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PROXIMAL TIBIAL FRACTURES MANAGED WITH COLUMN-SPECIFIC FIXATION

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ABSTRACT

Background: The femoral condyle exerts compressive and shearing pressures on the articular surfaces of the tibia in patients that experience valgus or varus forces with the axial load, leading to proximal fracture.

Aim: The purpose of this study was to evaluate the radiographic union of patients in an Indian medical facility who had proximal tibial fractures treated with column-specific fixation.

Methods: Sixty participants with proximal tibial fractures treated with column-specific fixation were evaluated in this study. All participants, including those with knee and functional subgroups, had KSS at the 9-month follow-up. Excellent, good, fair, and bad were determined by a knee society score of 80 to 100, 70-79, 60-69, and less than 60, respectively.

Results: The study's findings demonstrated that the range of motions measured during posterior column fixation was not carried out in groups. The completed group's mean was 130±22, whereas the unfinished group's was 129.52±10.503. With p=0.75, there was no statistically significant difference between the two groups.

Conclusion: The current study comes to the conclusion that column-specific fixation procedures are beneficial in multiplanar fractures involving the posterior column because they assist restore articular congruity, provide an appropriate anatomical reduction, and provide stiff fixation.

INTRODUCTION

Lateral and medial condyles are formed when the proximal tibia expands from the shaft.One The articular surface where the tibial condyle articulates with the femoral condyles is known as the tibial plateau. The tibial plateau has an anteroposterior slope ranging from 7° to 10°. Anterior cruciate ligament insertion is prevented by this mechanism, which also displays translation. Articular cartilage does not cover the most posterior part of the interspinous area.2

Strong varus or valgus forces combined with axial stress are typically the cause of upper tibia fractures. The corresponding femur condyle applies compression and shearing stresses to the articular surface of the tibia when a person experiences valgus or varus force in addition to the axial load. Usually, this results in split fractures, depressed fractures, or both. Adult individuals with thick cancellous bone that can withstand the compressive stresses on the joint surface are often the only ones that suffer isolated split fractures. As people age, the proximal tibia's robust cancellous bone gradually becomes thinner and less able to disperse compressive stresses. A split depression or depressed fracture is observed under impact force.3.

When valgus stresses push the lateral femoral condyle to the tibial plateau, the medial collateral ligament acts as a hinge. Medial plateau fractures are caused by the lateral collateral ligament, which functions similarly to varus forces. Ligament injuries are observed in a greater frequency of people with upper tibial fractures when using magnetic resonance imaging (MRI). Therefore, a lateral plateau fracture may be accompanied by an anterior cruciate ligament injury or a medial collateral ligament damage. However, fractures of the medial tibial plateau may be associated with a rupture of the cruciate ligament or the lateral collateral ligament.4,5

The extent to which the knee is extended or flexed determines the site of the fracture. However, explosive highly comminuted fractures are observed when the axial stress exceeds 8000 pounds. Clinically, this process is thought to be observed in cases of extended knee and height-related falls.6. In this study, a healthcare facility in India evaluated the radiographic union of patients who had proximal tibial fractures treated with column-specific fixation.

MATERIALS AND METHODS

The goal of the current study was to evaluate radiographic union in patients at an Indian healthcare facility who had proximal tibial fractures treated with column-specific fixation. The research participants came from the Institute's Department of Radiology. Prior to their involvement in the study, all participants gave their verbal and written informed permission.

60 adult participants of both sexes after presenting with a proximal tibial fracture, with or without other injuries, were evaluated for the study. The study's inclusion criteria were people of both sexes, between the ages of 18 and 60, with a tibial plateau fracture categorized using Luo et al.'s three-column concept from 20107, and consenting participants.

Subjects who did not volunteer to participate in the trial, those who were unwilling to have surgery, those with open tibial plateau fractures, those with foot, ankle, tibial shaft, or ipsilateral femur fractures, and those who were skeletally immature were all excluded from the study.

A thorough history was taken of each study participant after they were finally included based on the inclusion criteria. This was followed by a thorough clinical examination, knee aspiration, lateral and AP knee X-rays, CT knee with 3D reconstruction, and hematological testing for viral markers, serum creatinine, urea, blood sugar, and hemoglobin. Intravenous blood was drawn under very rigorous aseptic and sterile conditions for laboratory studies.

