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Orthopaedics

COMPARATIVE STUDY OF SUBTROCHANTERIC FRACTURES MANAGED BY PROXIMAL FEMUR NAILAND PROXIMAL FEMUR LOCKING PLATE

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Abstract:

This prospective studycompared the functional outcomes of subtrochanteric fractures treated with PFN and PFLCP.A total of 20 patients were follwed up. Perioperative information and complication were recorded and assessment of functional outcome was made. Even though both PFN and PFLCP are effective in the treatment of subtrochanteric fractures, we observed that PFN was a better implant than PFLCP, because PFN enables more of a biological fixation with less disturbance of fracture haematoma, faster healing than PFLCP and lesser amount of blood loss.

Keywords: *Subtrochanteric fractures, Proximal femur Nail, Proximal femur locking compression plate.*

Introduction

Sub-trochanteric fractures have evolved as one of the most important causes of morbidity and mortality in elderly patients. They account for approximately 10-30%[1] of peritrochanteric fractures. Subtrochanteric region is area below the inferior border of lesser trochanter extending distally 5 cm^2 to the junction of proximal and middle third of femur. These fractures have a bimodal distribution and are seen in two main populations, older osteopenic patients following low energy falls and younger patients with high energy trauma.

Early surgical intervention is needed in majority of the patients to avoid the major complications that can occur due to long term immobilisation which include deep vein thrombosis, thrombophlebitis, urinary and lung infections and ulcers. This pattern of fracture is associated with higher rates of malunion and non-union than any other femoral fractures because of the anatomical peculiarity of this area.

A number of modalities of management exists for this pattern of fracture. However the main modality of treatment can be divided into two groups, the cephalomedullary hip nails and the lateral plate screw systems.

Fixed nail plate devices were used for the treatment of these fractures initially. Later sliding hip screw devices became popular in the treatment of subtrochanteric fractures. Other implants used were angular blade plates, dynamic condylar screws and cephalomedullary nails. All these implants had its own advantages and disadvantages.

Traditionally the medial and posteromedial fracture fragments were considered to be important elements in determining severity of peritrochanteric hip fractures.[3] Later Gotfried emphasized the importance of lateral trochanteric wall in stabilizing subtrochanteric fractures. Locking plates for stabilising subtrochanteric fractures were developed in 21st century as it can act as a buttress for the lateral trochanteric wall and helps in the stabilisation of lateral trochanteric wall.

Materials And Methods

The study was conducted in 20 patients with subtrochanteric fractures admitted in the emergency department. Out of the 20 cases, 10 cases were treated by Proximal femur nail and 10 cases were treated by Proximal femur locking compression plate. The duration of study was from December 2015 to September 2017 at Govt. Mohan Kumaramangalm medical college Hospital, Salem, Tamilnadu.

Operative Procedure

PFLCP (Proximal Femoral Locking Compression Plate):

Patient is positioned in supine position in fracture table. Traction is given and satisfactory reduction and alignment is obtained and verified under C –arm guidance. A lateral longitudinal incision of about 10-15 cm is made from 2 cm below the tip of the greater trochanter. Subcutaneous tissues, the deep fascia and vastus lateralis muscle are split at its proximal insertion and the muscle is flipped to visualise the lateral aspect of proximal femur. Fracture is successfully reduced mostly by open reduction, using bone holding forceps and collinear reducion clamps. After successful reduction of the fracture the plate is placed on the lateral aspect of proximal femur. The most distal screw of the proximal hooded portion was first inserted to maintain the femoral neck shaft angle and other screws are inserted until they have satisfactory subchondral purchase. The plate is then fixed to the distal shaft with minimum cortical screws of 4.5mm (6 cortical purchases)

Operative Technique

Temporary Fixation

Plate Positioning And Proximal Screw

Distal Screw Fixation With Plate Application

Final C Arm Image

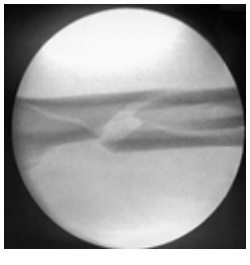
Operative Procedure

PFN (Proximal Femoral Nail)

