

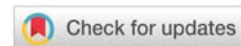
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Research Article

Comparision of transpatellar and medial parapatellar tendon approach in tibial intramedullary nailing for treatment of fracture shaft of tibia

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Introduction

Tibia is exposed to frequent injury there by being the most commonly fractured long bone. 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. 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].

Tibial shaft fractures are one of the most common fractures in young. The risk of fractures increases up to 37.5% [2]. 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 [3].

For the treatment of diaphyseal tibial fractures, tibial nailing has become the standard care, intramedullary nail act as an internal splint [4]. Tibial nail is advantageous in its intramedullary position, sharing physiologic loads and allowing weight bearing of affected extremity immediately after placement. This device is ideal for the management fracture [5]. Recently, due to the latest implant design interlocking intramedullary nailing has become the treatment of choice for tibial shaft fractures. Anterior knee pain is the most commonly reported complication, and incidence is about 18%-86%, the cause of this pain is multifactorial like, nail

prominence, fracture type, tibial plateau width, fracture union, sex, age, BMI, time elapsed from surgery, entry point location and intra articular structure injury, infrapatellar fat lesion, size and location of scar [6]. Iatrogenic injuries to infrapatellar branch of saphenous nerve is also believed to be cause of the anterior knee pain [7]. Some nail designs proximal screw placed obliquely which is believed more stable with this type of fixation may injure proximal tibiofibular joint and cause knee pain [8]. Traditionally, the starting point for intramedullary nailing of tibial shaft fracture has established via infrapatellar approach either by splitting the patellar tendon or dissecting just adjacent to patellar tendon. Nailing in semiextended position using medial patellar approach has recently gained significant attention [9]. Gerhad kuntscher developed his v-shaped nail and a cloverleaf nail in 1940s later on it was widely used to treat fracture shaft of tibia. Herzog modified the straight k-nail to accommodate the eccentric proximal portal. In the USA Hansen-street nail was introduced in 1947 this was solid diamond shaped nail designed to resist fracture rotation by its compression fit within the cancellous bone. In 1970 Gorsche and Kemfe developed nail with interlocking screw, which expanded the indication of nailing more proximal, distal and unstable fractures. Afterwards closed nailing technique appeared, this technique led to many of today's current technique. As surgical techniques continue to expand during this time, there was surge in clinical data regarding to use of reamed interlocking nail of both tibia and femur [10]. Various studies suggest that, medial parapatellar approach has less anterior knee pain but both the



approaches are considered safe. As compared to transpatellar approach for intramedullary interlocking nail insertion, medial parapatellar incision is more preferred in the management of tibial shaft fracture [3,11,12].

The objective of this study is to evaluate the post-operative complications of two approaches at 2 weeks, 4 weeks and 12 weeks postoperative periods with regards to: pain measurement with Visual Analogue Scale, impairment caused by that pain during different activities, and functional evaluation of kneeling and squatting, functional range of motion and also to study the incidence of anterior knee pain with the two different approaches of tibial Intramedullary Interlocking (IMIL) nail insertion technique.

Materials and methods

This is a prospective, randomized study comparing two methods of intramedullary interlocking nail insertion techniques: Medial Parapatellar tendon (MP) approach and Transpatellar tendon (TP) approach in the insertion of IMIL tibial nail for shaft of tibia fractures in terms of range of motion, anterior knee pain, impairment caused by that pain in different activities, functional ability evaluation with kneeling and squatting. Patient was asked to grade the pain as per Visual Analogue Scale (VAS) at 2 weeks, 4 weeks and 12 weeks after surgery. A total of 50 patients who had sustained tibial shaft fractures and treated with IMIL nail were considered in this study, divided in to two groups TP (Transpatellar) and MP (Medial Parapatellar). In each group 25 patients were included and followed up for 12weeks. Random allocation of the patient was done on the basis of Excel generated random numbers. The study was carried out in tertiary referral centre for a year.

Inclusion criteria

- Age more than 18 year
- Closed fracture indicated for IMIL nailing
- Open fracture Gustilo and Anderson type I, II, IIIA

Exclusion criteria

- Age less than 18 years
- Prior operations about the knee
- Neurovascular compromise
- Ipsilateral fracture of the femur or proximal tibia not amenable to intramedullary nailing
- Patients who are non-ambulatory
- Patients who have ipsilateral fractures involving the ankle or foot
- Patient who refused to consent

Immunocompromised

- All the patient were enrolled in the study only after giving

the informed consent by the patient. Ethical clearance was taken from the institutional review committee. The study did not add any sort of financial burden to the patient.

