

Prospective Study of Inter-Trochanteric Fractures of Femur Treated with Biaxial Plate Fixation (Hip Screw and Derotation Screw) with Indiginous Implant

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Abstract

Background: Intertrochanteric fractures remains the common type of injuries amongst hip fracture. There are different types of classifications systems and different modalities for fixation available. Surgical treatment represents the optimal strategy for managing intertrochanteric fractures. It allows early mobilization rehabilitation and functional recovery and reduces the risk of postoperative complications.

Material and methods: Our study consisted of forty two cases of intertrochanteric fracture of femur treated surgically with BIAxIAL PLATE SYSTEM at our institute between July 2012- Dec 2014. Two patients were died within six months of operation so 40 patients were available for follow up. So anatomical and functional assessment of forty patients done.

Results: Anatomical results were assessed by presence or absence of shortening, deformity and range of movement. 95 % cases had good results and 5% cases had poor results with shortening more than 1cm in one case and limited hip movement in another case. Functional assessment of 40 patients were done by Harris hip score system and we got excellent result were noted in 12 cases, good in 23 cases, fair in 05 cases and none had poor results.

Conclusion: Osteosynthesis with Biaxial Plate offers the advantage of high rotational stability of the head-neck fragment. The advantage of fixation in two axis is, Increased torsional strength 10 times than DHS. Decreases coring out and loosening. Increased axial deforming strength 3 times than DHS. Decreases posterior and superior cut out.

Keywords: Intertrochanteric fracture; Biaxial plate system; Osteosynthesis; Indiginous implant.

Introduction:

Intertrochanteric fractures of the femur are one of the most common fractures. Due to an increasing life span, the incidence of these fractures is on the rise. Also the geriatric age group has a higher incidence of osteoporosis [1].

Unstable intertrochanteric fractures in elderly patients are associated with high rates of morbidity & mortality due to the need for prolonged immobilization, although the results have improved with use of internal fixation [2].

Current surgical methods have replaced previous nonsurgical methods of prolonged bed rest, prolonged traction in bed, or prolonged immobilization in a full-body (spica) cast [3,4,5]. The acceptable healing rates for nonsurgical management were accompanied by unacceptable morbidity and mortality because of frequent non-orthopedic complications associated with prolonged immobilization or inactivity, as well as malunions compromising patient function.

Such complications included pneumonia, pulmonary embolism, DVT, metabolic disturbances, dehydration, atelectasis, pressure ulcers resulting from inactivity.

Various internal fixation devices are available to treat essentially all

trochanteric fractures like Jewett nail, Holt nail, Massie nail, Clawson Ken-pugh nail, DHS, PFN, TFN intramedullary locking nails to fix this fracture. However the complication rate in terms of morbidity and mortality was higher than in sliding hip screw.

Therefore Sliding Hip Screw Barrel system remains the mainstay of treatment of these fractures. However SHS has several pitfalls⁹⁷:

- The implant is bulky at the fracture phase (diameter of lag screw 12.5mm).
- It needs tapping of cancellous bone, and has poor purchase in the bone.
- The compression device is inefficient.
- A single screw offers minimal resistance to torsional loads.

So the design of the 'Biax Hip System' comes to overcome some of the pitfalls in conventional SHS. This system consists of:

- A sliding Lag screw (8.5 mm)
- An anti-rotation screw (6.5mm)
- A standard tunnelled plate (1200 to 1450)
- An optional tunnel plate for medialisation; and
- A compression nut and locking nut (9mm)

The screws are conical and self-tapping. The body of the screws is round. The plates are thickened to 10mm for lag screw, and a flange for antirotation screw.

Dr. Ashok Desai (the inventor of biaxial plate system), HOD Poona Hospital, Pune and Dr. Milind Modak senior consultant at Yogesh Hospital and HOD Dinanath Mangeshkar Hospital, Pune. They did the biomechanical studies and presented the paper regarding anatomical and functional outcome at various conferences like MOACON 2012,

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SICOT 2013 and other regional conferences. They got excellent results in terms of anatomical and functional outcome. So we inspired by this concept for treatment of intertrochanteric fracture femur and conducted the study in our institute. As this is new concept no published data is available.

