

## STUDY OF CLINICAL AND RADIOLOGICAL OUTCOMES OF ARTHROSCOPIC REDUCTION AND FIXATION OF DISPLACED ACL TIBIAL SPINE AVULSION FRACTURES IN ADULTS USING ARTHROSCOPIC PULL-OUT SUTURE TECHNIQUE IN INDIA



### Orthopaedics

**Dr. Kavyansh Bhan\***

Post Graduate Resident , Department of Orthopaedics , Ruby Hall Clinic, India  
\*Corresponding Author

**Dr. Umang Barot**

Post Graduate Resident , Department of Orthopaedics , Ruby Hall Clinic, India

### ABSTRACT

**Background:** ACL avulsion fractures are more common in children. They occur due to low velocity road traffic accidents or due to sports injury in which hyperextension of knee joint occurs. Undisplaced fractures are treated conservatively with excellent outcomes, however displaced fractures need to be managed operatively to produce better outcomes. The aim of this study is to assess the clinical and radiological outcomes of arthroscopic reduction and fixation of tibial spine avulsion in patients with closed physis with ACL suture pull out technique. ACL suture pullout technique is a relatively new operative modality for management of ACL avulsion fractures.

**Method:** 45 patients having displaced ACL Avulsion fractures were treated with ACL suture pullout technique and were followed up for 1 year. Lysholm knee score and

International Knee Documentation Committee (IKDC) score was used for evaluation.

**Result:** Out of 45 patients, 41 patients had Lachman test negative at final followup while 4 patients had mild laxity with otherwise satisfactory functional outcome. 2 patients had restricted flexion which was managed surgically. No infection or deep vein thrombosis was seen.

**Conclusion:** Based on this study, we can say the arthroscopic suture pull out technique is better than other management as the technique has better clinical outcomes and have very less complication.

### KEYWORDS

ACL avulsion fracture, suture pullout, tibial spine fracture, arthroscopic reduction, arthroscopic fixation

### INTRODUCTION

Anterior Cruciate ligament (ACL) avulsion fracture is seen in all age groups but remains more common in children. Most common cause includes low velocity road traffic accidents and contact sports [1] where forceful hyperextension of knee joint may occur. These injuries may be less common in adults but may lead to significant disability if excessively displaced fractures are not treated surgically.

Based on Meyers and McKeever classification there are four types of fracture [2].

Type 1 - minimally/non-displaced fragment

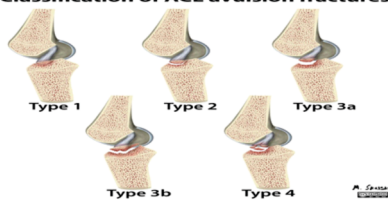
Type 2 - anterior elevation of the fragment

Type 3 - complete separation of the fragment.

3b- Involves the majority of the eminence.

Type 4 - comminuted avulsion or a rotation of the fragment.

#### Classification of ACL avulsion fractures



**Fig 1 - Classification of ACL avulsion Fracture (IMAGE CREDIT – DR M. SKALSKI)**

For displaced fracture, various modalities such as cancellous screws, Herberts screw [3], Kirchner wires, staples, stainless steel wire [4] and suture anchor may be used. Complication such as joint stiffness, infection, implant loosening or migration, implant breakage and non-union may be seen [1].

Arthroscopic suture pull-out technique [5] is becoming first line of choice for many surgeons since the past decade for treatment of displaced ACL avulsion fracture as it reduces complication associated with open arthrotomy. However, the technique is technically demanding and sometimes hardware removal may be required. The aim of our study was to assess the clinical and radiological outcomes of arthroscopic reduction and fixation of displaced ACL tibial spine avulsion fracture in adults using arthroscopic pull-out suture technique at a minimum follow-up of 12 months.

### MATERIALS AND METHODS

A prospective study of forty-five patients with displaced ACL tibial

spine avulsion fractures which presented to Ruby Hall Clinic, Pune between October 2017 and Jun 2018, was done.

#### Inclusion criteria

Patients with displaced ACL avulsion fractures (Meyers and McKeever's Type 3 & 4) who received arthroscopic pull-out suture technique and completed minimal follow-up of 1 year.

#### Exclusion criteria

1. Radiologically proven undisplaced/minimally displaced fractures (Meyers and McKeever's Type 1 & 2)
2. Fractures associated with meniscal injury.
3. Noncompliant patient or patients with incomplete follow-up.

The Lysholm knee score and the International Knee Documentation Committee (IKDC) score used to assess final outcome. Clinical, functional and radiological assessments with X-rays were done at 1, 3, 6 months and at final follow-up at around 1 year.

#### Operative Procedure

The procedure was performed under spinal anaesthesia on simple table and supine position with knee in 90° of flexion. Diagnostic arthroscopy was conducted first to confirm the displaced ACL avulsion fractures and associated lesions. Complete evaluation of avulsed fragment and crater after thorough soft tissue debridement with shaver. Fracture reduction was thereby achieved after debridement of interposed soft tissue in crater. A 4.5 mm drill hole was made on antero-medial aspect of tibia around 2 cm distal to tibial tuberosity through a small skin incision with ACL jig extended to crater. Fibre Wire was shuttled with suture passer in ACL Fibres and then pulled through the tibial tunnel and fixed over antero-medial cortex of tibia with exobutton (Suture wheel) after satisfactory reduction of avulsed fragment in crater, so as to tighten the ACL. Confirmation of fragment reduction was done with Image Intensifier and limb was post operatively immobilized in long knee brace in extension.

