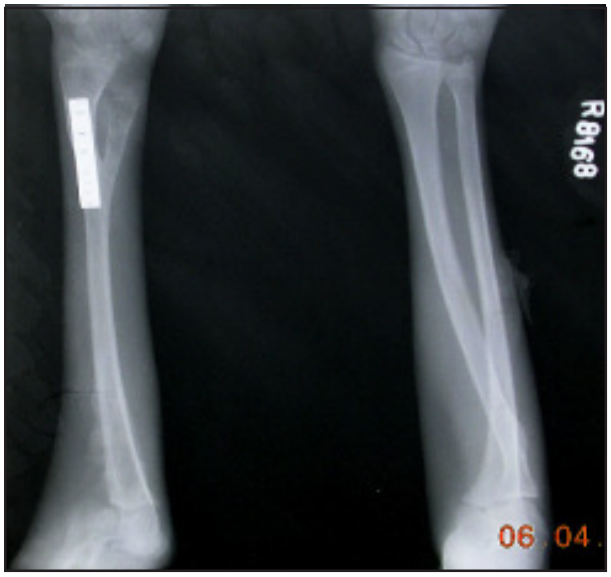

Fig. 3 : Single bone forearm with strong fusion along with diatal ulnar stump fusion.

DISCUSSION

Single bone forearm patients can be classified into two groups based on etiology: (1) post-traumatic; or (2) an oncologic or congenital etiology.[1] Superior functional and patient rated outcomes have been observed when Single bone forearm surgery has been done to treat forearm instability secondary to congenital or oncological disorders as compared to post-traumatic causes.[1,2,3]

The advantage of single bone surgery is its potential to provide a more predictable postoperative course with respect to pain and stability, especially in younger and more active patients. In our case, the application of a seemingly radical surgical intervention as the first line and definitive form of treatment proved to be a viable option that provided the patient with acceptable upper extremity function, no pain, and complete satisfaction up to 5 years of post excision survival. As nature would have it even the distal ulna united in this procedure giving a better, cosmetic and stronger forearm function.

REFERENCES

1. Jacoby SM, Bachoura A, DiPrinzio EV, et al. Complications following one-bone forearm surgery for posttraumatic forearm and distal radio-ulnar joint instability. J Hand Surg Am. 2013;38:976-982.e1.
2. Peterson CA 2nd, Maki S, Wood MB. Clinical results of the one- bone forearm. J Hand Surg Am. 1995;20:609-18.
3. Peterson HA. The ulnius: a one-bone forearm in children. J Pediatr Orthop B. 2008;17:95-101.

GLOMUS TUMOR OF THE KNEE: A CASE REPORT AND REVIEW OF THE LITERATURE

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ABSTRACT

Introduction: Glomus tumor is a rare benign soft tissue arising from modified smooth muscle cells typically occurring in a digital subungual location. The presentation is classical triad of pain, point tenderness and cold sensitivity. Extra digital locations are rare though have been described in intestine, neck mediastenum, thigh, shoulder, knee, elbow and wrist.

Case report: We report a rare case of extradigital glomus around knee which was cause of unexplained anterior knee pain. It was confirmed on biopsy

Conclusion: The awareness of the symptoms and locations of this clinical entity is necessary particularly cases of chronic unexplained pain.

Key Words: glomus tumor, knee, extra digital, cold sensitivity, histopathology.

INTRODUCTION

Glomus tumor comprises 1-5% of soft tissue tumorsthat arise from modified smooth muscle cells.[1] They present with classic symptom triad of pain, point tenderness and temperature sensitivity. Most glomus tumors represent in the subungual area of digits and extradigital tumors are a rare entity but can develop anywhere.[2] They have been reported in shoulder, elbow, knee, wrist, even stomach, colon, and larynx. Histologically, the tumors have variable quantities of glomus cells, blood vessels, and smooth muscle cells. We are reporting a case of a glomus tumor on anteromedial aspect of knee and discuss the diagnostic and histological findings.

CASE REPORT

A 47 year old male presented with a painful nodule on the antero-medial aspect of left knee joint for past 7 years (Figure 1). The exact location of the trigger point was 1 cm medial to the patellar tendon and 2 cm below the joint line in 90° knee flexion. Patient was not able to do deep knee bending activities such as squatting, cross leg sitting. Even light contact with cloths was exacerbating the pain. The pain was hypersensitive to cold. No inflammatory joint signs were observed. Conservative treatment like NSAIDS, local steroid injections, physical therapies failed to ease the symptoms.

Standard X-ray of knee was normal. MRI showed a solid well defined round mass of nearly 15 x 15 mm size in subcutaneous tissue lateral to patellar tendon. The lesion was hypo on T1 weighed sequence and hyper on T2 weighed sequences with a provisional diagnoses of neurofibroma or glomangioma (Figure 2). Excisional biopsy was planned and a small bluish nodule of 1.5 x 1.5 cm size was excised and sent for histopathological study (Figure 3a, 3b). Histopathological diagnoses was reported as glomus tumor consisting of well circumscribed encapsulated lesion composed of hyalinized blood vessels lined by flattened endothelium (Figure 4). Immuunocytochemistry staining confirmed glomus tumor as it stained positive for SMA and CD 34 and negative for desmin.

Post operatively patient had dramatic total relief of pain and patient is asymptomatic at last follow up at one year.

DISCUSSION

Glomus tumor, also termed as "Tumor of Popoff" or "Barre-Masson Syndrome" is a rare benign neoplasm most frequently occurs on fingers and toes. It has an incidence of 1.6% among 500 soft tissue tumors reported from mayo clinic.[1] At one time this tumor was considered to derive from neomyoarterial glomus structures. At present however, it is believed that tumor arise from the modified smooth muscle cells, that are found in wall of

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Fig. 1 : A painful nodule over anteromedial aspect of knee joint: marked loss of hair follicles over the lesion.

Fig. 2 : T2 weighted MRI showing hyerintense lesion adjacent to patellar tendon.

Fig. 3a : The mass can be seen with bluishtingeintraoperatively.

Fig. 3b : The mass after excision.

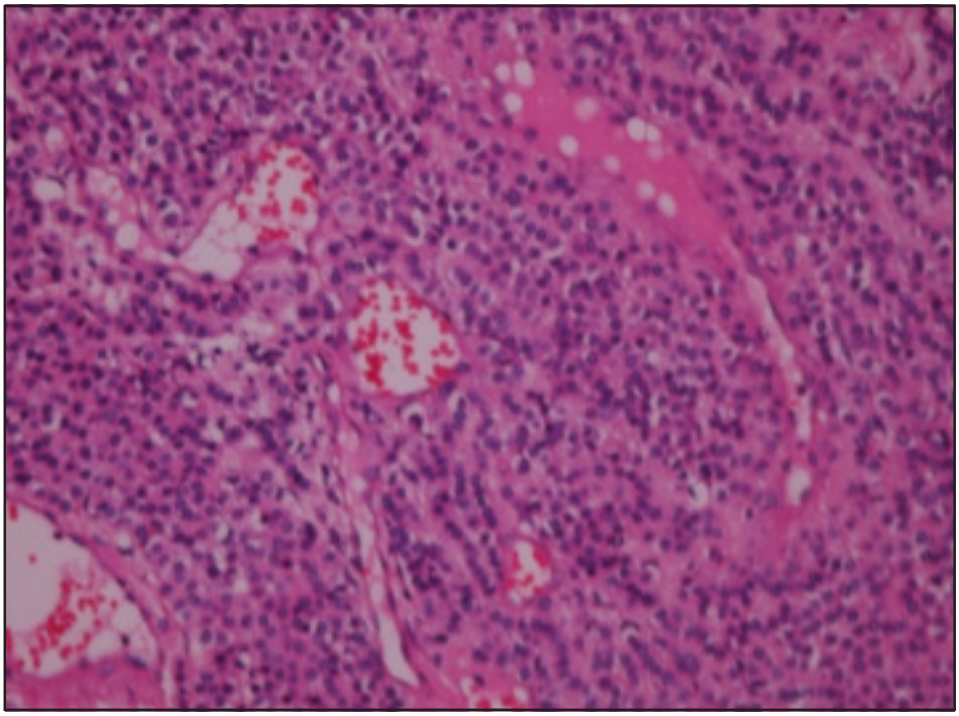

Fig. 4 : Hematoxylin and eosin stain showing hyalinized blood vessels lined by flattened endothelium.

blood vessels. They were first clinically described by Wood in 1812[3] and later explained in detail by Masson.[4]

These tumors occur most frequently in distal extremities like fingers and toes, mostly subungual.[5] However atypical extra digital locations reported are head and neck, lungs, mediastenum, stomach, intestine, mesentery, venous systems. There are multiple reported sites around knee like subcutaneous, subsynovial, patellar ligament, quadriceps muscle, lateral aspect of knee, a baker's cyst, beneath plica semilunaris, prepatellar region, within fat pad, near latellar collateral ligament, popliteal area, and at fibular head.[6-12] There are reports of glomus tumor eroding medial facet of patella and also after total knee arthroplasty.[13-14] A glomus tumor should be kept in differential diagnoses of anterior knee pain of unknown etiology for long time.

These tumors are mostly solitary and associated with a classic triad of pain, point tenderness and cold sensitivity.contraction of myofilaments of smooth muscle cell of glomus tumor due to cold temperature results in pain perception via unmyelinated nerve fibres. Reviews of hand glomus tumors have 2:1 female predominance. But extra digital glomus appears more commonly in males. Absence of classic symptoms in extra digital glomus makes them difficult in diagnosis. Compared to adults, glomus tumors in children are mostly multifocal, infiltrative, and not in subungual location rather superficially seen in extremities. Association of neurofibromatosis 1 with children with glomus tumors has been observed.[15] In children autosomal dominant type of inheritence has been observed.

Histological the tumors have variable quantities of glomus cells, blood vessels and smooth muscle cells. Histologically they are classified as solid glomus tumor (25%), glomangioma (60%) and glomangiomyoma (15%). Glomangiomyoma is rarest type and is frequently located in lower extremities. Malignant transformation is rare. Folpe et al propose the classification of malignant tumor as tumors with a deep location and a size of more than 2 cm or atypical mitotic figures or moderate to high nuclear grade.[16] MRI is a accepted method as a noninvasive tool for easy diagnoses of glomus tumor. Glomus tumor is avascular entity with typically black appearance on T1 and bright on T2 weighed image. CT scan is accepted radiologic evaluation especially in gastric glomus. Doppler USG shows vascular nature of the lesion. An ischemia test can be done even in intra articular locations. The ischemia test is the disappearance of pain after tourniquet is placed proximally.

Treatment of choice for isolated glomus is surgical excision. Accurate diagnoses followed by complete excision are regarded as curative for solitary lesions, and recurrence rates for solitary tumors are between 12 to 33%.[17] Sclerotherapy with sodium tetradecyl sulphate, poliodocinol, hypertonic saline has been reported in multiple glomangioma in extremities. Ablative therapies with argon and CO_2 laser are of potential benefit.

CONCLUSION

Glomus tumors is an uncommon condition more so when encountered in extra digital site and may pose difficulty in diagnosis in routine practice. Our case highlights the importance of maintaining high index of suspension in non anatomical distribution of clinical signs and unexplained symptoms. A glomus tumor should be kept in mind in differential diagnoses of anterior knee pain of unknown etiology for long time.

CLINICAL MESSAGE

Extradigital Glomus Tumors are rare clinical condition but are encountered in any non-anatomical site. The symptoms are classic and histopathology is diagnostic. Surgeons must be familiar with this entity and it should be kept in mind in differential diagnoses of anterior knee pain of unknown etiology for long time.

