



## **A HOSPITAL-BASED ASSESSMENT OF THE FUNCTIONAL OUTCOME OF ARTHROSCOPIC SUTURE PULL OUT FIXATION OF DISPLACED TIBIAL SPINE AVULSION FRACTURE: AN OBSERVATIONAL STUDY**

**Dr. Swaroop Solunke<sup>1</sup>, Dr. Meet Shah<sup>2</sup>, Dr. Kaman Kuity<sup>3</sup>, Dr. Ayush Taneja<sup>4\*</sup>**

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**Article History:** Received: 19.05.2023

Revised: 21.06.2023

Accepted: 24.07.2023

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### **Abstract**

**Aim:** The present study was conducted to assess the functional outcome of arthroscopic suture pull out fixation of displaced tibial spine avulsion fracture.

**Methods:** The present prospective study was conducted in the Department of Orthopaedics, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, over a period of 1 year with a sample size of 60.

**Results:** 60 patients with tibial spine avulsion were operated on with arthroscopic pull out suture technique. The majority of subjects were in the age group 18 to 30 years (66.66%). In the study, 83.34% were males and 16.66% were females. 10% had fall from the cycle, 58.34% had fallen from motorbike and 31.66% had fall while playing. Status of Physis in 60% was closed and opens in 40%. In the study 73.34% had Type III and 26.66% had Type IV Meyers and McKeever's classification. At 3 months, the mean Post op Lysholm score was 86.14±1.46, at 6 months was 96.84±2.05 and at 12 months 96.14±1.36. There was a significant increase in Post op Lysholm score at 6 months and 12 months. At 12 months when compared to 6 months Post op Lysholm score, there was no significant increase in Post op Lysholm score. 6.66% subjects had Post Op Knee Stiffness.

**Conclusion:** The present study concluded that Arthroscopic suture pull-out fixation for type III and IV tibial spine avulsion shows excellent outcomes without any significant complications.

**Keywords:** Arthroscopic Suture Pull Out Fixation, Tibial Spine Avulsion Fracture

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<sup>1</sup>Associate Professor, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India 411018.

<sup>2</sup>PG resident, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India 411018.

<sup>3</sup>PG resident, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India 411018.

<sup>4\*</sup>PG resident, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India 411018.

**\*Corresponding author:**

**<sup>4\*</sup>Dr. Ayush Taneja**

<sup>4\*</sup>PG resident, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India 411018.

**DOI: 10.31838/ecb/2023.12.s3.743**

## **1. Introduction**

Anterior tibial spine fractures are relatively rare with an incidence of approximately 3/100,000/year.<sup>1</sup> Anterior cruciate ligament (ACL) avulsed mostly from tibial attachment. According to Meyers and McKeever's classification<sup>2</sup> these injuries can be classified into 3 types. Type 1: minimal or no displacement and is usually treated conservatively; Type 2: partially displaced, where posterior hinge attached to tibia and only anterior fragment avulsed and superiorly displaced, showing as beak in lateral X-ray. Type 3: complete fragment elevation anteriorly and posteriorly; it has two sub types Type 3a: involves small portion of eminence Type 3b: involves the majority of the eminence. Type 4: displaced, comminuted fracture and type 4 added by Zaricznyj.<sup>3</sup> Type I fractures are usually treated non-operatively with cast immobilization, while closed reduction or arthroscopic evaluation can be attempted for the treatment of type II fractures. For displaced type III or IV fractures, open or arthroscopic reduction and fixation are generally required.<sup>4</sup> Interestingly, the outcome of arthroscopic fixation in children and adolescents is usually satisfactory, but the results in adults are less predictable.<sup>5</sup> Hunter and Willis found that the younger the patient is, the better the outcome after arthroscopic fixation for tibial eminence fracture.<sup>6</sup>

