e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(7); 1105-1109

Original Research Article

A Study on Post-Operative Knee Pain (VAS) and SCAR Scale Following Inter Locking Nail for Tibia Using Medial Para Patellar and Midline Trans Patellar Approaches

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Received: 10-05-2023 / Revised: 30-06-2023 / Accepted: 08-07-2023
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Conflict of interest: Nil

Abstract:

Fracture tibia has been a very common fracture. The adult diaphyseal fractures of tibia are commonly treated with interlocking nail as fixation implant with good fracture union. The most common complication of post-operative knee pain, sensitive scar can delay the recovery process and can add up to loss of productive days and increased morbidity. Our study has been conducted on post-operative patients of diaphyseal tibia fractures, where in fracture fixation is done with interlocking nail, with either of approached to acces the medullary canal viz., medial para patellar approach or midline tendon splitting trans tendon approach. The study has evaluated the post-operative knee pain with VAS and wound healing with SCAR Score.

Keywords: Post-operative knee pain, para patellar, midline trans patellar, Interlocking Nail.

Introduction

By far fracture tibia has been a common fracture. Almost all diaphyseal fractures of tibia in adults are managed with interlocking nails. The skin incisions chosen for inter locking nail for tibia diaphyseal fractures are medial para patellar and patellar tendon splitting through a mid-line incision. Most commonly the anterior knee pain is a common complaint in the follow ups of the patients undergone inter locking nailing of tibia. Even in the cases of ideal size of the implants the patients complain of the same in which case the etiology of pain is often not known. Any pathological changes in the patellar tendons of patients with a nailed tibial shaft fracture can be studied by sonographic evaluation.[1]

Many other complications like non-union, infection, malunion, deep venous thrombosis, thermal necrosis and compartment syndrome are reported following tibial nailing, but are relatively rare complications following interlocking nail for tibia. There multiple factors that can be incriminated in the development of chronic pain and scar complications viz., skin incision, damage to intra-articular structures, gender, size of tibial platue, and presence of implant in medullary cavity have been reported to be the cause of anterior knee pain. Combination of these factors also can play a role. Most of the times patients perceive in our study complained pain while kneeling, sitting crossed legged and squatting, not related to protrusion of nail. Abrasions, multiple stab incisions, tight sutures can cause damage and irritation to the patellar tendon. [2]

The approaches used for interlocking nail tibia are midline patellar tendon splitting, medial parapatellar approach and, rarely supra patellar approach. The first two approaches have common indications for diaphyseal fractures of tibia, but supra patellar approach has specific indications like proximal shaft fractures of tibia with pro curvatum

fracture deformities. All the three approaches will more or less meddle with integrity of the patellar tendon with variable degrees of injuries and also to the fat pad, cortical bone breech close to the articular surface.[3] The entry point ideally is on the anterior cortex of the proximal tibia 1– 1.5 cm distal to the knee joint in line with the medullary canal on AP radiographs and at the level of head of the fibula.

Even with the precise entry points, chronic pain has been a common complication. It has got several implications on the post-operative physiotherapy, prolonged morbidity, atrophic changes etc,. Nail protrusion and its friction on the gliding tissues for ebery act of physiotherapy and ambulation will have poor results. The loose paratendinous connective tissue, have nerve endings making it the sensitive portion of the tendon. There are large nerve fascicles, with perivascular innervation in the walls of some of the larger arteries and smaller blood vessels. Some of them correspond to sensory afferents, and some conform to cholinergic and, especially, sympathetic nerve fibres. The proper tendon tissue proper is less innervated than the surrounding tissue. The fat pad, inferior to the patella and tendon also known as Hoffa's fat pad. It's an intracapsular, extrasynovial structure that spans the anterior knee compartment), is also richly vascularized and innervated. Owing to the nerve supply and proximity to the synovial lining , it can be source for a variety of pain patterns.[4] The anterior knee pain quite often presents with no correlation to the preexisting quadriceps injury.[5]

Visual Analog Scale is easy to document and used as follow up parameter which can be used for evaluation the post-operative pain in the knee following interlocking nail for tibia.[6] The anterior knee pain, which has been reported as most common complication, has shown to eventually subsiding, self-limiting to a variable extent.[7]

The physiological motion of Hoffa pad and menisci during knee flexion can be facilitated as pain free with atraumatic mobilization of retrotendinous fat, reduces incidence and severity of anterior knee pain. [8]Few studies have reported the incidence of moderate severe pain is due to protruding nail more so on to the infra patellar fat pad and hitching on the tendon proper.[9] One of the implicated reasons for chronic pain, is cartilage injury during the procedure.