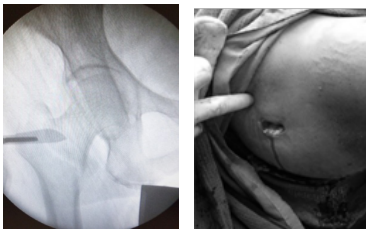
Patient in supine position on fracture table, reduction is achieved by traction adduction and internally rotating the limb. If reduction cannot be achieved by closed means the fracture site has to be opened using lateral approach, an anatomic reduction of the fragments is achieved using bone clamps, K wires and then the nailing is done. A 3cm incision made from the proximal tip of greater trochanter slightly bent dorsally. Subcutaneous tissue, deep fascia and gluteus maximus is incised along the line of skin incision. The tip of trochanter is palpated using finger for making the entry point. If reduction cannot be achieved by closed methods, then other techniques are attempted, this includes methods[4] like depression of proximal fragment with the help of a mallet externally, Insertion of Schanz screw into one of the proximal fragments, usage of a bone hook, use of collinear clamps and reduction clamps after opening the fracture .Guide wire is passed and serial reaming done. Nail is inserted and fixed with lag screw, derotational screw and distal locking bolt.

Operative Technique

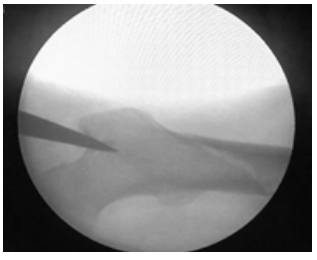
Positioning



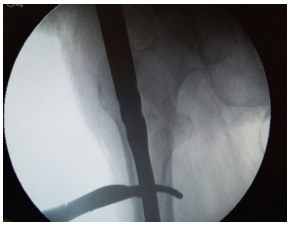
C Arm Image



Incision

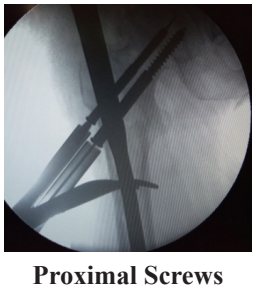


Entry Point



Reduction

Nail Insertion



Proximal Screws

Proximal Screws

Distal Locking Bolts

Observation And Results

In our study the average age of patients where PFN was used was found to be 47 and average age of patients where PFLCP used was 58.Among our 20 patients in the study 18 patients were males and 2 patients were females. Out of the 10 cases of PFN all patients were males and among the 10 cases of PFLCP only 2 were females. In our study we found that among 20 cases 8 cases were following accidental fall and 12 cases were due to RTA. In our study most of the cases were Russel Taylor Type IB.3 cases each were classified under Russel Taylor type IIB and 4 cases were classified under type IA.In our study bone grafting was done in a total of 4 cases out of which 3 cases primary bone grafting was done and for one case secondary bone grafting was done.Out of the 3 cases of primary bone grafting ,2 were done for PFN patients and one for a case treated by PFLCP.Secondary bone grafting was done for a case of PFLCP which had implant failure and later revision surgery was done with PFN and secondary bone grafting. Out of the 20 cases 4 cases went for non union,Among the 4 cases ,3 were treated with PFLCP.Among the three cases for one of the case revision surgery was done with PFN. The average time for union in weeks for cases managed with PFN was found to be 16 weeks and those managed with PFLCP was found to be 18 weeks. The average follow up of patients with PFN was 10 months for PFN and 12 months for PFLCP. In our study of 20 patients ,25% that is 5 patients had

an excellent Harris Hip Score. Out of this 5 cases with excellent Harris hip score,4 cases were managed by PFN and 1 case managed by PFLCP.2 cases that is 20% of cases had a poor outcome and these 2 cases with poor outcome was managed by PFLCP. In our study of 20 patients varus collapse was seen in 3 cases manged by PFLCP. In our study screw breakage of proximal locking screws were seen in 2 cases managed by PFLCP and in one case of PFN there was breakage of derotation screw. Among the 20 cases in our study, shortening was observed in 8 cases, out of which 3 cases was seen in PFN group and 5 cases belong to PFLCP group.3cm shortening was seen in one case ,all other cases had shortening of less than 3cm.