Results

In this study group a total of 50 patients were included out of which 25 were in the Medial Parapatellar tendon approach (MP) and 25 in the transpatellar Tendon approach (TP) Table 1.

Mean age for MP approach was 40.88years whereas in TP approach was 35.52 years Table 2.

Among total of 50 patient 35 were male and only 15 were female Tables 3,4.

Table 1: Showing distribution of patient between two study groups (approach).

Study group (Approach)	Number of patient	Percentage
Medial parapatellar	25	50
Transpatellar	25	50
Total	50	100

Table 2: Showing age of the patients.

Age in years	Number of patients	Percentage
≤50	39	78
>50	11	22
Total	50	100

Table 3: Showing number of patient in sex.

Sex	Number of patients	Percentage
Male	35	70
Female	15	30
Total	50	100

Table 4: Showing etiology of fracture and number of patients.

Etiology	Number of patients	Percentage
Road traffic accidents	34	68
Others	16	32
Total	50	100

Among 50 patient in 2 weeks range of motion extension to flexion in 40–60 degree there were 26 patient, 61–90 degree 24 patients there was no any patient in 40–60 degree 14 patient in 61–90 degree and 36 patient in >90 degree in 4 weeks. However all patient's range of motion was >90 degree in 12 weeks Tables 4–6.

2 weeks range of movement from 40–60, 61–90 in MP approach was 13(50%) and 12(50%) respectively with mean range of movement 62.8. and TP approach also 13(50%) and 12(50%) respectively with mean of 61.8. Where *p*-value was not significant and in 4weeks 61–90 and >90 in MP and TP group was 8(57.1%), 17(47.2%) with mean of 97.4 and 6(42.9%), 19(52.8%) with mean of 99.6 respectively, where again *p*-value



was not significant. However at 12weeks all patients in both study groups range of motion was >90 with mean 118.6 in MP approach and 122 in TP approach Tables 7,8.

Pain at the anterior knee of the operated leg was recorded by VAS in a scale of 0–10cm. The *p*-value was not significant at any time interval in both groups Tables 9–16.

Table 5: Showing type of fracture.

Type	Number of patients	Percentage
Close	41	82
Open	9	18
Total	50	100

Table 6: Showing knee range of motion at different time periods.

Range of motion at 2weeks	Number of patients	Percentage
40-60	26	52
61-90	24	48
>90	-	-
Total	50	100
Range of motion at 4weeks		
40-60	-	-
61-90	14	28
>90	36	72
Total	50	100
Range of motion at 12weeks		
40-60	-	-
61-90	-	-
>90	50	100
Total	50	100

Table 7: Showing different period of range of motion in two study groups.

Characteristics	Range Degree	Approach		P-value	Remarks
		MP	TP		
Range of movement at 2weeks	40-60	13(50%)	13(50%)	1.00	Not significant
	61-90	12(50%)	12(50%)		
Range of movement at 4weeks	61-90	8(57.1%)	6(42.9%)	0.53	Not significant
	>90	17(47.2%)	19(52.8)		
Range of movement at 12weeks	>90	25(50%)	25(50%)	*	-
	>90	25(50%)	25(50%)		

Table 8: Showing two study groups with regards to age, sex, etiology, and type and incision length.

Characteristics	Category	Approach		P-value	Remarks
		MP	TP		
Age(years)	≤50	18(46.2%)	21(53.8%)	0.306	Not significant
	>50	7(63.6%)	4(36.4%)		
Sex	Male	19(54.3%)	16(45.7%)	0.538	Not significant
	Female	6(40%)	9(60%)		
Etiology	Road traffic accidents	14(41.2%)	20(58.8%)	0.069	Not significant
	Others	11(68.8%)	5(32.2%)		
Type	Close	20(48.8%)	21(51.2%)	0.713	Not significant
	Open	5(48.7%)	4(44.4%)		
Incision(cm)	4-6	19(48.7%)	20(51.3%)	0.733	Not significant
	>6	6(54.5%)	5(45.5%)		

Table 9: Showing two study groups with regards to age, sex, etiology, and type and incision length.

