



A Comparative Study of Pediatric Fracture Shaft Femur Fixating by Plate and Screws Using Lateral Approach Between Subvastus Lateralis and Transvastus Lateralis Outcome

Haider O. Hayat Ali Al-Faily¹, Saif Nabeel Abd Alwahab², Mohammed Sh. Al-Edanni^{1*}, Sadeq A. Al-Mukhtar¹, Ghadeer H. Majeed¹

¹Department of Orthopedic Surgery, Al-Kindy College of the Medicine, University of Baghdad, Baghdad, Iraq; ²Department of Orthopedic Surgery, Ministry of Health, Baghdad, Iraq

Abstract

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***Correspondence:** Dr. Mohammed Sh. Al-Edanni, Department of Orthopedic Surgeon, Al-Kindy College of the Medicine, University of Baghdad, Iraq. E-mail mohammedaledanni@gmail.com
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BACKGROUND: Femoral shaft fracture is a common fracture in pediatric age group reaching 62% of all fracture shaft femur in children in spite of rapid union rate and successful conservative treatment but some cases need surgical intervention and one of the methods using plate and screw by the lateral approach.

AIM: This study aims to compare functional outcome fixation of mid-shaft femur fracture in children by plate and screws between (subvastus lateralis and transvastus lateralis) regarding infection, union, and limitation of knee movement.

PATIENT AND METHOD: The study was done on 30 children who had diaphyseal fracture femur in Al-Kindy Teaching Hospital in period (April 2018–April 2020) with 6 months follow-up, and the patient was divided into two groups: Group A first treated by subvastus lateral approach 15 patients and the second group, Group B by transvastus lateral approach 15 patients and follow-up done for them after 2 weeks, 4 weeks, 6 weeks, 3 months, and 6 months.

RESULTS: At week 16 of follow-up all patients in Group A had union, while in Group B, 14 of 50 patients had union and one patient had no union and one patient in Group B had an infection when compared to Group A. From 15 patients of Group A, two patients had limitation of knee movement in the 1st month of follow-up then in the 3rd month of follow-up, no patient had limitation of knee joint movement, while five patients had limitation of knee joint movement in Group B in the 1st month of follow-up and one patient had limitation knee joint movement in the 3rd month of follow-up.

CONCLUSIONS: The subvastus lateralis approach results better than transvastus lateralis in union.

Introduction

Fractures shaft femur in pediatric age group occurs commonly in the middle diaphyseal region accounting for 62% of other femoral fractures in children. The incidence rate of femur shaft fracture is 19.5/100,000 annually in children [1]. The goal of the management of such fracture is to achieve bone union with good alignment and restoration of the limb's function [2]. Many orthopedic surgeons manage this fracture conservatively with excellent remodeling of the immature bone in pediatric age group, on the other hand, other surgeons have revealed that shaft femur fractures in children do not always improve completely with non-surgical treatment [3]. Angulations, rotations, and shortenings not always adjusted by traditional treatment [4]. The conservative method, with reduction and early immobilization with a hip spica cast some time skin traction, is used before casting. This method may associate with some complications, such as loss of reduction and angulation or shortening of the limb [5], [6].

Four groups of blood vessels are responsible for nutrition of typical long bone, nutrient, metaphyseal, epiphyseal, and periosteal vessels. Usually, one nutrient entering the shaft of long bone through nutrient foremen, which is regarded as the chief source of blood to the long bones and thus is very vital in the development of bones during infancy, childhood, and all stages of bony ossification. This source represents about 70–80% of the blood supply of the bones, and ischemia of the bones can be result after restriction of this source [7], [8].

Modern techniques of plating shaft with minimal incisions, preservation of the periosteum, with long plates, and few select screw holes filling, have been accepted by several pediatric orthopedic trauma surgeons as an appreciated instrument to unstable femur fractures [9], [10].

Management of femoral fractures in 6–11 years old is extremely debated. For stable mild displaced femur fracture in children, immediate hip Spica casting is usually sufficient with good results, while older children with unstable and comminuted fractures, prefer a period

of traction (skin traction) initially followed by cast brace or Spica cast [11]. Interest for management that reduce hospital stay allows to the external fixation and flexible intramedullary nails in children from 6 years old till maturity [4]. Compression plating has been reestablished as a method with little hazards and significant advantage in the treatment of pediatric femoral shaft fractures [4], [12].

