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Outcome of Medial Parapatellar Versus Transpatellar Tendon Approach of Intramedullary Nail Insertion Techniques in Tibial Shaft Fractures

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ABSTRACT

Background: Fractures of the tibia are among the most serious long bone fractures.
Materials and method: This is a retrospective study conducted in Aden. We reviewed records of patients who were admitted and treated for tibial fractures by intramedullary nail. We gathered data from 48 patients, underwent MPA and TPA approach for surgery. SPSS version 17 was used to analyze the data. The Fisher test was used to compare the two groups, MPA and TPA group. The significance level was set at P<0.05.
Results: Males were (72.9%) and females were (27.1%). Their mean age was 37 ± 11.9 years. Stair ascending impairment were found in MPA approach (20.8%) and (29.2%) after TPA (p > 0.05). Limping was found in MPA group (22.9%) and (20.8%) in TPA group (p > 0.05). Inability squaring found in MPA group (27.1%) and (29.2%) in TPA group, (p > 0.05). Anterior knee pain was found in (27.1%) of MPA approach and (35.4%) in TPA approach, (p > 0.05). In the MPA insertion approach, (29.2%) patients showed a full flexion after two days of the surgical insertion while in TPA approach there were (16.6%) patients showed a full flexion (p > 0.05). Full extraction found in MPA approach (33.3%) after 2 days of surgery and (29.2%) in TPA approach, (p > 0.05). After 2 days (31.3%) patients whom treated with MPA approach and (22.9%) whom treated with TPA approach.
Conclusion: The study showed us the advantage of medial parapatellar tendon approach of treating the tibial shaft fractures.

Key words: Outcome, intramedullary nail, tibia, fracture.

INTRODUCTION

Because one third of tibial surface is subcutaneous throughout the most of its length and it also has a precarious blood supply than other bones, which are enclosed by bulky muscles [1].
Tibial fractures are most commonly caused by high-energy injuries and are frequently accompanied by extensive soft tissue damage and complex bone comminution. There are a variety of therapeutic methods available, but there is no consensus on the best treatment for tibial fractures, particularly those with concomitant soft tissue damage [2,3].
Tibial shaft fractures are one of the most common fractures in young. The risk of fractures increases up to 37.5% [4]. Fractures of the tibia are among the most serious long bone fractures, because of their potential for nonunion, malunion and propensity for their open injury [5].
The presence of the hinge joints at the knee and ankle allow to no adjustment of the rotatory deformity after fracture requiring during correction of reduction [1].
The importance of conservative treatment is secondary. Open reduction and plate fixation is a common treatment that allows for a direct view of the fracture for anatomical reduction. Plate fixation, on the other hand, has a major disadvantage in terms of axial and varus stability [6].
To minimize soft tissue injury, intramedullary nailing of these fractures appears to be the best treatment option.

Intramedullary tibial nailing has been done using a variety of approaches, including medial parapatellar (MPA), lateral parapatellar (LPA), and transpatellar tendon incisions (TPA). However, the MPA and TPA are the most commonly used approaches, each with its own set of benefits and drawbacks [7-9].

Intramedullary nail fixation remains the treatment of choice for unstable and displaced tibial shaft fractures in the adult [10]. The goals of surgical treatment are to achieve osseous union and to restore length, alignment, and rotation of the fractured tibia. Intramedullary nailing carries the advantage of minimal surgical dissection with appropriate preservation of blood supply to the fracture. Moreover, the surgical implant offers appropriate biomechanical fracture stabilization and acts as a load sharing device allowing for early postoperative mobilization. Recent advances in nail design and reduction techniques have expanded the indications for intramedullary nail fixation to include proximal and distal third tibial fractures [11]. As of today, intramedullary nail fixation represents a well-described and commonly performed surgical procedure for both the community orthopaedic surgeon as well as the subspecialized orthopaedic trauma surgeon. Despite its popularity, intramedullary nail fixation of displaced tibial shaft fractures remains challenging and is associated with multiple potential pitfalls. The surgical technique continues to evolve and numerous recent investigations have contributed significant advances in this area [11]. The aim of this study is to compare between the outcomes of medial parapatellar and transpatellar tendon approach of intramedullary nail insertion techniques in tibial shaft fractures.