REFERENCES

1. Enzinger FM and Weis SW. Perivascular tumorss In: (Soft tissue tumors) Eds. (Weis SW &Goldblun JR, 5th Edition 2008, USA:751-767.
2. Ayala H, Villas C, Ca ˜ nadell J. Glomus tumor. ActaOrthopBelg1980; 46:219-25.
3. Wood W. On painful subcutaneous tubercle. Edin Med J 1812; 8:283-91.
4. Masson P. Le glomosneuromyoarterial des regions tactile et les tumeurs. Lyon Chir 1924; 21:257-80.
5. Kale SS, Rao VK, Bentz ML. Glomustumorof the index finger. J CraniofacSurg 2006; 17:801-4.
6. Kato S, Fujii H, Yoshida A, HinokiS.Glomus tumor beneath the plicasynovialisin the knee: a case report. Knee 2007; 14:164-6.
7. Waseem M, Jari S, Paton RW. Glomustumor, a rare cause of knee pain: a case report. Knee 2002; 9:161-3.
8. Okahashi K, Sugimoto K, Iwai M et al. Glomus tumor of the lateral aspect of theknee joint. Arch Orthop Trauma Surg 2004; 124: 636-8.
9. Negri G, Schulte M, Mohr W. glomustumour with diffuse infiltration of the quadriceps muscle : A case report. Hum Path 1997 ; 28 : 750-752.
10. Mabit C, Pecout C, Araud JP. glomustumour in the patellar ligament : A case report. J Bone Joint Surg1995 ;77-A : 140-141.
11. Amillo S, Arriola FJ, Munoz, G. Extradigitalglomustumour causing thigh pain. J Bone Joint Surg1997 ; 79-B :104-106.
12. (11) Hardy P, Muller GP, Got C, Lortat-Jacob A, Benoit J. Glomus tumor of the fat pad. Arthroscopy 1998; 14 :325-328.
13. (12) Bonner TJ, Fuller M, Bajwa A, Gregg PJ. Glomustumour following a total knee replacement : a case report.Knee 2009;16: 515-517.
14. Ibrahim El HACHMI, Emmanuel T, Jacques M, Mohamed El H:Glomustumour eroding the medial facet of the patella: A case report. ActaOrthopædicaBelgica 2012; 78: 5 -12.
15. Harrison B, Moore AM, Calfee R, et al. The association between glomus tumors and neurofibromatosis. JHS 2013; 38: 1571-4.
16. A. L. Folpe, J. C. Fanburg-Smith, M.Miettinen, and S.W.Weiss, Atypical and malignant glomus tumors: analysis of 52 cases, with a proposal for the reclassification of glomus tumors.TheAmerican Journal of Surgical Pathology2001, 25; 1: 1-12.
17. Strahan J and Bailie HW: Glomustumour. A review of 15 clinical cases. Br J Surg 1972; 59: 91-3.

RESULTS OF ANTIBIOTIC IMPREGNATED "CEMENT COATED OR POLYMER COATED" INTERLOCKING NAILS IN MANAGEMENT OF INFECTED NONUNION OF FEMUR AND TIBIA

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ABSTRACT

Background: Infected non-union in bones is one of the most troublesome orthopaedic complication for modern orthopedicians. For that thorough debridement and use of antibiotic liberating intramedullary nailing either in one or two stage procedure are widely accepted as gold standard of treatment. Our study aim to evaluate the efficacy of antibiotic impregnated cement coated interlocking nails and antibiotic impregnated polymer coated interlocking nails in management of infected non-union of long bones.

Methods: Twenty patients of infected non-union were enrolled. Their pre-operative infection level n status of fracture ends were determined on basis of various lab parameters and radiography respectively. All patients were treated with either of the implants in one stage or two stage procedure. Post-operative intravenous antibiotic was given for six weeks on the basis of culture n sensitivity testing of debrided material or pus. Periodic follow-up for infection control and osseous union were done.

Results: Out of twenty cases infection was not controlled in four cases n osseous union was not achieved in five cases. For these cases secondary procedure were used. Overall, the outcome following treatment of infected non-union was good to excellent in 60% cases (bony criterion) and 65% cases (functional criterion) as using ASAMI criteria.

Conclusions: In our study we found that there is no significant difference between these two type of antibiotic loaded nails in treatment of infected non-union of long bones as far as infection control or osseous union is concerned.

Keywords: Infected non-union, Antibiotic impregnated cement coated interlocking nail (AICCILN), Antibiotic impregnated polymer coated interlocking nail (AIPCILN)

INTRODUCTION

The causes of infected non-union are generally inherent to the fracture, like open wound, loss of soft tissue or bone, severe communition, gross displacement, vascular compromise, deep seated infection at fracture area, periosteal stripping etc.[1] Infected non-union has been known as one of difficult diseases to treat in orthopaedic field because it often shows high incidence of recurrence and resistance to treatment by producing antibiotics resistant organisms.[2,3] Traditionally, the treatment strategy has been -two staged procedure: First stage was to control infection at fracture site and second stage involved procedures to achieve osseous union. Then the single-staged procedures such as debridement and application of Illizarov' fixator has been described. The main demerits of these procedure are long morbidity period, pin tract infection and antibiotic resistance.[4,5,6,7] Presently Antibiotic impregnated "cement coated or polymer coated" interlocking nails are emerging as latest modality of treatment for infected non-union of long bones. These nails can be used to treat the infection at fracture site by delivering high concentration of antibiotics locally as well as providing stability to fracture. This high concentration antibiotics are sufficient enough for penetration of biofilm formed by bacteria on implants surfaces.[8,9,10] Hence the use of Antibiotic loaded nails not only increases the local concentration of antibiotic but also allow early weight-bearing and prevents complications associated with external fixator, such as pin tract infections, joint stiffness etc. In our series of twenty patients this novel approach to treatment of infected non-union has been applied to minimize the number of additional surgical procedures required for infection control and to achieve bone union.

MATERIAL AND METHODS

Twenty patients with infected non-union coming to OPD of our hospital (DDU Hospital Hari-Nagar, Delhi) were included in the study. The study design was prospective and sample were chosen randomly. The

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informed consent from patients and clearance from ethical n scientific committee of hospital were taken before study.

All patients had history of discharging sinuses and most of them were gone through one or multiple previous surgical procedure. Before our surgical procedure the infection level were judged through total leucocyte count, neutrophil %, erythrocytic sedimentation rate (ESR) and C-Reactive protein (CRP) testing and status of healing was determined by radiology. The pus or material obtained after debridement were sent for culture n sensitivity.

The surgeries were performed in either one stage or two stage depending on state of infection, multiplicity of previous surgery and duration between original n index procedure. We had used two types of antibiotic loaded nails as antibiotic impregnated cement coated interlocking nail (AICCILN) and antibiotic impregnated polymer coated interlocking nail (AIPCILN)

Making of antibiotic impregnated cement coated interlocking nail:[11] these nails were prepared in OT at the time of surgery after debridement and reaming of medullary canal. The essential tools were as; Solid interlocking nails, Antibiotic mixed bone cement (2gm. gentamicin + 40gm. bone-cement), Antibiotic vancomycin (2gm.), Bladder washing syringe (50ml) /cement gun, Silicon-tube (internal diameter 10 mm), K-wire1.5mm, File, BP-blade, Drill bit 3.2 mm, Interlocking bolts 3.9mm. -and Drill machine. The steps were as follows:

(i) The length of the intramedullary nail was determined with the help of metallic scale and image intensifier machine. (ii) Diameter of the nail were selected four mm less than the maximum size reamer used ie two mm corresponded coating of cement and two mm would help in easy entry of the nail in marrow cavity (iii) 2 gm of gentamicin and 2 gm of Vancomycin were used for every 40 gm of bone cement.[12] (iv) A silicon tube of length equal to nail length and internal diameter 2 mm more than the selected nail diameter was taken. (v) Manual mixing of cement were performed and cement were poured in proper sized silicon tubing with the help of bladder washing syringe/cement- gun. Side by side distal end of the tube was closed with the help of surgeon's thumb. (vi) K-wire will be placed at the site of holes of interlocking nails for insuring centralization of nail and keeping the holes patents. (vii) After setting of cement (8 minutes) silicon tubing was splitted longitudinally and cement coated nail was separated. (ix) The holes of the nail were smoothened with the help of proper size drill bits, bolts and screw driver.

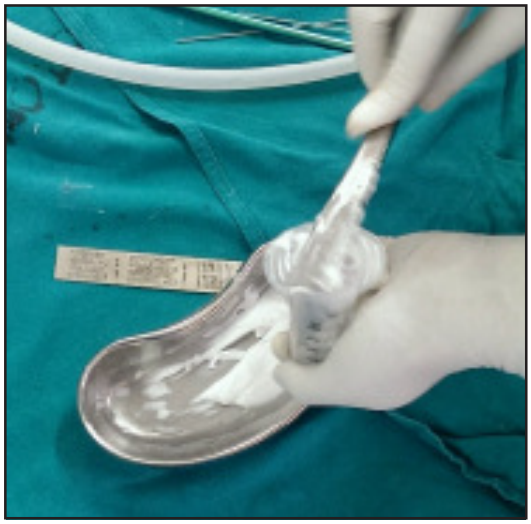
Making of antibiotic impregnated polymer coated interlocking nail: These nails were available ready made. Basically these coated implants have two layers. The first BASE LAYER which is a unique combination of antibiotic drug gentamycin and biodegradable polymer carrier poly (D, l-Lactide) which is programmed for sustained drug release. The second layer is TOP LAYER made up of same polymer which protect underlying layer from moisture light and premature activation /release. The main steps are as:

OPERATIVE PROCEDURE

After routine investigation and thorough testing for antibiotic sensitivity being used in bone cement; patients were taken for operation. The steps followed were as: (i) Patients were taken in supine/lateral position after anaesthesia. (ii) After painting and draping of patient; drapped C-ARM was positioned in proper place. (iii) Pneumatic tourniquet and exsanguinations of limb was used where ever possible. (iv) Implant removal was performed first. (v) The sinus tracts were excised; already traced with methylene blue injection. (vi) The fracture site was opened and radical debridement were performed with excision of infected bone end, scarred soft tissue and granulation tissue. (vii) The medullary canal was reamed till the fresh bleeding of medullary cavity was achieved. (viii) The reamed material and granulation tissue were sent for culture and sensitivity test. (ix) Once the debridement was completed, the instruments used for the dirty portion of the procedure were removed and the patient's limb was prepared and draped again. (x) Versatile intramedullary irrigation with 5-10 litre of normal saline was performed with pulsed lavage system.[13] (xi) The surgeon and the rest of the operating team also changed their gowns and gloves for the clean portion of the procedure.[11] (xii) Now antibiotic loaded nail was selected and interlocking nailing was performed as standard procedure. (xiii) The cases where intramedullary reaming were done maximally (eg. for femur 12 mm.) antibiotic impregnated cement coated nail were used otherwise antibiotic impregnated polymer coated nails were implant of choice. (xiv) The diameter of antibiotic impregnated cement coated nail used in this procedure was 2 mm. lesser than the diameter of maximally used reamer. But this difference was only 1 mm. for antibiotic impregnated polymer coated nails. (xv) No hammering were accepted during nail insertion that would make debonding of cement from nail. This restriction was specially with antibiotic impregnated cement coated nail.[11] (xvi) The cases where infection grade was low bone grafting were done. (xvii) Hemostasis was performed and wound was closed with or without drain.

Materials used in preparation of antibiotic impregnated cement coated interlocking nail

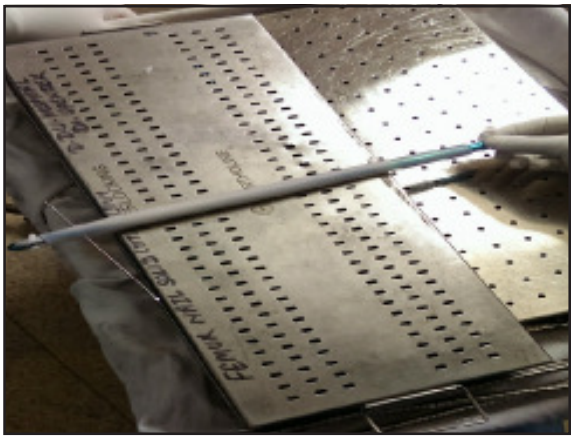
Preparation of proper size silicone tube



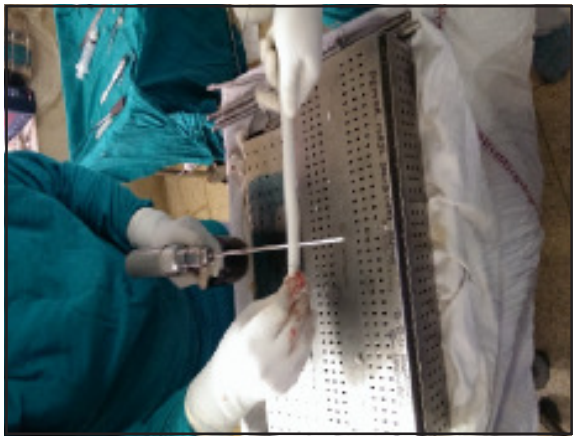
Mixing of cement and antibiotic

Filling of cement in bladder washing syringe acting as cement gun

Insertion of solid nail into cement filled tubing

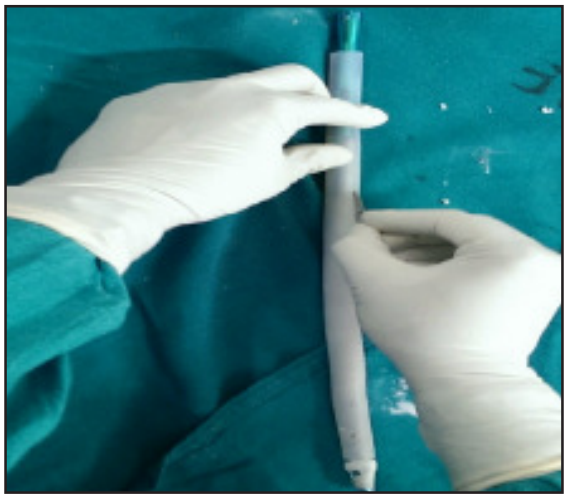


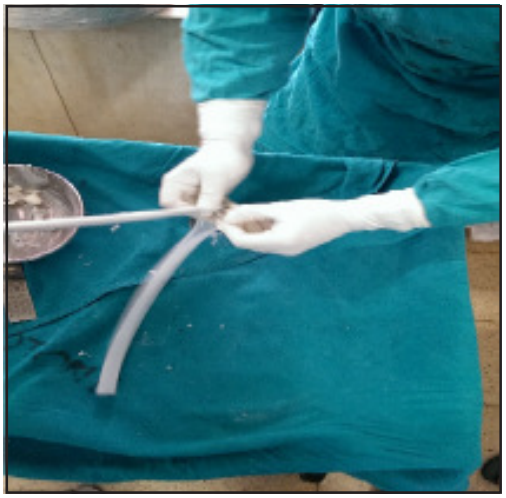
Rolling of tubing on hard surface for even distribution



