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Surgical management of pertrochanteric fractures with proximal lateral femur locking compression plate

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ABSTRACT

Background: Pertrochanteric femoral fractures are of intense interest globally. Pertrochanteric fracture is a one of the most serious cause of mortality and morbidity in elderly people. The number of such admissions is on a raise because of increasing life span, sedentary habits and increased road traffic accidents. Pertrochanteric region is a high stress area. Hence delayed union, implant failures, varus collapse and non-union are common complications. Choice of implant was also a tough decision for surgeons in this area. Hence this study was intended to evaluate the functional outcome of proximal femur fractures treated with proximal femur locking compression plate (PFLCP) in terms of union of fracture, patient compliance and complications.
Methods: This prospective study was conducted at the department of orthopaedics, Narayana Medical College and Hospital, Nellore from December 2014 to June 2016. The complete data was collected from all the patients by taking history of illness and by doing detailed clinical examination and relevant investigations. Finally after the diagnosis, the patients were selected for the study depending on the inclusion and exclusion criteria. Postoperatively all the cases were followed for the minimum period of 6 months to maximum period of 1 year.
Results: In this study 22 patients were involved. There were 14 males and 8 females, with a mean age of 46 years. 19 cases were admitted due to slip and fall and with slight predominance of right side. Mean duration of hospital stay was 20 days and mean time of full weight bearing is 10 weeks. Out of 22 cases 2 cases lost follow up before first follow up time of 6 weeks. Out of 20, remaining cases 8 were type 3 and 12 were type 4. Functional results were graded by Harris hip scoring system. Good to excellent results were seen in 87% cases of type 3 fractures and 83% cases in type 4 fractures.
Conclusions: Treatment with a PFLCP can provide good-to-excellent healing for proximal femur fractures, with a limited occurrence of complications especially for severe comminuted fracture and osteoporosis.

Keywords: Pertrochanteric femoral fractures, PFLCP, Harris hip score

INTRODUCTION

Pertrochanteric fractures are devastating injuries that most commonly affect the elderly and also in young, have a tremendous impact on both the health care system and society in general.[1,2] The frequency of these fractures has increased primarily due to the increasing life span and more sedentary life style brought on by urbanization. Trochanteric fractures occur in the younger population due to high velocity trauma, whereas in the elderly population it is most often due to trivial trauma.[1,3]

The trochanteric fractures can be managed by conservative methods and there is usually union of the fracture. If suitable precautions are not taken the fracture undergoes malunion, leading to varus and external rotation deformity at the fracture site and shortening and limitation of hip movements. It is also associated with

complications of prolonged immobilization like bedsores, deep vein thrombosis and respiratory infections.[4,5] Since this fracture is more common in the elderly patients, the aim of treatment should be prevention of malunion, and early mobilization. Taking all the factors into consideration surgery by internal fixation of the fracture is ideal choice.[1,3,5]

There are various forms of internal fixation devices used for trochanteric fractures; of them the most commonly used device is the dynamic hip screw with side plate assemblies but it provides only a limited treatment.[6,7] The latest implant for management of trochanteric fractures is proximal femoral nail, which is also a collapsible device with added rotational stability. This implant is a centromedullary device and biomechanically more sound and has other advantages like small incision, minimal blood loss.[8]

The lateral trochanteric wall is supposed to be an important factor in stabilizing petrochanteric fractures. Keeping the lateral wall integrated it can assist fracture healing and significantly reduces the rate of malunion.[9] A proximal lateral femur locking compression plate (PFLCP) provides a stress shield for the lateral trochanteric wall and prevents the lateral migration of proximal fragments and became a choice for subtrochanteric or transverse intertrochanteric fractures.[10]

This prospective study was carried out to evaluate the clinical results of PFLCP in cases of proximal femoral fractures. The efficiency of PFLCP was assessed by functional outcome in terms of union and Harris hip core.

METHODS

This was a prospective study conducted at the department of orthopaedics, Narayana medical college and hospital, Nellore during the period from December 2014 to June 2016. A total of 22 patients were selected for the study after meeting inclusion criteria and complete diagnosis. To be included in this study, patients should be aged between 20 - 60 years (both sexes), either with complex and sub-trochanteric femoral fractures, those are supposed to be willing and fit for surgery, fractures of Boyd and Griffin type-III and type-IV, type I-V of Seinsheimer classification or with closed fractures.