The valgus angle between the tibial and femoral shafts' anatomic axes was used to evaluate fracture alignment in the coronal plane. The KSS (knee society score) of 67 was used to determine the normal valgus angle, which was 5o–10o. By observing the angulation between the anterior cortices of the

proximal and distal portions, sagittal plane alignment was evaluated. Normal sagittal plane angulation is defined as being within 5 degrees of the opposing side. Until the bone union was observed at both the metaphyseal and articular fracture sites, subjects were monitored every six weeks. After that, they were monitored every three months for nine months.

KSS, including the functional and knee subgroups, is recorded at the 9-month follow-up. In terms of clinical results, a knee society score of 80 to 100, 70-79, 60-69, and less than 60 was considered excellent, good, fair, and bad, respectively. Fracture union and the development and advancement of callus were evaluated for radiological results. At every recall, lateral and anteroposterior radiographs of the knee and proximal tibia were obtained. Radiographs taken after nine months were evaluated for changes in secondary osteoarthritis, such as shrinking of the joint space.

SPSS (Statistical Package for the Social Sciences) software version 21.0 (IBM Corp., Armonk, NY, USA) was used to statistically analyze the collected data. This included chi-square, independent t-test, Mann Whitney U, and descriptive measure evaluation. The findings were presented as frequency, percentages, mean, and standard deviation. When the p-value was less than 0.05, it was deemed statistically significant.

RESULTS

The goal of the current prospective clinical investigation was to evaluate the radiographic union in patients at an Indian healthcare facility who had proximal tibial fractures treated with column-specific fixation. 60 participants with proximal tibial fractures treated with column-specific fixation were evaluated in this study. At 6 weeks, 3 months, 6 months, and 9 months, the modified Rasmussen scores were 9.95±1.157, 12.22±1.184, 13.62±1.161, and 13.90±1.192, respectively. This indicates a substantial increase with time (p=0.001). At 6 weeks, 3 months, 6 months, and 9 months, KSS was not significant between the done and not done groups for functional outcomes in participants with and without posterior column fixation at various time intervals (p=0.682, 0.783, 0.905, and 0.562, respectively) (Table 2).

At six-week and three-month intervals, individuals with and without posterior column fixation showed similar non-significant radiological outcomes (p=0.184 and 0.252, respectively). At 6 and 9 months, however, the done group's KSS was noticeably higher (p=0.01 and 0.04, respectively) (Table 3). In terms of the posterior column fixation group's radiological and functional results, two, thirty-two, and fourteen participants, respectively, had one, two, and three columns, whereas two, four, and six individuals, respectively, had posterior column fixation. The KSS scores were 190, 190, and 164 with a mean movement range of 140, 140, and 130, and the modified Rasmussen scores (AVG) were 32, 30, and 28 in 1-, 2-, and 3-column, respectively (Table 4).

In the non-fixation group, the mean movement range was 130 and 122.3, the AVG modified Rasmussen scores were 13.62 and 12.64, the KSS was 93.3 and 83.1, and the posterior column involvement was observed in 32 and 14 subjects in the 2-column and in 28 and 8 subjects in the 3-column (Table 5).

DISCUSSION

60 participants with proximal tibial fractures treated with column-specific fixation were evaluated in this study. At 6 weeks, 3 months, 6 months, and 9 months, the modified Rasmussen scores were 9.95±1.157, 12.22±1.184, 13.62±1.161, and 13.90±1.192, respectively. This indicates a substantial increase with time (p=0.001). At 6 weeks, 3 months, 6 months, and 9 months, KSS was not significant between the done

and not done groups for functional outcomes in participants with and without posterior column fixation at various time intervals (p=0.682, 0.783, 0.905, and 0.562, respectively). At six-week and three-month intervals, individuals with and without posterior column fixation showed similar non-significant radiological outcomes (p=0.184 and 0.252, respectively).

At 6 and 9 months, however, the done group's KSS was noticeably higher (p=0.01 and 0.04, respectively). Regarding the radiological and functional results in the group that had posterior column fixation, it was observed that in 2, 4, and 6 patients, respectively, 1 column, 2 columns, and 3 columns were seen in 2, 32, and 14 participants. The KSS scores were 190, 190, and 164 with a mean movement range of 140, 140, and 130, and the modified Rasmussen scores (AVG) were 32, 30, and 28 in one, two, and three columns, respectively.