Characteristics	Category	Approach		P-value	Remarks
		MP	TP		
Age(years)	≤50	18(46.2%)	21(53.8%)	0.306	Not significant
	>50	7(63.6%)	4(36.4%)		
Sex	Male	19(54.3%)	16(45.7%)	0.538	Not significant
	Female	6(40%)	9(60%)		
Etiology	Road traffic accidents	14(41.2%)	20(58.8%)	0.069	Not significant
	Others	11(68.8%)	5(32.2%)		
Type	Close	20(48.8%)	21(51.2%)	0.713	Not significant
	Open	5(48.7%)	4(44.4%)		
Incision(cm)	4-6	19(48.7%)	20(51.3%)	0.733	Not significant
	>6	6(54.5%)	5(45.5%)		

Table 10: Showing VAS for pain between two study groups at different time interval.

Visual Analogue Scale at walking	Approach (Study group)	Number of patients	Mean	Standard Deviation	Standard error of mean	P-value
2 weeks	MP	25	5.80	1.258	0.252	0.285
	TP	25	5.40	1.354	0.271	
4 weeks	MP	25	2.60	1.155	0.231	0.079
	TP	25	2.68	0.988	0.198	
12 weeks	MP	25	1.08	1.038	0.208	0.434
	TP	25	0.88	0.726	0.145	

Table 11: Showing impairment scale at rest.

Impairment scale at rest	Approach(study group)	Number of patients	Mean	Standard Deviation	Standard error of mean	P-value
4 weeks	MP	25	0.08	0.277	0.055	0.08
	TP	25	0.04	0.200	0.040	
12 weeks	MP	25	0.00	0.000(*)	0.000	(*)
	TP	25	0.00	0.000(*)	0.000	

The mean impairment scale at rest at 4 weeks for MP and TP approach was 0.8 and 0.4 respectively and *p*-value was 0.08. However at 12 weeks (*) the t-test could not be computed because the std. deviation of both groups were 0.

Table 12: Showing impairment scale on walking.

Impairment scale by walking	Approach(study group)	Number of patients	Mean	Standard Deviation	Standard error of mean	P-value
4 weeks	MP	25	3.08	1.579	0.316	0.149
	TP	25	2.48	1.295	0.259	
12 weeks	MP	25	0.80	0.707	0.141	1.000
	TP	25	0.80	0.816	0.163	

The *p*-value was not significant in both groups given interval of time.

Table 13: Showing functional evaluation by kneeling(FEK).

FEK	Approach(study group)	Number of patients	Mean	Standard Deviation	Standard error of mean	P-value
4 weeks	MP	25	0.28	0.458	0.092	0.400
	TP	25	0.48	0.510	0.102	
12 weeks	MP	25	1.48	0.510	0.102	0.250
	TP	25	1.68	0.690	0.138	

The *p*-value not significant in both approaches in given time interval.

None of the patient from either group had intraoperative and postoperative complications such as wound infection, broken hardware, patellar tendon rupture, scar neuroma Table 16.

**Table 14:** Showing functional evaluation by 25 squats (FES 25).

FES 25	Approach(study group)	Number of patients	Mean	Standard Deviation	Standard error of mean	P-value
4 weeks	MP	25	0.44	0.507	0.101	0.247
	TP	25	0.28	0.458	0.092	
12 weeks	MP	25	1.68	0.476	0.095	0.529
	TP	25	1.80	0.816	0.163	

The p-value was not statistically significant in both groups in given time interval.

Table 15: Showing impairment scale on kneeling.

Impairment scale by kneeling	Approach(study group)	Number of patients	Mean	Standard Deviation	Standard error of mean	P-value
4 weeks	MP	25	4.08	1.525	0.350	0.246
	TP	25	4.60	1.607	0.321	
12 weeks	MP	25	2.68	1.282	0.256	1.000
	TP	25	2.68	1.030	0.206	

The p-value was not significant in both groups in given interval of time.

Table 16: Showing impairment scale by squatting.

Impairment scale by squatting	Approach (study group)	Number of patients	Mean	Standard Deviation	Standard error of mean	P-value
4 weeks	MP	25	5.84	1.546	0.309	0.854
	TP	25	5.76	1.508	0.302	
12 weeks	MP	25	2.16	1.179	0.236	0.266
	TP	25	1.80	1.080	0.216	

The p-value was not significant in both groups in given interval of time.

