Original Research Paper

Volume - 7 | Issue - 7 | July - 2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96

Orthopaedics

BIOLOGICAL FIXATION OF COMMINUTED SUBTROCHANTERIC FRACTURES USING DYNAMIC HIP SCREW

DR. ANEEN N. KUTTY	ASSOCIATE PROFESSOR, DEPT. OF ORTHOPAEDICS, GOVT. MEDICAL COLLEGE, KOZHIKODE, KERALA
DR. RAVIKUMAR V	ASSOCIATE PROFESSOR, DEPT. OF ORTHOPAEDICS, GOVT. MEDICAL COLLEGE, KOZHIKODE, KERALA

ABSTRACT **INTRODUCTION -** Comminuted subtrochanteric fractures are the most difficult to manage among femoral fractures because of unique characteristics of proximal femur and as most of the cases are comminuted. Recently, fixation without exploration of the fracture site, known as "biologic fixation", has been introduced. Eventhough Intramedullary implants are preferred for unstable subtrochanteric fractures we opted bridge plating with Dynamic Hip Screw for such fractures.

AIM OF THE STUDY - To analyse the functional outcome of bridge plating with Dynamic Hip Screw for unstable comminuted subtrochanteric fractures.

MATERIALS AND METHODS - The study included 20 patients with comminuted subtrochanteric fractures of the femur treated by bridge plating with DHS.

RESULTS - The fractures united at a mean of 7.6 (range, 3-15) months postoperatively. Mobility was scored at 9 points in 18 patients and 6 points in 2 patients (Mobility score of Parker & Palmer).

CONCLUSION - The results of this study highly suggest use of bridge plating in the treatment of comminuted subtrochanteric fractures, especially in the third world countries.

KEYWORDS : biological fixation, bridge-plating, subtrochanteric fracture, dynamic hip screw, mobility Score

INTRODUCTION

Subtrochanteric fractures take place in the proximal region of the femur. Fielding described that the subtrochanteric region corresponds to the interval between the lesser trochanter and around 5–7.5 cm below it, toward the femoral isthmus. The fractures can extend to the proximal region (trochanteric or femoral neck) or distal region (diaphyseal).[1,2]

Subtrochanteric fractures account for 25% of the proximal fractures of the femur. High energy traumas produce complex fracture patterns in Young male adults whereas low energy falls produce spiral fractures in old patients, predominantly females.1 Due to the anatomical peculiarity and, especially, due to the difficulty in reduction, the treatment of subtrochanteric fractures is still a great challenge to the orthopaedic surgeon, not only because of fixation difficulties, but also for the still frequent complications.

Emphasis on preservation of blood supply and soft tissue integrity in the fracture zone has decreased the complications and permitted earlier functional recovery. Recently, fixation without exploration of the fracture site, known as "biologic fixation", has been introduced. Even though Intra medullary implants are preferred for unstable subtrochanteric fractures we opted bridge plating with Dynamic Hip Screw which is a cheap implant for such fractures in people with low socioeconomic status.

AIM OF THE STUDY

To analyse the functional outcome of bridge plating with Dynamic Hip Screw for unstable comminuted subtrochanteric fractures.

MATERIALS AND METHODS

The study included 20 patients with comminuted subtrochanteric fractures who came to the orthopaedic casualty of Govt. Medical College, Kozhikode from January 2012 to December 2014. All patients were treated by bridge plating using Dynamic hip screw and long plate spanning the fracture site.

Operative procedure

The patient was positioned in supine position on fracture table after spinal anaesthesia. Traction was given and reduction confirmed under image intensifier. Dynamic hip screw guide wire was introduced into the neck and head of femur using angle guide. Dynamic hip screw introduced after drilling and tapping. Submuscular plane was created over the fracture site using a long periosteal elevator. The long DHS plate was introduced submuscular plane so as to span the fracture site. The barrel of the plate introduced over the Dynamic hip screw and plate fixed distally to the shaft of femur using 4.5mm cortical screws through a small incision distal to the fracture site. Wound was closed in layers proximally and distally.