In the non-fixation group, the mean movement range was 130 and 122.3, the AVG modified Rasmussen scores were 13.62 and 12.64, the KSS was 93.3 and 83.1, and the posterior column involvement was observed in 32 and 14 subjects in the 2-column and in 28 and 8 subjects in the 3-column.

The range of motions in the posterior column fixation done and not done groups was 130±20 and 129.52±10.503 in the done and not done groups, respectively, according to the study results, indicating a statistically insignificant difference with p=0.73.

At 6 weeks, 42.9% (n=26) of the study participants showed full weight-bearing evaluation after fixation, whereas 100% (n=60) of the individuals showed this at 6 months. Study participants' union times for proximal tibia fractures were seen to vary over time; in one column, these times were 6 weeks, 3 months, and 6 months for subjects 0, 12, and 12, respectively. The union time for subjects 0, 32, and 34 was 6 weeks, 3 months, and 6 months in 2 columns. Union time for 0, 6, and 14 subjects was 6 weeks, 3 months, and 6 months, respectively, in 3 columns.

According to the study's findings, 16.66% (n=10), 13.33% (n=8), and 70% (n=42) of the individuals had steps of 1 mm, 2 mm, and nil. 52.5% (n=36), 16.5% (n=10), and 23.1% (n=14) of the individuals had varus/valgus angulation, valgus angulation, and varus angulation, respectively. Regarding the research participants' varus and valgus malunion, 2, 6, and 0 patients from 1 column, 2 columns, and 3 columns, respectively, had varus angles more than 3 degrees. In participants from 1 column, 2 columns, and 3 columns, respectively, varus malunion was seen in 0, 8, and 6. Four, two, and four individuals from one column, two columns, and three columns, respectively, had valgus malunion.

Varus malunion was seen in 14 subjects and valgus malunion in 10 subjects respectively (Table 9). For posterior tilt assessment in study subjects, posterior tilt of 5, 7, 8, 9, 10, 11, 12, and 14 degrees was seen in 3.3% (n=2), 6.7% (n=4), 46.7% (n=28), 6.7% (n=4), 6.7% (n=4), 10% (n=6), 13.3% (n=8), and 6.7% (n=4) subjects respectively. These data correlated with the findings of

CONCLUSIONS

According to the current study's limitations, column-specific fixation procedures are useful for multiplanar fractures involving the posterior column because they provide an appropriate anatomical reduction, aid in the restoration of articular congruity, and provide stiff fixation. When comparing the posterior column fixation group to the non-fixation group, radiological union is superior. To draw a firm conclusion, more long-term research is necessary.

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TABLES

S. No	Modified Rasmussen score (MRS)	Mean ± S. D	p-value
1.	6 weeks	9.95±1.157	**0.001**
2.	3 months	12.22±1.184	

3.	6 months	13.62±1.161	
4.	9 months	13.90±1.192	

Full weight-bearing ambulation	**Frequency (n)**	**Percentage (%)**
6 weeks	Nil	Nil
3 months	26	42.9
6 months	60	100

Table 1: Full weight-bearing assessment in study subjects following fixation

Classification	**Union time**		
	6 weeks	**3 months**	**6 months**
1 column	0	12	12
2 column	0	32	34
3 column	0	6	14

Table 2: Union time for proximal tibia fracture in study subjects at different time intervals

Step (mm)			**Varus/valgus**		
	Number (n)	**Percentage (%)**		**Number (n)**	**Percentage (%)**
1mm	10	16.66	None	36	52.5
2mm	8	13.33	Valgus	10	16.5
Nil	42	70	Varus	14	23.1
Total	60	100	Total	60	100

Table 3: Post-union assessment of study subjects

Classification	**Varus**		**Valgus**
	<3 degrees	**Varus malunion**	**Valgus malunion**
1 column	2	0	4
2 column	6	8	2
3 column	0	6	4
Total	8	14	10

Table 4: Assessment of valgus and varus malunion in study subjects

Post union assessment Posterior tilt (degrees)	**Frequency (n)**	**Percentage (%)**
5	2	3.3
7	4	6.7
8	28	46.7
9	4	6.7
10	4	6.7
11	6	10
12	8	13.3
14	4	6.7
Total	60	100

Table 5: Posterior tilt assessment in study subjects