Discussion

Regarding the treatment of diaphyseal tibial fractures, tibial nailing has become the standard care [4]. Tibial nail is advantageous due to its intramedullary position, sharing the physiological loads and allowing early weight bearing of affected extremity after placement. The device is ideal for fracture management [5].

Due to the latest implant design, tibial IMIL has become the choice for the treatment of tibial shaft fractures. Anterior knee pain is the most commonly reported complication with its incidence being 18–86%. The cause of pain is multifactorial like nail prominence, fracture type, tibial plateau width, fracture union, sex, age, body mass index, time required for surgery, entry point site and intra articular structure injury, infrapatellar fat lesion, size and location of scar [6]. Various authors 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 [3,11,12].

This study was undertaken in our set up to compare the incidence of anterior knee pain following nailing of tibial shaft fracture by use of medial parapatellar approach and transpatellar approach, and also over all outcomes between these two approaches using simple evaluating measures.

None of the patient from either group had intraoperative and postoperative complications such as wound infection, broken hardware, patellar tendon rupture, scar neuroma, that could have influenced the anterior knee pain. Sadeghpour A, et

al., studied 23 males and 2 females with mean age 28.6 ± 5.78 year in transpatellar group and 21 male and 4 female with mean age 28.80 ± 5.82 years in medial parapatellar group and in transpatellar 22 patients had closed fracture and 3 open, in the parapatellar 21 closed and 4 open [3]. Regarding anterior knee pain they found more pain in transpatellar approach compared to parapatellar approach after 3 months, but there was no significant difference between the two study groups with respect to mean age, sex, etiology, range of motion and skin incision length [3]. Similarly our study also shows there is no significant difference between the two study groups with regards to age, sex, etiology, range of motion and skin incision length.

Although they found significant difference in the anterior knee pain after 3 months, but our study does not show significant difference till 3 months regarding anterior knee pain between the two approaches. Pain being a subjective parameter, was reported in terms of Visual Analogue Scale (VAS) for the ease of understanding by our patients. Keating, et al., in their retrospective study had found a clear association between the transtendinous surgical approach and chronic anterior knee pain and they recommended the routine use of parapatellar approach and also mentioned that cause of anterior knee pain is multifactorial [11].

Another study conducted by Vaisto O, et al., stated that chronic anterior knee pain is a common complication after intramedullary nailing of tibial shaft fracture, But etiology of pain is often not known [13]. Tahririan MA, et al., conducted a study in which 60(63.2%) patients were paratendinous approach and 35(36.8%) transtendinous. 26(27.4%) or the patients had anterior knee pain, their study concluded that the main contributing factor for this pain was protrusion of nail from anterior cortex rather than type of fracture and type of surgery [14].

A prominent nail will cause anterior knee pain [15]. Although some authors claim that there is association between anterior knee pain and marked nail prominence, Indeed in the number of patients in our study groups, the nail had clearly been buried in the proximal tibial cortex. In our study the mean impairment scale on kneeling and squatting at 4 weeks and 12 weeks was not statistically significant between two study groups. Regarding functional ability to squat 25 times and kneeling in 4 weeks and 12 weeks was also not statistically significant. Ahmad, et al., 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 [12]. Anterior knee pain of the operated leg in our study was recorded by VAS in a scale. Our study shows anterior knee pain in both groups, the mean VAS at 2 weeks, 4 weeks and 12 weeks for the MP and TP group was 5.8, 5.4, 2.6, 2.68, 1.08 and 0.88 respectively. The p-value was not significant at any interval of time in both approaches. Most of the previous studies were conducted over a long period of follow-up [3,11,14]. As the etiology anterior knee pain is multifactorial and main limitation in our study was short



period of follow-up, anterior knee pain may be due to the other causes so further studies needed to compare all the possible causes of anterior knee pain.

Conclusion

A prospective randomized study was done in our set up to compare two methods of intramedullary interlocking nail insertion technique by using medial parapatellar tendon approach and transpatellar tendon approach in the management of tibial shaft fractures with intramedullary interlocking nails. We conclude that we could not find any distinct clinically relevant association between the types of surgical incision approach with regard to anterior knee pain.

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