Radiological And Functional Outcome of Closed Subtrochanteric Femur Fracture managed by proximal Humerus interlocking plate in adolescent patients – A Prospective study

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ABSTRACT

Background: Paediatric subtrochanteric fractures constitute 1% of all the fractures in children. Subtrochanteric fractures in paediatric age defined as 10% length of total femur below lesser trochanter. Mostly these fractures are unstable type. There are various treatment options available for management of this fracture depending on the age group of the patient. But there is no well defined management for adolescent subtrochanteric fractures.

Method: This study includes 20 patients present to orthopaedic emergency with closed subtrochanteric fracture without distal neurological deficit. Patients were managed operatively after informed consent with proximal humerus locking plate under regional anaesthesia. Postoperatively patients were kept non weight bearing with in bed exercises. Patients were followed at 2weeks, 6weeks, 12weeks, 24weeks and 36 weeks. Patients were evaluated functional and radiologicaly.

Results: There were 20 patients included in this study. There was no gender difference in incidence of fracture. The average time of union was 11.4 wks in adolescent age group. There was no other early and late complication. All patient were mobilized with protected weight bearing with some support at average of 10 wks. All patients were followed till 9 months. The final average harris hip score was 91.

Conclusion: Proximal humerus locking plate found to be excellent choice of implant for any pattern of subtrochanteric fracture. The plate surface found to be well contoured according to proximal femur lateral surface.

Keywords: Adolescent patients, Subtrochanteric fracture, Proximal humerus locking plate.

Introduction

Paediatric subtrochanteric fracture defined as 10% percent the length of whole femur below lesser trochanter [1]. Subtrochanteric fractures constitute 1% of all fracture in children [1,2]. Adolescent subtrochanteric fractures are unusual and have received less attention in literature [1,2,3]. There are various deforming forces around this fracture like proximal fracture tends to flex, abduct and external rotate and distal fragment adducts[1]. Due to various deforming forces around this fracture, this fracture requires special attention. There are various management available for this fracture in each age group. Infants are managed with Pavlik harness, children (6month – 5 years) with hip spica cast [1]. The dilemma starts after the age of 10 years [1]. There is no definite consensus available for this age group. Definite management of this fracture in adolescent age group is deficient. Traction alone found nonsatisfactory and incapable of providing reduction and stability to the fracture. According to literature fixation with elastic nailing is inadequate and had various complication like malunion and shortening [1,4,5].

Material and methods

Aims and objectives of the study: To study functional and radiological outcome of open reduction and internal fixation of closed subtrochanteric fracture with proximal humerus locking plate. .

Particulars:

1. **Study area**: This is a prospective study done for the time period from November, 2019 to june, 2021 at Government medical college Datia and kamla hospital Jhansi.
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2. **Study population**: In our study age of patients were 10 to 16 years with the diagnosis of closed subtrochanteric fracture attending the department of orthopaedics, Government medical college Datia and kamla hospital Jhansi, managed surgically.

3. **Sample size and sample technique**:
   This is a case series of 20 adolescent patients attended the hospitals within the duration of november, 2019 to june 2021 presented in emergency with closed subtrochanteric fracture.

4. **Data collection technique and tools**:
   20 adolescent patients presenting with the clinical diagnosis closed subtrochanteric fracture was managed with open reduction and internal fixation with proximal humerus locking plate, followed by physiotherapy and range of movement exercises. All the particulars related with the patients were recorded in a Performa. Patients were followed up at 2wks, 6wks, 12wks, 24wks and 36 wks. Radiological examination and functional assessment were done. Prior approval from ethical committee and informed consent for participation in the study from the patients were taken.

5. **Data analysis**: Qualitative variables/Categorical variables were presented in number and percentage (%) and Quantitative variables/continuous variables were presented as mean ± SD (whenever required). P value ≤ 0.05 was taken as a level of statistical significance. The data were analyzed by SPSS (statistical package for social sciences) Statistical software version 17.0.

1. Patient selection
2. Preoperative
3. Peroperative
4. Postoperative
5. Follow up

Patient selection – This study was conducted at our institution. The period of study was November,2019 to june,2021. Patients were chosen as per their presentation in emergency. Patients were examined thoroughly for any other injury. There were 20 patients (male – 13, female - 7). Average age was 12.3 yrs

Inclusion criteria – 1. Age 10 – 20 yrs, 2. Closed fracture 3. Fracture without distal neurovascular deficit.