Postoperative treatment

After biological fixation joint motion was started but weight bearing was avoided until radiographic evidence of union was shown.

CASE 1 - Pre-op, Post op, Follow up X-rays & Functional outcome

CASE 2 - Pre-op, Post op, Follow up X-rays & Functional outcome

CASE 3 - Pre-op, Post op, Follow up X-rays & Functional outcome

RESULTS

Patients were evaluated at 3 to 6 weeks intervals until fracture union and at 3 to 5 months intervals. Thereafter the activities of daily living and level of pain in patients treated with Dynamic Hip Screw using the bridge-plating technique were assessed one year after fracture. Walking ability was evaluated according to the criteria of Parker and palmer as follows:

Table 1 - Mobility Score (Parker and Palmer) 3

The maximum possible score is 9 points

The fractures united at a mean of 7.6 (range, 3-15) months postoperatively. Mobility was scored at 9 points in 18 patients and 6 points in 2 patients

Chart 1 - Mobility Score

Chart 2 – Postoperative Pain

Pain was absent in 14, mild in 3, and moderate in 3 patients.
Mean limb length discrepancy was 1.22 centimetres.

Complications

Surgical site infection developed in 2 patients which subsided with parenteral 3rd generation cephalosporins.

DISCUSSION-

Subtrochanteric fractures are the most difficult to manage among femoral fractures because of unique characteristics of proximal femur and complications are more because of co-morbid conditions and as most of the cases are comminuted. Restoration of femoral length and rotation and correction of femoral head and neck angulation to restore adequate abductor tension and strength are essential to regain maximal ambulatory capacity4. This can be achieved with operative treatment, but no single implant is universally recommended.

Biomechanical studies show that during weight bearing, mechanical stress acts on the femur. The compression stress is >1200 lb/sq inch in the medial subtrochanteric area and 3cm distal to the lesser trochanter. The lateral tensile stress is 20% less at 1000 lb/sq inch[5]. There is continuous stress on the implant system, even during bed rest .So, the attention of the medial cortical buttress is required to minimise the implant failure.

Higher forces are generated with eccentrically placed devices such as plates and screws, as compared to the centromedullary devices. Rotational shear forces may lead to implant failure due to cyclical loading. Plate and screw devices restored approximately 40% of the normal femoral torsional stiffness. Interlocking nails are better in bending stiffness than the hip compression screws. There was a marked improvement in the bending stiffness, torsional stiffness and the axial load to failure with the closed section interlocking devices[5].

Bending forces cause the medial cortex to be loaded in compression and the lateral cortex to be loaded in tension. The compression forces are much higher than the tensile forces and they are therefore mandatory in restoring the medial cortex stability. 2mm separation of the medial cortex will lead to medial collapse and lateral plate bending. The more comminution, the less the bio-mechanical stability and the more the bio-mechanical loading, the more the comminution. When the medial cortical support is inadequate, the internal fixation devices act as tension band in the lateral femoral cortex and the loads are concentrated in one area of the implant, thus resulting in implant failure or loss of fixation[5].

In young individuals they usually result from high energy trauma and often show significant comminution. Major compressive stresses in the femur are greatest in the medial cortex 2.5 to 7.5 cm below the lesser trochanter, exceeding 84 kg/cm and slightly less tensile forces of 63 kg/cm^2 occur at the proximal lateral femoral cortex.

Biomechanical studies have shown that the femoral cortex in the posteromedial sub-trochanteric region is subjected to the highest stresses in the body4 . Restoration of the integrity of the posteromedial column then allows the Dynamic Hip Screw to act as a tension band along the lateral femoral cortex[4].

However, if the column's integrity is not restored, all implants are subjected to high bending stresses. It is in this situation that the cephalomedullary nail is subjected to lower bending moments as it is closer to the neutral axis of the femur. There is thus a race between implant failure and fracture healing.

In comparing the Dynamic Hip Screw and the cephalomedullary nail, successful fracture healing has been shown to be more dependent on the indirect reduction techniques which preserve blood supply rather than being related solely to the mechanical strength of the implant.

