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A Study To Evaluate Functional And Radiological Outcome Of Trochanteric Stabilizing Platting As Supplementary Fixation In Intertrochanteric Femur Fractures.

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Abstract:
Intertrochanteric fractures are the fractures involving the region extending from the extracapsular neck region to the region along the lesser trochanter proximal to the medullary canal[(1)]. Injury creates a spectrum of fractures in the proximal metaphyseal region of the bone, damaging the trabecular networks and the weak cortical bone, resulting in displacement of the fracture fragments.
It is the most common fracture type having the highest morbidity rate. No significant improvement in mortality or functional recovery has been observed over the past 50 years of surgical treatment. Since general life expectancy of population has increased in the past two decades incidence of fractures of proximal femur are also increasing. Only moderate or minimal trauma is enough to cause proximal femur fractures in geriatric patients. In younger patients intertrochanteric femur fractures occurs due to high energy trauma such as road traffic accidents or fall from height. Gulberg et al in 1997 estimated the future incidence of hip fractures in the world would double in the upcoming years. The percentage of increase will be greater in men than in women. [(2)] The number of hip fractures that occurred in Asia in 1990, could rise to a significant level in 2025. The focus of surgical research regarding internal fixation in the early 20th century was to minimize implant failure and cut-out of the femoral head and neck fixation components with acceptance of loss of reduction of the fracture. Functional recovery was not considered to be related to the fracture malunion.
Intertrochanteric fracture line lies along extra capsular basilar neck region to region along the lesser trochanter, undisplaced fracturesand minimally displaced fractures with intact posteromedial cortex are said to be stable.
Most preferred modality of treatment is intramedullary nailing or dynamic hip screw platting [(3)].
There are five variables which are found to affect the biomechanical strength of the repair.
1. *Bone quality*
2. *Fracture pattern*
3. *Reduction*
4. *Choice of implant*
5. *Implant placement*

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In an unstable intertrochanteric fractures intact lateral wall plays a key role in stability. An intact lateral trochanteric wall provides biomechanical support and lateral buttress for the proximal fragment, thus improves stability[(4,5)]. The deficiency of lateral wall leads to excessive fracture collapse and varus malposition positioning.

Intramedullary nailing has become a popular method of stabilization of unstable trochanteric fractures in adults both stable and unstable type of fractures.[(6)] The nail itself gives support to posteromedial wall and resists excessive fracture collapse therefore biomechanically PFN is a better choice of implant for fixation of unstable trochanteric fractures due to short surgical time, less soft tissue dissection, less blood loss, short lever arm, load sharing device, lower bending movement owing to intramedullary, closer to weight bearing axis.

There are some pitfalls as implant failure does occur due to imbalanced biomechanical forces acting on implant around hip joint as there is no support to lateral wall. Hence screw migration, Z effect and cut out of the screws and implant breakage are common complications[(7)]. Dynamic hip screw (DHS) with trochanteric buttress plate stabilizes the trochanteric fracture but at the cost of open procedure with significant blood loss.

Unstable trochanteric fractures with coronal split continue to be a challenge for orthopaedic surgeons. Near-anatomical reduction and optimal positioning of implants are of paramount importance for good outcome and reducing the risk of complications.

The objective of our study is to hypothesize that anatomical reduction and supporting the lateral wall is important to prevent complications with an additional buttress plate along with PFN which increases the stiffness of the bone-implant construct reducing the rate of complications.

I. Materials and Methods

This is a prospective study of 20 cases of intertrochanteric fractures treated by early surgical fixation with both dynamic hip screw fixation and proximal femoral nailing with supplementary fixation with trochanteric stabilizing plate. The period of survey and follow up extends from July 2020 to January 2022. It includes all types of intertrochanteric fractures. The time protocol extends from within 24 hours of injury to 14 days of injury.

II. Surgical Technique

For proximal femoral nailing, lateral approach to femur was used, with incision made about 5cm above the greater trochanter adequate enough to make entry point. Entry point of the nail is the tip of the greater trochanter. Nowadays a modified medial entry point on the tip of greater trochanter is also used. Another incision of 6cm is put about 5 cm distal to the previous incision for the insertion of the proximal screws and trochanteric stabilization plate followed by nick incision for distal screws as necessary.

III. Results

All patients meeting the inclusion criteria and consenting for the study were included in the analysis. Most of the patients were brought to the casualty or admitted through out patient department. Basic clinical history was taken. Careful clinical examination of patients was done and recorded. Radiographs of the affected extremity were done. Primary treatment in form of skin traction and analgesics given. All patients were assessed and treated according to the fracture configuration, general conditions and other related factors after senior consultant's opinion.

