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Study of Management of Subtrochanteric Fractures of the Femur in Adults Using Long Proximal Femoral Nail

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Abstract

Background: Numerous variations of Intramedullary nails have been devised to achieve a stable fixation and early mobilization of subtrochanteric fracture, among which is the proximal femoral nail (PFN). We reported here the results of a prospective study carried out Institute on 30 consecutive patients who had suffered subtrochanteric fracture between from January 2013 – January 2015 and were subsequently treated with a PFN. *Materials and Methods:* The inclusion criteria being acute and / or pathological subtrochanteric femur fractures aged above 18 Years. The patients were maintained on traction preoperatively in cases whose surgical intervention was delayed for more than two days. All operations were performed under spinal / epidural anesthesia. Postoperative mobilization was started once the patient's conditions were favorable. Weight bearing was determined by the fracture pattern. *Results:* We came across 18 male patients and 12 female patients. 60% of the cases associated with RTA and 40% were associated with history of fall. The entire 30 patients with traumatic sub trochanteric fractures healed uneventfully except 2 cases of delayed union. No complication such as cut out or breakage of implant or peri implant fracture were encountered. *Conclusions:* Long proximal femoral nail is the most reliable implant for sub trochanteric fractures, leading to high rate of union. The high advantages include minimal exposure, better stability and early mobilization with biological and biomechanical advantages.

Keywords: Fracture; Hip; Sub-Trochantric; PFN.

Introduction

Sub trochanteric fractures occur as extension of intertrochanteric fractures or as independent entities. A sub trochanteric fracture femur is a fracture between the lesser trochanter and a point 5cm distal to lesser trochanter [1]. Subtrochanteric fractures account for approximately 10%- 30% of all hip fractures and these fractures have a bimodal distribution. The mechanism of sub trochanteric fracture is direct trauma, and significant forces are usually required. The sub trochanteric segment of femur is subject to high biomechanical stresses. The medial and postero-medial cortices are sites of high compressive forces whereas lateral cortex experiences high tensile forces.

The sub trochanteric area of femur is mainly composed of cortical bone with less vascularity in this region and potential for healing is diminished as compared with intertrochanteric fracture. These fracture have a characteristics deformity with deforming forces in proximal fragment include abduction and flexion and the distal fragment is pulled proximally and in to varus by adductors. Although these fractures are most difficult to manage in the femur ,our improve understanding of complex biology and biomechanics of trochanteric region as well as rapid development of orthopaedic philosophy

and implants has lead to consensus on the treatment of sub trochanteric fractures [2]. However the appropriate implant for internal fixation of sub trochanteric fractures remain debatable and a multitude of different intra – and extra medullary devices for their surgical fixation has been advocated [3-7].

The sub trochanteric region of the femur is subjected to many stresses resulting from bending movements and compressive forces, thus leading to non union, malunion and non-union of fractures and mechanical failure of the implants [8-9]. The objective of our study was to evaluate the clinical and radiological outcomes of traumatic sub trochanteric fracture femur fixed with long proximal femoral nail with emphasis on our experiences with surgical techniques, surgical time, postoperative rehabilitation, open reduction, hospital stay and list their various complication.

Material and Methods

The study will be carried out in department of orthopaedic surgery SAIMS Indore, with a series of 30 consecutive patients with sub trochanteric fracture, underwent intra medullary fixation specifically with long proximal femoral nail during a 2 year period from January 2013 – January 2015. The inclusion criteria include acute sub trochanteric femur fracture, patient age > 18 year and pathological sub trochanteric femur fractures. Patient with open fractures, cases infected in preoperative period and fractures age below then 18 year were excluded from the study. This is a prospective study and all fractures will be classified according to Seinsheimers classification. The patients were maintained in traction preoperatively in cases whose surgical intervention is delayed for more then two days. All operation was performed under spinal or general anaesthesia.

For surgery the patient was positioned supine on fracture table and fracture was reduced by longitudinal traction with limb placed in neutral or slight adduction to facilitate nail insertion with standard lateral incision which was made from tip of greater trochanter extending 4-6 cm proximally. Open reduction was used by extending the incision wherever necessary. Postoperatively, the patient were encouraged to do active flexion and extension of hip and knee and was started ambulation with walker without weight bearing on 3rd day and partial weight bearing was started at 6 weeks and full weight bearing was begun 8-12 weeks. Postoperatively all patient will be follow up at 6 weeks, 12 weeks, 6 months and 1year for clinical and radiological outcome.