Drillig of distal hole with 3.2 mm drill bit for
of cement around nail

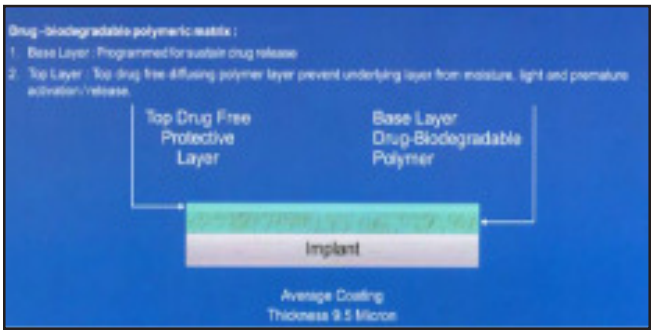
Waiting for setting of cement





Splitting of tubing

Schematic diagram of antibiotic impregnated polymer coated interlocking nail



Readymade antibiotic impregnated polymer coated interlocking nail

Those cases of infected non-unions which were operated multiple times, neglected for months and presented with pouring pus were handled in two stages. First debridement done and antibiotic impregnated cement beads were left for 6 weeks then beads removal and antibiotic loaded nailing were performed in second sitting.[14]

Post operative protocol: After surgery all patients were administered 2-4 weeks of intravenous antibiotic and 4-6 weeks of oral antibiotics postoperatively based on their culture and sensitivity reports.[15] Operated limb was kept elevated n patient was asked to do static exercises. Post-operative dressing was done immediately if any operative site soakage present otherwise done at 4th or 5th days. Stitches were removed at 14th day. Gentle joint mobilization exercises, and muscle strengthening exercises were begun as soon as the patient were comfortable.

The patients were be kept under follow up at 2 weeks interval up to minimum period of 13 months.[15] At every visit clinical examination, investigation like CBC, ESR, CRP and radiography of affected bone were done.[12] Infection was said to be controlled when CRP was less than <5 mg./lt[14] and bone was said to be united when 2 cortices (partial) or 4 cortices (complete) had bridged.[14] Although it was stable intramedullary fixation, non-weight bearing mobilization of patient were started as soon as possible. Removal of beads were done after 6-8 weeks where ever applied. Partial weight bearing was allowed at 12 weeks, when the radiographical signs of union appeared.[14] In some cases dynamisation of nail were performed at 12 weeks. Full weight bearing was allowed at 24 weeks (6 months).[14] At each follow up patients were assessed thoroughly for control of infection, progress of union, final outcome of limb and of course any complications.

The antibiotic loaded nail were left in the medullary canal indefinitely after the dual goals of control of the infection and union had been achieved. If both infection and non-union were persisted, the nails were exchanged for another antibiotic loaded nails, generally six to eight weeks after the index surgery. If there was any debonded cement in the medullary cavity, that were removed with J hook of revision THR set, sequential reaming with copious irrigation and by making distal vent or channel.[11]

Infection control was assessed by regular clinical examination, hematological investigations (CBC, ESR, CRP), as infection eradicated or not. Bony union was assessed by periodic radiological examination (cortical bridging callus formation). Final outcome of limb were assessed by ASAMI CRITERIA as excellent, good, fair, poor and failure.

ASAMI (association for the study and application of the methods of ILLIZARO) CRITERIA:

Bony results

Excellent	:	Union, no infection, deformity < 7°, limb length discrepancy < 2.5 cm
Good	:	Union + any two of the following: absence of infection, deformity < 7° and limb length discrepancy of 2.5 cm
Fair	:	Union + one of the following: absence of infection, deformity < 7° and Limb Length discrepancy of 2.5 cm
Poor	:	Non-union/re-fracture/union + infection + deformity of 7° + limb Length Discrepancy of 2.5 cm

Functional results

Excellent	:	Active, no limp, minimum stiffness (loss of < 15° knee extension/<15° dorsiflexion of ankle) , no reflex sympathetic dystrophy (RSD) , insignificant pain

Good	:	Active with one or two of the following: limp, stiffness, RSD and Significant pain.
Fair	:	Active with three or all of the following: limp, stiffness, RSD and Significant pain
Poor	:	Inactive (Unemployment or inability to return to daily activities due to injury)
Failures	:	Amputation

RESULTS

The study group included 20 patients in the age group of 23-50 years with a mean of 36.05 years. There were 13 (65%) male and 7 (35%) female. In our study group 12 (60%) were suffered from infected non-union of femur and in rest 6 (40%) patients tibia were affected. Out of 20 patients 10 (50%) patients sustained infected non-unions having history of compound injury; in 8 (40%) patients their fracture were closed and in 2 (10%) patients fracture were pathological as a result of osteomyelitis. The mean period of interval between the original procedure and index procedure was 10.85 months. On an average 1 to 2 surgical procedure had been used prior to index surgical procedure. Among 20 patients studied; 4 (20%) patients had active discharging sinuses, sinuses of 6 (30%) patients were healed and rest 10 (50%) patients were suffering from occasional discharge from infected bone. The mean value of erythrocytic sedimentation rate (ESR) and C- reactive protein (CRP) were 30.2 mm/ hr and 4.88 mg/ lt respectively. Out of total 20 patients ; the status of fracture ends were atrophic in 4 (20%) patients, hypertrophic in 6 (30%) patients and normotrophic in 10 (50%) patients. In all 20 patients, the organism isolated from their pus or debrided material were as follows:- methicillin resistant staph aureus in 8 (40%) patients, no organism cultured in 4 (20%) patients, mixed growth obtained in 3 (15%) patients, staph aureus & E.coli each in 2 (10%) patients and pseudomonas in 1 (5%) patient. The cultures obtained from all 20 patients were gone through antibiotic sensitivity testing. Their results were as follows; 8 (40%) cultures were sensitive to vancomycin, no culture n sensitivity in 4 (20%) specimen, 3 (15%) cultures were sensitive to ceftriaxone & gentamycin, 2 (10%) cultures were sensitive to imipenem & gentamycin, 1 (5%) culture was sensitive to meropenem& gentamycin and another 1 (5%) culture was sensitive to imipenem and last 1 (5%) culture was sensitive to ceftazidime. The minimum and maximum range of shortening after final debridement was 1 to 7 cm. and mean value was 3.18 cm. In present series 16 (80%) cases were handled with single stage procedure and remaining 4 (20%) cases were dealt with two stage procedure. Out of 20 cases of infected non-unions, 11 (55%) cases were treated with Antibiotic impregnated polymer coated interlocking nail and 9 (45%) cases were treated with Antibiotic impregnated cement coated interlocking nail. In our study infection was controlled in 16 (80%) patients but not in 4 (205) cases. The range of minimum and maximum period of infection control was 2-14 weeks and mean value was 7.38 weeks. In our series osseous union was achieved in 15 (75%) patients but not in 5 (25%) cases. The range of minimum and maximum period of union occurrence was 20-33 weeks and mean value was 7.38 weeks. The range of minimum and maximum duration of follow up period was 32 to 60 weeks (8-12 months) and the mean was 41.4 weeks. For all 20 cases taken under this study; their final outcome of limb was assessed by ASAMI (bony) criteria (Table 1). Excellent results were obtained in 4 (20%) cases, Good results were shown by 8 (40%) patients, Fair results were observed in 3 (15%) cases and poor result was given by 5 (25%) cases and as per ASAMI functional criteria, Excellent results were obtained in 5 (25%) cases, Good results were shown by 8 (40%) patients, Fair results were observed in 2 (10%) cases and poor result was given by 5 (25%) cases. All-together 7 cases were gone for complications where 2 (28.7%) patients suffered from persistent infection for which implant removal and debridement were done, 3 (42.9%) patients developed persistent non-union for which exchange nailing and bone grafting were done and remaining 2 (28.7%) patients persisted as infected non-unions for which revision antibiotic nailing were done. The overall infection control rate and union rate were higher with antibiotic impregnated polymer coated interlocking nails with p value of 0.285 & 0.617 respectively (insignificant ie $p>0.05$). The overall final outcome of limb as per bony criteria and functional criteria were better with antibiotic impregnated polymer coated interlocking nails with p value of 0.502 and 0.876 respectively. (insignificant ie $p>0.05$). The complication like persistent infection and persistent infected non-union were more with antibiotic impregnated cement coated interlocking nails with P value of 1.000 and 0.190 respectively but persistent non-union was found more with antibiotic impregnated polymer coated interlocking nails with P value of 1.00. Here the P value were again insignificant ie $P >0.05$.

DISCUSSION

Infected non-unions are imposing the greatest problem among orthopaedicians. These are prevalent in all ethnic groups irrespective of age and sex. Long bones are commonly affected and open fractures have higher incidence than closed fracture. The problem becomes very serious when it is operated multiple times and

patient presents with chronic osteomyelitis of bone as discharging sinus. The inflammatory marker like TLC, ESR and CRP are predictor of level of infection and proper radiographs comment on status of fracture ends.

Thorough debridement, rigid fixation, and prolonged antibiotics are the mainstay in treatment of infected non-union of the long bone. A variety of staged procedures have been described for the management of infected non-union. Intramedullary antibiotic loaded devices have been used in both infection control and bone healing in single stage but few special cases still depends upon two stage procedure. The pre-operative and per-operative culture and sensitivity determine the nature of antibiotic used for infection control. Out of these aminoglycosides and vancomycin are common choices for local and systemic delivery of antibiotics. In general, the systemic antibiotics are administered for 6 to 8 weeks until there is normalisation of inflammatory markers. The intramedullary device also ensures the fracture healing by giving stable fixation. Overall, the antibiotic loaded implant are very effective for treating infected non-unions.

CONCLUSION

We prospectively studied 20 cases of infected non-unions of long bones treated with Antibiotic loaded implants in our institution during the period of March 2013 to june 2014. We thoroughly studied these cases in terms of infection control, osseous union and final outcome of limb as per ASAMI criteria. Now it is proved that through debridement and stable fixation with antibiotic loaded interlocking nails are emerging as latest modality of treatment for infected non-union of long bones.

This prospective study was conducted in a small cohort (n=20) of patient with infected non-unions of long bones. Patient demographic and disease characteristic were random and not specified by the protocol. Furthermore infected non-unions of skeletally immature patient and non-unions without of infection were excluded from the study. The duration of follow-up period was also less.

Thus we can conclude with this message that Antibiotic impregnated "cement coated or polymer coated" interlocking nails poses a novel and effective modality of treatment in the management of infected non-unions of long bones. Large sample size, randomised controlled trials with longer duration of follow-up are needed to devise a standard treatment protocol for management of infected non-unions of long bones.