Current implants have shown excellent ability to with stand cyclic bending stresses while bridging callus is formed. Early callus formation in the medial cortex obtained by a flexible fixation and biological fixation averts implant failure. The proximal femur has a good muscular coverage all around and hence exposure of bone is uncommon. However the chances of infection in open fractures are increased and this may increase the complication rate unrelated to the procedure. Open fractures were therefore not included in the study. Intramedullary nailing has been satisfactory for stable or non-fragmented fractures; however various complications have been encountered in comminuted fractures, especially in AO type C fractures.

Po-Cheng Lee in 2002 showed Bridge-Plating Osteosynthesis of Comminuted Subtrochanteric Fractures with Dynamic Hip Screw leads to union of all comminuted Winquist types 1 and 2 fractures without major complications, and it is a valuable alternative to new intramedullary devices. This procedure offers the significant advantage of being less technically demanding[6].

Manzoor Ahmed Halwai et al in 2007 the dynamic condylar screw in the management of subtrochanteric fractures: does judicious use of biological fixation enhance overall results shows that dynamic condylar screw is a definite advance over previous methods of treatment; when combined with the utilization of biological fixation techniques for comminuted fractures, can be relied upon to treat all types of subtrochanteric fractures[7].

Emad G.K. El-Banna et al in 2010 Biological fixation with bridge plating of comminuted subtrochanteric fracture of the femur by using DHS is a useful method of surgical fixation without major complications. All the fractures united within 4-10 months with an average time of 6.2 months without additional procedures[8].

Mehrpour et al in 2012 showed the average time of the operations was 79.4 (ranging from 60-125) minutes. Mean blood loss was 634 (ranging from 340-1160) milliliters. Uneventfully, union occurred in all patients with no clinical pain or dysfunction. Conclusion: Submuscular plating with either DCS or DHS is a viable option to treat comminuted subtrochanteric fractures[9].

Devdatta S. Neogi in 2012 studied Biological plate fixation of comminuted subtrochanteric fractures with the Dynamic Condylar Screw. There was no statistically significant difference between the healthy and fractured sides with respect to femoral neck-shaft angles. Use of fracture table, adequate two plane fluoroscopy and adherence to technical details give predictable results with this implant available at an affordable cost, even in countries with low socio-economic status[10].

Pramod Saini et al in 2013 showed that Biological fixation of comminuted subtrochanteric fractures with proximal femur locking compression plate provides stable fixation with high union rate and fewer complications. Thirty-two patients with average age of 44.7 years were studied and Union was achieved in all cases with an average time of 15.62 weeks[11].

The advantages of indirect reduction and biological fixation are:

a. Two third of the blood supply to the femur is through the intraosseous vessels and bridge plating allows to maintain this as it avoids intramedullary reaming[1].
b. Soft tissue remains intact as the fixation is extra-periosteal and submuscular [2].
c. There is some mobility in the fracture zone which accelerates the callus formation[2].
d. With the average duration of surgery being one and a half hours, the average reported blood loss with biological fixation will be 400 ml [2].

Although interlocking intra-medullary nailing is the preferred treatment in comminuted fractures, there are limitations within this modality. For instance:

a. It is not useful in diaphyseal fractures with spreading into metaphysis and joint[2].
b. The duration of surgery for this method is long and not suitable for patients with time limitations. This method is also high-risk5.
c. Open growth plates in children makes the intramedullary nailing impossible [4].
d. Gluteus medius disruption is ~27% and trochanteric pain is ~40% [5].

CONCLUSION

Subtrochanteric femur fractures are often the result of complex, high-energy mechanisms and demand special surgical consideration. The Dynamic Hip Screw allows good fixation of a fracture that extends into the piriformis fossa, e.g., type V subtroc hanteric–intertrochanteric fracture and the long subtro chanteric fractures that extend to supracondylar area of the femur. The results of this study highly suggest use of submuscular plating in the treatment of comminuted subtrochanteric fractures, especially in the third world countries.