GROUPS		MEAN	STD DEVIATION	P VALUE
AGE	PFN	47.20	16.390	0.154
	PFLCP	57.50	14.524	
UNION	PFN	15.56	2.404	0.069
	PFLCP	18.00	3.024	
OPERATING TIME	PFN	80.00	13.944	.001
	PFLCP	104.00	13.499	
BLOOD LOSS	PFN	78.00	13.375	.000
	PFLCP	152.50	32.167	
FOLLOW UP(MONTHS)	PFN	9.80	2.440	.301
	PFLCP	11.80	5.412	

Discussion

In subtrochanteric fractures deforming forces are difficult to curtail and these fractures take a longer time to unite. Hence it is a great challenge for treating orthopaedicians. It still remains a controversial topic as to which is the best implant. The main system of implants widely used now are the intramedullary hip screw system, intramedullary interlocking nails and the plate screw systems each with its own advantages and disadvantages.

Intramedullary fixation has advantages over extramedullary implants as it is more of a biological fixation with less devascularisation, less bleeding , less surgical duration and early functional recovery. PFN is a load sharing device which carries most of the bending loads. Herscovici et al, in a retrospective study compared the functional outcomes of intramedullary and extramedullary implants and observed that functional results and complications rates were almost similar, but the advantages of intramedullary implants over extramedullary devices were in terms of less bleeding and faster surgical duration.

In one of our cases with PFN, cerclage wiring was done, this patient achieved union by 12 weeks. Tomas et al emphasised the importance of cerclage wiring, and all cases in his study showed complete union. Codesido et al[5] in a study compared open reduction and cerclage wiring with closed reduction and found that patients treated with cerclage wiring had better results than closed reduction. For this same case bone grafting was also done. A study by Thapa. P. et al[3,6] advocated bone graft as a routine procedure in all comminuted subtrochanteric fractures without posteromedial continuity. Bone grafting acts as protection factor for fixation device and prevents the varus deformity.

For better functional outcomes in PFN, an ideal entry point and reduction is crucial. Paulo Roberto Barbosa and Streubel et al[5] in their study after analysing 50 x rays of normal hips demonstrated that the ideal entry point was just medial to the tip of greater trochanter in 70% of patients and lateral in the remaining patients. Inspite of evolution of different implants for subtrochanteric fractures, reduction is considered as isolated crucial factor in prognosis of subtrochanteric fractures. Lag screw should be applied to the inferior part of the femoral neck close to the calcar in anteroposterior view and right in the central in lateral view.[3,7] The screw tip should reach the subchondral bone, 5-10 mm below the articular cartilage. Miedel et al[8] in their study analysing the results of intramedullary fixation in the treatment of subtrochnateric fractures, observed that in those cases with acceptable reduction, the rate of reoperation was 23% whereas those with good reduction, no patients were reoperated. The aim should be to restore the cervico diaphseal angle, in

addition to the correction of rotation and flexion of the proximal fragment with methods that cause minimal biological damage.

Among the patients operated with PFLCP, we had 3 cases of implant failure. Revision surgery using PFN was done for one of the cases, 2 other cases no revision procedure was done. One of the patients had plate breakage after 6 months with varus collapse. Plate exit was done and revision surgery with long PFN with cerclage wiring and bone grafting was done. Patient has not attained complete radiological union till now and had varus collapse. Patient also has a significant shortening of 3cm.Causes for implant failure in this patient was due to varus malreduction at the time of surgery, medial comminution and distraction at the fracture site which would have caused high stress at the plate screw interface, eventually leading to plate breakage. We could have avoided this complications by achieving a perfect reduction and earlier bone grafting.

