



ANTERIOR CRUCIATE LIGAMENT AVULSION TREATED ARTHROSCOPICALLY BY FIBRE TAPE AND SUTURE DISK (A PROSPECTIVE STUDY OF 25 CASES)

Orthopaedics

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ABSTRACT

Background: Tibial spine fractures typically occur at the bony insertion of the anterior cruciate ligament (ACL) on the tibia. These injuries occur at an estimated frequency of approximately 3 per 100,000 populations per year and are mainly found in children aged 8 to 14 years. In Our study we used Fibre Tape to Repair ACL Avulsion from tibial site. **Method:** 25 cases of ACL avulsion from tibial site treated with fibre tape a between Dec. 2018 to Dec. 2020 followed up for 6 months at 1 month interval and short-term functional result were analyzed by X-Ray and IKDC score. **Result:** IKDC score at final follow up was normal in 84% cases and near normal in 12% cases. Abnormal IKDC score were rated only in 4% cases. There were no cases in severely Abnormal category according to IKDC score. None of patient reported any re-injury between the surgery and latest follow-up. **Conclusion:** Arthroscopic ACL Avulsion from tibial Site repair with Fibre Tape is good option. Early functional and radiological results are normal and near normal.

KEYWORDS

ACL Avulsion, Arthroscopy, Fibre Tape, Suture Disk.

INTRODUCTION:

Tibial spine fractures typically occur at the bony insertion of the anterior cruciate ligament (ACL) on the tibia. Incidence approximately 3 per 100,000 populations per year and most common age group is 8-14 years¹. The typical mechanism of injury is hyperextension of the knee with a valgus or rotational force², often incurred in a fall from a bicycle, in a motor vehicle accident.^{3,4,5} Surgery is typically indicated in Meyers and McKeever⁶ classification type I fractures for whom nonsurgical treatment did not give fair results, type II fractures that are displaced 5 mm, type III displaced fractures. Arthroscopically fixation is now used for reduction of ACL avulsion from tibial site. It is minimally invasive nature, more accurate approach to the fracture site, decreased morbidity, earlier mobilization and a shorter hospital stay. Suture and screw fixation are the two most commonly used fixation techniques.

Fibre tape is made up of a multi-strand, long-chain ultra-high molecular weight polyethylene (UHMWPE). It has 2 mm width, ultra-high strength and provide broad compression and increase tissue cut-through resistance. It has the distinct advantage of enabling secure fixation of smaller fragments and fractures that are too small for screw fixation. It can be passed through the ACL holding the fracture fragments in place or, in patients with larger bony fragments, can be passed directly through bone. Patients with Fibre tape fixation have more stability on clinical examination.

METHODS:

This prospective study was performed in 25 cases of ACL bony avulsion from Dec 2018 to June 2020 followed up for 6 months and short-term functional result were analyzed by using IKDC score.

1. INCLUSION CRITERIA

- Bony avulsion of tibial spine
- Age group 8 - 30 years both male and female
- ACL avulsion from the tibial attachment site

2. EXCLUSION CRITERIA

- ACL tear
- Neuromuscular disorder
- Osteoarthritis of knee joint

Patients attending Trauma casualty and OPD of Orthopaedics department were randomly chosen according to the criteria mentioned above. Patients were considered for operation once swelling and pain subsides. Until then slab, crepe bandage or brace was applied and supplemented with analgesics. Physiotherapy was also advised.

Preoperative Assessment

Once the patient was admitted thorough clinical examination (Anterior

Drawer Test, Lachman Test, Posterior Drawer Test, Varus and Valgus Stress Test) were done.

After clinical examination we do radiological assessment of all patients. X-Ray anteroposterior and Lateral view of affected knee was performed. This showed tibial eminence fracture and, in some cases, there may be anterior translation of the femur on the tibia on the lateral view.

Computed Tomography scan also performed to determining the size, and comminution of the avulsion bone fragment with three-dimensional CT allowing better fracture depiction.

On the basis of 3D-CT scan findings fracture was classified according to Meyer and McKeever classification and it was observed that most of the cases (48%) were of type III followed by 36% type II and 16% type IV fractures.