MATERIALS AND METHODS

This is a retrospective study that took place in Algamhoria Teaching Hospital and Al-Salam hospital in Aden, Yemen. We reviewed records of patients who were admitted and treated for tibial fractures from January 2017 to December 2021. The study was comparing two methods of intramedullary interlocking nail insertion techniques: Medial Parapatellar tendon (MPA) approach and Transpatellar tendon (TPA) approach in the insertion of intramedullary tibial nail for shaft of tibia fractures in terms of stair ascending impairment, limping, inability squaring, knee pain, full flection, full extension and weight bearing. The total study patients were 48 who had sustained tibial shaft fractures and treated with intramedullary nail insertion techniques. They were divided in two groups MPA and TPA.

We gathered data from 48 patients, 24 of whom underwent MPA tendon approach for surgery and 24 of whom underwent TPA tendon approach for surgery.

SPSS version 17 was used to analyze the data.

Variables of sex and age mean, standard deviation and frequency were determined. The Fisher test was used to compare the two groups, MPA and TPA group. The significance level was set at $P<0.05$.

RESULTS

Out of 48 patients, 35 (72.9%) were males and 13 (27.1%) were females (male : female ratio 2.7 : 1). The age of patients ranged between 20 to 53 years and the mean age of the patients was 37 ± 11.9 years. In addition, the age group < 40 years, represented 26 (54.2%) while the age group 40 and more represented 22 (45.8%); as shown in Table 1 and Figure 1.

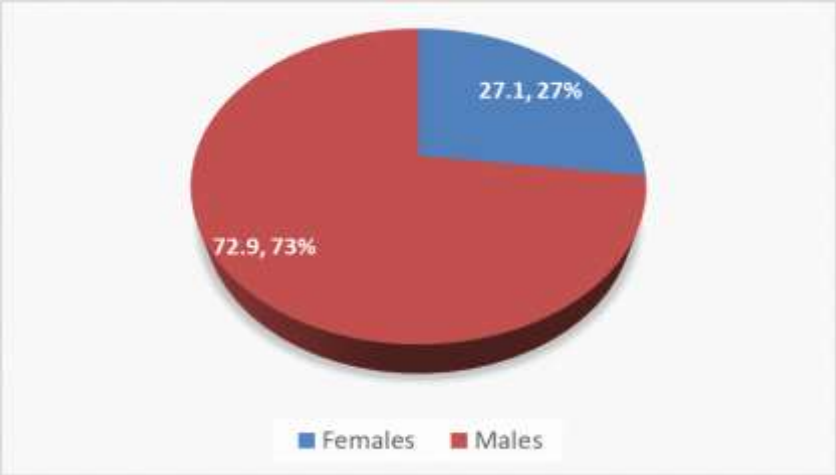
In addition, the mean age for MPA approach was 34.9 ± 10.3 years whereas in TPA approach was 39.0 ± 13.1 years, Table 1.

Table 1: Distribution of demographic characteristics of the study patients (n = 48)

Variable	Ratio	Range	Mean	No	%
Sex:					
Females				13	27.1
Males				35	72.9
Female to male	1:2.7				
Age range (years):		20 – 53			
Mean age ± SD*			37±11.9		
Age groups (years):					
< 40				26	54.2
≥ 40				22	45.8
Mean age of two approach (years):					
Mean age of MPA approach			34.9±10.3		
Mean age of TPA approach			39.0±13.1		

SD*: Standard deviation.

Figure 1: Distribution of proportion of patients related to sex



Among the treatment outcome of MPA insertion approach versus TPA insertion approach of intramedullary nail insertion techniques in tibial shaft fractures stair ascending impairment were found in 24 (50%) patients distributed 10 (20.8%) after MPA procedure and 14 (29.2%) after TPA ($p > 0.05$). Limping was found in 21 (43.7%) patients distributed 11 (22.9%) after MPA procedure and 10 (20.8%) after TPA procedure ($p > 0.05$).

Inability squaring found in 27 (56.3%) distributed as follows: 13 (27.1%) in patients of MPA and 14 (29.2%) in patients of TPA ($p > 0.05$).

