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ANTERIOR KNEE PAIN IN TRANSTENDINOUS AND PARATENDINOUS APPROACHES OF TIBIAL INTERLOCKING NAIL: A COMPARATIVE STUDY

Gyaneshwar Tonk¹, Gaurav Menwal², Amit Kumar Gupta³, Nitesh Rustagi⁴, Alok Kumar⁵

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ABSTRACT: BACKGROUND: Anterior knee pain has been described as the most common complication after intramedullary nailing of fracture shaft of tibia. Dissection of the patellar tendon and its sheath during transtendinous nailing is thought to be as one of the contributing causes of chronic anterior knee pain. The purpose of this prospective, randomized study was to compare the incidence of anterior knee pain after intramedullary nailing of a tibial shaft fracture with transtendinous and paratendinous incision technique. **MATERIAL AND METHODS:** From April 2012 to October 2013 eighty patients with closed tibial shaft fractures were admitted and treated in our institution. Patients were randomized for treatment with paratendinous or transtendinous nailing (as 24 patients did not complete their follow up or were lost in follow up, so 56 patients were analyzed finally). For assessment we used visual analogue scales to report the level of anterior knee pain. The scales described by Lysholm and Gillquist and by Tegner et al., were also used to quantitate the functional results. **RESULTS:** 12 of the 28 (42%) patients treated with transtendinous nailing, reported anterior knee pain whereas 8 patients out of 28 (28%), in which paratendinous technique was used had persistent anterior knee pain after minimum final follow up of 24 weeks, with no significant statistical difference. The Lysholm, Tegner functional scoring systems showed a significant difference between the two groups. **CONCLUSION:** Compared with a transtendinous approach, a paratendinous approach for nail insertion does not reduce the incidence of chronic anterior knee pain or functional impairment after intramedullary nailing of a tibial shaft fracture. In long term, anterior knee pain seems to disappear from many patients. Since our study is small and have short duration of follow up, further larger studies and long duration of follow up is needed to establish the results.

KEYWORDS: Tibial shaft fracture, Anterior knee pain, Intramedullary nailing, Transtendinous technique, Paratendinous technique.

INTRODUCTION: Intramedullary nailing has been described as the treatment of choice for many displaced tibial shaft fractures in adults.¹ Several complications have been described after IM nailing including infection, compartment syndrome, deep vein thrombosis, thermal necrosis of bone, implant failure, non-union and mal-union of fracture.⁴

However one of the commonest complications after tibial nailing is chronic anterior knee pain with incidence as high as 86%.⁹ Although most knee pain is mild, it can significantly affect patients quality of life, and can be an important handicap for the patient, affecting his employment and daily/leisure activities.⁶ After surgery complaints of anterior knee pain exacerbated by walking, squatting, kneeling and stair climbing are common.⁸

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However the exact etiology of this complication is still unknown.⁵ Some investigators have proposed that a transpatellar tendon approach for nail insertion is associated with a higher prevalence of anterior knee pain than a medial paratendinous approach.³

The purpose of this randomized prospective study was to evaluate the incidence of anterior knee pain in patients of various age groups and determine whether there is a difference in the incidence of chronic anterior knee pain after two different surgical approaches. We have also evaluated the functional outcome of patients after closed intramedullary nailing.

MATERIALS AND METHODS: This study comprised of 80 patients of displaced tibial shaft fracture treated with an intramedullary locking nail at L.L.R.M medical college, Meerut, between April 2012 and October 2013. Inclusion criteria of the study included patients aged more than 15 years, closed tibia fracture without intra-articular extension definitively treated by intramedullary nailing and absence of any co-morbid illness.

The exclusion criteria of the study were fracture shaft tibia treated with plating or primarily by external fixator followed by intramedullary nail, fractures treated conservatively with casting, patients with history of knee pain not related to intramedullary nailing and patients having other fractures around knee like Patella fracture. All the patients were thoroughly examined including all the injuries apart from the tibial fractures.

Every patient was investigated with blood profile, Antero- posterior and lateral views of X-rays. Following hospitalization a well-padded long leg plaster was given; analgesics and other supportive measures were administered as required. Nailing was done at the earliest opportunity after getting clearance from the anaesthesia department.

All patients were informed of the study procedure, purposes, known risks and all gave written informed consent. Patients were randomized preoperatively on alternate case basis. Each group, patellar tendon-splitting (transtendinous) approach and closed nailing with use of a paratendinous approach had 28 patients each at the time of final evaluation as 24 patients were lost due to various reasons in the final follow up period.