We observed that the cause of failure in our study among PFLCP patients was due to mechanical stress at the plate screw interface caused due to early weight bearing on the affected leg, before bone healing has completed. This was observed by Haidukewych et al[9] in their study the cause of plate breakage was due to the inability to win the race between fracture healing and implant failure among the patients.

Factors important in plate fixation are: critical technique and good surgical experience, protected weight bearing until evidence of bony healing is important, good anatomical reduction of the fracture fragments and maintenance of posteromedial continuity.[10] On weight bearing, mechanical stress acts on the femur and the highest compression stress is seen at an area 3cm distal to lesser trochanter, so the main focus is on medial cortical buttress, bending forces causes medial cortex to be loaded in compression and the lateral cortex in tension. As comminution increases the biomechanical stability decreases. In cases of inadequate medial cortical support the internal fixation device will act as a tension band in lateral femoral cortex, and loads are concentrated in an area of the implant resulting in implant failure and loss of fixation.

One of the key factures in subtrochanteric fractures is good anatomical reduction, In our study we observed that in a patient where we had done a good anatomical reduction using interfragmentary screws, the bone healing and union was quicker when compared to other cases where we had not used this techniques. We also observed that this patient had an excellent HARRIS hip score and weight bearing was stated earlier, Another case where we had done primary bone grafting healed well with excellent HARRIS hip score,in this case bone grafting was done in order to maintain the posteromedial continuity.

The concept of lateral trochanteric wall as a stabilising factor in management of subtrochanteric fractures led to the development of concept of locking plates for subtrochanteric fracture management. Following observations which we made in our study while using PFLCP were:

1. Delayed weight bearing, toe touch weight bearing can be delayed in unstable fractures with limited posteromedial continuity. Earlier weight bearing can be started in fracture with good posteromedial cortical contact.
2. Plate once locked in its position does not permit further collapse or does not increase the cortical contact, hence open reduction must be done whenever doubtful about reduction which further adds to blood loss and causes devascularisation of the fragments.
3. Avoid distraction while fixing which increases risk of implant breakage as the fracture heals.
4. Plate positioning and screw placement is crucial ,the proximal tip of the plate should engage with the tip of the greater trochanter and the plate with increased length spanning the whole fracture are more reliable. Proximal screws should be as long as possible and inferior most head screw should engage the calcar.
5. We observed that bone grafting must be considered in cases of subtrochanteric fractures both as a primary or secondary procedure.

In a study by Jie Wang et al[11] where biomechanical evaluation of different implants like PFN and PFLCP was compared it was observed that PFN was superior biomechanically than other implants in terms of its construct. We observed that PFN has more advantages as compare to PFLCP ,PFN has shorter bending lever arm and it can bear more compressive stresses on medial cortex of proximal femur.PFN also prevents varus collapse of the medial cortex of subtrochanteric region thus reducing the incidence of failure rate. In our study we observed that even though there were no major differences in

the functional outcomes and union, implant failure was less associated with PFN and there is significant decrease in the amount of blood loss and operating time in patients treated with PFN when compared to patients managed by PFLCP. Our observation was similar to study by V.Srivastava et al[12] where they observed that the blood loss, operating time and incision length was significantly lower in PFN when compared to PFLCP.

Conclusion

Both PFN and PFLCP are effective in the management of subtrochanteric fractures. Subtrochanteric fractures are fractures which take a longer time for union .No major differences were noted in the functional outcomes and complication between the PFN and PFLCP .Advantages of PFN over PFLCP are decreased blood loss,decreased duration of surgery and less devascularisation of the fracture fragments,with less disturbance of fracture haematoma, due to increased chances of closed reduction in PFN over PFLCP.PFN being a load sharing device is biomechanically stable than PFLCP a load bearing device.

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