Material and method:

Our study consisted of forty two cases of intertrochanteric fracture of femur treated surgically with BIAxIAL PLATE SYSTEM at our institute between July 2012-Dec 2014. Two patients died within six months of operation so 40 patients were available for follow up. So anatomical and functional assessment of forty patient were done.

Inclusion criteria

1. Inter-trochanteric fractures of femur (Boyd and Griffin type II, III,IV).
2. Both sexes.
3. Skeletally mature patient.
4. Patient ambulatory prior to fracture, though they may have used an aid like a cane or walker.

Exclusion criteria

1. Medically unfit patients.
2. Any infection around the affected hip (soft tissue or bone).
3. Skeletally immature patients.
4. Boyd and Griffin Type I fracture as fracture can be managed with DHS and without derotation screw placement.

'Biaxial Hip System' [6] consists of

- *A sliding Lag screw (9 mm)
- *An anti-rotation screw (6.5mm)
- *A standard tunnelled plate (angle 1200 to 1450)
- *An optional tunnel plate for medialisation; and
- *A compression nut and locking nut.

The screws are conical and self-tapping. The body of the screws is round. The plates are thickened to 10mm for lag screw, and a flange for antirotation screw.

Biomechanics of biax plate system [6]:

The bending and shear strength of the biax hip system is two times that of the conventional sliding hip screw (SHS) system. Torsional strength is three times that of SHS. And the purchase in the bone is far superior due to:

- Expanding conical profile of screws.
- Self-tapping ability causing compaction of bone and preservation of bone stock.
- The area of purchase is 3½ times more than conventional SHS.
- The jig achieves parallelism between the screws, facilitating compression at fracture phase. The deflection of Biax system is 0.09mm, well below the allowable 0.15mm. Hence it allows sliding. The Biax hip system does not get jammed.
- A single screw can rotate inside the cancellous bone with every flexion and extension, as it is locked in barrel. Two screws with large purchase area do not rotate in cancellous bone and prevent bone destruction.
- The tip-apex distance can be adjusted to optimum within 15mm in both planes. Cylindrical body of the Lag screw allows advancing or withdrawal of the screw to desired depth even after fixation of side plate



Figure 1- ????



Figure 2-????

Figure 3- ???

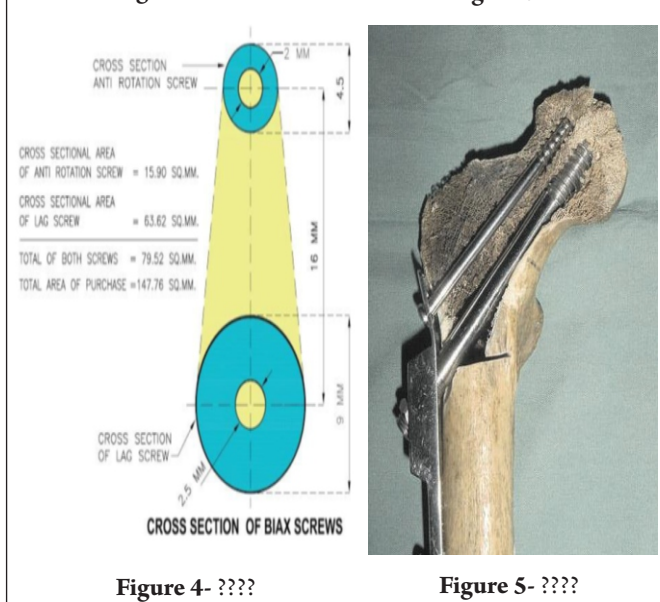


Figure 4- ????

Figure 5- ????

