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135^0 Angle blade plate fixation in elderly and osteoporotic inter-trochanteric fracture

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Abstract
Background: Inter-trochanteric fracture is very common fracture in osteoporotic and elderly patient. Dynamic hip screw is widely used implant for stable and unstable inter-trochanteric fracture. But there is a high rate of implant cutout particularly in osteoporotic bone (12.6%). We use 135^0 Angle blade plate for fixation of osteoporotic inter-trochanteric fracture in elderly, which gives stable fixation with low cut out rates and better functional outcome (compared with Harris hip score).
Material & Method: In this series, 19 case of inter-trochanteric fracture in elderly and osteoporotic patients were internally fixed with 135° angle blade plate. Angle blade plate in these patients was used to prevent cutting through of the implant. Average hospital stay was 24.78 days and most 17 (89.47%) patients were discharged within 7 days of operation. Functional assessment of the patient was done after clinical examination and Harris hip score at 4 week, 12 week and 24 week of follow-up. Radiological examination also helped in assessing the cases.
Result: Average follow-up of the cases was for 6 month. Average time of union at fracture site is 4.5 month and all cases show union at 6 month. In angle blade plate cases, Harris hip score was 72.15 at 6 month of follow up. At 6 month follow-up, 53.18% of case were ambulatory without support and 36.82% were walking independently with support of cane or crutch. In Angle blade plate fixation cases, there was no infection at surgical site, no cases of non union, and no case of cutting out of bone. In one case, blade migration in hip joint was there at 5 month of follow up. Results were excellent in 11 (57.89%), good in 5 (26.32%), fair in 1 (5.26%) and poor in 2 (10.53%).
Conclusion: Angle blade plate in 6 months of follow up shows better functional outcome and low cut out rate as compared to dynamic hip screw. This could be due to earlier union and better capability to bear weight, as the implant provided very good stability at fracture site as compared to dynamic hip screw.

Keywords: Inter-trochanteric fracture, Osteoporotic hip fracture, 135^0 angle blade plate

Introduction
The cause of fracture of the proximal third of the femur in elderly are bone fragility due to osteoporosis, predisposition to falling cause by diminished control of oscillation in the vertical stance or sudden drop in muscles tone in ambulatory elderly. These fragility hip fractures occur in a characteristic population with risk factors including increasing age, female gender, osteoporosis, a history of falls, and gait abnormalities[1]. Furthermore, a wide array of other causes should be mentioned, the more common of them including vetigenous disorder, postural hypotension, cerebrovascular disease, fall due to surrounding (Carpet, stairways, poor illumination) and relatively often alcohol consumption.
The graveness of the problem of proximal femur fractures in the elderly manifests in the functional state as well as in terms of mortality rates, because the already unstable biological equilibrium of the elderly is affected and the pathologic state is additionally aggravated and even further deteriorated by immobilization.
Various implants are used for fixation of inter-trochanteric fracture. The sliding hip screw is the most widely used implant for stabilization of both stable and unstable inter-trochanteric fracture. Sliding hip screw side plate angles are available in 5º increment from 130º to 150º, 135º DHS is the most commonly used [2-4].

Material and methods

The cases of this study have been selected from the patients attending the out-patient department of Orthopaedics and from those arriving at the emergency department of Jay Arogya Group of Hospitals, Gwalior from May 2004 to April 2006. Each patient was subjected to clinical and radiological examination. All patients were elderly and osteoporotic and were fixed with 135^0 angle blade plate. All patients were routinely followed for minimum of 6 month and their functional results were evaluated on the basis of Harris hip score.

Selection of the patients

Inclusion Criteria

- Close inter-trochanteric fracture.
- Fracture classification: AO Classification $3.A_1$, $3.A_{2.1}$, $3.A_{2.2}$, $3.A_{3.1}$ & $3.A_{3.3}$.
- Patients medically fit for surgery.
- Age of patient > 50 yrs.

Exclusion Criteria

- Compound inter-trochanteric fracture.
- Fracture classification: AO Classification $3.A_{2.3}$, $3.A_{3.2}$
- Fracture > 1 month old.
- Patient medically not fit for surgery.
- Patient's age < 50 yrs.

Implants**:** 135^0 Angle blade plate, 6.5 mm cancellous cannulated screw, 4.5 mm cortical screw.

135^0 Angle blade plate: Thickness 5.6 mm, Width 16 mm, Hole spacing 16 mm, U profile blade 6.5-16 mm.

The 135^0 Angle blade plate is available with 4 to 8 DCP holes. The upper most hole is designed oblique for insertion of 6.5 mm cancellous screw. The indentation at the junction between blade and shaft is for impaction of the plate. Different blade lengths also are available 50-110 mm with 5 mm increment. Uma company made these implant with 316L SS on request.

