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ARTHROSCOPIC FIXATION OF ANTERIOR TIBIAL SPINE AVULSION FRACTURE BY SCREW FIXATION: A PROSPECTIVE STUDY IN TERMS OF FUNCTIONAL OUTCOME

Orthopaedics

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ABSTRACT

Objective: The purpose of this study is to evaluate the functional outcome of displaced tibial eminence fractures managed by arthroscopic screw fixation method. **Material and Methods:** A total of fifteen patients of median age 25 years were followed up after arthroscopic screw fixation for displaced (type II, III and IV) tibial eminence fractures. The patients were followed with clinical examinations with Lysholm and Gillquist and International Knee Documentation Committee (IKDC) rating scales, range of motion, thigh girth. Radiographic . Radiographic assessments for time to union and for accuracy of immediate postoperative reduction were also performed during the follow-up to evaluate the healing of the fracture. Follow up was done on 9 weeks, 3 months, 6 months and 12 months. **Results:** There were 13 male patients and 2 female patients with 12 right knees, and 3 left knees included. All the fractures healed anatomically at 3 months follow-up. Also, no clinical signs of anterior cruciate ligament deficiency were detected. Mean IKDC score and mean Lysholm and Gillquist score at final follow up were 90.20±6.60 and 94.60±4.05 respectively. At the time of last follow-up, the percentage of excellent and good results in our patients treated with the described technique were 33.33% and 66.7%, respectively, with Lysholm and Gillquist knee scoring. **Conclusion:** Patients having tibial spine fractures treated surgically have high rates of good to excellent functional outcome. We recommend arthroscopic suture fixation of tibial avulsion of ACL in adults with advantage of rigid fixation, good postoperative functional outcome.

KEYWORDS

Anterior tibial spine fracture, arthroscopic screw fixation, functional outcome

1. INTRODUCTION

First described by Poncent; [1] avulsion fractures of tibial spine (also known as tibial eminence fractures) occur most commonly in skeletally immature patients between the ages of 8 and 14 years. [2] They account for 2% to 5% of knee injuries in the pediatric population [3] and 14% of ACL injuries [4] and represent a variant of anterior cruciate ligament injury. These fractures are analogous to anterior cruciate ligament (ACL) ruptures in adults. Meyers and McKeever[5] classified 3 types of tibial spine fractures: nondisplaced (type I), partially displaced or hinged (type II), and displaced (type III). Zaricznyj[6] added a fourth type to this classification to better describe comminuted fractures.

Surgical treatment of displaced intercondylar eminence fractures is essential to the restoration of knee function, return-to-sports participation, and overall quality of life; and to prevent non-union or malunion as closed reduction is rarely effective. First advocated by McLennan [7] in 1982, arthroscopic treatment for tibial eminence fractures is beneficial in comparison to open surgery in terms of minimal morbidity and treatment of associated lesions. With newer arthroscopic and fixation techniques, the benefits of surgery include restoring the ACL, retrieving interposed soft tissue, decreasing the risk of mal-union and potentially decreasing the period of immobilization to minimize the risk of arthrofibrosis. Many different types of arthroscopic fixation methods for tibial eminence fractures have been described including screw, suture, anchor, and suture-button fixation.

The purpose of this study is to evaluate the results of repairs of ACL tibial bony avulsion fractures using the arthroscopic screw fixation technique.

2. MATERIAL AND METHODS`

This hospital based prospective interventional study included 15 consecutive patients who underwent arthroscopic screw fixation of displaced intercondylar eminence fractures at a tertiary level hospital from July 2018 to March 2019. The study was undertaken after taking written informed consent from the patients and institutional ethical committee approval.

Patients having isolated displaced ACL tibial avulsion fractures (type II, III and IV) diagnosed on plain –radiography and contralateral normal knee were included in this study. Chronic injury (older than 6 weeks), type 1 avulsion, other associated ligament injuries of the knee, concurrent musculoskeletal condition, advanced degenerative changes in the knee, articular cartilage lesion exceeding grade III and patients not fit for anesthesia were excluded from the study. Routine investigations along with Antero-posterior and lateral knee X-rays; and magnetic resonance imaging (MRI) to classify fracture type using Meyers and McKeever fracture classification, check other concomitant injuries like bone contusion, meniscal and other ligament injury; were done. In a relaxed patient and in supine position, the uninjured knee was examined first to establish reference values after which the affected knee was examined. Questions of the subjective International Knee Documentation Committee questionnaire (IKDC, 2000) and the Gilquist–Lysholm Knee Scoring Scale were asked. Clinical examinations were performed in order to find out whether there was any presence of tenderness, joint effusion, pain or laxity (Lachman and anterior drawer tests); to document the range of motion and periodic knee X rays were done.