REFERENCES

1. Court-Brown CM. Fractures of the tibia and fibula. In: Bucholz RW, Heckman JD, Court Brown CM, editors. Rockwood and Green's fractures in adults. 6th ed. Lippincot Williams and Wilkins; 2006. pp. 2080-146
2. Patzakis MJ, Zalavras CG. Chronic posttraumatic osteomyelitis and Infectednonunion of the tibia: current management concepts. J Am Acad Orthop Surg.2005;13:417-27.
3. Zalavras CG, Patzakis MJ, Holtom P. Local antibiotic therapy in the treatment of open fractures and osteomyelitis. Clin Orthop Relat Res. 2004;427:86-93.bk
4. Cattaneo R, Catagni M, Johnson EE. The treatment of infected nonunions and segmental defects of the tibia by the methods of Ilizarov. Clin Orthop Rel Res. 1992;280:143-52.
5. Maini L, Chadha M, Vishwanath J, Kapoor S, Mehtani A, Dhaon BK. The Ilizarov method in infected nonunion of fractures. Injury. 2000;31:509-17].
6. Song HR, Cho SH, Koo KH, Jeong ST, Park YJ, Ko JH. Tibial bone defects Treated by internal bone transport using the Ilizarov method. Int Orthop. 1998;22:293-7.
7. Dendrinos GK, Kontos S, Lyritsis E. Use of the Ilizarov technique for treatment of non-union of the tibia associated with infection. J Bone JoiAm. 1995;77:835-46.
8. Paley D, Herzenberg JE. Intramedullary infections treated with antibiotic Cement rods: Preliminary results in nine cases. JOrthop Trauma. 2002;16:723-915.
9. Qiang Z, Jun PZ, Jie XJ, Hang L, Bing LJ, Cai LF. Use of antibiotic cement rod to treat intramedullary infection after nailing: Preliminary study in 19 patients. Arch Orthop Trauma Surg.2007;127:945-51
10. Madanagopal SG, Seligson D, Roberts CS. The antibiotic cement nail for Infection after tibial nailing. Orthopedics. 2004;27:709-12.
12. Ashok K Shyam, Parag K Sancheti, Salim K Patel, Steve Rocha, Chetan Pradhan Atul PatilUse of antibiotic cement-impregnated intramedullary nail in treatment of infected non-union of long bones Indian J Orthop. 2009 Oct-Dec;43 (4) : 396.
13. Cheng-Yu Fan, Ming-Shium Hsieh, Wei-Ming Chen, Cheng-Fong Chen. Successful Management of Infected Intramedullary Nailing With Reaming, Lavage, and Insertion of Antibiotic-Impregnated Cement Rods. Journal of Experimental and clinical medicine, Apr 5, 2011.
14. Thomas Fuchs, Richard Stange, Gerhar Schmidmaier, and MichaeJ.Raschke. The use of gentamicin-coated nails in the tibia: preliminary results of a prospecticve study. Arch Orthop Trauma Surg. 2011 October; 131 (10) :1419-1425.
15. Mayank Agrawal, P Yuvarajan, lalit Maini, V.K.Gautam:- Management of Infected non union of long bones, APOA2012

NEGLECTED POST TRAUMATIC FRACTURE DISLOCATION OF KNEE WITH SUPRACONDYLAR FRACTURE FEMUR MANAGED WITH BRIDGING PLATE AND TOTAL KNEE ARTHROPLASTY

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ABSTRACT

Acute dislocations or fracture dislocations of the knee are true emergencies as they are often associated with neuro-vascular damage. Hence, neglected fracture dislocations of the knee are rare entities.

Posterior dislocations of the knee are less common as compared to anterior dislocations amounting to only 14.4% of all acute dislocations of the knee. Dislocation of the knee may be associated with fracture of the proximal tibia. Approximately 13.6% of proximal tibial fractures are associated with severe ligamentous injuries and knee dislocations. However, fractures of distal femur are rarely seen with knee dislocation.

We are presenting a rare case, 15 years old posterior dislocation of right knee which was managed conservatively with cast application and analgesic; the patient sustained a supracondylar fracture 45 days back and was managed conservatively with above knee cast. The patient presented to us with inability to walk and deformity in right knee.Our set up the patient was managed with supracondylar plating and total knee arthroplasty

Keywords: Neglected fracture dislocation, Total Knee Arthroplasty, Old unreduced fracture dislocation.

INTRODUCTION

Posterior dislocations of the knee are less common as compared to anterior dislocations amounting to only 14.4% of all acute dislocations of the knee.[1,2] Dislocation of the knee may be associated with fracture of the proximal tibia. Approximately 13.6% of proximal tibial fractures are associated with severe ligamentous injuries and knee dislocations.[3] However, fractures of distal femur are rarely seen with knee dislocation. Hence, neglected fracture dislocations of the knee are rare entities. The impact of any injury to the knee is best defined by its effect on knee function, as described by Lorizou and also emphasized by Losee.[4,5]

CASE REPORT

A forty five years old male presented us in outpatient department with the pain with deformity in right knee since one and a half month after fall at home, In past history he had a road traffic accident 15 years back sustaining injury to right knee which was not treated and he was not bearing weight on right knee since then, he was ambulatory with crutch support.

Clinically he was having 45degree flexion deformity at right knee with posterior sag of tibia (Figure 1), further passive flexion up to 60 degree Segmental Shortening of thigh about 8 cm. There was no distal neurovascular compromise in that limb

X ray of that part showed comminuted Supracondylar fracture femur right with posterior subluxation of right knee joint with some osteophyte and some destruction of proximal tibia (Figure 2).

SURGERY

Patient was taken for surgery, intraoperatively distal femur and proximal tibial articular cartilage was found eroded. Supracondylar femur was fixed by locking plate and after preparing distal and proximal tibia total knee replacement was done for neglected Knee subluxation.

Patient was given Cylindrical Cast for 1 month. After 1 month the Cast was removed and patient was mobilized with Partial weight bearing with Walker and Knee ROM and Physiotherapy was started. Patients gained Right Knee Range of Motion from 5 - 100 degrees at the end of 3 month. Patient was ambulatory without support after 3 months post - op. X-ray at the end of 3 months showed good union of supracondylar fracture (Figure 5).

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Fig. 1 : Clinical presentation with flexion deformity and posterior sag of tibia

Figure 2 : X ray showing communized fracture supracondylar femur with posterior subluxation of knee

Fig. 3 : CT scan showed Supracondylar Fracture of Femur with displacement of fracture fragment posterior with posterior dislocation of Knee.

Fig. 5 : Post op 3 months showing united fracture

DISCUSSION

This is a rare case hardly reported in literature and provides an insight into the plan of management of the neglected fractures of the distal femur with posterior dislocation of the knee joint with total knee arthroplasty for a good functional out come with pain free range of motion.

Different modalities of treatment have been preferred by various authors previously such as ilizarov,[6] external fixator allowed staged reconstruction and early motion and provided reasonable stability, ROM, and activity level at follow-up in patients with especially in acute complex knee injuries.[7] Amputation being the last choice of treatment in patients with knee dislocation with or without associated fractures with vascular injury.[8]

REFERENCES

1. Freeman Bl Iii. Old Unreduced Dislocations; Crenshaw Ah (Ed) , In Campbell's Operative Orthopaedics, 8th Edition, Missouri, Mosby Year Book. 1992; 1374.
2. Speed K. Dislocations Of The Knee - In, A Textbook Of Fractures And Dislocations, 3rd Edition, Philadelphia, Lea And Febiger. 1935; 891.
3. More Tm. Fracture Dislocation Of The Knee. Clin Orthop May 1981; 156 : 128-40.
4. Lorizou G. Knee Ligaments, Clinical Examination. Berlin: Springer-Verlag, 1991:108.
5. Losee Res. Doc, Then And Now With A Montana Physician. New York: Lyons & Burford, 1994:212.
6. Watanabe, Kota; Yamada, Yasuharu; Kura, Hideji; Itou, Masaaki; Tsuchida, Yoshihiko; Yamashita, Toshihiko ; Ishii, Seijchi Journal Of Trauma-Injury Infection & Critical Care: Case Reports Chronic Knee Fracture Dislocation Treated By The Ilizarov Technique: Case Report January 2001 - Volume 50 - Issue 1 - Pp 151-154
7. Maurilio Marcacci, Stefano Zaffagnini, Tommaso Bonanzinga, Andrea Pizzoli, Mario Manca, And Enzo Caiaffa. Surgical Technique: Articulated External Fixator For Treatment Of Complex Knee Dislocation Clin Orthop Relat Res. Mar 2012; 470 (3) : 869-876. Published Online Oct 12, 2011. Pmcid: Pmc3270168
8. Almekinders, Louis C. M.D.; Logan, Thomas C. B.S. Clinical Orthopaedics & Related Research: November 1992 Section Ii: General Orthopaedics: Knee: Pdf Only Results Following Treatment Of Traumatic Dislocations Of The Knee Joint.

GOSSYPIBOMA IN THIGH- A CASE REPORT

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ABSTRACT

Introduction: The word Gossypibomahas been used for a retained surgical sponge/swab and is derived from gossypium (latin:cotton) and boma (Swahili-place of concealment). Other synonyms for this entity aretextiloma, retained textile foreign body (RTFB) "/muslinoma. It is rare in muskulo- skeletal surgery.

Case report: An eighteen year old boy was operated upon for failed plating of right femur. He had a globular swelling in mid thigh. There were no discharging sinuses, no signs /symptoms of infection. While operating on him to remove the failed implant and fix the fracture, while following standard procedures, we found a full size sponge embedded in the fracture site.

Conclusion: In all cases presenting with an incidental mass with/without sinus, Gossypiboma be kept in the differential diagnosis. Awareness of the condition is a must to diagnosesuch a rare condition.

Keywords: Textiloma ;gossypiboma ; osteoarticular surgery ;femur ; retained sponges.

INTRODUCTION

In 1884, Wilson[1] described the case of aretained foreign body after a laparotomy. Sincethen, many authors have reported their experiences withforgotten surgical sponges. [2-16] The true incidenceand prevalence of the gossypibomacannot bedetermined precisely because of low rate of reporting (because of its medicolegal implications). Its frequency is reported between 1/1000 and 1/32672 operations. [4,13] This pathology is mainly encounteredafter abdominal surgery (In about 75% of thecases). [13] Textilomas after bone and soft tissuesurgery are rare. [5] Some cases have been reported with forgotten sponges in surgical sites at the level of pelvis, hip, thigh and knee joint. [8] Some cases have also been reported after posterior spine surgery. [6] But no fatal complications have been reported in musculoskeletal sites. [12] Diagnosis is variable : from a loud post operative evolution, with fever, suppuration of wound, fistula track, spontaneous erosion into various hollow organs with history of surgery. [13] Reactive changes can, sometimes, mimic a bone / softtissue malignancy. [3,4,8] There may be a long asymptomatic period. [13]

Surgeon must be aware of this condition, should consciously prevent occurrence of such a thing. If this happens, it is of grave medicolegal importance to the surgeon, his reputation and of the institution he is working for. We, herewith, report a case of forgotten sponge during a femur plating surgery, recovered two years post second surgery.

CASE REPORT

An eighteen year old male presented with a failed plating of femur. He had a globular swelling over middle of right thigh. The local temperature was not raised and there were no prominent blood vessels. There were no discharging sinuses. He did not report any fever. He was operated upon for fracture shaft femur about four years back and the fracture was fixed using plate and screws at a peripheral hospital. One year later, he fell and had peri-prosthetic fracture. He was taken to the same surgeon at the same hospital where the fracture was re-fixed using plate and screws. Two years, post second surgery, he reported to this hospital in February 2013 with complaints of inability to bear weight on the right lower limb with the above findings. Radiographs showed failed implant. There was some calcification in soft tissues which was thought to be a part of fracture healing process (Fig. 1).

In operation room, while attempting to freshen bone ends after removal of failed implant, a big guazepiece (sponge) was found in between the fragments (Fig. 2). The sponge could be extricated in full with great patience without damaging any of the vital structures (Fig. 3). Some tissues had grown into it. The fracture was appropriately treated and fixed with interlocking nail andcancellous bone grafting (Fig. 4)

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Figure 1: Pre-operative x-ray of Gossypiboma in thigh. Fig shows failed implant. Some calcification is seen in soft tissues but it was thought to be a part of healing process.

Figure 2: Shows the sponge being extricated from between the bone fragments- A per-operative photograph.

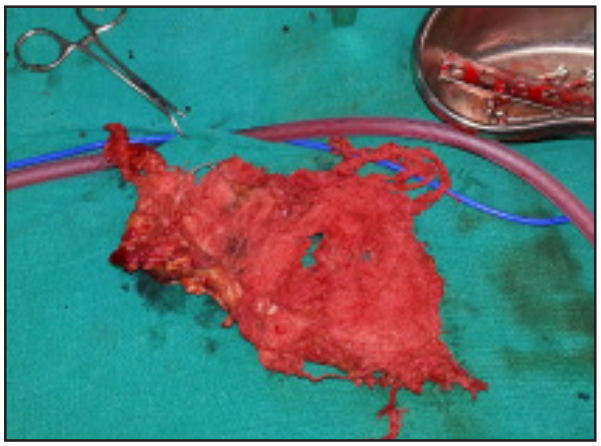
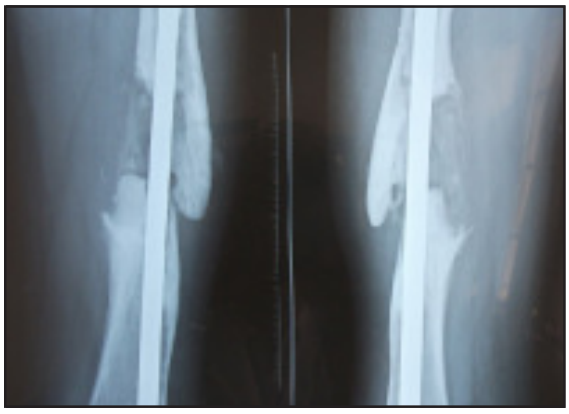


Figure 3: Photo of sponge recovered from the case.



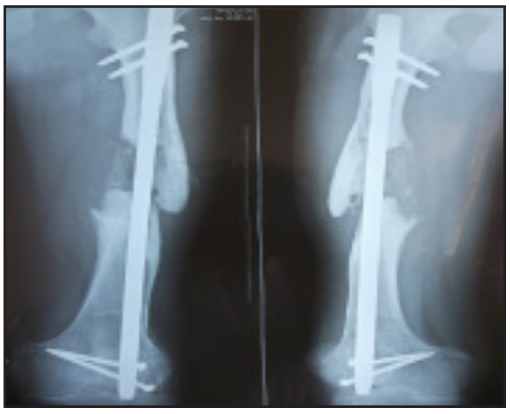


Figure 4: X-ray Photograph showing one month after surgery on first follow up visit.