Observation and results:

The study consist of 42 cases managed with biaxial plate system. Two patients died postoperatively. There were 18 males (42.85%) and 24 females (57.14%). The age of the patient in the study, ranged from fifty years to eighty nine years, average being 69.5. The most common mode of injury in our series were domestic fall accounting for forty cases, followed by road traffic accident in only two cases. Left side was affected in 23 cases and right in 19 cases. Fracture were classified according to Boyd and Griffin classification. Our study consist of 15 patients of type II, 20 of type III and 07 cases of type IV. In this study most of the patients i.e. 14 cases were hypertensive with ischemic heart disease, 07 were suffering from DM, 04 cases of DM+HTN, 03 cases of cataract and 02 cases of COPD. 19 patients were operated between 1-4 days of trauma, 13 patients within 5-7 days, 07 patients between 8-12 days and 03 were operated in more than 12 days of trauma. Anatomical and functional results were assessed. Two patients died within 6 month of operation so anatomical and functional assessment of forty patients done.

Excellent result were noted in 12 cases, good in 23 cases, fair in 05 cases and none had poor results

Figure 6- Case 1

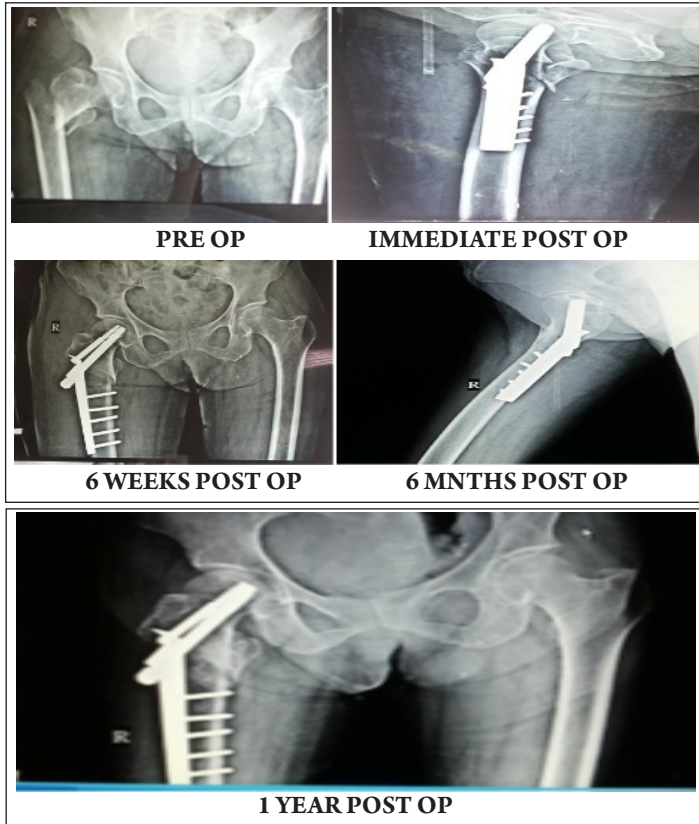


Figure 7- Case 2

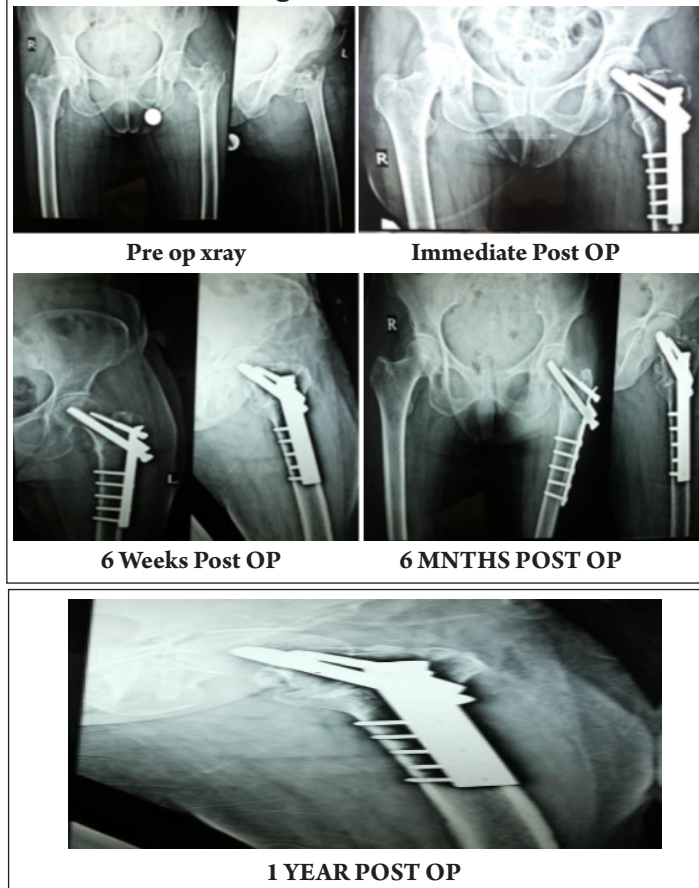


Table (a) Anatomic Results

Results	No. of patients	Percentage
Good	38	95
Poor	2	5

Table (b) Functional results

Results	No. of patients	percentage
Excellent	12	30
Good	23	57.5
Fair	5	12.5
Poor	--	--

Discussion:

Outcomes of treatment of intertrochanteric fractures depends on quality of bone, age of patient, general health, trauma surgery interval, and adequacy of treatment, comorbidities and stability of fixation [7,8,9]. Intertrochanteric fractures in the elderly pose certain special problems. In this age group the fracture configuration is generally comminuted with presence of extensive osteoporosis. There is problem with correct and accurate placement of the implant and hold of the implant. So if the fixation is not stable, prolonged immobilization may be required to achieve complete union. On the other hand there is a need for rapid weight bearing and mobilization of this group of patients as they are generally medically compromised due to age and associated diseases. Biological and biomechanical changes that occur in osteoporosis make the management of these fractures more difficult. Cancellous bone has reduced bone mineral density and changes in trabecular pattern. Cortical bone also becomes thin. So in these comminuted fractures in cancellous areas, fixation of all fragments is difficult. Also the posteromedial void which is usually present in these fractures makes them very unstable. Thus implant fixation is compromised [10].