Result

A total of 31 patients met the selection criteria, treated specifically using long PFN. One patient who had been was lost to follow up, so finally we included 30 patients with sub trochanteric fracture treated with long PFN. Highest number of patient were in the age group of 50-70 followed by 18-30, 30-50, and >70 age with number of patient being 15, 7, 5, 3 respectively. The male represented 18 cases out of study whereas female were 12 in number. 60% of the cases associated with RTA and 40% were associated with history of fall. The mean operative time in our study was 60-100 minutes in an average. All patients underwent surgery with in 6 days of admission except 1 due to pre-existing cardiac and neurological diseases was treated by medical team prior to surgical procedure.

During intervention open reduction and fixation with circlage wiring through an incision was made in 10 cases and their average operative time was 69 minutes. Only 10 cases needed size 11 LONG PFN and rest has operated for size 10 nail. In contrast of these only 2 cases (0.6%) of implant dissembled was noted due to strong flexion pull of muscles at proximal fragment, this will lead to delayed union eventually, but did not associated with relevant shortening or rotational mal alignment. The average time to radiological union was 5 months and at the end of 6 month all except 2 patients could mobilize independently. Two patients were using walker to mobilize up to 9 months postoperatively. Walking and standing ability was completely restored in each case at follow up examination of 6 months postoperatively and there is not any complaining of limping.

The entire 30 patient with traumatic sub trochanteric fractures healed uneventfully except 2 cases of delayed union. No interventions were required in Delayed union case only wt bearing was delayed in these cases. No complication such as cut out or breakage of implant or peri implant fracture were encountered. Removal of distal locking bolt for dynamization of nail to improve bone union was not made as it was not necessary in any case.

