

The Effectiveness of Biological Fixation of Proximal Femoral Fractures Using Angle Stable Implant Pf-LCP in Restoring Function and Bone Union - A Study on 56 Cases

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Abstract:

Proximal femoral fractures occur in the old and the young. The locking compression plate for proximal femur by biological plating with screws into the neck and head of femur in 58 consecutive patients allowed early mobilization and avoid complications with acceptable results even in osteoporotic bone and comminuted fragments irrespective of the type of fracture. The intra operative radiation was found to be less compared to other series .

Key words: Locking compression plate, lesser radiation, biological plating, proximal femur fractures

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I. Introduction

Proximal femur fractures commonly occur in high velocity injuries in young adults and low velocity injuries in case of old individuals. The problems are comminution and osteoporosis.

These injuries left un-operated lead to bed sores, lung, urinary tract infections, Deep vein thrombosis, and pulmonary embolism. Prolonged immobilization in bed can cause muscle contracture and wasting, heterotrophic ossification, malunion or non-union with shortening. These fractures need surgical intervention. Conventional fixation methods used are proximal femoral nail ·Dynamic hip screw ¹ long intramedullary nail with Reconstruction option ², Dynamic condylar screw³, angle blade plates ⁴ and sometimes if fractures are not amenable for fixation then primary hip arthroplasty⁵.

Of these comminuted and unstable Inter or Sub trochanteric fractures with or without extension into piriform fossa and combined Intracapsular and Extra capsular fractures and fractures in Osteoporotic bones are challenging injuries needing good decision making. In this study we to analyse the effectiveness of biological fixation of proximal femoral fractures using angle stable implant PF-LCP mainly restoring hip function and achieving union radiologically with minimum c-arm exposure.

II. Methodology

The study was approved by the institutional ethical committee of Thanjavur Medical College. Between April 2011 and May 2020, 58 patients with fractures of proximal femur treated by biological fixation using locking compression plates were selected for inclusion in this study.

Selection bias

It is both retrospective and Prospective study and it was done between 2011 and 2020 on the adult cases of proximal femoral fractures of both sexes that underwent PF-LCP with specific variables as shown in the table. We included all intertrochanteric and sub- trochanteric fractures (classified by Seinsheimer or Boyd and Griffin classification). There were a total of 58 cases in this time. Those patient with above injuries but significant coexisting diseases with contra indication for anaesthesia fractures in paediatric age group pure neck

of femur fractures and bilateral injuries were excluded from the study.

Treatment done

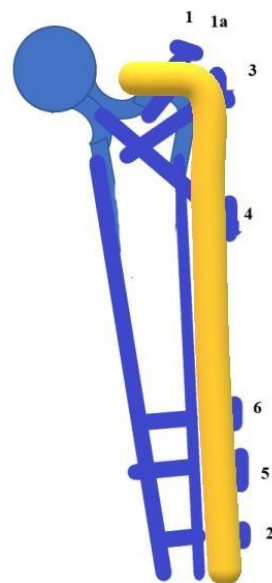
Once patient received in triage ATLS protocols of airway and shock management applied and surveying for other system injuries done. Splinting and bed side radiographs were done. A detailed history as to injury, smoking alcoholism and drugs previous surgeries and injuries done. Proper systematic clinical examination was done to find out nature of trauma, mechanism of injury and the duration since injury, any associated injuries and local examination of injured limb to rule-out neuro vascular status and wounds.

After hemodynamic stability, CT of hip done to exclude undisplaced neck of femur fracture. A series of radiographs taken including the AP and lateral views of the both side hips, thigh and knee, pelvis to rule out other fractures in opposite hip, for comparison and templating purposes and for assessing fracture reconstruction after surgery. Those patients, who fit the inclusion criteria, were explained about the nature of the study, various surgical options and a written informed consent in their own language was obtained.

Surgical Procedure:

After spinal or spinal cum epidural anaesthesia patient positioned in a lateral position on a regular arm compatible table without a fracture reduction table. After prepping the parts and draping, by a direct longitudinal incision made to expose the trochanteric flare.

PFLCP of same side is selected then the plate is passed along the proximal femur in the sub muscular plane. This step can be facilitated by a Cobb's elevator. The proximal most hole is drilled with a 3.2mm drill bit and an ordinary 4.5mm cortical screw is passed through this to position the plate. With longitudinal traction and keeping the proximal femur plate matching the contour of proximal femur which is exposed above, another incision is given to expose the distal three holes of the plate seated on the distal part of femur. Proper alignment of femoral condyles to proximal femur which is now exposed in the proximal wound is done and thus the sagittal alignment of the bone is achieved even without opening the fracture site. The distal most 5mm locking screw is applied with above alignment. Now the second proximal hole is drilled with sleeve for 6.5mm cancellous locking screw and the screw is applied (usually 75-85mm long). Third 6.5mm cancellous locking screw is also applied below this screw. (Usually – 80-90mm long) Then the proximal most 4.5mm screw is exchanged for a 6.5mm cancellous locking screw (usually – 50-60mm long) The other two 5mm distal locking screws are then applied. We use a maximum of three 5mm distal locking screws only. Then wound is closed.



