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ARTHROSCOPIC PULLOUT SUTURE TECHNIQUE FOR FIXATION OF ACL AVULSION FRACTURE: A NOVEL TECHNIQUE

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ABSTRACT

Background: Arthroscopic ACL avulsion fracture fixation has gained popularity in recent years, but there is no consensus on which method of fixation works best. A total number of nine patients who met the inclusion criteria were enrolled in the study. From our study, all patients achieved overall good postoperative functional outcomes. Hence, ACL avulsion fractures can be effectively treated with arthroscopic pull-out suture fixation. **Method:** Patient symptoms like knee pain, locking, clicking, sensation of giving way and clinical signs like tenderness, range of motion, Mc Murray's test, stability test and Lysholm knee scores were evaluated pre operatively and post operatively at 3 months and 6 months. Patient satisfaction was noted at latest follow up. The aim of this study is to evaluate the clinical outcome of the arthroscopic reduction and pull-out suture technique in displaced ACL avulsion fractures. **Conclusion:** The arthroscopic suture "bridge" pull out technique is an effective method for fixation of ACL tibial avulsion fractures with respect to knee stability, range of motion and resumption of pre injury activity level.

INTRODUCTION

Anterior cruciate ligament (ACL) avulsion fractures are common injury in children and adolescents. In adults they account for 1% to 5% of ACL injuries (1). They are caused by a hyperextension injury of the knee or by a direct force over the distal femur with the knee in flexion.

Non operative treatment in form of immobilization is indicated for type 1 fractures. Non operative treatment for type 2 to type 4 fractures, in form of manipulation in extension fails to achieve reduction of the fragment as the fracture lies in the intercondylar notch and not between the articulating surface of the tibia and femur (2).

Operative treatment is indicated for type 2, 3 and 4 fractures as these displaced fractures can develop non-union or malunion resulting in knee instability and anterior impingement causing loss of knee extension (3). Surgical techniques include open or arthroscopic reduction and internal fixation.

Although Shelbourne et al recommend excision of displaced avulsed fragment and report good result, (4) we believe that displaced tibial spine fractures are best treated with fixation because the native ACL has mechanoreceptors for proprioception and neuromuscular control (5).

Various techniques are described to achieve secure fixation of the avulsed fragment in type III and IV fractures which vary from Kirschner (K) wire, (6) cancellous screws, (7) Herbert screws, staples, (8) stainless steel wires, suture anchor, (9) meniscal arrows, sutures (10) or combination, (11) and so forth, using the mini-open or arthroscopic approach (12).

The optimum method of reduction and fixation is still unknown (13). The purpose of this study is to evaluate the clinical outcome of the arthroscopic reduction and pull-out suture technique in ACL avulsion fractures.

MATERIAL AND METHODS:

This was a retrospective study conducted in the department of orthopedics at Global Hospital, Gwalior between 2020 to 2021. Patients having displaced ACL tibial avulsion fractures as diagnosed on plain -radiography were included in this study. Chronic injury, concomitant tibial plateau fractures and other severe injuries which will influence knee joint stability were excluded. Nine patients were included in this study (eight males and one female). Mean age of patients was 18.11 years (15-21 years). Six patients were of type II and three were of type III as per Meyers and Mckeever classification (14).

Pre-operative data recording included age, sex, side, mechanism of injury, duration since injury and complains with respect to pain, locking, clicking, sensation of giving away and swelling. Clinical examination included tenderness, range of motion, Mc Murray's test and tests for instability. Lysholm knee score was recorded preoperatively. Radiological investigations included X-rays, CT scan and magnetic resonance imaging (MRI) of the knee. (Table 1)

Spinal anesthesia was administered to all patients. A high thigh tourniquet was applied and the patient's leg was positioned in an arthroscopic leg holder at the edge of the table. Postoperatively the knee was placed in a long knee brace and ankle pump exercise, static quadriceps sets, active straight leg raises were started immediately after surgery. Active knee bending was started as per pain relief, usually from the 2nd postoperative day.

Treatments modalities range from conservative to open fixation to arthroscopic fixation and is usually guided by fracture displacement:

Type I: -Conservative management.
Type II: -Operative treatment if reduction lost in X-rays.
Type III & IV: ORIFI (open reduction internal fixation) or by Arthroscopic reduction and fixation.