Table 1 : Case Distribution according to Mayer and McKeever Classification

Meyer and McKeever Classification	Description	Cases
Type I	Minimally/non-displaced fragment	0%
Type II	Anterior elevation of the fragment	48%
Type III	Complete separation of the fragment	36%
Type IV (Casalunga et al ⁴ and Zaricznyj ⁷)	Comminuted avulsion or a rotation of the fragment.	16%



Fig.1: CT Scan of Knee Joint

In suspected cases of other ligaments injuries (Meniscus injury, Collateral ligament injury, Posterior cruciate ligament injury), we asked for MR imaging.

Surgical Procedure

Once the patient was fit for surgery after pre-anesthetic checkup, patient was posted for surgery. The limb to be operated was prepared and scrubbing was started one day before surgery.

The surgery was performed under regional Anesthesia. Prophylactic antibiotic (Cefuroxime 750mg) was administered before procedure. Patient was placed in supine with leg hanging position. Thorough examination of the injured knee was performed under anesthesia to see other ligamentous injuries. Pneumatic tourniquet was applied on the thigh (300-350 centimeter of water pressure). Limb was prepared and draped in the usual manner under all aseptic conditions.

All patients were undergone for diagnostic arthroscopy to confirm the preoperative diagnosis. All the ACL Avulsion repair procedures were performed by the same senior arthroscopic surgeon by use of Fibre Tape and suture disk.

Surface anatomy were marked on skin of the operative knee. Two standard portals (Anterolateral and Anteromedial) and one assessor portal (Trans Patellar) were made.

Preparation of the Tibial Spine Avulsion bed - The ACL was probed to ensure that the femoral attachment was intact. The tibial spine avulsion was identified and inspected. A shaver was used to aggressively debride the tibial fracture bed to remove clots and loose fragments, as well as to create a recess to anatomically reduce the fracture. A probe was used for a trial reduction of the avulsed fragment. Suture lasso along with a monofilament loop of suture was passed near the base of ACL insertion just above the fracture fragment. After the tip was passed through soft tissue, the suture loop is retrieved with help of suture retriever from central portal. Along with suture loop Fiber Tape passed around the ACL near the base of its insertion on the fragment.

An incision was made medial and distal to the tibial tuberosity. One drill hole was made with a 6.0 mm drill bit by using a Tibial zig, starting medial to the tibial tubercle and passing obliquely and superiorly to fracture bed of the tibia without drilling through the fracture fragment. The technical pearl was then to shuttle the suture anterior to the fracture fragment, and then through the tibial tunnel, thus "levering" down the fragment inferiorly and posteriorly to an anatomic reduction. Once the fracture fragment was reduced anatomically, fracture reduction was assessed with arthroscope by keep pulling Fiber Tape, impingement checked in knee full range of motion. Fiber Tape was tied through suture disk on medial tibial cortex and the wound was closed and dressing was done. A Cylindrical slab was applied.

Post-Operative Care

Patient was advised to perform Quadriceps isometric contractions, straight leg raises with cylindrical slab in full extension, Hip Adduction, abduction, extension, active ankle dorsiflexion / plantarflexion, toe movements exercise till one-month post-operative.

Cylindrical slab was discontinued after one-month post operatively and knee brace was advised. Partial weight bearing started and progress to full weight bearing by 6 weeks. Progressive knee bending was started along with quadriceps and hamstring strengthening exercises. Jogging and light running were started at 12 weeks.

Surgical Procedure

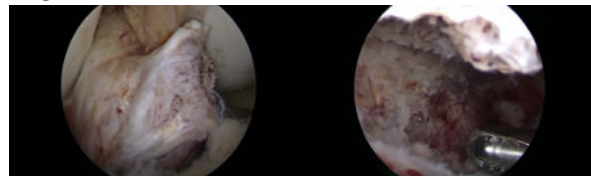


Fig.2: Fracture Fragment (Arthroscopic View)

Fig.3: Tibial Spine Avulsion bed (Arthroscopic View)

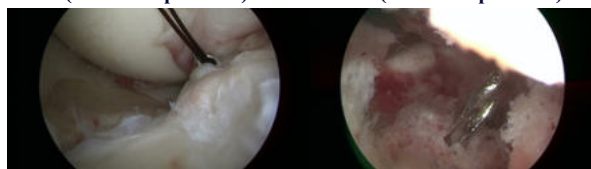


Fig.4: Suture Lasso to pass Fiber Tape (Arthroscopic View)

Fig.5: Guide wire emerging out of the ring in tibial zig at tibial spine avulsion bed



Fig. 6: Fibre Tape tied at base of ACL near fracture



Fig.7: Pre-operative X-Ray

Fig.8: Post-Operative X-Ray

RESULTS:

In our study males were more vulnerable than females for ACL injury. There were 84% males and 16% females. Most vulnerable age group for injury of the ACL was 20 -30 years. Mean age was 19.92 years. We also found that Road traffic accident (84%). was the most common mode of injury. Right knee was more frequently involved than left knee. Mean Duration of patient presented in hospital after Injury is 24 days.