Tables, Charts and Photos Photo 1 - Case 1 Pre-op, Post op, Follow up X-rays & Functional outcome

Photo 2 - Case 2 Pre-op, Post op, Follow up X-rays & Functional outcome

Photo 3 - Case 3 Pre-op, Post op, Follow up X-rays & Functional outcome

Table 1 - Mobility Score (Parker and Palmer)

Mobility Score (Parker and Palmer)	No difficulty	With device	Help of a person	With no help
Walk inside house	3	2	1	0
Walk outside house	3	2	1	0
Go shopping or visit family	3	2	1	0

Chart 1 - Mobility Score

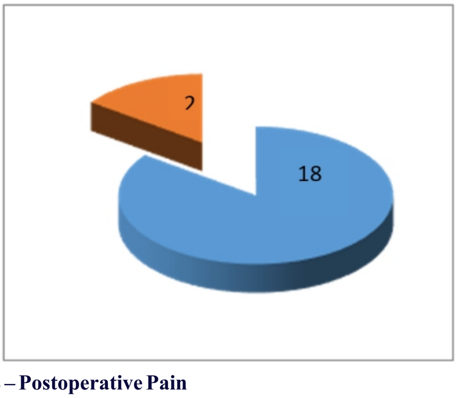
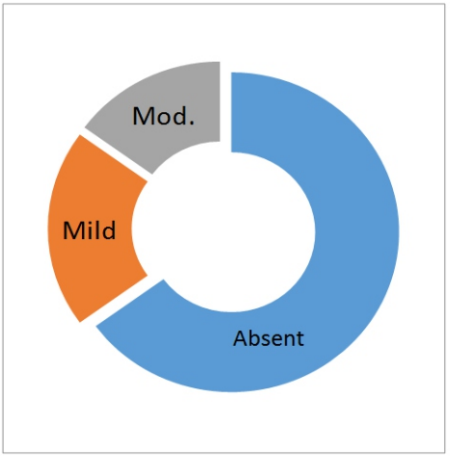


Chart 2 – Postoperative Pain



REFERENCES

1. Bucholz RW, Heckman JD, Court Brown C et al. eds., Rockwood and Greene's fractures in adults, 6th ed.
2. Biological plating of fractures Javdan et al. Journal of Research in Medical Sciences July & August 2007; Vol 12, No 4. 187.
3. Parker MJ, Palmer CR. A new mobility score for predicting mortality after hip fracture. J Bone Joint Surg Br, 1993; 75: 797-8.
4. Biological internal fixation of comminuted femur shaft fractures by bridge plating in children. J Pediatr Orthop 2003; 23(2):184-189.
5. Vengsarkar NS, Goregaonkar AB. "Biologic plating of comminuted femoral fractures". Bombay Hospital Journal 2001; 43(1):169-174.
6. Bridge-Plating Osteosynthesis of 20 Comminuted Subtrochanteric Fractures with Dynamic Hip Screw Po-Cheng Lee et al, Chang Gung Med J Vol. 25 No. 12, Dec 2002
7. The dynamic condylar screw in the management of subtrochanteric fractures: does judicious use of biological fixation enhance overall results? Manzoor Ahmed Halwai et al, Strategies Trauma Limb Reconstr. 2007 Dec; 2(2): 77–81.
8. Biological Fixation with Bridge Plating of Comminuted Subtrochanteric Fractures of the Femur in Adults, Emad G.K. El-Banna et al, Med. J. Cairo Univ., Vol. 78, No. 1, December 495-498, 2010
9. Biological plating in comminuted subtrochanteric fractures. Mehrpour et al, Tehran University Medical Journal, May2012, Vol. 70 Issue 2, p104-109.
10. Biological plate fixation of comminuted subtrochanteric fractures with the Dynamic Condylar Screw: A clinical study, Devdatta S. Neogi et al, Acta Orthop. Belg., 2009, 75, 497-503
11. Biological fixation of comminuted subtrochanteric fractures with proximal femur locking compression plate, Pramod Saini et al, injury.2012.10.037