The goal of the operative treatment is to restore full range of motion and knee stability. Arthroscopic technique has the advantage of minimal invasive, better visualization, allow us to address associated intra-articular pathologies and decreased morbidity if compared to open surgery. Arthroscopic fixation may be accomplished with either sutures or hardware like metal screws, Kirschner wires and suture anchors.

Operative techniques:

All patients were operated under spinal anesthesia, with knees hanging down in tourniquet.

Diagnostic arthroscopy done. Displaced bony fragment was exposed by debriding all fibrous issue and blood clots. The fracture crater was thoroughly curetted with shaver. Trans patellar portal was also established to aid in reduction. From antero-medial portal, a suture lasso of 45°was passed through the mid substance of ACL near to its attachments along with an ethilon suture was passed. One more suture of fiber wire was passed in similar way and both ends wire pull out from central portal. Tibal aiming device for ACL was inserted through

anteromedial portal and a 2 mm incision made at tibial tubercle. Through this incision two intraosseous tunnels were created of size 4.5 mm. With pulling these sutures, the fragment was adjusted, both sutures lying in front of ACL substance in fig 8 fashion. The fragments held reduced and knee is moved full ROM to check any impingement and finally sutures tied at anteromedial cortex of Tibia with suture disc or button. (Fig 1)

Post op Management:
Isometric exercises for quadriceps and SLRT exercises started immediately. Knee Immobilized in full extension in knee brace for three weeks. ROM was limited to 0-90°till three weeks and further flexion allowed after three weeks. Patient kept non weight bearing till three weeks. At six weeks post operatively, the patient moved on to standard ACL rehabilitation protocol.

Results
All nine patients were followed for 3-8 months (average 5.33 months). The outcomes were measured on the basis of clinical ground by assessing International Knee Documentation Committee (IKDC) evaluation, Lysholom knee score, range of motion and signs of instability on final follow-up. Serial X-rays were taken to assess fracture union which showed fracture healing in average of 3 months.

Complications and clinical improvements:
No patients had any sign of infection or neurovascular injury. At last follow-up anterior drawer test and Lachman test were negative except in one case of 1+ degree. Follow up continues to assess the return of patients to pre injury level, where most of patients were satisfied with outcome.

Table 1 showing classification, duration of follow up, ROM, IKDC Score and Lysholm knee score

Sr. No.	Name	Age/ Sex	Classification	Duration of Follow-op	Rom in Degree	IKDC Score	Lysholm Knee Score
1	Ajay	16/M	II	8 Months	0-120	95	94
2	Sunil	20/M	II	3 months	0-110	85	89
3	Monu	18/M	II	4 months	0-115	91	89
4	Sanjay	21/M	III B	3 months	0-100	89	92
5	Poonam	18/F	III B	6 months	0-110	97	94
6	Ravi	15/M	II	5 months	0-100	94	94
7	Ahmed	20/M	III A	6 months	5-110	92	94
8	Raja	18/M	II	7 months	5-110	85	83
9	Suraj	17/M	II	6 months	0-110	90	85
Average		18.11 Years	5.33 months	1-111 Degree	90.80 %	90.44 %	

DISCUSSION:
The most significant finding of our study which concurs with the available literature is that suture pull-out fixation of displaced ACL avulsion from tibia gives excellent results in all age groups (skeletally immature and mature) without any significant complications. The mean subjective IKDC and Lysholm scores reported in our series in all age groups and all types of fractures (McKeever type III and IV) were similar to the ones reported by other authors who used suture pull-out technique to fix ACL bony avulsion, suggesting that arthroscopic suture fixation provides excellent clinical outcome after ACL bony avulsion (5). (15-17) Though Berg et al had raised concern about clinical failure of arthroscopic fixation, (18) we did not find any instance of fixation failure even in comminuted fractures.

All our patients with displaced ACL avulsion fractures achieved excellent functional and stability out come after this pull-out suture technique with mean follow-up of 5.33 months.

Advantages of our technique is that it is suitable for all types of displaced ACL avulsion fracture. No intra-articular hardware is used. Minimal risk of wound healing complications. The technique is effective and economical with a shorter operative time. Early recovery and rehabilitation. The main disadvantages are that it is technically demanding procedure.

Conclusion:
Despite smaller number of patients this pull-out suture technique using two trans-tibial tunnels is an easy to operate and effective method for the treatment of the displaced ACL avulsion fracture with excellent functional stability and outcome.it shows good post-operative functional outcome, excellent union rate without functional instability in all the cases regardless of age and fracture type. Thus, we recommend this simple and reproducible technique.

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