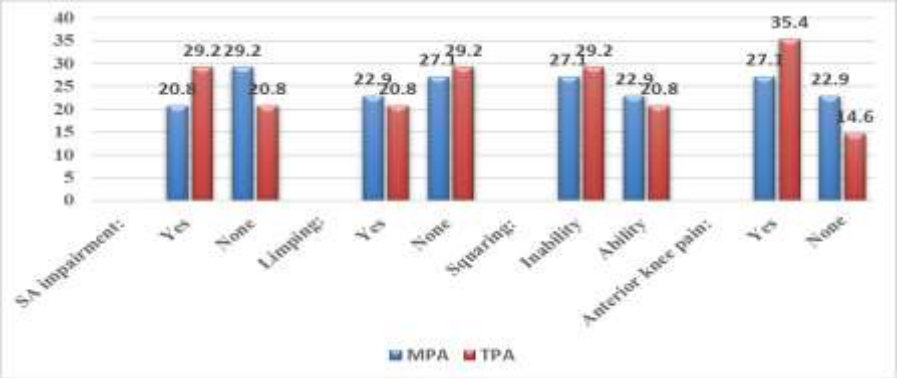
In addition, among the treatment outcomes of MPA and TPA insertion approach anterior knee pain was found in 30 (62.5%) patients distributed as 13 (27.1%) in MPA approach and 17 (35.4%) in TPA insertion approach, ($p > 0.05$); as shown in Table 2 and Figure 2.

Table 2: Distribution of treatment outcomes relating to type of insertion

Variables	Insertion approach				Total		P-value
	MPA		TPA				
	No	(%)	No	(%)	**No**	**(%)**	
Stair ascending impairment:							
Yes	10	(20.8)	14	(29.2)	24	(50.0)	0.193
None	14	(29.2)	10	(20.8)	24	(50.0)	
Limping:							
Yes	11	(22.9)	10	(20.8)	21	(43.7)	0.500
None	13	(27.1)	14	(29.2)	27	(56.3)	
Squaring:							
Inability	13	(27.1)	14	(29.2)	27	(56.3)	0.500
Ability	11	(22.9)	10	(20.8)	21	(43.7)	
Anterior knee pain:							
Yes	13	(27.1)	17	(35.4)	30	(62.5)	0.186
None	11	(22.9)	7	(14.6)	18	(37.5)	

MPA = medial parapatellar; TPA = transpatellar;

Figure 2: Proportions of treatment outcomes relating to type of insertion



Stair ascending impairment = SA impairment

Table 3 and Figure 3 illustrated the distribution of flexion, extension and weight bearing related to type of insertion approach.

In the MPA insertion approach, 14 (29.2%) patients showed a full flection after two days of the surgical insertion while in TPA approach there were 8 (16.6%) patients showed a full flexion ($p > 0.05$).

Full flexion was found after 7 days post MPA insertion approach in 3 (6.3%) patients and in the TPA insertion approach was found in 9 (18.8%) patients. Eight patients showed full flexion after 14 days distributed between MPA approach and TPA approach with 4 (8.3%) in each one. After 21 days 6 (12.6%) patients showed full flexion in each insertion approach 3 (6.3%).

Full extension found in both insertion approaches 30 (62.5%) after 2 days of the surgical insertion distributed as follows 16 (33.3%) in MPA approach and 14 (29.2%) in TPA approach, ($p > 0.05$). After 7 days there were 8 (16.6%) with full extension, 2 (4.2%) in the MPA approach and 6 (12.5%) in TPA approach.

After 14 days, full extension was found in 6 (12.5%) patients, distributed equally between MPA approach and TPA approach with 3 (6.3%). After 21 days, we found full extension in 4 (8.3%) patients and 3 (6.3%) of them in MPA approach.

Table 3 also, revealed the full weight bearing among the patients whom treated with medial parapatellar or with transpatellar tendon approach of intramedullary nail insertion techniques in tibial shaft fractures. After 2 days 26 (54.2%) patients were able for full weight bearing, 15 (31.3%) were patients whom treated with MPA approach and 11 (22.9%) whom treated with TPA approach. After 7 days 4 (8.4%) treated with MPA approach were able for full weight bearing and 8 (16.6%) patients of the group with TPA approach.