Pre-Operatively Lachman test 1+ positivity was present in 4% cases, 2+ positivity in 80% and 3+ positivity in 16% cases. Post operatively 76% patients had negative Lachman test, 24% cases had 1+ Lachman Test. 96% cases had negative Anterior drawer test.

We compared MRI finding with arthroscopy finding. We observed that MRI showed medial meniscus tear in 5 cases and lateral meniscus tear in 4 cases but in arthroscopy we observed only 2 cases had Medial Meniscus tear and no case detected with lateral meniscus tear.

At 6 month we assessed patient radiologically. In this we analyzed the X-Ray of operated knee and seen that all cases had union of Tibial spine Fracture Fragment and not a single case showed displacement of fracture fragment.

Final assessment of present study was done using patient oriented questionnaire that assesses symptoms and function in daily living activities by IKDC Score. We observed that 84% cases were normal and 12% cases were near normal according to IKDC score. Only 4% cases fall in Abnormal category and no case in severely abnormal category according to IKDC score. Mean IKDC score was 92.15/100.

Table 2: Final Result by IKDC Score

IKDC Score	Number	Percentage
Normal (>90%)	21	84
Nearly Normal (76-89%)	3	12
Abnormal (50-75%)	1	4
Severely abnormal (<50%)	0	0

Complications:

Main complications associated with tibial spine avulsion fractures are residual laxity, arthrofibrosis, extension loss, surgical site infections, post-operative displacement of fracture fragments.

In our study no major complication occurred. Few minor complications like knee effusion occur only in one case which subsided spontaneously. 28% patients didn't showed ROM as expected at 3 months. In these patients we started intensive physiotherapy and about 8% patients responded well. In remaining 20% cases we performed under GA manipulation along with intensive physiotherapy which helped them to gain full ROM.

Only one case showed Extension lag of 5° at knee Joint. In spite of this deformity patient was clinically asymptomatic.

DISCUSSION

Treatment of displaced fractures is controversial and multiple methods have been described. Native ACL has mechanoreceptors for

proprioception and neuromuscular control ⁸so it is necessary to preserve it.

We performed 3D-CT scan in all patients but we observed that there is no need of CT scan in all cases as X-Ray of affected knee joint AP and Lateral view is sufficient to diagnosis. CT scan may be useful in cases where comminution of fracture fragment suspected. MRI is needed only in suspect of ligaments injuries.

Different types of fixation for ACL avulsions include cancellous screws, staples, sutures, K wires to bio- absorbable suture anchors.⁹ The conservative method carries its complications of prolonged immobilization, knee stiffness, and residual instability. Open methods of fixation produce variable degree of knee stiffness due to the extensive dissection done and require long period of immobilization.

Suture fixation is relatively better than screw fixation. As there is no need for second surgery for hardware removal, no impingement of the hardware in the notch. Suture fixation is better both, clinically and biomechanically¹⁰⁻¹².

Tran Trung Dung et al. (2019)¹³ did a Cohort study in arthroscopic ACL avulsion repair by fiber wire and they found that mean IKDC score was 90.7 (range 76-100) at 3 month follow up. In our study mean IKDC score was 92.15/100.

This technique of using fibre tape overcome most of complications related to ACL avulsion repair. At Final follow up by using fibre tape and suture disk 96% patients had normal functional outcomes and reached at the pre injury work level.

CONCLUSION:

ACL Avulsion from tibial Site has various methods to repair according to various surgeons. Arthroscopically repair with Fibre Tape and suture Disk has minimal complication rate with good functional and radiological outcome.

Limitations of study:

Our sample size is small. We do not have any repeat arthroscopy to ascertain the healing status of repair site. A larger number of sample size with longer follow-up is required to more authenticate the study.

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