Meyers and McKeever classified avulsion into three types.<sup>7</sup> Type I as undisplaced, type II as partially displaced with an intact posterior hinge, type 3 as completely displaced. Zaricznyj proposed a fourth category for comminuted avulsed fragments.<sup>3</sup> A complication of such untreated and displaced type III and type IV avulsion fracture include nonunion and malunion, which may lead to significant disability in the form of flexion deformity, loss of extension, instability. Hence it is important to reduce accurately fix type III

and type IV and prevent complication.<sup>8</sup> Complications of such untreated and displaced type III and IV avulsion fracture include nonunion or malunion, which can lead to significant disability in the form of flexion deformity, loss of extension, or instability.<sup>8,9</sup> Hence, it is important to reduce accurately and fix type III and IV fractures and prevent such complications. Although Shelbourne et al recommend excision of displaced avulsed fragment and report good result.<sup>10</sup> In literature, the reported complication of tibial spine fracture includes anterior knee instability, extension loss, quadriceps weakness, and chondromalacia.<sup>11,12</sup>

The present study was conducted to assess the functional outcome of arthroscopic suture pull out fixation of displaced tibial spine avulsion fracture.

## **2. Methods**

The present prospective study was conducted in the Department of Orthopaedics, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, over a period of 1 year with a sample size of 60.

### **Inclusion criteria**

Patients who had pain and disability resulting from tibial spine avulsion inactive patient type II, type III and type IV, Age: < 60 years, the patient must be able to use crutches / walker, patient should have sufficient muscle strength and motivation to carry out a rehabilitation program, closed injuries were included in the study.

### **Exclusion criteria**

Patients with Type I tibial spine avulsion according to Meyers and McKeever classification, associated with Proximal tibia fracture, associated with Multiple ligaments injuries, present or past history of inflammatory arthritis, open injuries, previous operated or infected knee for any reason were excluded from the study.

## **Methodology**

Diagnostic arthroscopy was performed under spinal or general anesthesia through the standard anterolateral portal. The joint and fracture bed was cleared of hematoma using continuous irrigation. Then, the standard anteromedial portal was established. Chondral and meniscal injuries were assessed and managed as per established guidelines. The tibial spine avulsion was identified, and the type of fracture was confirmed by probing. Next, 1-inch-long skin incision was made parallel and medial to the tibial tuberosity.

The remaining dissection was done with care to arrive up to the periosteum protecting the pes anserinus tendons and underlying medial collateral ligament. The tip of the ACL tibial guide was subsequently placed via an anteromedial (AM) portal on the medial-most edge and at the equator of the avulsion crater. Next, a tibial tunnel was drilled using a 1.8 mm K-wire.

Once the K-wire tip was visualized emerging out at the crater edge, the tibial

guide was disengaged, and the K-wire was left in situ. A similar step was performed for the lateral edge of the crater with another K-wire keeping 1 cm of the bone bridge intact between two tunnels over the tibia. Once the needle tip was visualized on the lateral side of ACL, the PDS suture was advanced through the lateral PDS loop. The advanced end of the PDS was pulled out of the joint via AM portal using an arthroscopic grasper. Frequently, the suture grasper was used to pull the PDS out of the lateral loop in a case where it did not enter into the lateral loop. A similar step was repeated by taking a bite through the anterior third of the ACL substance, and PDS was pulled out via AM portal. Next, the shuttling technique replaced the two PDS sutures by ethibond. Then, the needle and PDS loops were pulled out of the tunnel, which further pulls the ethibond sutures out of the joint through the tibial tunnels. Ethibond sutures were tied one by one over the bone bridge or suture button keeping the knee in 30-degree flexion.

## **3. Results**

Table 1: Age and gender distribution of subjects

<b>Age group(years)</b>	<b>N(%)</b>
18-30	40 (66.66%)
31-40	8 (13.34%)
>40 years	12 (20%)
Total	60 (100)
<b>Gender</b>	<b>N(%)</b>
Male	50 (83.34%)
Female	10 (16.66%)
Total	60 (100)

60 patients with tibial spine avulsion were operated on with arthroscopic pull-out suture technique. The majority of subjects

were in the age group 18 to 30 years (66.66%). In the study, 83.34% were males and 16.66% were females.

**Table 2: Mode of trauma distribution**

<b>Mode of trauma distribution</b>	<b>N (%)</b>
Fall from Cycle	6 (10%)
Fall from Motorbike	35 (58.34%)
Fall While playing	19 (31.66%)
Total	60 (100)

10% had fall from the cycle, 58.34% had fallen from motorbike and 31.66% had fall while playing.