Patients with these criteria were excluded: Compound injuries, Boyd and Griffin type-I and type-II, children, pregnant women, patients with neurological deficit, inability to walk independently prior to injury, medically unfit and not willing for surgery.

Detailed information was recorded individually including intra-operative blood loss, total time of the surgery, temporary fixation with K wires, length of incision, implant details, radiation duration, intraoperative blood loss. Patients were revisited at 6 weeks, 1st month, 3rd month and 6th month after operation with clinical and radiographic assessment of the progress of healing and complications. The functional outcome of the patients was evaluated by Harris hip score.

Surgical technique

Surgery was performed with the patient in supine position on a fracture table in traction. Closed fracture reduction was obtained before surgery under fluoroscopic view in anteroposterior (AP) and lateral/axial views and subsequently secured in traction. Care must be taken to achieve an adequate rotation of the femur with the patella in a horizontal position. In highly comminuted and unstable fractures that cannot be adequately reduced by traction on a fracture table, draping of the lower extremity in the supine position was made on a radiolucent operating table. A lateral approach typically is performed by a straight incision from the major trochanter, extending approximately 10 cm distally. After a longitudinal incision of the iliotibial band, the fascia of the lateral vastus is incised in an L shape at its proximal insertion and the muscle is flipped anteriorly to visualize the lateral aspect of the proximal femur.

In cases where a closed reduction is successful and less-invasive plating technique feasible, the plate is slid distally in the submuscular plane by the use of a distal counter incision at the level of the tip of the plate. The most distal hole of the plate can be used to attach a suture that is pulled through the distal counter incision to facilitate the correct distal alignment of the plate to the bone that must be visualized under fluoroscopy.

For more complex and comminuted fractures, the plate can be used as a reduction tool. In this case, the proximal fragment is first fixed to the plate, and the plate is then reduced to the femoral shaft. To facilitate reduction, a strong K-wire or Schantz pin can be temporarily fixed to the greater trochanter as a joystick to reduce the proximal segment. After ensuring perfect anatomic placement of the plate to the proximal fragment, a 2.5 mm drill tip guide wire is inserted through a wire sleeve that is threaded to the most proximal hole at a predetermined 95^{o} angular blade plate. A second guide wire is then inserted through the drill sleeve of the second hole in a 1200 angle Finally, a third guide wire is inserted through the sleeve on the third hole above the calcar in a 135^{o} angle. The three guide wires are advanced to the subchondral bone and their correct placement is confirmed by fluoroscopy in AP and lateral/axial views. Two 7.3 mm, cannulated, self-drilling and self-tapping, locking head screws are inserted through the first 95^{o} and the second 12^{o} holes.

The plate fixed to the proximal segment may now be used for anatomic reduction to the shaft in cases where the initial closed reduction was unsuccessful. The plate can be held to the shaft by a reduction clamp and perfect anatomic reduction and head/neck/shaft angle must be ensured again under fluoroscopy. A K-wire inserted through the most distal plate hole or a conventional 4.5

mm screw in the most distal combi-hole of the plate can be used for holding the alignment of the plate to the shift. Thereafter, a 5.0 mm, cannulated, self-drilling and self-tapping, locking head screw is inserted through the third 135° hole. Correct placement and screw length is ensured under fluoroscopy in two planes and the guide wires are removed. The convergence of the three locking head screws in the AP plane and the divergence in the lateral plane allows an angular stable buttress that increases the stability of fracture fixation. The plate is then distally fixed with an additional 2 to 3 bicortical locking head screws.

In metaphyseal comminution, at least 3 to 4 holes of the plate should be left empty at the level of the fracture. This allows a large area of stress distribution on the plate and reduces the strain at the fracture. Filling all screws holes may lead to stress concentration and high strain, which can lead to implant failure after cyclic loading.