The para patellar approach has low risk of non-weight bearing zone cartilage injury.[10] The supra patellar approach though requires less fluoroscopic exposure time and easy location of entry point and tracking of guide wire and nail with AP, Lateral views, it has got the potential to damage weight bearing cartilage and meniscal foot prints, which ae definitely raise a concern compared to para patellar and trans patellar approaches. [11]

The Scar Cosmesis Assessment and Rating (SCAR) scale was developed and validated as a tool to assess the quality of postoperative scars in clinical and research settings. The SCAR scale that measures postoperative scar cosmesis, with scores ranging from 0 (best possible scar) to 15 (worst possible scar), based on 6 clinician and 2 patient items. [12]

The Scar Cosmesis Assessment and Rating (SCAR) scale

Parameter	Descriptor	Score
Clinician questions		
Scar spread	None/near invisible	0
	Pencil-thin line	1
	Mild spread, noticeable on close inspection	2
	Moderate spread, obvious scarring	3
	Severe spread	4
Erythema	None	0
	Light pink, some telangiectasias may be present	1
	Red, many telangiectasias may be present	2
	Deep red or purple	3
Dyspigmentation	Absent	0
	Present	1
Suture marks	Absent	0
	Present	1
Hypertrophy/atrophy	None	0
	Mild: palpable, barely visible hypertrophy or atrophy	1
	Moderate: clearly visible hypertrophy or atrophy	2
	Severe: marked hypertrophy or atrophy or keloid formation	3
Overall impression	Desirable scar	0
	Undesirable scar	1
Patient questions		
Itch	No	0
	Yes	1
Pain	No	0
	Yes	1

The visual analog scale (VAS) is a pain rating scale which is rated by the patient and can be used for tracking the pain progression or improvement. It ranges from 0 as no pain to 10 as worst pain. [13] For severely symptomatic patients where nail protrusion either anteriorly or superiorly, nail removal only can restore pain free movements. [14] Our study is aimed at assessing post-operative pain with Visual Analog Scores and The Scar Cosmesis Assessment and Rating (SCAR) scale to find the correlation to these variables with inter locking tibia for diaphyseal adult fractures of tibia performed with medial para patellar approach and midline tendon splitting trans tendon approach.

Materials & Methods

This study is done 58 post-operative cases of adult tibia diaphyseal fractures treated with inter locking nail either with medial para patellar approach and midline tendon splitting trans tendon approach in our institution from Jan 2022 to Dec 2022.

The cases are booked in to the study form the first post op month with the following inclusion criterion: Closed fractures of Tibial diaphysis , patient ages from 20 to 50 years , unilateral fractures, treated with inter locking nail for tibia, medial parapatellar approach, midline patellar tendon splitting trans tendon approach.

Exclusion criterionare Open fractures, concomitant fractures, concomitant injuries to the ipsilateral knee, proximal and distal third tibia fractures. These cases are operated by surgeons who are not informed whether the case will be booked in to the study or not. The data is collected till the first 6 months follow up visits of the patient timed at first month, second month, fourth month and sixth month. The timing is decided to coincide with initial weight bearing to scar maturity. The case are basically divided into two groups as cases with medial para patellar approach and cases with midline tendon splitting trans tendon approach cases. In each group the data is collected with two parameters for the study viz., visual analog scale (VAS) for post-operative knee pain and The Scar Cosmesis Assessment and Rating (SCAR) scale.

The statistical analysis is done to know whether there is any correlation between post-operative knee pain and wound healing associated with different approaches for accessing entry into medullary canal for inter locking tibia with medial para patellar approach and cases with midline tendon splitting trans tendon approach.

Analysis: Out of 58 cases included in the study, there are 28 cases in the group of medial para patellar approach and 30 cases in the group of midline tendon splitting trans tendon approach. The VAS is obtained with markings from 0 as no pain 5 as moderate pain and 10 as severe pain. Any marking as more than 5 is taken as painful knee post operatively. The Scar Cosmesis Assessment and Rating (SCAR) scale is recorded with 0 to 13 as clinician observed parameters and 2 for patient voluntary findings. Scores up to 4 are considered normal and 5 – 15 are relatively undesirable. The summary of results is tabulated as follows for calculating the p value for any significance T value to compare the two groups to establish any differences in the groups.