DISCUSSION

A gossypiboma is an iatrogenic mass lesion caused by a forgotten sponge in the body. It may remain asymptomatic/result in abscess development[8,13] which may burst leading to sinus formation. It was silent in this case even after it had been there for over two years. No history of fever was forthcoming. It was a per -operative diagnosis as it usually is. Clinical diagnosis was initially invoked in only 35% of 117 cases reported from literature.[16] Radiographs may show gauze/sponge if it had any radio opaque markings in it.[10] In this case there was none. It may also show as a soft tissue shadow or if calcified may show a whorl like pattern.[10] In ourcase some calcification in soft tissues wasthere but it was thought to be a part of attempts at union of fracture site.

MRI, which can show textile piece in situ,[17] was not possible in this case because of the presence of implant. Moreover, it could be ordered only if we had a suspicion. Ours was a per operative diagnosis.

Gossypiboma as a complication can occur in all forms of surgery, but it is rarely reported because of medicolegal implications. Only 6% of textilomas are reported after musculoskeletal[5]/spine surgery[6] when compared to abdominal surgery (abdomen and pelvis combined is 75%).[13] No fatal complications have been noted in musculoskeletal sites.[12]

Best way to prevent gossypibomas is simple gauze counting. Eleven cases of retained sponges are reported in one series where eight had presumed incorrect sponge count.[14] Sponges with radioopaque markers can be used to identify them postoperatively and avoid later problems. But the morbidity will still occur in the form of a second surgery to remove it. Human errors cannot be completely abolished. One of the known causes is when patient is critical, bleeding on OT table and surgeon is in a hurry to control bleeding and bring patient out of OT. Another reason is high work pressure and late night emergency surgical procedure where surgeon is tired. However, there can be no excuse for lapse and if there were a court case surgeon (alone) is wholly responsible for this lapse.

CONCLUSIONS

Its incidence can certainly be reduced by strict training schedules, like using only sponges with radioopaque markers, sponge counting, per-operative radiographs to confirm that none was left inside. But, these images, taken with image intensifier in operation room, are mostly of sub optimal quality and are of no help. Another suggestion could be research focused on inert and absorbable sponges soliciting little inflammatory reaction could help eradicate the problem. While awaiting future improvements, the most importantthing to do is not to forget to consider atextiloma in the differential diagnosis of a previouslyoperated patient presenting an incidentalmass. But in orthopaedics, discharging sinuses (which are there after any infection) can not, always, be indicative of a retained textile foreign body. However, pre-operative diagnosis of Gossypiboma can be made with high degree of suspicion alone.

CLINICAL MESSAGE

- One must ensure that no sponges are left inside because it is of great medico-legal/consumer court significance.
- Orthopaedic surgeons should keep Gossypiboma in differential diagnosis of any case presenting with an incidental mass with/without discharging sinuses. Though rare, Gossypibomas do occur in musculo-skeletal surgery.

REFERENCES

1. Wilson C. P. Foreign bodies left in the abdomen after laparotomy. Gynecol. Tr. , 1884, 9, 109-112.
2. Rajagopal A, Martin J. Glossipiboma:" A surgeon's legacy": Report of a case and review of literature. Dis Colon Rectum 2002; 45:119-20[PUBMED}.
3. Mboti B, Gebhart M, Larsimont D, Abdelkafi K. Textiloma of thigh presenting as a sarcoma. Acta Orthop Belg 2001 ;67:513-8.
4. Grieten M, Van Poppel H, Baert Al, Oyen R. Renal pseudo tumor due to a retained perirenal sponge:CT features. J Comput Assist Tomogr 1992;16:305-7[PUBMED]
5. Kominani M, Fujikawa A, Tamura T, Naoi Y, Horikawa O. Retained surgical sponge in thigh : report of third known case in the limb. Radiat Med 2003;Sept-Oct. 21 (5) :220-2. {PUBMED-Full text}
6. Atabey C, Targut M, Ilico A T. Retained surgical sponge in d/d of para spinal soft tissue mass after posterior spinal surgery. Report of 8 cases. Neurol India 2009;57:320-23.
7. Patel AC, Kulkarni GS, Kulkarni SG. Textiloma in the leg. Indian J Orthop 2007;41:237-8
8. . J. C Sane, L. Lamah, EHS Camara, AN Kasse, M Tall, B. Mbaye, B Thian, A Bourso, MHSy. Gossypiboma in osteo articular surgery. A report of 5 cases. Nigerian Journal of Orthopaedics and Trauma. Vol. 7 (2) 2008:pp 79-81.
9. Malot R & Devi SM:Gossypiboma of thigh mimicking soft tissue sarcoma. Case report 7 review of literature. J Orthopaedic case reports 2012 July-Sept. 2 (3) uploads/ 2012/11/jocr-July-Sept-2012-article-6 pdf.
10. Mouhsine E, Garofalo R, Cikes A, Leyvraz PF. Leg textiloma. A case report. MedPrincPract 2006;15:312-5.
11. Kouwenberg IC, FrolkeJPM. Progressive ossification due

to retained surgical sponge after upper leg amputation. A case report. Cases Journal 2009 ncbi. nim. nih. gov.

12. ILiessi G, Semisa M, Sandini F, Roma R, Spaliviero B, Marin G. Retained surgical gauzes:Acute and chronic Ct and US findings. Eur j Radiol 1989;9:182-86
13. Andronic D, Lupascu C et al. ChiRurgia (Bucur). Gossypiboma-retained textile foreign body (article in Rumanian) 2010, Nov-Dec;105 (6) 767-77
14. LiessiG, SemisaM, SandiniF, RomaR, SpalivieroB, MarinG. Retained surgical gauzes:Acute and chronic CT and US findings. Eur J Radiol 1989;9:182-86
15. Bani-Hani KF, Gharaibeh KA, YaghanRj. Retained surgical sponges (Gossypiboma). Asian J Surg 2005;28:109-15.
16. Ile Neel J. C. De Cussac J. B. , Dupas B, letessier E, et al. A propos de 25 cas et revue de la literature. Chirurgie, 1994-1995, 120, 272-277.
17. Lo CP, Hsu CC, Chang TH. Gossypiboma of the leg:MR imaging characteristics. A case report. Korean J Radiol 2003;4:191-3.

SIMULTANEOUS ARTHROSCOPIC RECONSTRUCTION OF CHRONIC ANTERIOR AND POSTERIOR CRUCIATE LIGAMENTS IN MULTILIGAMENT KNEE INJURIES

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ABSTRACT

Introduction: Multiligamentous injuries, with increased high velocity trauma and incidence, pose a challenge for today's orthopaedic surgeon, so as to reconstruct both the cruciates (or not) along with meniscal lesions and rehabilitation. In this prospective study, simultaneous cruciates reconstruction with hamstring tendon grafts and the outcomes of such knee are studied.

Material and Methods: This prospective study was performed on ten patients with combined chronic ACL-PCL injuries who underwent simultaneous arthroscopic ACL-PCL reconstruction with autologous hamstring tendons. Evaluation of functional outcome was by IKDC score.

Results: In the present study mean age of patients was 34 years, with six of the patients belonging to some sort of national security sector. Return to full-time work was around 12 weeks and to sports or rigorous activity seven months. All patients had full range of motion except for two patients with 5 degrees of flexion loss; All had negative Lachmann test and pivot shift and at final follow up. Mean IKDC score was 90 (range 81 - 94) and all patients had subjective satisfaction.

Conclusion: Simultaneous arthroscopic ACL and PCL reconstructions using hamstring tendon for combined ACL and PCL injuries is clinically effective, safe, time saving and cost-effective procedure with better patient compliance and timely return of motion and function.

Keywords: Arthroscopic, Hamstring, Simultaneous ACL/PCL Reconstruction, Cruciate

INTRODUCTION

With increased high velocity trauma and more competitive sports activities on rise, the knee joint has been one of the most commonly injured resulting in multiligament injury and instability. Combined ACL and PCL injury are also being diagnosed increasingly and subjected to treatment. After gaining significant experience with ACL reconstruction worldwide, the focus has now shifted to simultaneous reconstruction of both the cruciatesligements in one sitting, thereby addressing the instability of knee at once with shortened rehab and faster return to activity. Staged procedures are much more time consuming for the patient, and it requires two operative procedures as well as two rehabilitation programs.[1,2]

There have been a few studies regarding multiligamentous knee injuty but there is no consensus yet on material of graft, technique orrehabitation protocol.[3,4] Allografts, though recommended, are expensive, not easily available and have delayed remodeling.[5] So, autologous hamstring grafts from both limbs were harvested for reconstruction as it has minimum donor site morbidity, adequate strength and good experience with the surgeons.[6,7]

In this study, ten patients with combined chronic ACL and PCL injury were addressed arthroscopically with single sitting reconstruction of both the ligaments with hamstring tendon grafts.

MATERIAL AND METHODS

This study was conducted during November 2012 to 2016 on ten patients with combined ACL-PCL injuries who underwent simultaneous arthroscopic ACL and PCL reconstruction with hamstring tendon autografts. The patients with associated fracture, acute injury, previous ligament reconstruction, neoplasm or skin infection were excluded from the study.

Patients underwent a preoperative physical examination clinical diagnosis of ACL tear was determined by positive findings on anterior drawer test, Lachmann's test, and pivot shift test and of PCL tear by positive findings on posterior drawer test and posterior

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sag (Godfrey test).

In all the cases, neurovascular status was checked and antero-posterior and lateral radiographs of the knee and MRI were obtained.

SURGICAL TECHNIQUE

The patient was placed supine under spinal anaesthesia with both legs draped.After performing diagnostic arthroscopy and confirming the diagnosis, gracilis and semitendinosus tendon grafts were obtained from both the legs with a tendon stripper using an incision just medial to the tibial tubercle. Quadruple graft was made separately for ACL and PCL and tensioned after graft preparation.

Under fluoroscopy guidance, PCL tibialtunel tunnel preparation done wih the help of PCL jig and 2.4 mm drill pointed guide wire, which was protected with the protector at end of the tunnel (Figure 1). Appropriate size of tunnel was drilled with flower shaped cannulated drill bit. A double folded loop of stainless steel wire was passed through the tunnel and retrieved from posterior end of tunnel by a grasper from AM portal, shuttled with ethibond no. 5.

The portal was changed with telescope on AM portal and PCL femoral tunnel was drilled transportally with free hand technique over the PCL footprint, followed by drilling with 4.5 mmcannulated drill bit and then fower shaped cannulated drill bit of appropriate size.

The telescope was switched to AL portal and ACL femoral tunnel was transportally made and drilled as per appropriate graft size. Then Ethibond or fiberwire no. 5 was passed in the femoral tunnel, followed by which ACLtibial tunnel was drilled with ACL jig. ACL Ethibond was retrieved from tibial tunnel and then PCL tibial tunnel thred was shuttled with PCL femoral tunnel. Both the grafts were embedded with appropriate size of Endo CL after reassessing both the tunnel size.

The PCL graft was passed through appropriate end; Passage of button posteriorly and shuttling through thread with fixation anteriorly with interference screw at 90 degrees of knee flexion after reduction of posterior translation of tibia was done.

Similarly, ACL graft was passed, shuttled and fixed in knee extention with anteroposterior screw.

Arthroscopic confirmation of stability with both the reconstructed ligaments was assessed followed by closure.

The knee was braced in extension in the first 2 weeks. The brace was used for the first 2 months at rest, locked in 0° to prevent extension limitation, and was also used when bearing weight to prevent hyperextension. Isometric muscle contraction and patella manipulationwere performed. Flexion and active assisted knee range of motion exercise began from the third week. Full range of motion was started by the end of third week, along with partial weight bearing ambulation with long knee brace for three weeks and full weight bearing for six weeks. Follow-up was done monthly for 6 months and then at one year. Proprioception exercises were started by eight to twelve weeks as per knee range of motion. Atlast follow up, no patient had more than 5 degrees of extensor lag. Grading was done by International Knee Documentation Committee (IKDC) score.