Postoperative X-ray examination showed anatomical reduction in 20 out of 20 cases, Mean duration of surgery was 118min in all the patients. Out of 20 patients 5 patients developed complications (screw backout was seen in 1 patient, infection was seen in 2 patients, Z effect was seen in 1 patient and broken screw was seen in 1 patient).

DISTRIBUTION OF PATIENTS ACCORDING TO MODE OF INJURY

Table 1. Mode of injury

Mode of injury	No. of patients
Domestic fall	16
Fall from height	1
Road traffic accident	3
Total	**20**

DISTRIBUTION OF PATIENTS ACCORDING TO TYPE OF FRACTURE

Table 2. Types of fracture

Tronzo classification	No. of patients
Tronzo type 1	0
Tronzo type 2	0
Tronzo type 3	3
Tronzo type 4	4
Tronzo type 5	13
Total	**20**

DISTRIBUTION OF PATIENTS ACCORDING TO IMPLANT USED

Table 3. Implants used

Implant Used	No. of patients
PFN+TSP	17
PFN+TSP+ENCIRCLAGE	2

DHS+TSP	1
Total	**20**

DISTRBUTION OF PATIENTS ACCORDING TO COMPLICATION

Table 4. Complications

Complication	No. of patients
Screw backout	1
Infection	2
Broken screw	1
Z effect	1
Nil	15
Total	**20**

ANALYSIS OF FUNCTIONAL OUTCOME

Table 5. Harris Hip Score

Grading	No. of cases	Percentage
Excellent	6	42.85
Good	5	35.71%
Fair	0	0
Poor	3	21.42%

Table 6. Haris Hip Score

	Grading
Excellent	90-100
Good	80-90
Fair	70-80
Poor	<70

Domains and items	Point
Pain	
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 diclofenac	30
Moderate pain, tolerable but makes concessions to pain, some limitation of ordinary activity and work: may require occasional pain medicine stronger than diclofenac	20
Marked pain, serious limitation of activities	10
Totally disabled, crippled, pain in bed, bedridden	0
Function: Gait.	
Limp	
None	11
Slight	8
Moderate	5
Severe or not able to walk	0
Support	
None	11
Cane for long walks	7
Cane most of the 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	0
Functional activities	
Stairs	
Normally without using a rail	4
Normally using a rail	2
In any manner	1
Unable	0
Squatting	
With ease	4
With difficulty	2
Unable	0
Sitting cross legged	
With ease	5
With difficulty	3
Unable	0
Public transportation	
Able to use	1
Unable to use	0
Hip range of motion (Clinician assessed)	
Flexion (maximum = 140°)	
Abduction (maximum = 40°)	
Adduction (maximum = 40°)	
External rotation (maximum = 40°)	
Internal rotation (maximum = 40°)	
Range of motion scale (sum of the range of motion)	
211–300	5
161–210	4
101–160	3
61–100	2
31–60	1
0–30	0
Absence of deformity (Clinician assessed)	
•Less than 30° fixed flexion contracture – Yes/No	
• Less than 10° fixed abduction – Yes/No	
• Less than 10° fixed internal rotation in extension – Yes/No	
• Less than 3.2 cm limb length discrepancy – Yes/No	
If all 4 yes	4
If less than 4 yes	0

IV. Discussion

The evolution of management of intertrochanteric fracture has come a long way from totally conservative management to definitive surgical treatment at present. Over the years surgical management has also progressed from extramedullary fixation to intramedullary fixation according to type of fracture. Intertrochanteric fractures are classified as stable or unstable fractures. Stable IT fractures are usually two part fractures with intact posterior-medial buttress which resists displacement after adequate reduction and these can be treated by sliding hip screw. Unstable IT fractures are fractures with posteromedial comminution, reverse oblique, and fractures with subtrochanteric extension and these have tendency to drift into varus and excessive collapse leading to suboptimal results.

In order to prevent these complications, it is important to restore the integrity of the deficient lateral wall, irrespective of the type of primary fixation method used. Intramedullary nails although provides stability to posterior-medial part, but they alone are insufficient to compensate for the broken lateral wall. Nie et al., in a cadaveric study, showed that on loading the PFN implanted femur, nail supported the medial wall well and failure in all the stabilized femora occurred at the greater trochanter or at the lateral wall, demonstrating that PFN alone is insufficient to support the lateral wall[8].

Thus, broken lateral wall treated with intramedullary nails also requires lateral wall augmentation. Broken lateral trochanteric wall can be reconstructed in both extramedullary and intramedullary devices by additional application of cerclage wire or screws[9]. Kulkarni et al. and Jafarrullah et al. classified the broken lateral wall into subtypes such as single large fragment, coronal split, and comminuted type and suggested different patterns of supplementation of cerclage/screw fixation for these subtypes[9,10]. But this addition of cerclage or

screw forms a weak construct for high forces around hip and fails to effectively buttress the lateral wall leading to breakage, back out, loosening, impingement, non-union, delayed healing, and malreduction, especially in osteoporotic bone.