Figure1:

Table 1:

S.no.:	Approach	VAS	SCAR Score
1	MPP	5	6
2	TP	1	2
3	TP	5	7
4	MPP	2	3
5	MPP	4	4
6	TP	0	0
7	MPP	0	0
8	TP	1	3
9	MPP	5	8
10	MPP	2	1
11	MPP	3	4
12	TP	5	7
13	MPP	1	0
14	TP	3	1
15	MPP	2	0
16	TP	1	1
17	MPP	3	1
18	MPP	4	2
19	TP	2	0
20	TP	1	3
21	MPP	4	2
22	TP	2	1
23	TP	5	9
24	MPP	0	0
25	MPP	5	6
26	TP	0	1
27	TP	1	0
28	TP	0	0
29	MPP	2	1
30	MPP	5	8
31	TP	0	0
32	MPP	5	6
33	TP	5	8
34	MPP	1	2
35	TP	1	1
36	TP	0	1
37	TP	5	8
38	MPP	0	0
39	TP	1	1
40	TP	1	2
41	MPP	0	1
42	TP	0	0
43	TP	1	1
44	MPP	0	0
45	TP	1	1
46	MPP	0	0
47	MPP	1	0
48	MPP	0	1
49	TP	1	0
50	TP	0	0
51	MPP	1	3
52	TP	0	1
53	TP	1	0
54	MPP	0	1
55	MPP	1	1
56	TP	2	3
57	MPP	1	1
58	TP	0	0

Difference Scores Calculations for VAS

Medial Para Patellar Approach

N_1: 28

$df_1 = N - 1 = 28 - 1 = 27$

M_1: 2.04

SS_1: 96.96

$s^2_1 = SS_1/(N - 1) = 96.96/(28-1) = 3.59$

Mid line tendon splitting trans tendon approach

N_2: 30

$df_2 = N - 1 = 30 - 1 = 29$

M_2: 1.53

SS_2: 87.47

$s^2_2 = SS_2/(N - 1) = 87.47/(30-1) = 3.02$

T-value Calculation

$s^2_p = ((df_1/(df_1 + df_2)) * s^2_1) + ((df_2/(df_2 + df_2)) * s^2_2) = ((27/56) * 3.59) + ((29/56) * 3.02) = 3.29$

$s^2_{M1} = s^2_p/N_1 = 3.29/28 = 0.12$

$s^2_{M2} = s^2_p/N_2 = 3.29/30 = 0.11$

$t = (M_1 - M_2)/\sqrt{(s^2_{M1} + s^2_{M2})} = 0.5/\sqrt{0.23} = 1.05$

The t-value is 1.0535. The p-value is .148317. The result is not significant at $p < .05$.

Difference Scores Calculations for SCAR Score

Medial Para Patellar Approach

N1: 28

df1 = N - 1 = 28 - 1 = 27

M1: 2.21

SS1: 168.71

s21 = SS1/(N - 1) = 168.71/(28-1) = 6.25

Mid line tendon splitting trans tendon approach

N2: 30

df2 = N - 1 = 30 - 1 = 29

M2: 2.07

SS2: 223.87

s22 = SS2/(N - 1) = 223.87/(30-1) = 7.72

T-value Calculation

s2p = ((df1/(df1 + df2)) * s21) + ((df2/(df2 + df2)) * s22) = ((27/56) * 6.25) + ((29/56) * 7.72) = 7.01

s2M1 = s2p/N1 = 7.01/28 = 0.25

s2M2 = s2p/N2 = 7.01/30 = 0.23

t = (M1 - M2)/√(s2M1 + s2M2) = 0.15/√0.48 = 0.21

The t-value is 0.21218. The p-value is .41637. The result is not significant at $p < .05$.

Whereas a P value close to 1 suggests no difference between the groups other than due to chance; In our study the P Value was less than 1 suggesting that there is no difference in the groups.

Conclusion

Being a common fracture the adult diaphyseal tibia fracture has better fracture union chances with interlocking nail in most of the cases. The most common complication of post-operative knee pain can occur with both approaches commonly used for accessing entry into medullary canal viz., Medial Para Patellar Approach, Mid line tendon splitting trans tendon approach. Pain in the knee joint and healing with a sensitive painful scar are occurring with equal proportions in both the approaches. These complications can delay the recovery process adding to the more loss of productive days and increased morbidity.

The incidence has been occurring in both approaches without relation to the nail protrusion superiorly and anteriorly. The other contributing factors can be tendon attrition, fibrotic changes, cartilage breech etc,

The incidence of these complications can be minimized by careful handling of soft tissues and choosing appropriate size of implants.

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