Our aim of this study is to compare functional outcome fixation of midshaft of femur fracture in children by plate and screws between (subvastus lateralis and transvastus lateralis) regarding infection, union, and limitation of knee joint movement.

Patients and Methods

A prospective study consisted of 30 children who had femur fractures and were attending Al-Kindy Teaching Hospital in Baghdad from April 2018 till April 2020, 6 months' follow-up period.

The consent of the parents of the children was taken to be members of the current study. The study was divided into two samples; Group A treated by fixating shaft of the femur by plate and screw using subvastus lateralis approach and second sample; Group B fixating shaft of the femur by plate and screws using transvastus lateralis approach.

Our inclusion criteria are children between 3 and 10 years, butterfly midshaft femoral fractures, comminuted midshaft femoral fractures, oblique midshaft femoral fractures, and transverse midshaft femoral fractures, while children age under 3 years, children above 10 years, open fractures of the femur, proximal femoral fractures, distal femoral fractures, vascular injury, and pathological fractures were exclusive from the study.

Under general anesthesia, the child was put in supine position. A longitudinal lateral skin incision was made, tensor fascia lata was cut for both groups (Figure 1), then the bone exposed either a reflection vastus lateralis muscle in Group A or through vastus lateralis muscle in Group B. After the fracture site was

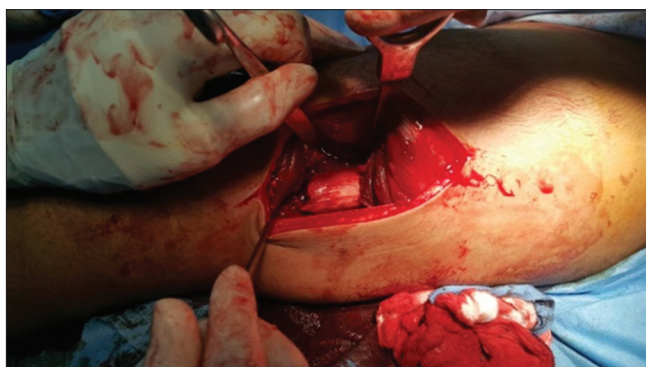


Figure 1: Intraoperative picture showing reflection of vastus lateralis muscle

exposed, both bone ends are held with bone holders and the fracture reduce, then the bone fixating with plate (LCP type) and cortical screws 3.5 mm according to fracture pattern at least three screws proximal and three screws distal to fracture site (Figure 2a). Irrigation of wound done by normal saline and closed drain put in the wound, then suture the vastus lateralis muscle in Group B and tensor fascia late and subcutaneous tissue in both groups and finally suture the skin and dressing done.

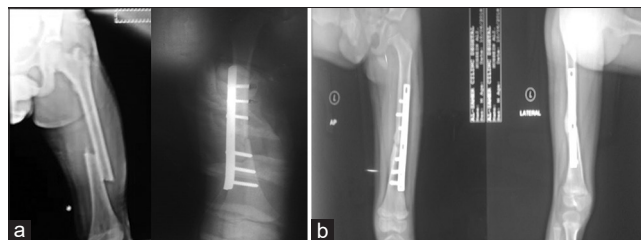


Figure 2: (a) Pre- and post-operative. (b) Three months' post-operative

Postoperatively, the child nursed supine without casting with a pillow under the affected limb while weight-bearing and limb motion was adapted according to the fracture shape and stability, the size of the implant, and associated injures. Partial weight-bearing was permitted about the 4 weeks post-operative for the transverse types, while oblique and comminuted types were recommended to restrict weight-bearing on the fractured femur till early callus was observed on follow-up X-ray.

The patients were seen after 2 weeks, 4 weeks, 6 weeks, 3 months, and 6 months postoperatively (Figure 2b) and evaluated the functional recovery time regarding pain during movements in the knee joint, fracture healing time, range of movement of the knee joint, and specific complication.