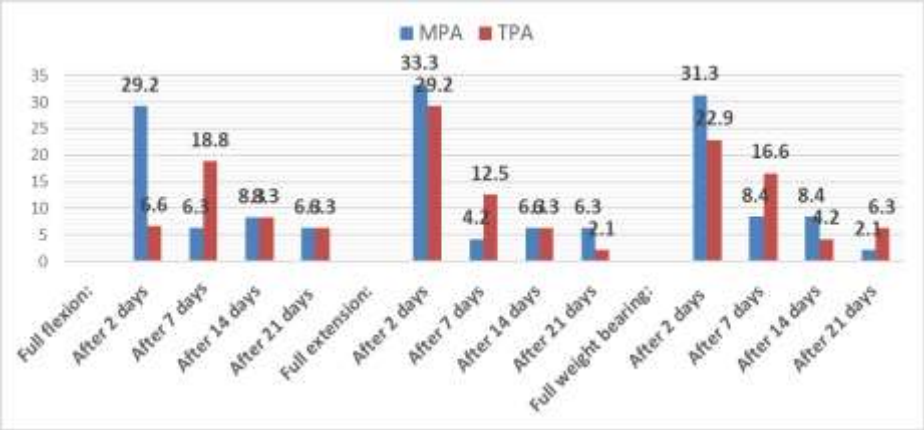
After 21 days only 1 (2.1%) patient of the group MPA approach was able for full weight bearing and 3 (6.3%) of the group with TPA approach, ($p > 0.05$).

Table 3: Distribution of flexion, extension and weight bearing related to type of insertion

Variables	Insertion approach		Total		P-value
	MPA No (%)	TPA No (%)	No	(%)	
Full flexion:					
After 2 days	14 (29.2)	8 (16.6)	22	(45.8)	
After 7 days	3 (6.3)	9 (18.8)	12	(25.0)	0.211
After 14 days	4 (8.3)	4 (8.3)	8	(16.6)	
After 21 days	3 (6.3)	3 (6.3)	6	(12.6)	
Full extension:					
After 2 days	16 (33.3)	14 (29.2)	30	(62.5)	
After 7 days	2 (4.2)	6 (12.5)	8	(16.6)	0.419
After 14 days	3 (6.3)	3 (6.3)	6	(12.5)	
After 21 days	3 (6.3)	1 (2.1)	4	(8.3)	
Full weight bearing:					
After 2 days	15 (31.3)	11 (22.9)	26	(54.2)	
After 7 days	4 (8.4)	8 (16.6)	12	(25.0)	0.353
After 14 days	4 (8.4)	2 (4.2)	6	(12.5)	
After 21 days	1 (2.1)	3 (6.3)	4	(8.3)	

MPA = medial parapatellar; TPA = trans-patellar;

Figure 3: Proportion of flexion, extension and weight bearing related to type of insertion



DISCUSSION

Tibial shaft fractures are extremely common injuries [12]. The preferred management for most tibial shaft fractures is intramedullary nailing, which generally yields a high rate of union, low complication rates, and good functional outcomes [13]. Fractures of the tibia are among the most serious long bone fractures, due to their potential for nonunion, malunion, and long-term dysfunction, as well as their propensity for open injury. Intramedullary nailing is the gold standard treatment option for displaced closed or open tibial diaphyseal fractures [4,14]. Intramedullary nailing acts as an internal splint and permits early weight bearing along with fracture healing [15]. Intramedullary nailing is the treatment of choice for displaced tibial shaft fractures in adults [16,17].

In our current study, we found out of the total study patients. The female patients were (27.1%), and male patients were (72.9%). Rijal et al [18] reported similar to our result in their study that among the study patient (70%) were males and only (30%) were females.

In the present study, the mean age of the patients was 37 ± 11.9 years. Their age ranged between 20 to 53 years. The age group < 40 years, represented (54.2%) while the age group 40 and more represented (45.8%). These findings were in agreement with results reported by Hussain et al [19] in which the mean age was 38±10 years (range 20-60 years), and out of the 60 patients, (75.0%) were males and (25.0%) were females with ratio of 3:1.

