ORIGINAL ARTICLE

Outcomes of Subtrochanteric Fractures; A Prospective Study Focusing on the Comparison of Open and Closed Surgical Technique

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[1]*Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work*
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ABSTRACT

Objective: To review the outcome of surgery by looking at function, deformity and pain according to Harris Hip Score comparing two surgical procedures i.e. open technique and closed technique using relatively recently developed implants.

Methodology: This comparative prospective study was conducted in the department of orthopaedic surgery PIMS Islamabad, from June 2013 to May 2015. By using purposive sampling patients aged 20-50 years with closed subtrochanteric fractures of less than 2 weeks duration were included in the study. The patients with open fractures, pathological fractures, multiple fractures/ poly trauma, and old and neglected fractures of more than 2 weeks were excluded. All included cases of subtrochanteric fractures were managed by either closed technique, using Proximal Femur nail (PFN) or open technique using a Proximal Femur anatomical locking plate (PFP). This comparative study was planned to determine union rates, complications & functional outcome of fixation of subtrochanteric fractures. Descriptive analysis was done using SPSS version 20. Chi-square test was applied for comparing qualitative variables.

Results: A total of 100 cases were included in the study with the mean age was 38.5 ± 8.6 years in the open technique group () while 34.6 ± 1.2 years in closed technique (). There are 72 males and 28 females. Union occurred 84% in open technique and 96% in closed technique. In open technique group mean Harris hip score was 68.9 ±5.4 compared to 72.4 ± 6.2 in the closed technique group (p-value <0.001). In open technique group 6 (12.0%) cases had delayed union and 2 (4.0%) had non-union compared to 3 (6.0%) cases and 1 (2.0%) cases in closed technique group respectively.

Conclusion: Outcome favours closed technique compared to open technique for subtrochanteric fractures fixation, when assessed on Harris hip Score. There was no statistically significant difference in the fracture union and frequency of complications between the two groups.

Keywords: Subtrochanteric fractures, open technique, closed technique

Introduction

Subtrochanteric fracture of the femur is a variant of peritrochanteric fracture of the femur. Subtrochanteric fractures occur in a zone extending from the lesser trochanter to 5-7cm distal to the lesser trochanter. The subtrochanteric fractures are a variant of peri trochanteric fractures of femur and account for 10% - 34% of all hip fractures. They have bimodal age distribution (20-40 years) because of major trauma in younger patients, or trivial trauma in elderly, having osteoporotic bones.[1] The weight bearing forces acting asymmetrically on this region of bone interferes with union.[2] The incidence of nonunion varies between 0- 8%.[3] The healing of bone in this region is through cortical healing predominantly. Hence, fractures in this region

are slow to heal.[4] In recent times, subtrochanteric fracture remains challenging to fix even for experienced and senior surgeons.[5,6] There are various surgical techniques and implants to fix a subtrochanteric fracture including external fixation such as Ilizarov fixator or AO fixator, open reduction and fixation with anatomically contoured locking plates and screws (PFP), and closed intramedullary fixation using proximal nail (PFN). External fixation is only indicated in open fractures. For most patient's external fixation is temporary and a subsequent internal fixation may be required once the wound has healed.[7,8] The accuracy of intraoperative reduction and surgical skill are important for the clinical outcome and the patients' prognosis.[9] This study aimed to compare the functional outcome of after open or closed surgical technique assessed by Harris hip scoring System. The results of this study can help surgeons decide a surgical technique that is most beneficial for the patients.

Methodology

A comparative prospective study was conducted in department of orthopaedic, Pakistan Institute of Medical Sciences (PIMS) Islamabad for two years. Patients with subtrochanteric fractures, admitted through outpatient and Accident &Emergency Department were enrolled by using purposive sampling technique. Informed consent was obtained from all patients. Data regarding history and physical examination was collected on proforma. Routine investigations and X-rays were obtained. Fracture anatomy was determined based on X-ray. The patients between age 20-50 years, with fractures less than two weeks duration and having closed fractures were included in this study. Pathologic fractures, open fractures, multiple fractures and old neglected fractures (more than two weeks old) were excluded from this study. Open technique involves open access to the fracture and applying a plate with compression screws whereas the closed technique involves minimally invasive surgery, without exposing the fracture.