The data were collected and analyzed using Statistical Package for the Social Sciences version 24. Descriptive statistics were represented as frequencies and proportions (%) or mean \pm SD. $P < 0.05$ was considered statistically significant.

Results

In our study, there were four transversals, six obliques, and five comminuted fractures operated by subvastus approach (Group A), and five transversals, three oblique, and seven comminuted fractures operated by transvastus lateralis approach (Group B).

The average age was 3–10 years, there were no significant differences in the average ages, and the injuries were different causes, mostly due to trauma suffered by children, there were 17 injuries in the right thigh and 13 injuries in the left (Table 1).

The average union of the two groups, in subvastus group (Group A) occurs in all patients while

Table 1: Sample of study

Data	No.	Group A	Group B
Number	30	15	15
Age	3–10 years		
Sex			
Male	20	8	12
Female	10	7	3
Injured side			
Right	17	9	8
Left	13	6	7

in transvastus group (Group B) occurs in 14 cases out of 15 patients in 15 weeks, while one case of infection reported in Group B and none infection recorded in Group A.

Table 2 shows that 96.7% of the sample members of the study had a shaft union happen and 3.3% had non-union in Group B, while union in Group A was 100%.

Table 2: Percentage of users of shaft union and infection

Data	Subvastus	Transvastus	Sum	%
Shaft union	15	14	29	96.7
Infection	0	1	1	3.3
Total	15	15	30	100

To identify the differences between the two groups that happened to have the shaft union and infection rate, the differences between the two groups were calculated.

The results in the Table 3 showed that after the completion of all process procedures, the infection rate is lesser and the union rate is higher in subvastus group than in transvastus group.

Follow-up of 30 patients shows that five patients had restriction of movement of knee joint in Group B and only two patients had restriction of the movement of knee joint in Group A, during 3 months of follow-up restriction of the movement of knee joint in Group B became one, while all patients retain normal knee joint movement in Group A [Table 4].

Discussion

The outcome of our study was that infection occur in one case (7%) and delay union also in one case (7%) in transvastus group. This result agrees with Collin May [13] that had a rate of infection 6.8% and delays union 6.4% in splitting vastus lateralis. The union rate was 100% in subvastus group and this is similar to the results of other researchers, Reeves et al, Ward et al, Kregor et al and Van Niekerk [12], [14], [15], [16]. The infection rate in our study in subvastus group was 0% and the result agree with Reeves et al, Ward et al, Kregor et al and Van Niekerk [12], [14], [15], [16]. The limitation of knee movement in our study occurred in five patients out of 15 in transvastus group in first month postoperative(33.3%) and became in one patient in three months postoperative (6.66%) and at

Table 3: Differences between children in shaft union

Data	Group A	p-value	Group B	p-value
Shaft union	n (15)	0.031	N (14)	0.07
Infection	0	0.3	1	0 (0.033)
Mean	1.07		1.0	
STD	0.258		0.000	

six months of follow up remain one patient (6.66%). We agree with Riemer et al [17] who showed that limitation of knee movement was at 6 months in 7%, while we no recorded any limitation of knee movement postoperative in our study in subvastus group follow up and this similar to result of Riemer et al [17].

Riemer et al. [16] who showed that the limitation of knee movement was at 6 months 7%, and in our study, limitation of knee movement post-operative in subvastus group was 0% in the 3rd month of follow-up and that agree with Riemer et al.

Table 4: Different rate of limitation of knee movement after operation

Data	Subvastus group	Transvastus group	Sum
Limitation of knee movement 1 st month	13.3%	33.3%	46.6%
Limitation of knee movement 3 rd month	0%	6.66%	6.66%

We recommended to use the subvastus method in fixating shaft of femur in children by plate and screws, and long-term follow-up for those patients.

Conclusions

- Approved that in lateral approach in fixation midshaft femur in children, the subvastus lateralis results better than transvastus lateralis in the union of fracture and less rate of infection than transvastus lateralis
- Limitation of knee movement occurs at a higher rate in transvastus lateralis than subvastus lateralis method.

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