Fig. 1: Case 1 Pre op

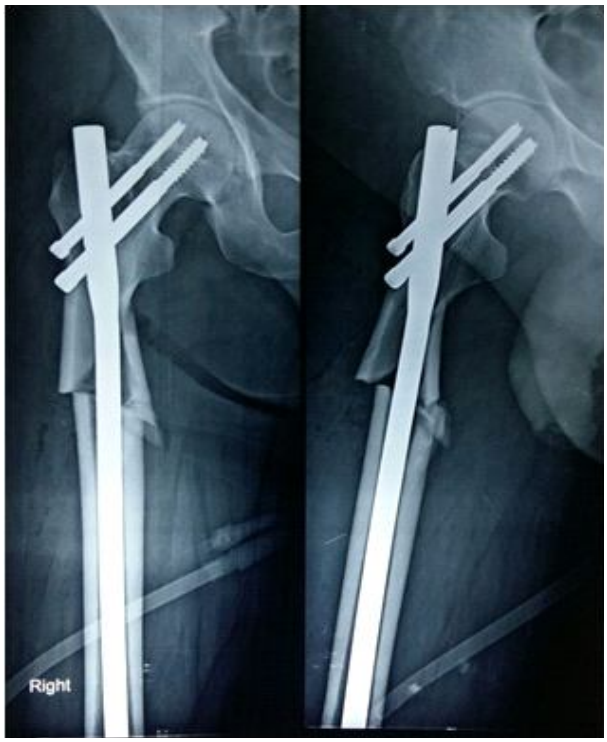

Fig. 2: Post op

Fig. 3: 1 month Post op

Fig. 4: Case 2 Pre op

Fig. 5: Post-op

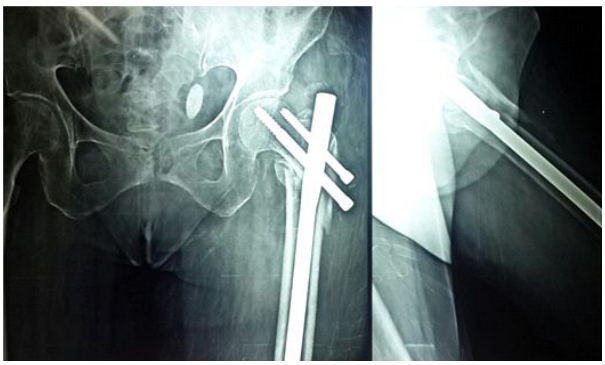

Fig. 6: 1 month Post op

Discussion

Sub trochantric fractures are usually the result of high energy trauma and often subjected to significant displacement and great difficulties in closed reduction through traction and these fractures are associated with high incidence of delayed union, malunion, and non union of fractures has left conservative treatment as advocated by DeLee et al [10]. Open reduction and internal fixation with plating has the disadvantages of extensive surgical exposure, soft tissue damage and excessive blood loss and there are high chances of fatigue and breakage of plate which are eccentrically placed in proximal fragment [3,5,7,11]. MIPPO technique in sub trochanteric fracture has not been successful as a fracture of distal femur or proximal tibia. As great difficulties were often encountered during fracture reduction and plate pre-contouring open reduction is sometimes inevitable, thus making this technique not truly minimally invasive [12,13,14].

Allowing a minimally open approach intra medullary nailing is closely linked to "biological internal fixation", in addition to its mechanical benefits over plate fixation [15]. Initially in sub trochanteric fracture femur standard femoral nail was used , which not give much stability in proximal fragment and the entry point in standard femoral nail was in piriformis fossa so there is much more difficulty during passing guide wire and nail on the fracture table while the patient is in supine position. The recent development of reconstruction nail which change the direction of the proximal interlocking bolts has gradually expanded the indication of intra medullary fixation for sub trochanteric fractures [16].

From a mechanical point of view the use of long intra medullary nail in combination with proximal screw to be more appropriate treatment for sub trochanteric fracture of femur [17,18]. The surgical technique for guide wire and nail insertion is much easier with this long proximal femoral nail because entry point is shifted laterally and the blood supply of the femoral head were preserved . closed reduction of the fracture preserve the fracture hematoma an essential element in consolidation process and intra medullary fixation allows the surgeon to minimize soft tissue dissection thereby reducing surgical trauma ,blood loss, infection and other wound complication . The current failure rates of most frequently used intra medullary nail vary from 4- 20% [19-24]. The most commonly described failure are due to cut out of the neck screw which has been reported between 0 and 10% [20] of cases followed by migration of distal screw fractures of the femoral shaft at the tip of implant , mal rotation ,and deep infection [20,23]. Besides a technical problem related to mismatch of the proximal end of some nails depending on the population has been reported [25].

In this study all 30 cases of traumatic sub trochanteric fracture healed uneventfully except 2 cases of delayed union .walking and squatting ability was completely restored in each case (included the patients with delayed union). No complication such as cut out or breakage of the implants or peri- implant fractures were encountered. Many authors believed that the long PFN must be distally interlocked in order to prevent rotational mal alignment of distal fragment and some of them even recommended that 2 bolts be necessary for distal interlocking [26,27]. Because radiolucent drill is not available in most hospitals, distal locking is mainly through freehand technique and it will increase the operative time and increases the fluoroscopic exposure of surgeon. We did distal interlocking with 2 bolts in all type of Seinsheimer classification.

We also realise that the key for success of operation depend on correct determination of entry point which must be on top of greater trochanter in AP view and in line with the centre of femoral canal in LATERAL view. The abundant muscle around the sub trochanteric region usually cause significant displacement of the fracture fragments, leading to great difficulties in closed reduction under traction. Sometimes open reduction with small incision at the fracture site is inevitable. The fractures that needed open reduction were always those with long spiral fracture line. In our study we also found that lag screw of the LONG PFN should be placed in lower part of femoral neck close to femoral calcar with screw tip reaching the sub chondral bone 5 - 10 mm below the articular cartilage in AP view . In lateral view it should be placed in centre of femoral neck. There the lag screw will be definitely placed in the area of best bone quality in addition, cut out is also related to the timing of weight bearing.

In our study we started partial weight bearing as soon as possible, to prevent other medical disorder and improve the compliance of the patient and early hospital discharge. In our prospective study we have some limitation that we have no control group or any other type of internal fixation method to serve as a comparison to the surgical technique being investigated. Secondary, we did not use an accepted outcome measure such as "Harris hip score" to presents our results. We have only two criteria of clinical and radiological assessment with no limp, which was crude method. But still in Asian population small changes in surgical technique and preoperative planning and rehabilitation protocol leads to favourable out come.

Conclusion

Long proximal femoral nail is the most reliable implant for sub trochanteric fractures, leading to high rate of union. The high advantages include minimal exposure, better stability and early mobilization with biological and biomechanical advantages, and it also required great patience and gradual learning in order to make this method truly minimally invasive.

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