DHS and TFN/PFN are still the standard implant used for management of intertrochanteric fracture femur but since the complication rates of these implants are higher, which are discussed later, we have used the new implant called BIAXIAL PLATE SYSTEM for the management of intertrochanteric fracture femur and studied the anatomical and functional outcome of the same. 42 cases of intertrochanteric fractures were treated by BIAXIAL PLATE FIXATION implant system are included in the study. Out of 42 patients two patients died before 6th month post operatively due to age factor associated comorbid conditions. So the anatomical and functional assessment of 40 patients was done. The purpose of the study was to evaluate the result of treatment in these patients.

Conclusion:

In the present study of 42 patients with intertrochanteric fracture femur were surgically managed with biaxial plate system. Two patients were died within six months of operation, so anatomical and functional assessment of forty patients done. The data was assessed, analyzed,

evaluated and the following conclusion were made.

Intertrochanteric fracture of femur is common in elderly, due to osteoporosis. The mode of injury for intertrochanteric fracture in the elderly is a trivial trauma, however in the young individual it occur following high velocity trauma. Since the fracture is common in elderly the incidence of associated diseases requiring medical attention is high. The degree of comminution depends on the quality of bone, in the elderly individual as the bone is osteoporotic the incidence of comminution is more. As the fracture is more common in the elderly, early reduction and internal fixation increases patients comfort, facilitates nursing care, helps in early mobilization of the patient and decreases the duration of hospitalization. Osteosynthesis with Biaxial Plate offers the advantage of high rotational stability of the head-neck fragment. The advantage of fixation in two axis is, Increased torsional strength 10 times than DHS. Decreases coring out and loosening. Increased axial deforming strength 3 times than DHS. Decreases posterior and superior cut out.

The advantage of lag screw is, it is core taper, outer diameter taper, self-taping, no loss of cancellous bone, has better fixation strength, 6.5mm derotation screw prevents rotation and coring effect. Biaxial gives more distribution bony contact area for stability and union specially, for Indian hips. Our results indicate the necessity of a careful surgical technique and modification that are specific to the individual fracture pattern in order to reduce complication.

In the light of these results, one can conclude that,

- Biaxial plate fixation construct is an indigenously designed implant for Indian hips.
- Gives consistent, good, stable, fixation in unstable osteoporotic fracture.
- Can be used for smaller hip diameter globally.

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