Technique: PFP was done on traction table after an appropriate anaesthesia. A 15-23 cm long lateral incision was made, centered over the fracture. Vastus lateralis was lifted to access the fracture. Fracture fragments were curated and reduced and held temporarily with fracture reducing clamp or bone holding forceps. Fixation was done with anatomically contoured titanium locking plate. After a normal saline washout, a suction drain was put in place and the wound was closed in layers.

PFN was also done open traction table under fluoroscope assistance. The incision was about 5 cm long just proximal to the tip of greater trochanter. Bone awl was then used to make a portal just lateral to the pirifomis fossa. The line of this portal was confirmed on two view fluoroscope image. Hand reamer wasn't then used to widen the portal. Next a guide wire was inserted through this portal, closed reduction of fracture was done under fluoroscopic control, and the guide wire was passed distally in the medullary canal, traversing the fracture. Once the position of guide wire was confirmed on two view fluoroscopic image, the medullary canal was reamed using power reamers. Appropriate nail was then 'rail roaded' over the guide wire using the jig/aiming device. The position of the intra medullary nail was confirmed with fluoroscopic images. Next a guide sleeve was used to drill a lateral portal for femur neck screw, this was done through a separate half an inch incision just distal to the greater trochanter. Length and orientation of the femur neck screw was confirmed on fluoroscopic images. Distal locking screws were inserted percutaneous. All wounds were sutured after a wash out.

Routine antibiotics, analgesics were given to patients post-operatively. Peri-operative, immediate, late complications of surgical procedure were noted. The patients were called for follow-up at 2 weeks, 6 weeks, 8 weeks and 12 weeks in which hip function,

range of motion of hip joints were assessed using Harris Scoring of hip function. In Harris Hip Joint Scoring various domains included are pain, function, absence of deformity and range of motion. The function domain includes daily activities like stair use, public transport use, sitting, walking, and limp. Deformity includes hip flexion, adduction, internal rotation and length discrepancy. There were 10 objects and maximum score is 100 points. Post-surgery X-ray evaluation was done to evaluate healing and union of fracture.

Collected data was converted into variables and was analyzed using SPSS version 20. Descriptive statistics including mean ± SD were computed for quantitative variables like age and Harris score. Frequencies and percentages were calculated for qualitative variables i.e. gender and final outcome. Chi-square test was applied for comparing qualitative variables like infection, union, malunion, nonunion and implant failure between study groups. Student t-test and Chi square test was applied to assess the difference. P-value < 0.05 was considered as significant.

Results

A total of 100 patients with subtrochanteric fracture were enrolled. Half of those underwent open technique and the other half had closed technique for the fracture fixation. The mean age of patients in open technique group were 38.5 ± 8.6 years while in closed technique group 34.6 ± 1.2 years. The demographics are shown in table I.

Both techniques showed no statistically significant difference in fracture union at 2 weeks, 6 weeks, 8 weeks and 12 weeks after surgery (Table II).

At 12 weeks post fixation patients who had undergone closed technique had scored higher at Harris Hip Score System 72.4 ± 6.2 than those who had open technique done for hip fracture 68.9 ± 5.4, there was a significant difference in outcome between two methods (p-value<0.001). (Figure I) Figure is missing

Table I: Demographic of patients

Variables		Open technique (n=50) Mean±SD/ n (%)	Closed technique (n=50) Mean±SD/ n (%)
Age (years)		38.5 ± 8.6	34.6 ± 1.2
Age categories	20 – 30	11 (22.0%)	19 (38.0%)
	31 - 40	13 (26.0%)	14 (28.0%)
	41 – 50	26 (52.0%)	17 (34.0%)
Gender	Male	30 (60.0%)	42 (84.0%)
	Female	20 (40.0%)	8 (16.0%)
Type of Fracture	Seinsheimer type I	0 (0.0%)	8 (16.0%)
	Seinsheimer type II	7 (14.0%)	19 (38.0%)
	Seinsheimer type III	24 (48.0%)	17 (34.0%)
	Seinsheimer type IV	19 (38.0%)	6 (12.0%)

Table II: Comparison of union between the two groups

	Open technique (n=50)	Closed technique (n=50)	p-value
2 weeks	38 (76.0%)	40 (80.0%)	0.81
6 weeks	40 (80.0%)	44 (88.0%)	0.59
8 weeks	43 (86.0%)	47 (94.0%)	0.22
12 weeks	42 (84.0%)	48 (96.0%)	0.09

Delayed union was the most common complication that was noticed in both groups

of patients after surgery. Infection, implant failure and non-union were other complications that were noted in follow up visits in patients in both surgical repair groups. Although there was no significant difference in occurrence of these complications between these groups (Table III).