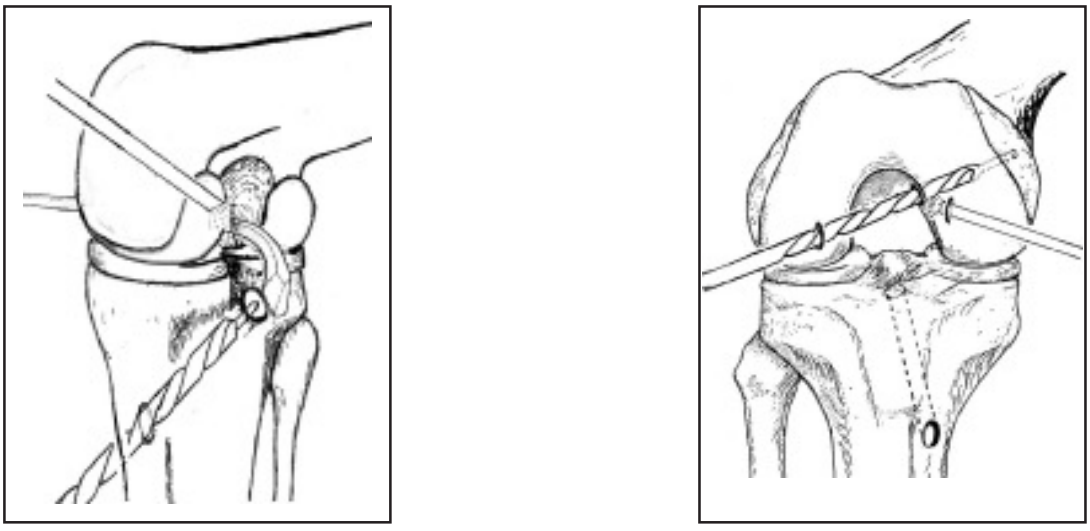

Fig. 1 : PCL tunnel

RESULTS

Simultaneous ACL/PCL reconstruction was done in ten patients, all males, with hamstring tendon auto graft; the mean duration of follow up was 15 months (12 to 25 months). The mean age at time of surgery was 34 years (range 20-42 years) with no side predilection. The mean time from injury to the reconstructive procedure was nine months (range 3 to 12 months). The mechanism of injury was sports activities in four patients and road traffic accidents in six patients. The mean operating time (also the total tourniquet time) was 110 minute (range 100 - 130 minutes). Three patients required partial menisectomies for associated meniscus tears (two patients had medial meniscus tear and one had lateral meniscus tear).

At the last follow-up, no patients showed knee extension limitation. Knee flexion degree was 143° on average (range, 130° to 150°). Manual examination showed that Lachman sign was (+) in 1 joints (10%) , (-) in 9 (90%) ; Anterior drawer sign (ADS) was (+) in 1 joints (10%) , (-) in 8 (53%) ; pivot shift sign was (+) in none ; and posterior drawer sign (PDS) was (+) in no joints.

As per IKDC score at last follow up, 7 (70%) patients had average score of grade A (70-100) and three had grade B (50-70). The patients who had grade B score included the patients with old injury and more quadriceps atrophy. The average duration of rehabilitation process was 12 weeks. The mean time to return to full-time work and to full sports was 8 weeks and 6 months. No joint was "abnormal" or "severely abnormal" (grade C or D). Two of the patients had serous discharge post-operatively from donor site for six weeks which had no growth on culture media and eventually subsided and one patient (with highest tourniquet time) had a bleb over tourniquet site, which healed uneventfully. No other major complications in the perioperative and postoperative period, such as wound healing problems, thrombosis, pulmonary embolism, or infections, were encountered.

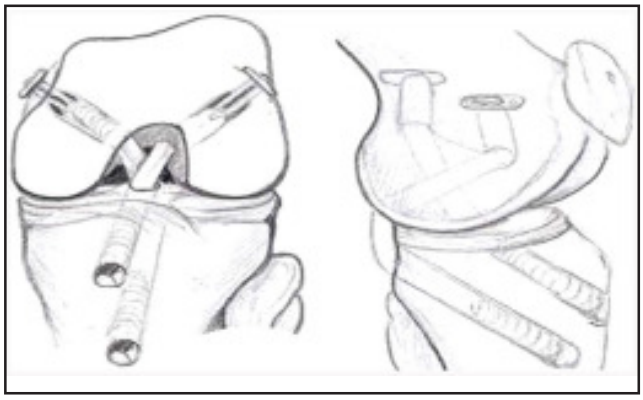

Fig. 2 : The grafts were placed through the bony tunnels, which were precisely created to reproduce the anatomic insertion site of thebundle of the PCL, and the anatomic insertion site of the ACL, which were simultaneously secured with the endo-button technique in femur and BioRCI screw in the tibia.

Fig. 3 : Immediate post op radiograph

Fig. 4 : Two year post op radiograph

Fig. 5 : Clinical photograph at two year

Fig. 6 : Clinical photograph at two year follow up

DISCUSSION

There are various opinions regarding the treatment of combined injury of the ACL andPCL, conservative treatment', solitary ACL reconstruction, two-stage reconstruction of the ACL and PCL, and simultaneous reconstructionof the both ligaments'.[1-3] Because PCL injury has lesser subjective effect on knee function with lesser knee arthritis as compared to ACL injury and is also surgically less easily accessible, previously PCL was either left untouched or constructed at second stage.[10,11]

Studies have shown that primary surgical repair yields better results than conservative treatment with regardto the objective stability and motion of the joint.[12] Simultaneous ACL/PCL reconstruction through openprocedure has also been reported with good results.[7,13] One stage reconstruction of combined ligamentinjuries can restore adequate knee stability; Simultaneous reconstruction of both cruciate ligaments is more advantageous than two stage reconstruction to regain a stable knee and also achieve a correct rotation axis.[14] Open ligamentous reconstruction with acute injuries have good healing potential, but also may cause arthrofibrosis, hence calling for arthroscopic intervention.[14]

The choice of grafts is one of the most important issues on reconstructing multiple ligaments. Allogenous tissues are not available easily, hence autografts serve as choice of graft for reconstruction. Fanelli et al reported the technique of simultaneous arthroscopic reconstruction of the ACL and PCL in 1996, and the 2- to 10-year follow-up results of 35 cases in 2002. In the studies, allograft Achilles tendon, allograft bone-patellar tendon- bone, autograft bone-patellar tendon- bone, and autograft hamstring tendon were used. Statistically significant improvement was noted in knee stability and function.

Wascher et al. reviewed the results of 13 patients (9 acute, 4 chronic) who underwent simultaneous

reconstruction of the cruciate ligaments using fresh-frozen Achilles or patellar tendon allograft and found 6 patients (5 abnormal, and 1 grossly abnormal) having abnormal IKDC rating.[7] Mariani et al. studied over 15 patients retrospectively who underwent arthroscopic reconstruction with hamstring and patellar tendon autograft, and observed, on final IKDC evaluation, 7 were graded B, 3 were graded C, and 1 patient was graded D.[15] Lo YP et al. (21) using hamstring and quadriceps tendon auto grafts reported 82% (9 of 11) of the patients normal or nearly normal (grade A or B) in IKDC rating.[16] Based on previous biomechanical studies, the graft construct using Hamstring graft has strength comparable to the bone patellar tendon bone graft secured with interference screws.[17] However, one of thecritical issues when using the autograft is potential graft site morbidity as more than two graft constructs are needed in combined ligament reconstruction. Still, multi-strand, bilateral hamstring tendon graft was preferred over bone patellar graft in this study for reconstruction because of the size, superior structural properties, and easy passage through bony tunnel.

The normal PCL is 2 times as strong as the ACL. It was reported that the ultimate load in the intact PCL was determined to be around 1, 800 N for the entire ligament in a study by Harner et al.[18] The maximum strength for a quadruple semitendinosus/ gracilis tendon was measured to be around 4,000 N in a study by Hoher et al.[19] So it seems that the initial strength of a 4-stranded hamstring tendon is good enough for both ACL and PCL reconstruction.The obvious weaknesses of this study are that there were only ten patients and the duration of the injury was not constant in every patient. Also, there is no comparative group using other methods of reconstructing the ACL and PCL.

CONCLUSION

Performing simultaneous arthroscopic ACL and PCL reconstructions using hamstring tendon auto grafts for combined ACL and PCL injuries is an optimal method that is effective and reproducible for a timely return of motion, strength, and function with favorable outcome. It is a safe, reliable, time saving and cost-effective option with better patient compliance without compromising the functional results

REFERENCES

1. Fanelli GC, Edson CJ. Arthroscopically assisted combined anterior and posterior cruciate ligament reconstruction in the multiple ligament injured knee: 2- to 10-year follow-up. Arthroscopy 2002;18:703-714.
2. Ohkoshi Y, Nagasaki S, Shibata N, Yamamoto K, Hashimoto T, Yamane S. Two-stage reconstruction with autografts for knee dislocations. ClinOrthop2002;398:169-175
3. Colosimo AJ, Carroll PF, Heidt RS Jr, Carlonas RL. Simultaneous ACL and PCL reconstruction.J Knee Surg2003;16: 191-196.
4. Hoher J, Scheffler S, Weiler A. Graft choice and graft fixation in PCL reconstruction. Knee Surg Sports TraumatolArthrosc2003;11:297-306
5. Noyes FR, Barber-Westin SD. Reconstruction of the anterior and posterior cruciate ligaments after knee dislocation. Am J Sports Med 1997;25:769-778
6. Panigrahi R, MahaparaAOutcome of Simultaneous Arthroscopic Anterior Cruciate Ligament and Posterior Cruciate Ligament Reconstruction With Hamstring Tendon Autograft: A Multicenter Prospective Study. Asian J Sports Med. Inpress. 2016:e29287
7. Wascher DC, Becker JR, Dexter JG, Blevins FT. Reconstruction of the anterior and posterior cruciate ligaments after knee dislocation. Results using fresh-frozen nonirradiated allografts.Am J Sports Med. 1999;27 (2) :189-96.
8. Zhao, Jinzhong et al. Simultaneous Arthroscopic Reconstruction of the Anterior and Posterior Cruciate Ligaments WithAutogenous Hamstring Tendons.Arthroscopy. 2006 May;22 (5) :497-504.
9. Piontek T, Ciemniewska-Gorzela K, Szulc A, Naczk J, Wardak M, et al. (2013) Arthroscopically Assisted Combined Anterior and Posterior Cruciate Ligament Reconstruction with Autologous Hamstring Grafts-Isokinetic Assessment with Control Group. PLoS ONE 8 (12) : e82462.
10. Kobayashi, T., Fujikawa, K., Takeda, T., et al.: Secondary osteoarthritic changes after chronic posterior cruciate ligament injury. Journal of Tokyo Knee Society. 1992; 13 : 97-100.
11. Tegner, Y., Lysholm, J., Gillquist, J.: Two-year follow- up of conservative treatment of knee ligament injuries. ActaOrthop. Scand., 55:176-180, 1984.
12. Almekinders LC, Logan TC. Results following treatment of traumatic dislocations of the knee joint. ClinOrthopRel Res 1992;284:203-207.
13. Ibrahim SA. Primary repair of the cruciate and collateral ligaments after traumatic dislocation of the knee.J Bone Joint Surg Br 1999;81:987-990.
14. Hayashi R, Kitamurac N. Simultaneous anterior and posterior cruciate ligament reconstruction in chronic knee instabilities: surgical concepts and clinical outcome.Knee Surg Sports TraumatolArthrosc (2008) 16:763-769
15. Mariani PP, Margheritini F, Camillieri G. One-stage arthroscopically assisted anterior and posterior cruciate ligamentreconstruction. Arthroscopy 2001.17:700-707.
16. Lo YP, Hsu KY, Chen LH, Wang CJ, Yeh WL, Chan YS, et al. Simultaneous arthroscopic reconstruction of the anterior and posterior cruciate ligament using hamstring

and quadriceps tendon autografts. J Trauma.2009;66 (3) : 780-8

17. Yamanaka M, Yasuda K, Tohyama H, Nakano H, Wada T. The effect of cyclic displacement on the biomechanical characteristics of anterior cruciate ligament reconstructions. Am J Sports Med. 1999;27:772-777

18. Harner CD, Vogrin TM, Hoher J, Ma CB, Woo SL. Biomechanical analysis of a posterior cruciate ligament reconstruction. Deficiency of the posterolateral structures as a cause of graft failure. Am J Sports Med 2000;28:32-39.

19. Hoher J, Scheffler S, Weiler A. Graft choice and graft fixation in PCL reconstruction. Knee Surg Sports TraumatolArthrosc 2003;11:297-306.

MANAGEMENT OF UNSTABLE INTERTROCHANTRIC FEMUR FRACTURES BY PROXIMAL FEMORAL NAIL- A PROSPECTIVE STUDY

Kundu A.K.* **Wale N.**** **Phuljhele S.***** **Banchhor R.******

ABSTRACT

Background: The incidence of intertrochanteric fracture has increased significantly during recent years due to the advancing age of the world's population. Proximal femoral nail (PFN) was devised in 1996 for unstable intertrochantric femur facture with various biomechanical advantages over Dynamic hip screw(DHS). Our purpose of study was to evaluate the functional and radiological outcome of unstable intertrochantric fracture fixation by PFN and to observe the complications associated with it.

Material and Methods: In a observational, prospective study we evaluated 53 cases of unstable I/T# between Oct 2014 - Oct.2016, that underwent PFN in Dept of Orthopaedics, DR BRAM Hosp& Pt.JNM Med college, RAIPUR (C.G.). Patients included with age more than 18 years, intertrochanteric fractures of unstable TypeA2.2-A3.3 (AO/OTA classification) less than 3 weeks duration whereas patients of I/T fractures with subtrochanteric extent, pathological fractures due to tumor lesions and previous incapacity to walk, were excluded from this study. The functional assessment was made through analysis on Harris Hip score and radiologically by measuring neck shaft angle and TAD index at every followup visit of 6 wk, 3 month, 6 months and finally 1 year after the surgery.

