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Dr. Rasik B Dabhi
Assistant Professor Orthopaedics
PDU Government Medical
College, Rajkot, Gujarat, India

Dr. Bhargav G Parmar
SMT. Nhl Medical College,
Ahmedabad, Gujarat, India

Dr. Ketan K Parmar
SMT. Nhl Medical College,
Ahmedabad, Gujarat, India

A study of the clinical and radiological outcomes of arthroscopic reduction and fixation of displaced ACL avulsion fracture in adults using arthroscopic pull-out suture technique

Dr. Rasik B Dabhi, Dr. Bhargav G Parmar and Dr. Ketan K Parmar

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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 gain better outcomes. 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 2 years. We used Lysholm knee score and International Knee Documentation Committee (IKDC) score for evaluation. We used SPSS 16 for statistical evaluation.

Result: Out of 45 patients, 41 patients had Lachman test negative at final followup while 4 patients had mild laxity with good 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, excellent outcome

Introduction

Anterior Cruciate ligament (ACL) avulsion fracture is seen in all age groups but remains more common in children than adults. 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 more displaced fracture are not treated surgically.

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

Type I: Undisplaced fracture.

Type II: Partially displaced with intact posterior hinge.

Type III: Completely displaced.

Type IV: Comminuted avulsed fracture.

Undisplaced or minimally displaced fractures may be treated conservatively and will have excellent outcomes^[2], but for displaced fracture various modalities such as cancellous screws, herberts's screw^[3], Kirchner wires, staples, stainless steel wire⁴ 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 trending since past decade for treatment of displaced ACL avulsion fracture as it reduces complication associated with open arthrotomy but 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 avulsion fracture in adults using arthroscopic pull-out

Correspondence

Dr. Rasik B Dabhi
Assistant Professor Orthopaedics
PDU Government Medical
College, Rajkot, Gujarat, India

suture technique at a minimum follow-up of 24 months.

Materials and Methods

A prospective study of forty-five patients displaced ACL avulsion fractures presented to a tertiary level referral centre, P.D.U. Medical College, Rajkot, between April 2014 and Dec 2017, was done.

Inclusion criteria

Patients with displaced ACL avulsion fractures (Meyers and McKeever's Type 3 & 4) who received arthroscopic pull-out suture technique completed minimal follow-up of 2 years.

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 around 2 years.

Operative Procedure

The procedure was performed under spinal anaesthesia on simple table and supine position with knee 90° of flexion. Diagnostic arthroscopy was conducted 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 thus achieve after debridement of interposed soft tissue in crater. A 4.5 mm drill hole made on antero-medial aspect of tibia around 2 cm distal to tibial tuberosity through small skin incision with ACL jig to crater. Fibre Wire shuttled with suture passer in ACL Fibres and then pulled through 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 can be done with Image Intensifier and limb immobilized in long knee brace in extension.

Post-operatively analgesics and antibiotics were given and physiotherapy with ankle pumping and static quadriceps strengthening exercises was started immediately on first post-op day. Initially partially weight bearing following by full weight bearing walking with walker with knee brace started as soon as possible. Then gradually 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 24 months (range 12-36 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 classification², 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 does not shows 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 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 were seen in our study.

Discussion

The study describes many option for treatment of ACL avulsion fracture with cancellous screws, herberts's screw^[3], Kirchner wires, staples, stainless steel wire^[4] and arthroscopic suture pull out technique. But of them all arthroscopic suture pull out technique has gained wide popularity for treatment of ACL avulsion fracture.

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 better fixation method for displaced ACL avulsion fractures because of early knee mobilization, compatibility with MRI, suitability even in comminuted fractures and eliminates the requirement of implant removal.

Transverse intermeniscal ligament was seen in about 50% of cases. If entrapped it could be either partially resected or retracted as per the need as it could hinder with process of healing or may block reduction of fracture. As this ligament is necessary it could not be completely resected.

Most common complication was knee stiffness due to arthrofibrosis or mechanical obstruction by displaced fragment^[10]. However in our study only 2 patients had complain of knee stiffness^[11]. 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 24 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 demends on type of suture used. We have used nonabsorbable suture (Fiber wire) in all our patient which is consistent with study proves that nonabsorbable suture is safer than absorbable suture, in terms of ability to bear stresses of ligament and allows early range of motion^[12].

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.

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