Mean Age: In our study, we had total of 20 patients, mean age was 55.85 years, which is inconsistent with Saurabh Jain at el 60.13 years of mean age.

Harris Hip Score: In our study, we had a total of 14 patients, out of which 6(42.85%) patients had excellent Harris hip score, 5(35.71%) patients had good Harris hip score, 0(0%) patients had fair Harris hip score, 3(21.42%) patients had poor Harris hip score, which is inconsistent with Saurabh jain at el (excellent=83.33%, good=13.33%, fair=0%, poor=3.33%). The average scoring in study of Shashikant Basavraj Ganjale et al in 32 patients according to Salvati and Wilson criteria was excellent in twenty eight patient [87.5%] and good in two patients [6.25%] and fair in two patients [6.25%].

Table 7. Comparison between studies

Study	Excellent	Good	Fair	Poor
Saurabh jain at el	83.33%	13.33%	0%	3.33%
Shashikant Basavraj Ganjale et al	87.5%	6.25%	6.25%	0%
Present study	57.14%	21.4%	14.28%	7.14%

Operating Time: In our study, we had a total of 20 patients, mean operating time was 118 min, which is inconsistent with Saurabh jain at el 91.86 min and Shashikant Basavraj Ganjale et al 75 min. According to study of Cyril Jonnes at el[(11)] in 30 patients average operating time for PFN is 90 min and for DHS is 105 min.

Complication: In our study, we had a total of 20 patients, Infection was seen in 2(10%) patients, Screw backout was seen in 1(5%) patient, Z effect was seen in 1(5%)patient and Broken screw was seen in 1(5%) of patients. Which is inconsistent with Saurabh jain at el (infection=0%, screw back out=0%, broken screw=0%, Z effect=0%) and Shashikant Basavraj Ganjale et al (infection=0%, screw back out=5.7%,broken screw=0%, Z effect=0%).

In our study of 20 patients 2 patient died within 2 weeks of post operative periods and 4 patients died within 3 months post operatively.

Only 1 patient was treated with dynamic hip screw platting with trochanteric stabilizing platting but lost follow up as patient died before 2 month of post operative period.

In our study radiological parameters measured are varus collapse and medialization of anatomical axis of shaft femur.

Varus collapse is measured by comparing axis passing from the neck of femur and anatomical axis of shaft femur on both sides.

Shaft medialization is measured by distance between anatomical axis of shaft femur and midline at the level of 10 cm distal from pubic symphysis.

In our study 1 patient has varus collapse of 4 degree and two patients have more than 5 mm of femoral shaft medialisation. Out of which one patient is having screw backout.

V. Conclusion

This prospective study concludes clinical and radiological outcome of intertrochanteric femur fracture treated with proximal femoral nailing and dynamic hip screw platting with supplementary fixation by trochanteric stabilisation platting.

Unstable intertrochanteric fractures are with posteromedial comminution, reverse oblique type (Tronzo Type V) and fractures with subtrochanteric extension. These fractures have tendency to drift into varus and excessive collapse on weight bearing which leads to femoral shaft medialisation. Lateral wall augmentation is required in these unstable intertrochanteric fractures in addition to intramedullary or extramedullary fixation.

In our study it is found that intertrochanteric fractures commonly occur in people around age of 5th decade most commonly due to domestic fall injury and in adults it occurs due to high velocity trauma such as road traffic accidents

Fracture stabilization by rigid internal fixation by proximal femoral nailing with trochanteric stabilizing plate gives anatomical and stable reduction and gives excellent radiological outcome after 6 months.

Intertrochanteric femur fracture treated with proximal femoral nailing with lateral wall augmentation with trochanteric stabilisation platting gives good to excellent functional outcome.

Operative time in trochanteric stabilization plate with proximal femoral nail is higher than proximal femoral nail alone. But over the period of time with experience trochanteric stabilizing plate can be done in lesser time with less soft tissue dissection and exposure by placing the plate form same incision for proximal screw insertion.

Trochanteric stabilization plate prevents excessive varus collapse and medialization of shaft especially in unstable fractures reverse oblique type, subtrochanteric extension, with comminuted lateral wall.

Pain, limp, support, distance walked, sitting, public transport, walking stairs, put chapels, absence of deformity, range of motion assessed by harris hip score. In our study mean harris hip score is 80.

11 patients having excellent and 3 patients having poor result after 6 month follow up.

Proximal femoral nailing in unstable intertrochanteric femur fracture with supplementary fixation with trochanteric stabilisation platting is better choice of implant then sliding hip screw with trochanteric stabilisation plate due to poor quality of bone in geriatrics, less exposure, less blood loss and less operative time.

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