Mode of anaesthesia given to the patient was either general anaesthesia or regional (Spinal) anaesthesia depending on the anesthetist choice. The incision for the transtendinous approach was made longitudinally through the midline of the tendon for a distance of 3-5cms. For the paratendinous approach, a medial longitudinal incision was made with care taken not to violate the patellar tendon or its sheath. The entry portal in the bone was made immediately behind the patellar tendon in all patients. Reaming was done after insertion of guide wire.

The nail was inserted after selection of appropriate length. Proximal and distal locking screws were always used, and all nails were countersunk below the cortical bone of the proximal part of the tibia. Postoperatively radiographs were taken and the limb was kept elevated and passive exercises of toes were started immediate post operatively. Active exercises of knee and ankle were started as early as possible

All the 56 patients were strictly followed minimally up to 24 weeks. The interval of follow up was 2 weeks, 6 weeks, 12 weeks and 24 weeks or earlier if required. Serial radiographs were taken to assess the radiological healing and photographic records were taken for final functional outcome. Patients were advised weight bearing between 8-16 weeks postoperatively after clinical and

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radiological examination of fracture union. The patients who did not come for follow up or were lost during the follow up were not included in the study.

At follow ups patients were asked about the severity of pain and amount of disability. Patients were specifically asked whether they had knee pain. If patients complained of knee pain they were asked to localize the pain. Only pain over the anterior portion of the knee was taken as a positive response for knee pain. If the patients specifically points to pain over fracture site or screw head it was excluded.

Patients were asked to grade the pain as per VAS scale, a 100mm visual-analogue scale, with 0 denoting no pain and 100 denoting the worst pain that the patient could imagine. In addition functional outcome was also seen using Tegner Lysholm score, a 100 point, validated, reliable and responsive outcome tool for functional assessment of knee.

The statistical analysis in this study was carried out using SPSS 15 software for Windows program. The differences between both the groups were tested using Mann-Whitney Wilcoxon test and Friedman test.

RESULTS: From out of 56 patients of fracture shaft tibia included in our study, there were 42 men (75%) and 14 women (25%) with a mean age 34.60 years with the youngest being 16 years old and the oldest being 60 years old. In the 56 patients of our study, 24 (43%) had right limb involved, 28 (50%) had their left limb involved; whereas 4(7%) of patients had a bilateral injury. In our study the mechanism of injury was road traffic accident in 40(71%) patients, fall from height in 14(25%) patients; whereas 2(4%) patients had assault as a mode of injury.

Fractures in the middle 1/3 of the shaft of tibia were the commonest consisting 36(64%) out of 56 cases. Involvement of lower 1/3 was in 14(25%) cases and 6 cases were in upper 1/3(11%). In our study no segmental fractures were found. The majority patients had short oblique fractures, 32 (57%) with a variety of comminution followed by transverse fractures 24(42%). Out of the 56 patients, 20 patients (36%) were treated within 48 hrs of sustaining trauma. 18 patients (32%) were treated within 4 days of sustaining trauma. This delay was mainly because of gross swelling of the operated part. 18 patients (32%) were operated within 7 days of sustaining trauma. The delay in this group was mostly because of associated injuries and delay in anaesthesia fitness.

At the time of final follow up of 24 weeks, 12 patients out of 28(42%) in which transtendinous technique was used, had persistent knee pain. Whereas 8 patients out of 28(28%), in which paratendinous technique was used, had persistent anterior knee pain. It was clearly seen that both the techniques are equally effective in terms of pain (p value <.001). It was seen that at the follow ups of 2nd, 6th, 12th weeks, both the techniques showed almost similar results in term of median, minimum and maximum values. Further, it was also noted that as the duration of follow up increases, median analogue score decreases with a minimum of 0 and maximum of 10. P-values at various follow ups were also statistically not significant.

TECHNIQUE	VAS_2 WEEKS	VAS_6 WEEKS	VAS_12 WEEKS	VAS_24 WEEKS	p- value
TRANSTENDINOUS	MEDIAN= 50	20	10	0	<0.001
PARATENDINOUS	MEDIAN = 50	30	10	0	<0.001

TABLE 1

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The first table shows the test of significance of Visual analogue scale of both the techniques at different follow ups.

DURATION	TECHNIQUE	NO. OF PATIENTS	MEDIAN	MIN	MAX	p-VALUE
VAS_2 WEEKS	TRANSTENDINOUS	28	50	30	70	0.054
	PARATENDINOUS	28	50	30	60	
VAS_6 WEEKS	TRANSTENDINOUS	28	20	20	40	0.543
	PARATENDINOUS	28	30	10	40	
VAS_12 WEEKS	TRANSTENDINOUS	28	10	0	20	0.92
	PARATENDINOUS	28	10	0	20	
VAS_24 WEEKS	TRANSTENDINOUS	28	0	0	10	0.58
	PARATENDINOUS	28	0	0	10	

TABLE 2

This table shows the mean, minimum and maximum values of Visual analogue scale at different time intervals in both the techniques used and significance of it.