In surgery, standard lateral approach was used in all cases. Sitting was allowed from the next post operative day and isometric quadriceps exercise were started. Sutures were removed after twelve days. Patient was allowed to bear weight as tolerated. Follow up of the patients was done in follow up clinic and out patient department to evaluate the range of movements, pain at hip and to determine limb length discrepancies. Monthly follow-up regime was adopted and x-ray were taken every month to check progress of union and implant position. Patients were called for follow up even after union to check the intrusion, extrusion, bending or breakage of implants after weight bearing and late segmental collapse. In our study, partial weight bearing was started on the second post-operative day or as tolerated by the patient and full weight bearing started after 24 weeks

Results

Average time of union was 4.5 month and all cases shows union in 24 weeks. In our study, 6 patients (31.57%) had no pain, 7 patients (36.84%) had mild pain. At 6 month of follow up, marked pain was seen only in 1 case (5.26%), in which the blade penetrated inside the joint.

Most of the patients, 17 (87.04%) in our series, were walking with a cane or crutch in opposite hand. However, 2 (10.53%) could walk independently upto six blocks, 2 (10.53%) could walk independently upto 2-3 blocks, 8 (42.12%) could performed indoor activities and 7 (36.84%) could walk only with support of cane or crutch in opposite hand at six month of follow up. At 6 month follow-up, 53.18% of case were ambulatory without support and 36.82% were walking independently with support of cane or crutch.

Results were excellent in 11 (57.89%), good in 5 (26.32%), fair in 1 (5.26%) and poor in 2 (10.53%).

Case 1

Preoperative Xrays

Postoperative Xrays

Xrays after 6 months with radiological union-AP view

Xrays after 6 months with radiological union-LAT view

Case 2

Preoperative xrays

Postoperative Xrays-AP view

Postoperative Xrays-lat view

Xrays after 6 months with radiological union-AP view

Xrays after 6 months with radiological union-LAT view

Discussion

Dynamic Hip Screw (DHS) is technically easy to insert and there is controlled collapse at fracture site. With DHS, there is average cut out of implant from femoral head of 12.6% and there is bone loss during reaming for DHS screw, which weakens the already compromised osteoporotic bone, hold of lag screw is also poor in these cases. There is no need of reaming in fixing fracture with 135º Angle blade plate which provide good hold of blade in head and neck of femur. 135° Angle blade plate provides more surface area which resist cutting out through femoral head. Raised edges of plate prevent rotational and shearing stresses on to femoral head and provides early union. Fixing angle blade plate is technically demanding procedure and there are chances of blade penetration into hip joint in cases, where excessive collapse is there at fracture site. 135^0 Angle blade plate can be used in osteoporotic fractures where chances of cut out with DHS is high. Harris hip score and functional activities are better with blade plate fixation.

In our study, 42.10% of the patients are between 65-80 years of age. Male to female ratio is 3.75:1 (78.94% male, 21.06% female). Left hip was involved in 63.16% of cases and right hip in 36.84%. 68.42% of patients got injury due to fall and 31.57% cases were of road traffic accident. Most of the patients in our study (73.67%) were operated within 4 weeks of injury. In our study, partial weight bearing was started on the second post operative day or as tolerated by the patient and full weight bearing was started usually after 2 months.

Mobilization of hip fracture patient out of bed and ambulation training was initiated on post-operative day one and all patients were allowed to bear weight as tolerated [5]. Restricted weight bearing after hip fracture has little biomechanical justification, because activities such as moving around in bed and use of bed pan generate forces across the hip approaching those resulting from unsupported ambulation [6]. Even foot and ankle range of motion exercises performed in bed produces substantial load on the femoral head secondary to muscle contraction. Koval *et al*. [5] also demonstrated that unrestricted weight bearing does not increase complication rates following fixation of inter-trochanteric fracture.

An average time of union in cases of Angle blade plate fixation is 4.5 months and all case (100%) shows union in 24 weeks. Early union with angle blade plate fixation is probably because of stability provided by flat blade with raised edge, there was no rotating or shearing stresses at fracture site which leads to early union. An average time of union in cases of DHS fixation is of 4.5 months to 6 months in operative series and 6 months for those treated by traction [7].

In Angle blade plate fixation cases, no infection was there at surgical site, no cases of non union, and no case of cutting out of bone was there. In series of DHS fixation, infection was found in 1.63%cases [8], non-union in less than 2% cases [9-11], cut out rate of 3.27 [2] to 12.15% [12], implant migration is 2.54% [8] to 7.54% [13].