Result: End result of clinical assessment over 1year period showed mean Harris Hip score to be 84.4. Thirty nine patients(74%) did not had any postoperative clinical complications, 11 patients(20.75%) presented with anterior thigh pain whereas screw backout was seen in 2 patients(3.77%) resulting in varus malunion. In one case(1.6%) antirotation screw breakage has been documented. We have not found any cases of peri- implant fracture, implant failure or nonunion and the mortality rate over the evaluation period was 0%.

Discussion: With PFN there is improved biomechanical advantage with shorter lever arm which counteracts the bending force more efficiently hence provides more efficient load transfer than does a sliding hip screw. It is an intramedullary device, the load is shared partially by the bone and partially by the nail which limits the amount of sliding and therefore limb shortening and deformity. It is a minimally invasive biological fixation with no loss of fracture haematoma & requires shorter operative time, resulting in decreased overall morbidity. Early mobilization and rehabilitation is a major advantage.

Conclusion: Osteosynthesis using proximal femoral nailing in unstable trochanteric fractures resulted in low rates of clinical complications, excellent stabilization, few mechanical complications and adequate functional results. The authors consider that this is an appropriate technique for treating unstable inter-trochanteric fractures of the femur.

Keywods: Unstable Intertrochanteric Fracture, proximal femur nail, biomechanic, osteosynthesis

INTRODUCTION

Present data estimates that 1.6 million osteoporotic hip fractures occur worldwide annually, and by 2050 this figure is projected to reach 6.3 million. Asia is projected to experience 51% of all osteoporotic hip fractures by 2050, which amounts to 3.3 million per year. Hip fractures account for more than half of the total hospital admissions of all fractures. In older age group, the major contributing factors are osteoporosis and the propensity of older patients to fall. In the age group between 11 and 60 years, the causative factor is high-energy trauma. From the early 1800s on, the literature revealed that intertrochanteric hip fractures routinely healed but were malunited in varus, leading to deformity and decreased function secondary to a limp and hip abductor weakness. Because of these significant problems, conservative treatment was deemed unacceptable regardless of the mortality. The introduction of dynamic hip screw was a major advancement and throughout 70's and 80's the dynamic hip screw gradually established itself as the gold standard fixation device. Proximal femoral nail (PFN) devised in 1996 promising implant in intertrochanteirc femur fracture with some biomechanical advantages.

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MATERIAL AND METHODS

In a observational, prospective study we evaluated 53 cases of unstable I/T# between Oct 2014 - Oct.2016, that underwent PFN in Dept of Orthopaedics, DR BRAM Hospital & Pt.JNM Med college, RAIPUR (C.G.). Patients included with age more than 18 years, unstable fractures (Type A2.2-A3.3) of AO/OTA classification (Figure 1) less than three weeks. Patients with intertrochanteric fractures with subtrochanteric extent, pathological fractures due to tumor lesions, previous incapacity to walk, were excluded from this study.

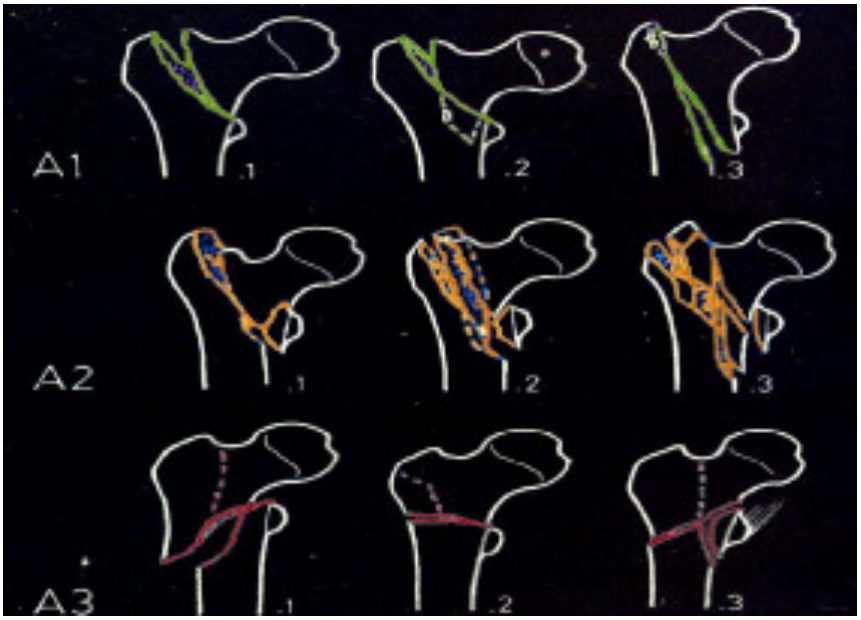


Fig. 1 : AO/OTA Classification of Inter trochanteric Fractures

Patient was shifted in supine position in fracture table and closed reduction was achieved under fluoroscopic control. Any posterior sag was prevented by the assistance with hip skid. In case of failed close reduction, reverse oblique fracture and presence of gap medially or posteriorly, open reduction was done. Affected limb was kept adducted allowing enrty point to be made over tip of greater trochanter with pointed awl, followed by guide wire insertion and then proximal femoral nail with attached jig (Figure 2) Proximal locking was done along the guide wires passed through the neck with one inferio-centrally and another superior-centrally confirming antero-posterior & lateral view flouroscopically, followed by distal locking through zig.

(a) (b) (c) (d)

Fig. 2 : (a) Entry point throught GT Tip (b) Guide wire insertion (c) Nail crossing fracture site (d) Proximal locking through jig

Postoperative antibiotic, painkiller and antacids were started and vital parameters were regularly monitored. Next day patients were made to sit up and to do static quadriceps exercise. Non-weight bearing crutch assisted walking started on the 8th day, partial weight bearing on 6th week and then full weight bearing on 3rd month. Patients were followed up on 4th week , 6th week and then every 6th week till 1 year and were functionally assessed (Figure 3) according to harris hip score (Table 1). Radiologically fracture union, TAD index, neck-shaft angle and other complications were documented (Figure 4).

Fig. 3 : Range of motion of hip and knee at 12 post-op week

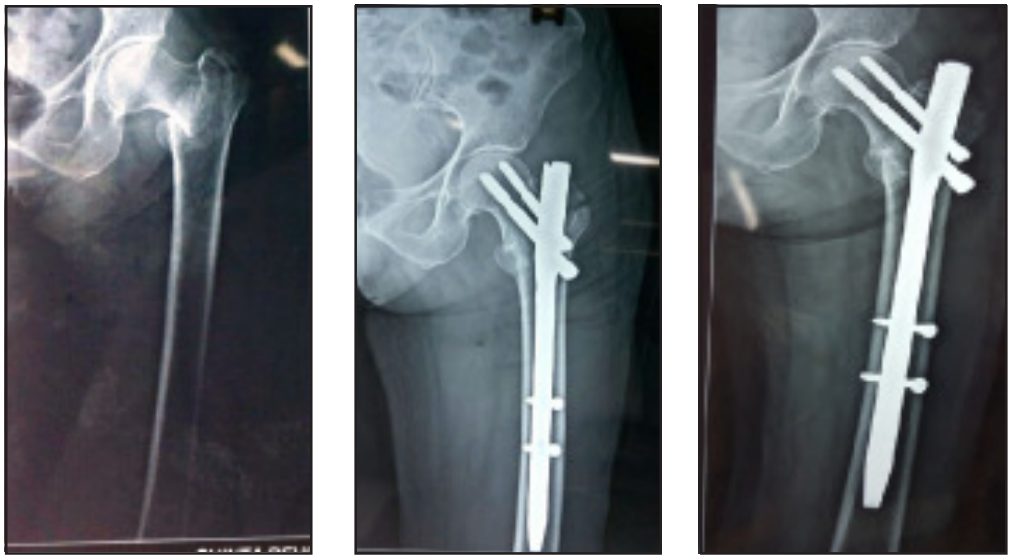


Fig. 4 : Pre-op xray, Immediate post-op, 6 mnth post-op

Table 1
Harris hip scoring

Hip ID:

Study Hip:Left Right

Examination Date (MM/DD/YY):

Pain (check one)

None or ignores it (44)

Slight, occasional, no compromise in activities (40)

Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)

Moderate Pain, tolerable but makes concession to pain. Some limitation of ordinary activity or work. May require Occasional pain medication stronger than aspirin (20)

Marked pain, serious limitation of activities (10)

Totally disabled, crippled, pain in bed, bedridden (0)

Limp

None (11)

Slight (8)

Moderate (5)

Severe (0)

Support

None (11)

Cane for long walks (7)

Cane most of time (5)

One crutch (3)

Two canes (2)

Two crutches or not able to walk (0)

Distance Walked

Unlimited (11)

Six blocks (8)

Two or three blocks (5)

Indoors only (2)

Bed and chair only (0)

Sitting

Comfortably in ordinary chair for one hour (5)

On a high chair for 30 minutes (3)

Unable to sit comfortably in any chair (0)

Enter public transportation

Yes (1)

No (0)

Stairs

Normally without using a railing (4)

Normally using a railing (2)

In any manner (1)

Unable to do stairs (0)

Put on Shoes and Socks

With ease (4)

With difficulty (2)

Unable (0)

Absence of Deformity (All yes = 4; Less than 4 =0)

Less than 30° fixed flexion contracture

Less than 10° fixed abduction

Less than 10° fixed internal rotation in extension

Limb length discrepancy less than 3.2 cm

Range of Motion (*indicates normal)

Flexion (*140°)

Abduction (*40°)

Adduction (*40°)

External Rotation (*40°)

Internal Rotation (*40°)

Range of Motion Scale

211° - 300° (5)	61° - 100° (2)
161° - 210° (4)	31° - 60° (1)
101° - 160° (3)	0° - 30° (0)

Range of Motion Score

Total Harris Hip Score

• < 70	poor
• 70 to 80	reasonable
• 80 to 90	good
• 90 to 100	excellent

RESULTS

In our study of 53 patients, 38 were male (71.7%) and 15 female (28.3%) ranging from age of 20 years to 84 years with mean age of 54.2 years. High energy trauma i.e. road traffic accident were responsible for fracture in 41.6%, trivial trauma i.e. fall on hard surface accounted for 54.8% cases and fall from height and assault accounted for 1.8% of cases. Thirty one (58.5%) patients had unstable intertrochanteric femur fracture on right side while 22 (41.5%) patients on left side.

In the present study, type A 2.3 was in majority of 27 patients (51%). And average time for complete union (mature union) is 11.5 weeks. Twelve cases showed delayed fracture consolidation with time taking more than 12 weeks. Non-union was not seen in any case of our study.

In our study mean neck shaft angle was 132 degree with 48 (90.5%) patients of having angle in between 125 to 135 degree and 3 (5.7%) patients having angle less than 125 degree and 2 (3.8%) patients having angle of more than 135 degree (Table 2).

Table 2
Neck shaft angle

S. No.	Neck shaft angle (in degree)	No. of cases	Percentage (%)
1	<125	3 (mean- 120.6 Sd 2)	5.7
2	125-135	48 (mean- 132.1 Sd 2.6)	90.5
3	>135	2 (mean- 140.5 Sd 2.1)	3.8

Mean TAD index was found to be 22 with 51 (96.3%) patients having TAD index of less than or equal to 25 while 2 (3.7%) cases having TAD index more than 25 resulting in malunion in varus and screw backout (Table 3).

Table 3
TAD INDEX

S. No.	TAD index	No. of cases	Percentage (%)
1	<25	51 (mean- 21.5 sd - 2.4)	96.3
2	>25	2 (mean- 33.5 Sd 0.7)	3.7

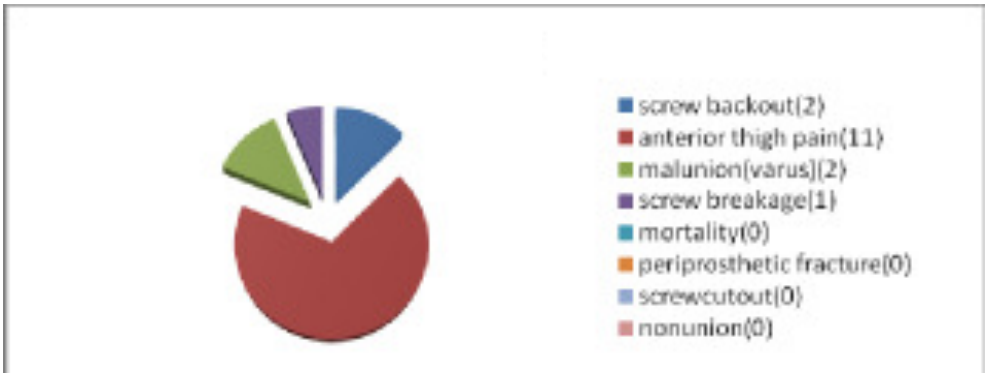
Mean harris hip score in this study was calculated to be 84.4 among which good result was seen in 37 patients (69.8%) and fair result (HHS MORE 70-80) occurred in 14 patients (26.4%) whereas in two patients poor result was seen (Table 4).