Among those who even after 24 weeks had pain, the pain was worst on kneeling, squatting and after long term sitting. The above noted prevalence of anterior knee pain is the same as that reported in previous studies.^{4,5,7} With the numbers available, we could not find any association between the entry incision and anterior knee pain.

Our study showed that there was a statistically significant difference between the two groups in the final functional outcome. There was a clear difference between the Lysholm, Gillquist and Tegner knee scores in the respective study groups. In our study patients, patients who had anterior knee pain at follow up had lower functional scores than those who never had knee pain or those whose knee pain has disappeared over time.

TECHNIQUE	LKS_6 WEEKS	LKS_12 WEEKS	LKS_24 WEEKS	p-VALUE
TRANSTENDINOUS	MEDIAN=24	45	74	<0.001
PARATENDINOUS	MEDIAN=27	55	83	<0.001

TABLE 3

The table shows the test of significance of Tegner Lysholm knee score of both the techniques at different follow ups.

It was observed that there was no significant difference in the final functional outcome of patients in both the compared techniques ($p < 0.001$). However, it was also seen that the median LKS score at 24 weeks of patients with Paratendinous technique (83) was slightly higher than the patients with Transtendinous technique (74).

On evaluation of final functional outcome scores at 24 weeks, 9 patients (32%) had excellent results, 5 patients (18%) had good results and 14 patients (50%) had fair results in Paratendinous technique group whereas 10 Patients (35%) had excellent results, 18 patients (65%) had fair results in Transtendinous technique group. So, we can clearly say that there is significant difference in terms of functional outcome of the patients in the two compared techniques.

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DISCUSSION: As with other various treatment modalities, intramedullary nailing also has its pearls and pitfalls. Of which, chronic anterior knee pain is one of the most frequently reported complication of closed nailing. It is apparent from the literature that the source of anterior knee pain is multifactorial. Some investigators have proposed that a transpatellar tendon approach for nail insertion is associated with a higher prevalence of knee pain than a medial paratendinous approach, which was not observed in our study.

In a retrospective study in which the nail was inserted via a paratendinous incision in 65 fractures and via a tendon splitting incision in 36 fractures, Keating et al (1997)⁸ reported that insertion of an intramedullary nail paratendinously resulted in an incidence of knee pain of 50%, whereas this incidence in the tendon splitting incision group was 77%. This difference was significant ($p < 0.01$). They thus recommended a parapatellar tendon incision for nail insertion.⁸

Toivanen et al (2002) undertook a prospective randomized study of 56 patients with tibial shaft fracture requiring intramedullary nailing. At the time of the 8 year follow up, 4(29%) of the 14 patients treated with the transtendinous approach and 4(29%) of the patients treated with the paratendinous approach reported anterior knee pain, assessed with the visual analogue scale. They thus concluded that it was not possible to reduce the anterior knee pain by using a paratendinous approach rather than a transtendinous approach.¹⁰

In our final follow up of six months 36 (65%) patients were painless and only 20 (35%) patients had chronic anterior knee pain. Anterior knee pain had thus vanished from 36 patients in the final follow up. In the two compared groups, 12 patients out of 28 (42%) in which transtendinous technique was used, had persistent knee pain. Whereas 8 patients out of 28(28%), in which paratendinous technique was used, had persistent anterior knee pain after final follow up of 24 weeks.

There are many other factors than the surgical approach that may cause anterior knee pain after intramedullary nailing of a tibial shaft fracture. Possible causes include iatrogenic/injury related intra-articular damage, nail prominence, violation of patella tendon or damage to the infra patellar nerve.

Hernigou and cohen (2000) investigated 12 pairs of cadaver knees after intramedullary nailing of the tibia. The intra-articular structures particularly at risk for damage during tibial nailing are medial meniscus, the lateral tibial plateau, and the transverse ligament. They also retrospectively analyzed 30 patients radiologically who had undergone tibial nailing and recorded unrecognized articular penetration and damage during surgery in 4patients.⁷

In our study, 20 patients (35%) had persistent anterior knee pain after 24 weeks of follow up. of which 14(70%) were male and 6(30%) were females. Maximum patients having persistent knee pain were in the age group of 20-45 years. In their study Keating et al (1997) reported that the incidence of anterior knee pain is more common among younger than older patients.⁷ This may be due to the more sedentary lifestyle of the elderly patients.