Post-operatively analgesics and antibiotics were given and physiotherapy with ankle pump and static quadriceps strengthening exercises was started immediately on first post-op day. Initially partially weight bearing followed by full weight bearing walking with walker with knee brace was started as soon as possible. Over time, active rehabilitation program was started to achieve the full range of motion.

### RESULTS

**Table 1: A total of forty-five patients were studied post-operatively and mean follow-up was for 12 months (range 9-15 months).**

Gender	No. of patients	Percentage
Male	34	75.55

Female	11	24.45
Total	45	100

**Table 2: Average age was 40.6 ± 12.7 (range, 19-63 years)**

Mode of injury	No. of patients	Percentage
Sports injury	6	13.33
Road traffic accidents	39	86.67
Total	45	100

Of 45 patients, according to Meyers and McKeever's classification[2], 30 were type 3 and 15 were type 4 fractures. At clinical examination on final follow-up, lachman test was negative in 41 patients, whereas 4 patients showed mild laxity and did not exhibit feeling of giving away during daily routine activities.

At final follow-up, the mean IKDC and Lysholm knee scores were, 94.2 (range 89–95) and 95.6 (range 91–97) respectively. All patients showed full activity of knee at about 6-7 weeks and resumed sports activity 7-8 months.

Radiologically, fracture union was seen at about 6 weeks and all fractures united well. No intraoperative or postoperative complications were noted. 2 patients had restricted terminal flexion of 140 degree, and rest had achieved Full range of motion of the knee joint at final follow-up. Both patients recovered completely after arthroscopic adhesiolysis. 3 patients had Extensor lag in early follow-up which was recovered after aggressive physiotherapy. No secondary surgeries were required to remove hardware and no surgical site infections or deep vein thrombosis was seen in our study.

## DISCUSSION

The main finding of this study was that arthroscopic stabilization of displaced ACL tibial spine fractures achieved satisfactory outcomes with a minimum followup of 1 years. Patient satisfaction was high with good functional recovery.

Advantages of this technique included low morbidity, the ability to diagnose and treat concomitant injuries, anatomic reduction of the fragment and stabilization in a limited surgical time and early rehabilitation with full weight bearing. Last but not least, there was no need for device removal. Nevertheless, the described technique requires a transphyseal tunnel and may not be used in paediatric populations with immature growth plate.

Cannulated Screw Fixation often have disadvantage of either damaging ligament fibres or crushing the bony fragment or need of secondary surgery for implant removal and has reoperation rate of about 44%.

Arthroscopic pull-out suture techniques appears to be the better fixation method for displaced ACL avulsion fractures due to the possibility of early knee mobilization, compatibility with MRI, and suitability even in comminuted fractures & elimination of the requirement of implant removal.

Most common complication was knee stiffness, most likely due to arthrofibrosis or mechanical obstruction by displaced fragment [6]. However in our study, only 2 patients had complains of knee stiffness [7]. Early knee mobilization in suture pull out technique in post-operative period may be playing an important role in reducing the complication of knee stiffness.

The mean follow up period of 12 months was good enough to study clinical, functional and radiological outcomes of ACL avulsion fractures. Most patients had achieved full range of motion and resumed to routine actives in 6-7months. However, longer follow up may be need to assess degenerative arthritic changes The only problem with suture pull-out technique is dependent on type of suture used. We have used nonabsorbable suture (Fiber wire) in all our patients which is consistent with study which proves that nonabsorbable suture is safer than absorbable suture, in terms of ability to bear stresses of ligament and allows early range of motion [8].

## CONCLUSION

Based on this study, we can say the arthroscopic suture pull out technique provides a satisfactory functional and radiological outcome. In addition, this minimally invasive procedure does not require device removal and allows early weight bearing and rehabilitation.

## Funding

None

## Conflict of Interest

None

## Acknowledgement

Dr. Baldev Dudani, Professor & Head of Department, for his invaluable support.  
Dr. Raghav Barve, Consultant (Orthopaedics), for his guidance.

## REFERENCES

1. Kendall NS, Hsu SY, Chan KM. Fracture of the tibial spine in adults and children. A review of 31 cases. *J Bone Joint Surg Br.* 1992; 74(6):848-852.
2. White E, Patel D, Matcuk G et-al. Cruciate ligament avulsion fractures: Anatomy, biomechanics, injury patterns, and approach to management. *Emerg Radiol.* 2018
3. Wiegand N, Naumov I, Vámhidy L, Nöt LG. Arthroscopic treatment of tibial spine fracture in children with a cannulated Herbert screw. *Knee* 2014; 21(2):481-485
4. Oohashi Y. A simple technique for arthroscopic suture fixation of displaced fracture of the intercondylar eminence of the tibia using folded surgical steels. *Arthroscopy* 2001; 17(9):1007-1011.
5. Wagih AM. Arthroscopic treatment of avulsed tibial spine fractures using a transosseous sutures technique. *Acta Orthop Belg.* 2015; 81(1):141-146.
6. Montgomery KD, Cavanaugh J, Cohen S, Wickiewicz TL, Warren RF, Blevens F. Motion complications after arthroscopic repair of anterior cruciate ligament avulsion fractures in the adult. *Arthroscopy*, 2002
7. Perugia D, Basiglioni L, Vadalà A, Ferretti A. Clinical and radiological results of arthroscopically treated tibial spine fractures in childhood. *Int Orthop* 2009; 33(1):243-248
8. Michele AV, Andrea P, Enricomaria L, Pietro T, Francesco C. Arthroscopic absorbable suture fixation for tibial spine fractures. *Arthroscopy techniques* 2013; Available online 14 December.