Exclusion criteria – 1. Patient with other life-threatening comorbidities 2. Previous hip surgery 3. Pathological fracture 4. Previous hip pathology.

Preoperative – Patient's informed consent was taken. Common preoperative blood investigations were done. Patient's anaesthetic clearance was taken. Temporary Bohler braun splint with skin traction was given to relieve some pain and improve some fracture deformity.

Peroperative – Implant choice –Under regional anaesthesia, open reduction and internal fixation was performed with proximal humerus interlocking osteosynthesis plate through lateral approach to thigh. Proximal humerus locking plate found to have low profile and narrow which is right amount of thickness for adolescent patients.

Procedure – 1. Under regional anaesthesia, patient was positioned on fracture table in supine position. Patient's affected limb was prepared, painted and drapped.

Dead lateral incision over thigh centering fracture was given. Good haemostasis was achieved. Vastus lateralis was lifted from lineaaspra instead of splitting it. Partial proximal origin of vastus lateralis was removed to make space for plate. Open reduction was done with temporary k wire fixation. Proximal lockingscrews were kept short of femoral head physis to avoid its injury.

Fracture was fixed with Proximal humerus interlocking plate. Thorough wash was given. Incision was closed in layers with sunction drain insitu.

Postoperative – First dressing was done after 48 hrs of surgery. Immediate postoperative x rays was taken. Static quadriceps exercise, knee range of motion exercises and ankle range of motion exercises were started after 24 hrs from time of surgery. Patients were discharged on fourth postoperative day.

Follow up – Patients were advised for strict nonweight bearing and in bed ambulation exercises. Patients were followed at 2wks, 6 wks , 12 wks and 24 wks as outpatients.

2wk -Sutures were removed at 2 wk follow up x rays. In bed ambulatory exercises were continued.

6 wks – Follow up x rays were done assess radiologically. Harris hip scoring was done. As patient was adolescent walker assisted walking was started late.

12wks – follow up xrays and Harris hip scoring was done.Non weight bearing walking with walker support was started.

24 wks – As patients were adolescent, Partial weight bearing was started after achieving radiological and functional improvement at 24 wks.

36wks – Radiological and functional evaluation.

Expected outcome and complication –

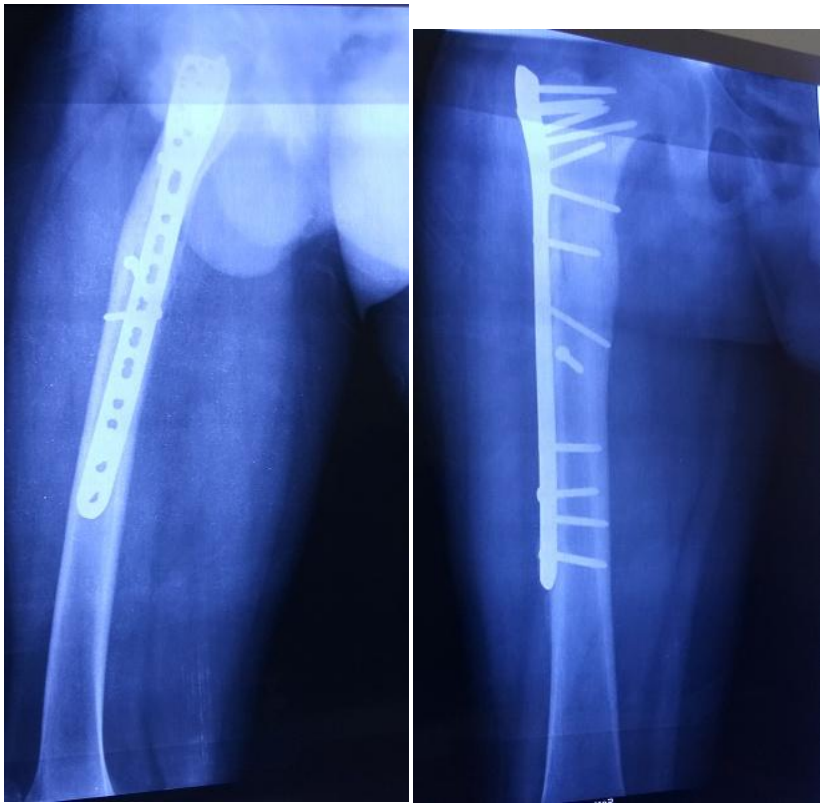
1. Union -
2. Nonunion
3. Infection
4. Implant failure