The L-shaped incision of the vastus fascia and the iliotibial band are closed with absorbable O-vicryl in interrupted technique, followed by closure of the subcutaneous layer and the skin. Postoperative radiographs taken with the patient on the operating table ensure acceptable fracture reduction and fixation before the patient is extrubated. Postoperative management includes immediate partial weight with 10 to 15 kg for approximately 6 weeks with gradual increasing to weight bearing as tolerated.

Figure 1: Proximal femur fracture fixed with PFLCP.
a) Preoperatively b) Postoperatively c) 3 month follow-up d) 6 month follow-up.

All patients had closed suction of drainage and received i.v. antibiotics for 72 hours later shifted to oral administration. Static quadriceps exercises were started on the second postoperative day. Active quadriceps and exercise were started on 6th and 7th postoperative day. Dressing was done on 2nd, 5th and 8th postoperative day. Sutures were removed on 12th postoperative day. Patients were advised to walk non weight bearing walking on walker as soon as tolerable usually after suture removal. Partial weight bearing walking was started at about 6 weeks postoperatively. Full weight bearing walking was allowed after assessing for radiological and clinical union. Follow up at outpatient level at regular intervals at 1, 3, 6 months and 1 year was done for serial clinical and radiological evaluation as given in Figure 1.

RESULTS

Among all patient admission, 22 underwent surgery. Two patients were lost to follow up. Remaining 20 patients were followed until complete revision of surgery (1 year postoperatively). Table 1 demonstrates patients characteristics involved in the study. The study involved patients above 20 years of age. The age distribution was from 20 to 60 years. Out of 22 patients 14 were males and 8 were females with an average age group of 46.18 years. Right sided fractures were seen in 14 patients and left sided in 8 patients. The most common mode of injury in our study was trivial fall followed by road traffic accidents and fall from height. According to Boyd and Griffin, type-III fractures were seen in 10 patients, and type-IV in 12 patients.

Table 1: Patient Characteristics.

Patients characteristics	Number of patients
Age group	
21-30 yrs	2 (9.11%)
31-40 yrs	4 (18.18%)
41-50 yrs	7 (31.81%)
51-60 yrs	9 (40.9%)
Sex	
Male	14 (63.64%)
Female	8 (36.36%)
Side effected	
Right sided	14 (63.64%)
Left sided	8 (36.36%)
Mode of injury	
Trivial fall	15 (72.72%)
Road traffic accident	3 (13.64%)
Fall from height	3 (13.64%)
Type of fracture	
Type III	10 (45.45%)
Type IV	12 (54.54%)
Singh index of osteoporosis	
Grade I (severe)	0
Grade II	0
Grade III	5 (22.73%)
Grade IV	10 (45.45%)
Grade V	6 (27.27%)
Grade VI (normal)	1 (4.54%)
Average duration of hospital stay	20 days
Average mean time of union	18 weeks

According to Singh index of osteoporosis grade III was noted in 5 patients, grade IV in 10, grade V in 6 and grade VI in 1 patient. The average duration of hospital stay was 20 days (ranging from 15 to 30 days) and the average time of union was 18 weeks, maximum number of fractures united between 17 to 20 weeks. One case with delayed union (30 weeks) was noticed.

The intraoperative details of all the patients were exhibited in Table 2. There were no intraoperative complications as well as mortality. Table 3 presents postoperative complications among the patients.

Table 2: Intraoperative details of the patients.

Sample size	22
Mean operative time	1 hour 30 min
Average length of incision	10 cm
Implant details (no. of hole plate)	Range from 4 to 8
Blood loss	3 mops avg

Table 3: Postoperative complications.

Postoperative complications	Number of patients
Immediate complications	-
Delayed complications	
Delayed union	01
Union in varus <10 degree	03
Shortening upto 1 cms	03
Knee stiffness	04

Table 4: Functional outcome among 20 patients.

Functional outcome	Number of patients
Harris hip score	
Excellent	14 (70%)
Good	3 (15%)
Fair	2 (10%)
Poor	1 (5%)
Boyd and Griffin classification	
TYPE IV	12 (60%)
Excellent to Good	10 (83%)
Fair to Poor	2 (17%)
TYPE III	8 (40%)
Excellent to Good	7 (87%)
Fair to Poor	1 (13%)
Singh index of osteoporosis	
Grade VI to IV (Mild to Moderate)	15 (75%)
Excellent to Good	14 (93.3%)
Fair to Poor	1 (6.7)
Grade III to I (Moderate to Severe)	5(25%)
Excellent to Good	3 (60%)
Fair to Poor	2 (40%)

The functional outcome was assessed only for 20 patients. 2 patients were lost to follow up. According to Harris hip score, Boyd and Griffin classification and Singh index of osteoporosis the functional outcome was given in table 4.