Keating et al and Toivanen et al⁸ found no association between nail protrusion and anterior knee pain. In our study it is also seen that difference in the limb length and nail size do not differ significantly in the patients having knee pain as compared to those who do not have knee pain.

Our study also showed that there was a statistically significant difference between the two groups in the final functional outcome. There was a clear difference between the Lysholm, Gillquist and Tegner knee scores in the respective study groups. Bleakney and Maffuli et al (2002) measured

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quadriceps musculature and atrophy using high-resolution real time ultrasonography (HRRTU) in 13 skeletally mature male patients with an isolated unilateral diaphyseal fracture of the femur or the tibia.^{2,3} They found clear differences in quadriceps morphology in the nailed and unnailed limb.⁹ Patients who had anterior knee pain at final follow up had lower functional scores than those who never had knee pain or those whose knee pain has disappeared over time.

Overall 43% excellent to good results and 57% fair results functionally, seen in this study, suggest closed intramedullary nailing as an optimum treatment for tibial diaphyseal fractures. We conclude that it is not possible to reduce anterior knee pain by using a paratendinous approach rather than a transtendinous incision for closed nailing of tibial shaft fractures.

There are many factors other than the surgical approach that may cause anterior knee pain after intramedullary nailing and additional studies to assess the role of these other factors in chronic anterior knee pain are warranted.

Although our data showed no differences between the groups, the groups were relatively small to accept this null hypothesis with full confidence and a longer study will establish the final results.

REFERENCES:

1. Alho A, Benterud JG, Høgevoid HE, Ekeland A and Stromsoe K. Comparison of functional bracing and locked intramedullary nailing in the treatment of displaced tibial shaft fractures. *Clin Orthop*; 1992; 277: 243–250.
2. Bhandari M, Guyatt GH, Tornetta P III, Swiontkowski MF, Hanson B, Sprague S, Syed A and Schemitsch EH. Current practice in the intramedullary nailing of tibial shaft fractures: an international survey. *J Trauma*; 2002; 53:725–732.
3. Bleaky R, Maffuli N. Ultrasound changes to intramuscular architecture of the quadriceps following intramedullary nailing. *J sports Med Phys Fit*; 2002; 42: 120-125.
4. Bohnsack M, Wilharm A, Hurschler C, Ruhmann O, Stukenborg-Colsman C and Wirth CJ. Biomechanical and kinematic influences of a total infrapatellar fat pad resection on the knee. *Am J Sports Med*; 2004; 32: 1873–1880.
5. Court-Brown CM, Gustilo T, and Shaw AD. Knee pain after intramedullary tibial nailing: Its incidence, etiology and outcome. *J Orthop Trauma*; 1997, 11: 103–105.
6. Devitt TA, Coughlan KA, Ward T, McCormack D, Mulcahy D, Felle P, and McElwain JP. Patellofemoral contact forces and pressures during intramedullary tibial nailing. *Int Orthop*; 1998, 22: 92–96.
7. Hernigou P and Cohen D. Proximal entry for ontramedullary nailing of the tibia. The risk of unrecognised articular damage. *J Bone Joint Surg*; 2000, 82-B: 33–41.
8. Keating JF, Orfaly R, and O'Brien PJ. Knee pain after tibial nailing. *J Orthop Trauma*, 1997; 11: 10–13.
9. Nyland J, Bealle DP, Kaufer H, and Johnson DL. Long-term quadriceps femoris functional deficits following intramedullary nailing of isolated tibial fractures. *Int Orthop*; 2001, 24: 342–346.
10. Toivanen JAK, Väistö O, Kannus P, Latvala K, Honkonen S, and Järvinen M. Anterior knee pain after intramedullary nailing of fractures of the tibial shaft. A prospective, randomized study comparing two different nail-insertion techniques. *J Bone Joint Surg*; 2002: 84-A: 580–585.

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AUTHORS:

1. Gyaneshwar Tonk
2. Gaurav Menwal
3. Amit Kumar Gupta
4. Nitesh Rustagi
5. Alok Kumar

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Orthopaedics, Lala Lajpat Rai Memorial Medical College, Meerut.
2. Senior Resident, Department of Orthopaedics, Lala Lajpat Rai Memorial Medical College, Meerut.
3. Lecturer, Department of Orthopaedics, Lala Lajpat Rai Memorial Medical College, Meerut.
4. Junior Resident, Department of Orthopaedics, Lala Lajpat Rai Memorial Medical College, Meerut.

5. Senior Resident, Department of Orthopaedics, Lala Lajpat Rai Memorial Medical College, Meerut.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Gaurav Menwal,
S-11, PG Boys Hostel,
IIRM Medical College,
Meerut.
Email: gauravmintu07@gmail.com

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