Results –

There were 20 patients (Male – 13, female – 7). There was no gender difference in incidence of this fracture. Paediatric age group were found to have high potential for union. Long spiral fracture found to be most common pattern of fracture in our study. There was no failure in our study. Patient's visual analogue scale for pain improved in two weeks from an average of 8 to 3. Radiological first sign of union on x ray was visible at an average of 4 weeks of fixation. Average Harris hip score was 34 (2wks), 68 (4wks), 87(6wks), >90 (after 2months). Patients were mobilized with protected weight bearing with some support at 2.5 months. Weight bearing was gradually increased according to comfort of the patient. Patients were started long walking at end of 5 months. Patient started using public transport at end of 8 months.

X-ray Image 1- Preoperative X ray of the patient

X-ray Image 2- postoperative x ray of the same patient



X-ray Image 3- Final follow up x ray of the same patient

Photo 1 –function, picture of the patient of the same patient.

Serial No.	Age/sex	Complication	Time of union	Final herris hip score	Nature of fracture	End point	Follow up
1	11	-	12 weeks	92	Long spiral	Union	36wks
2	13	-	11 weeks	91	Comminuted	Union	36wks
3	11	-	10 weeks	87	Short oblique	Union	36wks
4	14	-	14 wks	95	Long spiral	Union	36wks
5	12	-	10 wks	89	Long spiral	Union	36wks
6	15	-	12 weeks	90	Long spiral	Union	36wks
7	11	-	11 weeks	89	Comminuted	Union	36wks
8	14	-	14 wks	85	Long spiral	Union	36wks
9	12	-	12 weeks	95	Short oblique	Union	36wks
10	13	-	11	87	Long spiral	Union	36wks

			weeks				
11	11	-	11 weeks	86	Comminuted	Union	36wks
12	13	-	14 wks	89	Long spiral	Union	36wks
13	12	-	14 wks	84	Short oblique	Union	36wks
14	11	-	12 weeks	89	Long spiral	Union	36wks
15	14	-	10 wks	90	Comminuted	Union	36wks
16	10	-	12 weeks	92	Long spiral	Union	36wks
17	11	-	14 wks	93	Long spiral	Union	36wks
18	14	-	10 wks	86	Long spiral	Union	36wks
19	15	-	10 wks	90	Long spiral	Union	36wks
20	12	-	11 weeks	90	Comminuted	Union	36wks

Table 1 – clinical profile of the patient.

Conclusion –

Open reduction and internal fixation with proximal humerus locking plate found to be excellent implant for fixation of subtrochanteric fracture n adolescent age group. Proximal humerus locking plate found to have optimum amount of profile thickness for adolescent proximal femur. This plate found to be well fitting to proximal femur. Proximal humerus locking plate found ro be good for any pattern of subtrochanteric fractures. The direction of locking screw in this plate found to have good purchase in calcar of neck of femur which absolute stability for fracture union.Direction of locking screw didn't damage the proximal femur physis. Most proximal screw were kept short of physis to avoid damage to proximal femur physis.

Discussion –

Paediatric subtrochanteric fracture is rare and unstable type of fracture [4,5]. Closed displaced subtrochanteric fracture is usually require operative intervention.

Sanders and Egol [6] presented two cases in which adult, precontoured, lower extremity periarticular locking plates were utilized for fixation of subtrochanteric femur fractures in paediatric patients. They proposed that a proximal tibial locking plate in an adolescent and distal tibial locking plate in a young child correspond well to the proximal femur and are thus a viable option in their management.

Cortes et al. [7] managed atrophic non-union of subtrochanteric femur fractures in an 11-year-old boy using an adult proximal humerus locking plate and packing the non-union site with demineralized bone matrix. They chose PHLP as they found it to be adequately adept to the anatomy of the proximal femur. Six months after the surgery for non-union, radiographs showed complete union with maintenance of fracture alignment and morphology of proximal femoral epiphysis. The child was completely asymptomatic with symmetric range of motion of his hips and knees.

In our study, Proximal humeral locking plate found to good implant for fixation of any pattern of subtrochanteric fracture. Plate's pre-contouring found to be well fitting to the the proximal femur lateral surface.

Conflict of the study-

There was no conflict of interest in study.

Limitation of the study –

There were various limitations to our study. Short numbers of cases due to low incidence, affordability of the patient's attendant and different pattern of fractures were the limitation to our study. Though we recommend study with larger number of patients with longer period of follow up.

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