We found in our study, the mean age for MPA approach was 34.9 ± 10.3 years whereas in TPA approach was 39.0 ± 13.1 years. Our findings similar to the results reported by Hussain et al [19]. They found the mean age of patients in group MPA approach was 38±11 years and in group TPA approach was 38±9 years.

In the present study, stair ascending impairment were found in (50%) patients distributed (20.8%) after MPA insertion approach and (29.2%) post TPA insertion approach ($p > 0.05$). Also, we observed that limping was found in (43.7%) patients distributed as follows: (22.9%) post MPA insertion approach and (20.8%) post TPA approach, ($p > 0.05$). The inability squaring was found in (56.3%) distributed as follows: (27.1%) in patients of MPA insertion approach and (29.2%) in patients of TPA insertion approach, ($p > 0.05$).

Erin-Madsen et al [20] mentioned that even years after the occurrence of a tibial shaft fracture functional limitations in everyday life, reduced quality of life, and restrictions in sports activities, and limited joint mobility.

In the current study, anterior knee pain was found in (62.5%) patients distributed as (27.1%) in MPA insertion approach and (35.4%) in TPA insertion approach ($p > 0.05$).

Anterior knee pain is one of the most common complaints after tibial intramedullary nailing. This has a

significant economic impact, since the majority of tibial fractures that require nailing are sustained by men with an average age of 31 years [13].

Court-Brown et al [21] found the incidence of anterior knee pain to be 56%. The only difference between patients who developed pain and those who did not was that patients with pain were younger. Ninety-one percent of these patients experienced pain with kneeling and 33% had pain at rest. Possible explanations for this include nail protrusion leading to soft tissue irritation or damage to the gliding tissues in front of the knee during nail insertion. It has been suggested that the patellar tendon-splitting approach may be associated with increased pain due to lateral retraction of the tendon, compared to paratendinous approaches [1,22].

Various authors reported similar to our results and suggest that, medial parapatellar approach has less anterior knee pain compared to transpatellar approach for intramedullary interlocking nail insertion technique in the management of tibial shaft fracture but both approaches are considered as safe [5,9,23].

Erin-Madsen et al [20] reported in their study that the most frequent complication after tibial shaft fractures is anterior knee pain. It is reported in 30–70 % of patients in particular during stair climb or kneeling and therefore significantly limits everyday activities. The most common complication 1 year after treating a tibia shaft fracture with an intramedullary nail is knee pain, which has been reported in up to 40 % of patients [24].

Ahmad, et al [9] conducted a study in Pakistan showed that patients who underwent medial parapatellar approach had less pain as compared to transpatellar approach and also concluded that avoidance of damage to intra-articular structures and prominent nail can reduce knee pain. This finding was similar to our study finding.

In the MPA insertion approach, (29.2%) patients showed a full flexion after two days of the surgical insertion while in TPA approach there were (16.6%) patients showed a full flexion ($p > 0.05$). The study showed that full extension found in MPA (33.3%) while in TPA (29.2%), ($p > 0.05$). in addition, we found after two days full weight bearing among (31.3%) patients whom treated with MPA approach and (22.9%) whom treated with TPA approach ($p > 0.05$).

In a similar fashion, many authors have addressed the success of intramedullary nailing in treating tibial shaft fractures [25,26], though most frequently in the context of comminution, a large degree of angulation or displacement, or an open fracture pattern. Placement of an intramedullary nailing carries with it the inherent risks of infection, postoperative compartment syndrome, chronic knee pain, and anesthesia-related risks [27,28].

CONCLUSION

The study was comparing two methods of intramedullary nail insertion techniques: medial parapatellar tendon approach and transpatellar tendon approach in the insertion of intramedullary tibial nail for shaft fractures of tibia in terms of stair ascending impairment, limping, inability squaring, knee pain, full flection, full extension and weight bearing. The study showed us the advantage of medial parapatellar tendon approach of treating the tibial shaft fractures.

Declaration by Authors

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