



Prospective study: Arthroscopic fixation of tibial spine avulsion fractures using suture pull through technique

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Abstract

Introduction: ACL avulsion fractures of the tibial insertion are often caused by traffic accidents and sports injuries. Various fixations techniques are available for fixation of tibial spine avulsion fracture. Our study includes patients treated with arthroscopic pull through suture technique used for tibial spine avulsion fractures.

Objective: To study the radiological and functional outcome of arthroscopic pull through technique in displaced tibial spine avulsion fracture.

Material and Method: Seventeen patients with displaced tibial spine avulsion fractures without other associated ligament injuries were included in the study. All underwent arthroscopic fixation using pull through suture technique. All patients were evaluated following the guidelines of the radiological union, the Lysholm knee scoring scale, and the International Knee Documentation Committee (IKDC).

Results: Mean age of patients was 20.6 years. Mean follow up period was 13.5 months. Fractures were united within 3 months after surgery in all 17 patients. During the last follow-up, all the anterior drawer and Lachman tests were negative, except in 2 patient whose anterior drawer test was positive. The range of motion was $131^{\circ} \pm 21^{\circ}$ at the last follow-up. The mean Lysholm score was 91.9 (range 88 -100), mean IKDC score was 88.4 (range 85-96), 1 patient had Post-Operative knee stiffness (ROM 0-110°);

Conclusion: Arthroscopic pull through suture technique is an easy-to-operate and effective method for the treatment of displaced avulsion fractures of tibial spine, with excellent anatomic reduction and good clinical results.

Keywords: anterior cruciate ligament; arthroscopy; avulsion; suture; fracture; knee

Introduction

ACL avulsion fractures of the tibial insertion¹ are common in children and adolescents. These are commonly caused by road traffic accidents and sports injuries. As the tibial spine is the site of anterior cruciate ligament (ACL) attachment, tibial spine avulsion may be associated with ACL insufficiency.⁵ Concomitant injury to a collateral ligament and menisci may also occur, and there is evidence that associated injuries are common in adults.

According to Meyers and McKeever², the tibial avulsion fractures are classified into four types: Type I -minimally displaced fracture, Type II -anterior elevation of the fracture fragment, Type III -complete separation of the fragment from the tibia, Type IV -comminution of the fragment. 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.

A variety of fixation methods, including Kirschner wire, screw, stainless steel wire, suture, suture anchor, and TightRope (Arthrex)-suture button fixation have been reported, along with a series of known complications, such as non-union after the loss

of reduction, extension lag due to remaining intra articular hardware, lesions of the physis, pain, residual laxity, and irritation and pain from retained hardware.

The objective of the present study was to study the radiological and functional outcome of arthroscopic pull through technique in displaced tibial spine avulsion fracture.

Material and Methods

Prospective study was conducted in Department of Orthopaedics, SRMS hospital, Bareilly from November 2018 to May 2020. A total of 17 patients were included in the study. Inclusion criteria: 1) adult patient (age>18 years), 2) displaced type III or IV tibial avulsion fractures (Meyers and McKeever), 3) fixation done arthroscopically with suture pull through technique, 4) at least 6 months of clinical follow-up completed. Exclusion criteria 1) type I or II tibial avulsion fractures, 2) associated other ligament injuries, 3) open injuries.

Thorough clinical examination was done preoperatively to rule out other ligamentous injury. Anterior drawer and Lachman test was done particularly in all patients. Preoperative CT scan or MRI were done in all cases. All patients were treated within 1 week of injury using arthroscopic suture pull through technique. Surgical technique: Standard anteromedial and anterolateral

portals were used. Fracture bed was cleared of hematoma using a shaver. Temporary reduction achieved using 2mm k wire under c-arm. ACL zig was used with 2.7mm guide wire to drill two holes medial and lateral to ACL. 90 degree suture lasso used to take a bite first in posterior half and then in anterior half close to fragment in ACL and taken out. Both ends of suture were shuttled from the tibial tunnel of respective side. Both the threads were pulled and reduction was checked. Sutures were tied independently over endobutton or suture disc.

Post operatively, follow ups were done at 2 weeks, 6 weeks, 3 months and 6 months and then yearly. Radiographs were assessed and fracture was considered united if no fracture line seen. Lachman and anterior drawer test was used to assess laxity in all cases. Knee ROM was recorded. Lysholm and IKDC scores used to assess function.

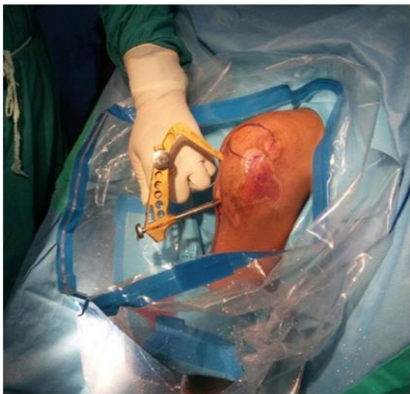


Fig 1



Fig 2



Fig 3



Fig 4



Fig 5

Results

Mean age of patient- 20.9 years. Mean follow up period was 13.5 months. Out of total 17 patients, 16 were male and 1 was female. 15 patients had type 3 fracture and 2 had type 4 fracture. Fracture was united in all 17 patient by 3 month follow up. At last follow up, anterior drawer and lachman test were negative in all patients except 2, in which anterior drawer was positive. Mean knee ROM was 131 ± 21 degree at final follow up. Mean Lysholm score was 91.9 (range 88 -100). Mean IKDC score was 88.4 (range 85-96). Only 1 patient had post-operative knee stiffness (ROM 0-110 degree).

Discussion

To date, ACL treatments for many displaced tibial avulsion fractures have been reported to yield^{4,5,6} poor clinical results, limited knee extension, slight anterior knee instability. The main causes are improper reduction and unstable fixation. Given that the need for postoperative restrictions depends significantly on the initial strength at the fixation site, firm fixation of the ACL avulsion fragment is crucial for mitigating motion complications. The characteristics that determine management include the size, the degree of displacement, the comminution and orientation of the fracture fragment, and the integrity of the attached cruciate ligament. Avulsed fragments that are of a sufficiently big size may be treated arthroscopically, including fixation with a cannulated cancellous screw or Kirshner wire, or suture fixation. Screws may cause fracture fragment comminution during the insertion process, and screws or Kirshner wires have to be removed using another procedure. Many cadaveric studies prove

superior fixation properties of suture pull through technique over others [7] It also obviates the need of implant removal. With adequate arthroscopic expertise of surgeon and necessary special instruments, arthroscopic pull through technique is preferable minimally invasive technique.

Conclusion

Arthroscopic pull through suture technique is an easy-to-operate and effective method for the treatment of displaced avulsion fractures of tibial spine, with excellent anatomic reduction and good clinical results.

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