- 1= 4.5 cortical screw , 2= 5mm lock, 3 = 6.5 cancellous lock
4 6.5 cancellous locking screw , 1a = 6.5 cancellous lock exchanged for 1
5 5mm lock 6 5mm lock

Figure shows the steps and order of the screw application.

In the first three cases, we used C-arm to confirm the length of the screw. In later case we did not use C-arm-we used blunt K-wires to find out the breach in cortex and the length of the screw. Blood Transfusion was done for cases only whose preoperative haemoglobin was ten and below. Post operative intravenous broad spectrum antibiotics were given, Suction drain was removed at 48 hours. From the 2nd post-operative day onwards Continuous passive mobilisation (CPM) was given, gentle hip, ankle and knee mobilisation was done

.Static quadriceps exercises and hamstring strengthening exercises were started as pain tolerated The patient was strictly advised not to bear weight. Radiological scoring, template using the uninjured proximal femur with operated femur especially the neck shaft angle is done. Then the normal radiographs were compared with the operated side for assessing the adequacy of varus correction and reduction.

Two patients were lost for follow up. Of the remaining patients 56 patients were followed up for 2 years. In every follow up these patients were evaluated for radiological healing. Patient was allowed to weight bear only after radiological union and the functional status was assessed with modified Harris hip score.

Table showing the details of the cases which were studied

Total Number of. Cases	58
Gender	Males 45(78%) Females 13 (22%)
Mechanism of injury	Vehicular accident in majority of the cases.
Diabetes	3
Age distribution	18-30=14(24%),31-45 =17(29%) 46-60 =14(24%),61-75=9(16%),More than 75 = 4 (7%) patients.
Mean age	Males 43 years Females 55 years
Side distribution	Right 33- Left-25
Mode of injury	VA in 35(60%). Accidental fall in 18(30%) Fall from height 2 (3.5%) Assault in 2(3.5%) Wall collapse in one patient (2%)
Comorbidities	HT-8,DM-3,Achondroplasia,Limb muscle dystrophy, PRPP- each 1
Associated fractures 11	Pelvic fracture, ulna fracture, bimalleolar fracture , patella fracture,Both
	Bones leg fracture crush injury foot - each one case respectively Distal femur fracture - 2 Distal radius fracture - 3
Fracture pattern	Sub trochanteric - 37Seinshiemer type I-3,II-11,III-8, IV-5,V-10 Intertrochanteric #- 21Boyd and Griffin type I-3, II-3, III-5 Few patients had comminution at fracture side.
The mean duration between injury and surgery	Time lag-10 days.
Anaesthesia	Spinal ± epidural
Team of doctors	SK, SVS, VKSSame team of doctors did all the surgeries
Length of incision	Proximal 10 cm distal 5 cm
Reduction	Biological
Implant	PF-LCP
Average time for union 8 to 12 wks	8 wks-33, 12 wks-19, 16 wks-3, 20wks-2 24 wks-1 United well-54Malunited-4
Average no of C-arm shots	Three
Average duration of surgery	55 minutes Shortest time -40 minutes Longest time 1 hr 30 minutes
Blood transfusion	Needed in 50 % cases for Hb % less than 10 gms %
Secondary procedures-bone grafting	No
Mean follow up	56 cases were followed up for a period of 8 months to 24 months
Lost for follow up	Two
Clinical assessment by modified Harris Hp score	39 excellent (67%), 11 good (19%),3 average (5%),5 poor (9%).
Radiological outcome	Excellent 30 (52%) Good 20 (34%).Acceptable 3(5%) Poor in 5(9%)
Complications	Implant failure - 3, Infection- superficial - 4,Deep infection-1, Foot drop-1

After surgery patients were mobilized well in hospital. Post-operatively followed up for once in two weeks for first two months, then monthly interval for four months, there after once in 3months for next one year

Since all our cases showed signs of healing from 8-10 weeks and united at 12- 14 weeks none were grafted.Only Non-anatomical reduction could be achieved,because of fracture comminution and closed biological

fixation. In the subgroup as obvious intertrochanteric fractures had better healing and it cannot be compared with subtrochanteric fractures.