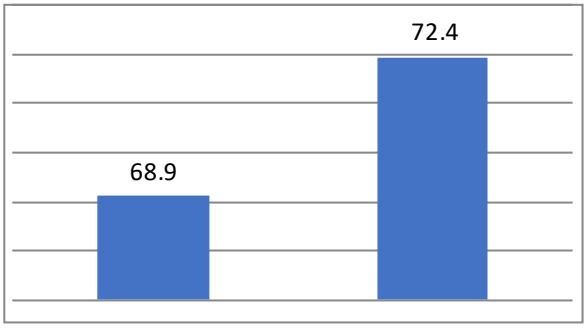

Figure I: Comparison of means of Harris hip score between the two study groups

Table III: Comparison of complications

Complications	Open technique (n=50)	Closed technique (n=50)	p-value
Infection	4 (8.0%)	1 (2.0%)	0.36
Delayed union	6 (12.0%)	3 (6.0%)	0.45
Non union	2 (4.0%)	1 (2.0%)	0.78
Implant failure	3 (6.0%)	1 (2.0%)	0.61

Discussion

Hip and subtrochanteric fractures account for high mortality rate and impairments in quality of life. Recent guidelines suggest that surgeons should perform hip fracture surgery earlier rather than late because earlier surgery shows better functional outcome and lower rates of mortality and complications.[9] Nevertheless, survivors have a shorter life span.[10] Subtrochanteric fractures affect approximately 10%-30% of all peritrochanteric fractures and can occur at any age.[11,12] In the current study, age of patients was slightly inconsistent as it was 38.5 ± 8.6 years in open technique compared to 34.6 ± 1.2 years in closed technique group. However, majority of patients in both groups were between 20 and 50 years of age. The mean age was reported to be 44 years ranging between 25 and 65 years[13,14], while a study from India, 75% of cases had the range of age between 20 and 40 years.[15]

Our study showed that in the open technique group, there were 60.0% males compared to 84.0% in the closed technique group. Burnei C and colleagues also found that male gender was dominant.[16] Studies reported more than 85.0% of the cases were males.[14,15] Evidence shows that males of all ages young or old are prone to get subtrochanteric fractures.

Our study showed most of the patients had type III and IV Seinsheimer criteria fractures comparable with another study that showed more than 80% of patients had type IV and V fractures according to Seinsheimer classification.[14] In the current study the post-operative Harris Hip Score was significantly better in the closed technique group when compared with open technique (72.9 ± 6.2 vs 68.9 ±5.4). In one study, the mean Harris Hip Score was found to be 88% after closed surgery for subtrochanteric hip fracture fixation.[14] There are reports showed that intramedullary fixation is biologically superior to extra medullary fixation.[17] The Harris Hip Score was found to increase progressively from one month 66± 7 to 76 ± 6 at three years follow up after hip fracture repair surgeries.[18] In terms of fixation, intramedullary nailing is the gold standard of treatment and can be performed safely for both typical and atypical ST fractures.[19] In another study patients were followed up for 6–12 months. According to HHS system, the proportion of the patients with excellent and good recovery was 96.05%.[9] Factors that affect in non-unions include patient's age, fracture line and quality of reduction. Though a good reduction can be achieved with open reduction and internal

fixation, but striping of periosteum, handling of soft tissue and loss of fracture haematoma, may be the reason for delayed union and other complications. The surgical exposure can increase the risk of delayed union, infection, non-union, and implant failure.[20,21] There are frequent malunions and non-unions noted after treating subtrochanteric fractures with surgical approach.[22] In another study it was found that 3 patients developed malunions and 1 patient had non-union in open reduction group as compared to 6 malunions and 2 non-union in closed reduction group.26[23] In one study, bone union was achieved in 97% of cases of subtrochanteric fracture.27[24] In a study on hip fracture fixation deep wound infection was noted in 1.2% patients while 1.1% had superficial wound infection.[25]

In this study, infection was noted in 4 (8.0%) of patients having open repair surgery, delayed union in 6 (12.0%), non-union in 2 (4.0%) as compared to 1 (2.0%) infection, 3 (6.0%) delayed union and 1 (2.0%) delayed union in closed repair group.

Conclusion

This study highlights the better results of closed technique compared to open technique for subtrochanteric fractures when assessed on Harris Hip Score however there is no statistically significant difference in the fracture union and frequency of complications between the two groups.

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