Operative procedure

All the patients included in the study were operated by standard arthroscopic screw fixation technique by a single surgeon.

Follow-up evaluation

No patients were lost to follw up. All the patients were instructed to attend OPD at 9 weeks, 3 months, 6 months and 12 months and were evaluated with clinical and radiographic assessments during the follow-up. The patients were followed with clinical examinations with Lysholm and Gillquist, and International Knee Documentation Committee (IKDC) rating scales. Range of motion, thigh girth and complaints if any, were documented at every follow up. Radiographic assessments were also performed during the follow-up for evaluating the healing of the fracture (time taken for union).

Statistical analysis

Data thus collected were entered in ms excel worksheet in form of masterchart. Those data were classified and presented as tubular and

chart form and analysed as per aims and objective. Qualitative data were expressed in percentage and proportion significance of difference and proportion were inferred by chi square test. For results P value less 0.05 was considered significant.

3. Results

Of the 15 patients included in the study, 13 were males and 2 were females having a median age of 25 years (range: 12 to 40 years). According to the Meyers and McKeever classification, there were 9 type II fractures, 5 type III fractures, and one type IV fracture. The left knee was involved in 3 cases and the right knee in 12 cases. 11 patients had a road traffic accident (RTA) and five had a twisting injury during a sporting activity. The basic characteristics of the patients included are shown in Table 1. Mean duration of surgery from tourniquet was 82.33±6.5 minutes.

Table 1: Demographic characteristics of patients

Parameter	Number of patients	Percentage
Mean age (years)	24.13±8.13	
Male: female	13/02	86.67/13.33
Mode of injury RTA/sports/fall	11/04/00	73.33/26.67/ 00
Side involvement Right knee : left knee	12/03	80/20
Meyers and McKeevers type of fracture II/III/IV	09/05/01	60/33.33/6.6 7

Radiological outcomes (Table 2)

5 patients had radiographic union on x ray at 9 week and at 3 months all had radiographic union. 11 patients had only optimum reduction and 4 had accurate reduction on same day postoperative x ray.

Table 2: Post-operative radiological outcomes

Parameter	Number of patients	Percentage
Immediate post operative reduction on x ray accurate/ optimum	04/11	26.67/73.33
Time to radiographic union Up to 9 wk/9 wk-3 month/3 month-6month	05/10/00	33.33/66.67

Clinical outcomes (Table 3)

Table 3: Post-operative clinical outcomes

Parameter	Number of patients	Percentage
Thigh girth Normal/decreased	13/02	86.67/13.33
Mean range of motion in flexion	124.0±15.491	
Loss of extension up to 15o /No loss of extension	04/11	26.67/73.33
Mean IKDC Score at final follow up	90.20±6.60	
Mean LYSHOLM and GILLQUIST Score at final follow up	94.60±4.05	
Complications: Knee laxity Knee stiffness Superficial infection Screw impingement needing removal	00 02 00 02	00 13.33 00 13.33
Patient's own estimate of functional outcome Excellent/good/fair/bad	03/10/02/00	20/66.67/13.33/ 00

Mean IKDC Score and mean LYSHOLM and GILLQUIST Score at final follow up were 90.20±6.60 and 94.60±4.05 respectively. At the time of final follow up, 13 patients had normal thigh girth and 2 had reduced thigh girth as compared to contra lateral non-operated, non-injured thigh.

Mean range of motion in flexion was 124.0±15.49 degrees at final follow up. 4 patients had loss of extension. Only 1 patient had up to 15 degrees loss of extension and 3 patients had loss of extension up to 10 degrees. 2 patients had knee stiffness and 2 patients required hardware removal due to screw impingement.