One patient developed severe wound infection which needed debridement, superficial infection developed in 4 patients settled with intravenous antibiotics, another patient developed post-operative peroneal nerve palsy which recovered on its own. Three patients had mechanical failure of implants. . Two patients did not care to adhere to protocol and started to weight bear earlier and presented with broken implant later, one patient had screw breakage and another had plate breakage at the site of contouring.

ILLUSTRATED CASES



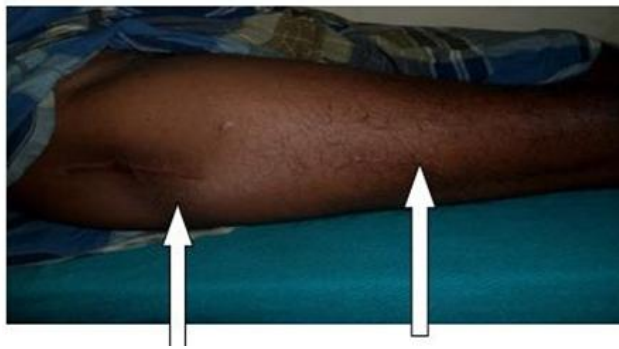
Shown above is a 52-year male with history of road traffic accident sustained Subtrochanteric-fracture Right Femur. Initially he was stabilized and upper tibial pin traction done. Later after 2 weeks patient internal fixation was done with proximal femur locking plate.



He was started static quadriceps exercises the next day and knee flexion and extension exercises later. he was discharged after 3 weeks later after suture removal His 2 months follow up radiographs are shown below



Solid union shown by arrows



Upper and lower operated scars



Good result



Another patient with a Non anatomic reduction



Good functional recovery of the patient whose radiographs are shown immediately above.

III. Discussion

In this study, results of 56 patients with proximal femoral fractures treated with biological fixation with PFLCP were analysed and functional analysis based on Harris hip score were assessed. Pre-existing injury of the femur was not there and all were 1st fractures. All patients had reasonable violence for their injury and there were no specific lytic lesion in any to denote a pathological fracture.

91% of patients with good results and 9% of patients with poor results. In this study we have used angle stable implants like PFLCP for these fractures and obtained 91% of good results. LCP was used in a series with 90% of good results. The implant we used PFLCP is minimally invasive and revision surgeries if necessary would be easier than if DCS was been used. Preservation of fracture haematoma is the most important principle behind this surgery. Properly seated PFLCP can allow the screws to be passed inside the femoral head without much difficulty. A small rotational mal-alignment is well tolerated in sub-trochanteric fracture as hip polyaxial joint. This problem of rotational malalignment usually occurs because we have done closed reduction in all cases instead of open reduction and aligning each fracture fragment. Also a perfect anatomical reduction thus is not necessary due to the factors seen above. The rigidity of the implant allows early mobilization of the limb so that stiffness of the joint is prevented. Average exposure in a trochanteric fixation is 30 number of shots of C-arm- While in our method it is only 3 per patient. The radiation dose per shot is around 1.54 mSV^{6,7,8}

Only limitation -though the study is done by the same team of workers it is retrospective in nature. The other factors of failure could have been included like body mass index, intelligent quotient, neuro condition affecting rehabilitation, alcohol use, smoking, usage of drugs – Etidronate, associated autoimmune disease. Other studies on biological fixation of comminuted sub trochanteric fractures with similar implant had resulted in F-LCP provides good fixation achieving often solid bony union and less complications. However they have not mentioned about lesser use of image intensifier.⁹

IV. Conclusion

Pre-contoured rigid plate “internal fixator “ passed **biologically** across the fracture to fit the regional contour , allowing passage of **non parallel angle stable screw** into the neck and head of femur with ante version by side specificity, reduced intra operative radiation and allows **early mobilization and acceptable results even** in osteoporotic bone and comminuted fragments. Trained well, such fracture can be fixed without image intensifier

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Plate

Legend for the image

A side specific a limited contact angular stable anatomically pre-contoured plate PF-LCP, to fit proximal metaphyseal portions of the femur was used. (SSEPL[®]). Three proximal threaded round holes of this plate are designed for average femoral neck anteversion were made for 6.5mm cancellous locking head screws that are inserted at predetermined angles of 95°, 120° in relation to the shaft of the femur. Third 6.5mm cancellous locking head screw is inserted at the level of the calcar at 135° angle. The remaining screw holes which range from 4 to 16 holes in the PF-LCP are classical LCP combi-holes that allow the placement of either a conventional (4.5 mm) or a locking head screw (5.00) at the level of the shaft. The most distal oval hole is for applying Kirschner wire for temporary fixation to ensure plate positioning

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