**Table 3: Status of Physis distribution**

<b>Status of Physis distribution</b>	<b>N (%)</b>
Closed	36 (60%)
Open	24 (40%)
Total	60 (100)

Status of Physis in 60% was closed and opens in 40%.

**Table 4: Meyers and McKeever's classification distribution**

<b>Meyers and McKeever's classification distribution</b>	<b>N (%)</b>
Type III	44 (73.34%)
Type IV	16 (26.66%)
Total	60 (100)

In the study 73.34% had Type III and 26.66% had Type IV Meyers and McKeever's classification.

**Table 5: Post-op Lysholm score distribution**

<b>Post-op Lysholm score</b>	<b>Mean±SD</b>	<b>p-value</b>
3 months	86.14±1.46	<0.001
6 months	96.84±2.05	<0.001
9 months	96.14±1.36	<0.001

At 3 months, the mean Post op Lysholm score was 86.14±1.46, at 6 months was 96.84±2.05 and at 12 months 96.14±1.36. There was a significant increase in Post op

Lysholm score at 6 months and 12 months. At 12 months when compared to 6 months Post op Lysholm score, there was no

significant increase in Post op Lysholm score.

Table 6: Complication distribution

Complication	N (%)
Nil	56 (93.34%)
Post Op Knee Stiffness	4 (6.66%)
Total	60 (100)

6.66% subjects had Post Op Knee Stiffness.

#### 4. Discussion

In adults the treatment option for displaced tibial eminence fractures are, suture or hardware fixation of the avulsed fragment and ACL reconstruction. Native ACL should be retained so as to maintain the proprioceptive function and neuromuscular control provided by the presence of mechanoreceptors in ACL.<sup>13</sup> Both sutures and hardware fixation techniques have been studied in cadavers.

Although variety of implants (screws, staples, wires, anchors, and sutures) have been used for arthroscopic fixation of tibial spine, but currently arthroscopic suture pull-out fixation seems to be the most preferred fixation method in all age groups.<sup>14-16</sup> 60 patients with tibial spine avulsion were operated on with arthroscopic pull out suture technique. The majority of subjects were in the age group 18 to 30 years (66.66%). In the study, 83.34% were males and 16.66% were females. 10% had fall from the cycle, 58.34% had fallen from motorbike and 31.66% had fall while playing. Status of Pysis in 60% was closed and opens in 40%. In the study 73.34% had Type III and 26.66% had Type IV Meyers and McKeever's classification. At 3 months, the mean Post op Lysholm score was 86.14±1.46, at 6 months was 96.84±2.05 and at 12 months 96.14±1.36. There was a

significant increase in Post op Lysholm score at 6 months and 12 months. At 12 months when compared to 6 months Post op Lysholm score, there was no significant increase in Post op Lysholm score. 6.66% subjects had Post Op Knee Stiffness. Tsukada et al studied that there was significant anterior translation with cyclic loading in fractures treated with pullout suture compared with screw fixation.<sup>17</sup> On the contrary, Bong et al, in their study of screw versus pull out suture fixation concluded that fibre wire fixation was stronger than screw fixation.<sup>18</sup>

Ballal MM et al found that fractures were united within 3 months after surgery in all 30 cases. The Lysholm score was improved to 98(98.17 ± 1.599). In 2 patients, post-operative knee stiffness was noted and arthrolysis was done for the same. All patients returned to their preinjury physical activities at the last follow-up.<sup>19</sup> Sapre V et al evaluated all patients at 18 months after the surgery. Radiographs showed that all fracture healed anatomically at an average duration of 3 months after surgery. At the final follow-up, all patients reported no symptoms of instability, such as giving-way episodes, clinical signs of anterior cruciate ligament deficiency were negative. The mean Lysholm score was 96.9 (range 91-100), mean IKDC score was 87.9 (range 83-93), and all patients achieved their preinjury Tegner activity levels.<sup>20</sup>

## 5. Conclusion

Arthroscopic reduction and repair of the avulsed tibial spine with high strength non-absorbable sutures employing an I.V. cannula needle as a penetrator and suture retriever is a straightforward and reproducible procedure that yields excellent clinical results in all age groups without substantial problems. According to the findings of this study, arthroscopic suture pull-out repair for type III and IV tibial spine avulsion results in great outcomes with no notable sequelae.

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