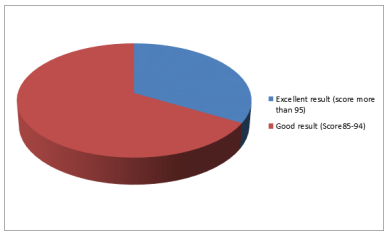

Figure 1: Result according to Lysholm and Gillquist score

DISCUSSION

Average age of our patient population was 24.13 years (range 12 to 40 years) and in 73.3% cases cause was road traffic accidents. Traditionally tibial eminence fractures are said to be related to sports injury and described in pediatric and early adolescent population. It is now known that they occur with much more frequency in adults than previously reported, and according to Kendall et al.,[4] approximately 40% of tibial eminence fractures occur in adults. Our results are similar with other studies having adult population which describe tibial eminence fractures primarily as a result of road-traffic accidents.[8-12] All patients presented with chief complaints of knee pain and had knee swellings and anterior knee joint line tenderness.

Post-operative antero-posterior and lateral x ray of operated knee was done on the same day. Although only 4 (26.67%) patients had accurate reduction on x ray and rest 11 (73.3%) had only optimum reduction; but the functional outcome was good to excellent in majority of these patients. 5 patients had radiographic union on x ray at 9 week and all had radiographic union at 3 months follow up. No patient in our study went into non union implying the excellent results of arthroscopic screw fixation.

In our study mean IKDC Score at final follow up was 90.20±6.60. 46.67% patients had IKDC Score above 90 and none had IKDC Score less than ^{80}.

Mean LYSHOLM and GILLQUIST Score at final follow up was 94.60±4.05. At the time of last follow-up, 5 patients had Lysholm and Gillquist knee scoring above 95 and all patients had scoring above 85. According to LYSHOLM and GILLQUIST Score 66.67% patients had excellent and rest 33.33% had good results (Figure 1).

At the time of final follow up, thigh girth of operated thigh was compared with contra-lateral, non-operated, non injured thigh girth as a measure of muscle wasting. 13 (86.67%) patients had normal thigh girth implying no apparent muscle wasting.

In the present study full range of motion for flexion which was more than 120 degrees was regained in 66.67% (10 patients) of cases. 4 patients had range of motion of 100-120 degrees and 1 patient had range of motion 90 degrees. Mean range of motion in flexion was 124.0±15.491degrees at final follow up. In our study 2 patients had knee stiffness. Loss of motion, a common problem after treatment of tibial spine fractures, may be caused by arthrofibrosis or malunion of the fracture. Arthrofibrosis has been attributed to prolonged postoperative immobilization. The use of rigid internal fixation by screw may allow more aggressive rehabilitation and limit loss in range of motion.

Preoperative x ray Postoperative x ray

X ray after screw removal

Final follow up ROM

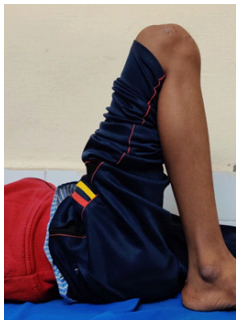

Figure 2: Clinical photographs of a patient who required screw removal and attained good functional outcome

4 patients had loss of extension. Only 1 patient had up to 15 degrees loss of extension. Remaining 3 patients had loss of extension up to 10 degrees. In two patients who required screw removal due to impingement, full extension was regained (Figure 2). Loss of extension is due to screw impingement. Rest two patient refused for screw removal as they were not having much functional impairment. May JH et al [13] carried out a retrospective study on tibial spine fractures to study the outcome of surgically treated patients with tibial spine fractures and found that patients with screw fixation had a higher reoperation rate for removal of symptomatic hardware.

No patient of ours reported any residual knee laxity, superficial infection, non union or malunion. No case of iatrogenic growth disturbance was observed which may be explained by primarily an adult population comprising only two patients with open physis in this study. Nevertheless, incorrect position of the screw can cause impingement and cartilage damage leading to growth disturbance and leg-length discrepancy might occur in patients with open physis, so physeal-sparing technique should be used in skeletally immature patients for excellent radiographic and clinical outcomes.

At last follow up all the patients were satisfied with their knee function with respect to pain, range of motion and stability and had resumed their previous level of activities.

Fixation of tibial eminence fractures with arthroscopic screw fixation has good post-operative functional out come in our study. The screw technique is therefore simple and reproducible, provides stable fixation and allows early mobilization and weight-bearing leading to less incidence of knee stiffness. So, we recommend this technique for treatment of these types of fractures. However our study sample and follow up duration is less, further study is required with large sample and long follow up.

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