DISCUSSION

The PFLCP is a limited contact angular-stable plate designed for treatment of complex, communited fractures of inter and sub-trochanteric femoral region. The complications like primary or secondary varus collapse, hardware failure by cut-out of the femoral head screw of dynamic hip screw and higher incidence of secondary implant failure with the use of cephalomedullary nails are reduced with PF-LCP.[11-13] The success of PFLCP depended on good surgical technique, proper instrumentation and good C-arm visualization. All the patients were operated on fracture table.

In this study, 22 patients with pertrochanteric fractures were participated. The average age observed in our study was 46 years. Among them males were 14 and females were 8. 72% in the present series had a history of trivial fall. 3 (13.6%) from road traffic accident and 3 (13.6%) from fall from height as the mode of injury. Two patients were lost at follow up. Boyd and Griffins classification was used to classifying trochanteric fractures. In our study, type II fractures were presented in 10 patients and type IV in 12 patients. The severity of osteoporosis in patients with proximal femur fracture in this study assessed by using Singhs index grading. Grade III osteoporosis was observed in 5 cases, grade IV in 10, grade V in 6 and grade IV in 1 case. Results were evaluated in terms of functional outcome for proximal fractures using PFLCP in terms of Harris hip score, Boyd and Griffin classification and Singh index of osteoporosis.[14-16]

Among different techniques available for fixation, PFLCP was considered as strong construct for proximal femoral fractures.[17] In this study delayed union was seen in 1 patient, 3 cases of union with varus <10^{o}, knee stiffness in 4 patients but improved after rigorus physiotherapy. 3 cases had shortening upto 1 cms and treated with sole raise. In our study we used three screws for fragment fixation and 100% union was achieved after PF-LCP at the end of one year. This was in accordance with the results of Zha et al.[18] In this study, the average time of union was 18 weeks, maximum number of fractures united between 17 to 20 weeks and one case with delayed union had taken 30 weeks and this span of union was almost comparable with the studies of Sasnur et al.[19] In the present study the average operating time was 1 hour 30 minutes from the incision to closure with mean intra operative blood loss of 150 ml and it was similar to the earlier reports of Sansur et al.[19]

In the previous studies of Malcolm et al and Moore et al the average hospital stay was 25.9 days and 21 days

respectively.[20,21] In this study the average hospital stay was 20 days. It was more in patients with co-mordid conditions and complications with highest being 35 days.

In this study elderly patients were more affected with fractures. This was due to osteoporosis in the older patient and post-menopausal females that was measured by the Singh's index. After PFLCP, a total of 17 cases showed excellent to good improvement in grade VI to I osteoporosis. The functional outcome was graded according to Harris hip scoring system. In our study scoring was excellent in 70%, good in 15%, fair in 10% and poor in 5% cases. Similar scoring was observed in the study of Xu et al. In their reports Harris hip score was excellent in 24 cases, good in 20 cases, and poor in 4 cases.[22]

CONCLUSION

PFLCP provides good fixation for pertrochanteric fractures if proper preoperative planning, good reduction and surgical technique are followed, leading to high rate of bone union and minimal soft tissue damage.

Limitations of the study

1. As this was a descriptive study, due to the absence of a control or comparator group, it was difficult to make a definitive conclusion whether this implant was the best treatment option for the unstable pertrochanteric fractures. To make a definitive conclusion, a randomized controlled trial should be done.

2. Our sample size reflects the routine patient inflow in our hospital. A study with a larger sample size would have made a better assessment of this surgical intervention.

3. As the present study was time bound, the patients were followed up for a minimum of 6 months and a maximum of 1 year. Therefore, the long term effects of this intervention remain unknown in our cohort. A longer follow up would have made a complete assessment of this surgical intervention.

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