Table 4
Harris Hip score

S. No.	HHS (100)	No. of cases	Percentage (%)
1	Good (>80)	37 (mean- 88.29) (S D 4.35)	69.8
2	Fair (70-80)	14 (mean- 76.5) (S D 2.73)	26.4
3	Poor (<70)	2 (mean- 67.5) (S D 2.12)	3.8

In our study 39 patients (74%) did not have any postoperative complications. Eleven patients presented with anterior thigh pain and screw backout was seen in two patients which resulted in malunion in varus. Anti-rotation screw breakage has been documented in single patient. We have not seen any case of periprosthetic fracture, screw cutout, nonunion or any mortality (Figure 5).

COMPLICATIONS



DISCUSSION

Successful treatment of intertrochanteric fractures depends on bone quality, patient age, general health, interval from fracture to treatment , treatment adequacy , co-morbidities , and fixation stability.

PFN offers biomechanical advantage with shorter lever arm which counteracts the bending force more efficiently hence provides more efficient load transfer than does a sliding hip screw (Figure 5). It is an intramedullary device the load is shared partially by the bone and partially by the nail which limits the amount of sliding and therefore limb shortening and deformity.

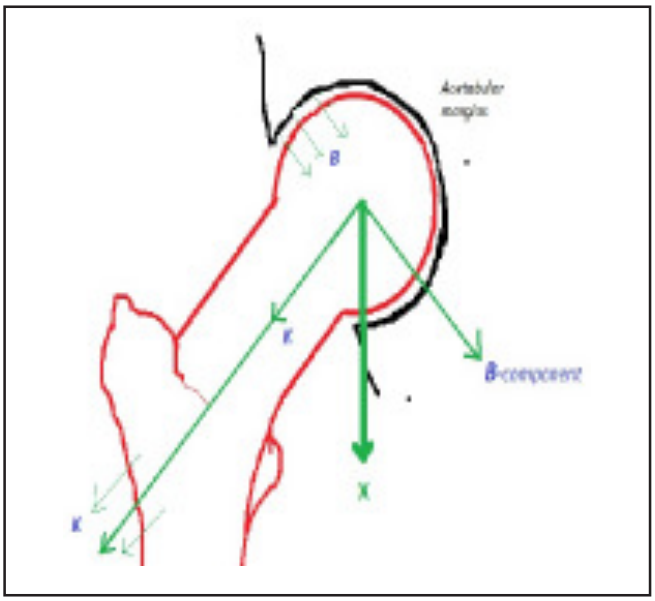


Fig. 5 : X- vector is the direction where gravitational force acts at the centre of head. K & B are the component force vectors of X vector at the centre of head.

K component is in direction of neck compensated by force within neck and inter-trochantric part. A & N are two vectors of K component at the base of neck.

"N" component in successful implant is compensated by counter force within the shaft of femur. "A" component works in lateral direction, compensated by strength of Lateral wall ?excessive collapse in lateral wall deficiency in DHS. B component of this X vector pushes head of femure in inferomedial direction and responsible for breakage of screws or cut thru of screws in neck through superolateral part of head and neck of femure

Malkani AL et al demonstrated intramedullary nails to be biomechanically superior to dynamic hip screw and angled blades. This superiority is thought to be a consequence of the efficient load transfer due to the closed proximity of the nail to the mechanical axis. Furthermore, there is a lower risk of mechanical failure due to load reduction on the implant due to the shorter lever arm and a controlled fracture impaction. The nail is intramedullary and medialization of the distal end is prevented, especially in reverse oblique fracture types. Parker MJ et al found that with intramedullary nail insertion, immediate postoperative weight bearing and mobilization are possible, particularly in elderly patients. We also observed in our study that intramedullary nails provided a stronger fixation and proximal end of the nail acts as lateral wall controlling collapse in contrast to DHS which may cause excessive collapse as described by Palm et al that fracture of lateral femoral wall occurs intraoperatively when the larger diameter hole is drilled thereby converting A2 type fracture to A3.

In our study two patient had limb length discrepancy of more 1 cm with overall average shortening of less than 3mm. Janardhana Aithala P et al in their study assessed limb length discrepancy with mean shortening less than 4mm which is definitely less than shortening observed in DHS with mean shortening 10.8 mm in J.Pajarinen et al.

Mehboob I.et al found PFN to be suitable implant for unstable intertrochanteric femoral fractures as it has

low per operative and post operative morbidity. We have also found it to be minimally invasive biological fixation with no loss of fracture haematoma requiring shorter operative time, resulting in decreased overall morbidity.

Richard Armelin Borger et al in 2010 reported mean cervicodiaphyseal angle to be 131.7°, there were no cases of varus collapse, mean tip-apex index was 22.8 and mean Harris Hip score was 69 in their study of 70 patients with trochanteric femur fracture that underwent intramedullary femoral nailing. Kubiak et al demonstrated that the two lag screw design provides equivalent rigidity and stability compared single lag screw which has significantly higher failure strength. Results of these study almost correspond to our present study.

Christian Boldin et al in 2003 reported three cases of mortality unrelated to implant, 3 cases of Z effect, 2 cases of reverse-Z-effect and 2 cases of implant cut out, in their study of 55 patients with unstable proximal femoral fractures managed with proximal femoral nail. In our study there were no cases of periprosthetic fracture, screw cutout, nonunion, Implant failure and superficial or deep infection or medical complications like deep vein thrombosis, pulmonary thromboembolism. According to Schipper et al, in 2004 the most common postoperative , complication seen in radiological evaluations is cut-out. Its incidence has been described in the literature as 0.7 to 10.6%. Inadequate reductions especially with varus presentation, incorrect implant positioning and advanced osteoporosis are the factors that determine its occurrence.

CONCLUSION

Osteosynthesis using a intramedullary proximal femoral nailing , used in unstable trochanteric fractures, level has low rates of clinical complications, excellent stabilization, few mechanical complications and adequate functional results. Lastly achieving a good reduction between two main fragments without varus malalignment and placement of hip screw in a correct position are two important technical aspects which prevent most of the complications associated with these procedure. The authors consider that proximal femoral nailing is an appropriate technique for treating unstable trochanteric fractures of the femur if done with proper surgical technique.

REFRENCES

1. Parker MJ, Handoll HH. Intramedullary nails for extracapsular hip fractures in adults. Cochrane Database Syst Rev. 2009;(3):CD004961.
2. Kaplan K, Miyamoto R, Levine BR, Egol KA, Zuckerman JD. Surgical management of hip fractures: an evidence-based review of the literature. II. Intertrochanteric fractures. J Am Acad Orthop Surg. 2008;16(11):665-73.
3. Haidukewych GJ. Intertrochanteric fractures: ten tips to improve results. J Bone Joint Surg Am. 2009;91(3):712-9.
4. Todd CJ, Freeman CJ, Camilleri-Ferrante C, Palmer CR, Hyder A, Laxton CE, et al. Differences in mortality after fracture of the hip: the east Anglian audit. Br Med J. 1995;310(6984):904-8.
5. Müller ME. Classification and international AO-Documentation of femur fractures. Unfallheilkunde. 1980;83(5):251-9.
6. Tronzo RG. Symposium on fractures of the hip. Special considerations in management. Orthop Clin North Am. 1974;5(3):571-83.
7. Laros G, Moore JF. Complications of fixation in intertrochanteric fractures. Clin Orthop Relat Res. 1974;(101):110-9.
8. Schipper IB, Steyerberg EW, Castelein RM, van der Heijden FH, den Hoed PT, Kerver AJ, et al. Treatment of unstable trochanteric fractures. Randomised comparison of gamma nail and the proximal femoral nail. J Bone Joint Surg Br. 2004;86(1):86-94.
9. Herrera A, Domingo LJ, Calvo A, Martinez A, Cuenca J. Comparative study of trochanteric fractures treated with the Gamma nail or the proximal femoral nail. Int Orthop. 2002;26(6):365-9.
10. Bridle SH, Patel AD, Bircher M, Calvert PT. Fixation of intertrochanteric fractures of the femur. A randomized prospective comparison of the gamma nail and the dynamic hip screw. J Bone Joint Surg Br. 1991;73(2):330-4.
11. 1EM Evans,"the treatment of trochantric fracture of femur",journal of bone and joint surgery, vol311-B,1949,pp190-203.
12. H Parvez, M J Parker, G A Pryor and L Lutchman, "classification of trochantric fracture of proximal femur: A Study of reliability of current systems; Niashan Chirodian Injury", Injury vol. 33 No.8 2002, pp713-715.
13. Schipper IB, Bresina S, Wahl D, Linke B, van Vugt AB, Schneider E, et al. Biomechanical evaluation of the proximal femoral nail. Clin Orthop Related Res. 2002;(405):277-86.
14. Baumgaertner MR, Curtin SL, Lindskog DM. Intramedullary versus extramedullary fixation for the treatment of intertrochanteric hip fractures. Clin Orthop Related Res. 1998;(348):87-94
15. Pajarinen J, Lindahl J, Michelsson O, Savolaien V, Hirvensalo E. 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(1):76-81.
16. Helwig P, Faust G, Hindenland U, Hirschmüller A, Konstantinidis L, Bahrs C, et al. Finite element analysis of four different implants inserted in different positions to stabilize an idealized trochanteric femoral fracture. Injury.

2009;40(3):288-95.

17. Guimarães JA, Guimarães AC, Franco JS. Avaliação do emprego da haste femoral curta na fratura trocantérica instavel do fêmur. Rev Bras Ortop. 2008; 43(9):406-417.
18. Guimarães RP, Alves DP, Silva GB, Bittar ST, Ono NK, Honda E, et al. Tradução e adaptação transcultural do instrumento de avaliação do quadril "Harris Hip Score". Acta Ortop Bras. 2010;18(3):142-7.
19. Hefley FG, Nelson CL, Puskarich-May CL. Effect of delayed admission to the hospital on the preoperative prevalence of deep-vein thrombosis associated with fractures about the hip. J Bone Joint Surg Am. 1996;78(4):581-3.
20. Werner-Tutschku W, Lajtai G, Schmiedhuber G, Lang T, Pirkl C, Orthner E. Intra-and perioperative complications in the stabilization of per-and subtrochanteric femoral fractures by means of PFN. Unfallchirurg. 2002;105(10):881-5.
21. Janardhana Aithala P, Sharath Rao. Proximal Femoral Nailing: Technical Difficulties and Results in Trochanteric Fractures, Open Journal of Orthopedics, 2013, 3, 234-242.
22. Kubiak EN, Bong M, Park SS, et al. 2004. Intramedullary fixation of unstable intertrochanteric hip fractures: one or two lag screws. J Orthop Trauma 18:12-17.
23. Palm H1, Jacobsen S, Sonne-Holm S, Gebuhr P; Hip Fracture Study GrouIntegrity of the lateral femoral wall in intertrochanteric hip fractures: an important predictor of a reoperation. J Bone Joint Surg Am. 2007 Mar;89(3):470-5
24. Anjum MP, Hussain FN, Mehboob I. Treatment of intertrochanteric femoral fractures with a proximal femoral nail (PFN): A short follow up. Nepal Med Coll J 2009;11:229-31.
25. Malkani AL, Karandikar N. Revision fixation for failed intertrochanteric fractures. Tech Orthop. 2002;17:443-7.
26. Müller ME, Nazarian S, Koch P, et al. (1990). The Comprehensive Classification of Fractures of Long Bones. New York: Springer-Verlag.

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VIII. JOURNAL'S IMPACT

Points: 0.00

Frequency of quotations	0.00
The citation rate dynamics	0.00

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JOURNAL'S GRADE - SUMMARY

journal's evaluation: **Journal of Orthopedis,the** (ISSN: 0975-7333)

ICV 2015: 36.94

ICI Value is consists of the two elements:

1. **The quality of the journal is based on the grade criteria fulfillment: 36.94**
   The grade is composed of criteria from the following groups:
   - Editorial quality
   - Standards
   - Stability
   - Indexing in databases
   - Digitalization
   - Internationalization
   - Experts Peer-Review Opinion

   Top ICI Journals Master List grade is: ICV=100.
   If the journal receives between 100 and 127 points, it will gain ICV=100.
   If the journal is given less than 100 points, the grade will be equal to the number of received points.

2. **journals impact – determined by the citation rate and the dynamics: 0.00**

Data provided by the scientific journals in the evaluation questionnaires are partially verified and updated.

ICV grade for 2016 is calculated on the basis of:

- questionnaire including detailed information about the journal, filed in electronic form by the editors of the journal
- analysis of the issue of the journal based on the Index Copernicus delivered to *(hard copy)*
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Appeals can be sent by e-mail: odwolania@indexcopernicus.com within 14 days from the day the grade was received.

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