In Angle blade plate fixation, chances of gap nonunion is always there. This can be offset to a large extent by final firm blow over base of blade with impactor and mallet, after loosening of traction on the limb. Further, insertion of a cancellous screw across the fracture site, through the upper hole in plate improves impaction at fracture site. In one of our patient, blade migrated into hip joint after 5 months of operation, this was due to excessive collapse at fracture site, as angle blade plate has no provision of backing out. This can be a major problem with such fixation. However, this can be minimized with selecting short blade which remains approx. 20mm from hip joint in both AP and LAT radiographs. Most inter-trochanteric non-union in cases of DHS follows unsuccessful operative stabilization with subsequent varus collapse & screw cut-out through the femoral head [14]. Another possible etiology for inter-trochanteric non-union is an osseous gap secondary to inadequate fracture impaction. This can occur as a result of jamming of the lag screw within the plate barrel or mismatch of the lag screw & plate barrel length leading to loss of available screw barrel slide. Both problems can be avoided with proper attention to the details of device insertion. In the study of compression hip screw in stable fracture, the average compression hip-screw device slide is 10.2 ± 11.76 mm, and in unstable fracture, there is a more sliding of the lag screw 19.0 ± 7.84 mm [15]. K. S. Leung *et al* reported mean sliding of lag screw: with stable fracture 4.88 mm (3.65 mm), and with unstable fracture 5.61 mm (5.88 mm) [16]. Simon H. Bridle *et al*. (1991) in his study of 51 cases of DHS fixation reported that screw tip migrated within the head in 4 cases (7.54%) [13].

Osteonecrosis of the femoral head is rare following inter-trochanteric fracture [8]. No association has been established between location of implant within the femoral head. Although one should avoid the posterior superior aspect of the femoral head because of the vicinity of the lateral epiphyseal artery system.

In our series, there is no case of malrotation with angle blade plate fixation. The flat blade portion, which snugly fix in the neck and flat plate portion both prevent malrotation; this gives additive advantage. K.S. Leung *et al*. reported one case of malrotation in a series of 93 patients fixed with dynamic hip screw. When malrotation is severe and interferes with ambulation, revision surgery with plate removal and rotational osteotomy of the femoral shaft should be considered [16]

Tomaz Zigon *et al*. (2003) [18] in similar study of 70 patients of stable fracture fixed with dynamic hip screw, reported 43% patient were independent at daily activity. In our study, 17 (89.48%) patients were independent at daily living, which shows better outcome of angle blade plate. In angle blade plate cases, Harris hip score was 72.15 at 6 month of follow up. In cases of DHS, Harris hip score was 62 at 6 month of follow up [13].

This data shows better Harris hip score of angle blade plate in 6 months of follow up and low cutout rate as compared to dynamic hip screw. This could be due to earlier union and better capability to bear weight, as the implant provided very good stability at fracture site as compared to dynamic hip screw.

Table 1: showing Comparison between our study of 135^0 Angle blade plate and other studies of DHS

	Infection	Non Union	Cut Out	Implants Migration	Osteon ecrosis	Shortening	Malrotation
Our Study	None	None	None	2	None	Avg.8mm ± 0.2	None
Malcon L Ecker etal DHS 62 cases (1975) [19]	1 case (1.61%) superficial 1 case deep infection	3 cases (4.83%)	---	---	---	> 20mm 12cases (17.32%)	---
Ingemer sernbo *et al* DHS (1988) 102 cases [20]	2 cases superficial	---	---	---	---	---	---
Sasa Milenkovic (2003) DHS 61 cases 1yrs follow up [8]	1.63%	---	---	4 Patients 2.44%	---	---	---
Michael w chapman 3rd edition Orthopaedics Surgery (DHS)	---	---	---	---	Rare	---	---
Boyd *et al* (1957)	---	< 2%	---	---	---	---	---
Kyle *et al* (1979)	---		---	---	---	---	---
Hunker GA *et al* (1978)	---		---	---	---	---	---
Wilson AJ *et al* (1980)	---		---	---	---	---	---
TRC Davis *et al* DHS(1990) [12]	---	---	12.5%	---	---	---	---
Simon H Brittle DHS 51 Cases (1991) [13]	---	---	5.88%	4 Patients 7.54 %	---	---	---
K.S. Leug *et al* 93 Cases x 6 Month (1993) [16]	---	---	3 Patients 3.22%	---	---	---	1 Patients 1992
Benlizet RA *et al* 49 DHS 6 Month (1997) [25]	---	---	4 Patients 1.96%	---	Rare	---	---
Antonio Moroni *et al* 60 DHS x 6 month(2005) [17]	---	---	4 Patients 2.4%	---	---	---	---

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