Anchor suture fixation for displaced tibial spine fractures

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Background
Treatment of displaced tibial spine fractures includes varied modalities. The goal of this study was to assess the results of fixation of tibial spine fractures using anchor passing nonabsorbable braided sutures through the substance of the anterior cruciate ligament.

Patients and methods
Thirteen patients with displaced fractures of the anterior tibial spine were treated in Mansoura emergency hospital with nonabsorbable suture fixation from January 2008 to October 2009; 11 patients were men and two were women. Ten cases were type III and three were type IV following Meyers and McKeever's classification; the evaluation was performed using the Lachman test and anterior drawer test. The Lysholm score was used as a functional evaluation score.

Results
Lachman and anterior drawer tests were negative in 10 cases and the other three cases had mild positive tests. The mean postoperative Lysholm score was 96, ranging from 88 to 100.

Conclusion
Anchor with suture fixation for displaced tibial spine fracture is a reliable technique with excellent functional outcomes that does not need a further operation for implant removal and with less potential breakage of the bone fragment than with the use of screws. Also, the use of screws can be avoided as they have a tendency to migrate into the bone substance.

Keywords:
anchor suture, anterior cruciate ligament, tibial spine

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Introduction

Avulsion fractures of the tibial spine account for only 1–5% of anterior cruciate ligament (ACL) injuries in adults [1]. Meyers and McKeever [2] developed a system for the classification of these fractures. In type I fractures, the fragment is minimally displaced, type II fractures show elevation of the anterior half of the fragment, and type III fractures show complete displacement.

This system was modified by Zaricznyj [3], who considered comminution of a displaced avulsion fracture as a type IV fracture. Surgical intervention is indicated for types II, III, and IV because displaced fractures may cause nonunion or malunion as well as loss of knee extension or instability [3–6].

The use of K-wires or screw fixation needs further operation for implant removal in addition to the problems of displaced implants and lack of rigid fixation; also, the use of screws may lead to an increase in fragment comminution. Hence in this study, open surgery and anchor suture fixation of the fractures were used to avoid these problems [7,8].

Sixteen patients with displaced fractures of the anterior tibial spine were treated by open reduction and internal fixation using an anchor fixed to nonabsorbable sutures; of these, only 13 patients completed their follow-up and were included in this study. The results of surgery were assessed clinically and radiologically. The functional outcome was evaluated using the Lysholm knee scoring system [9].

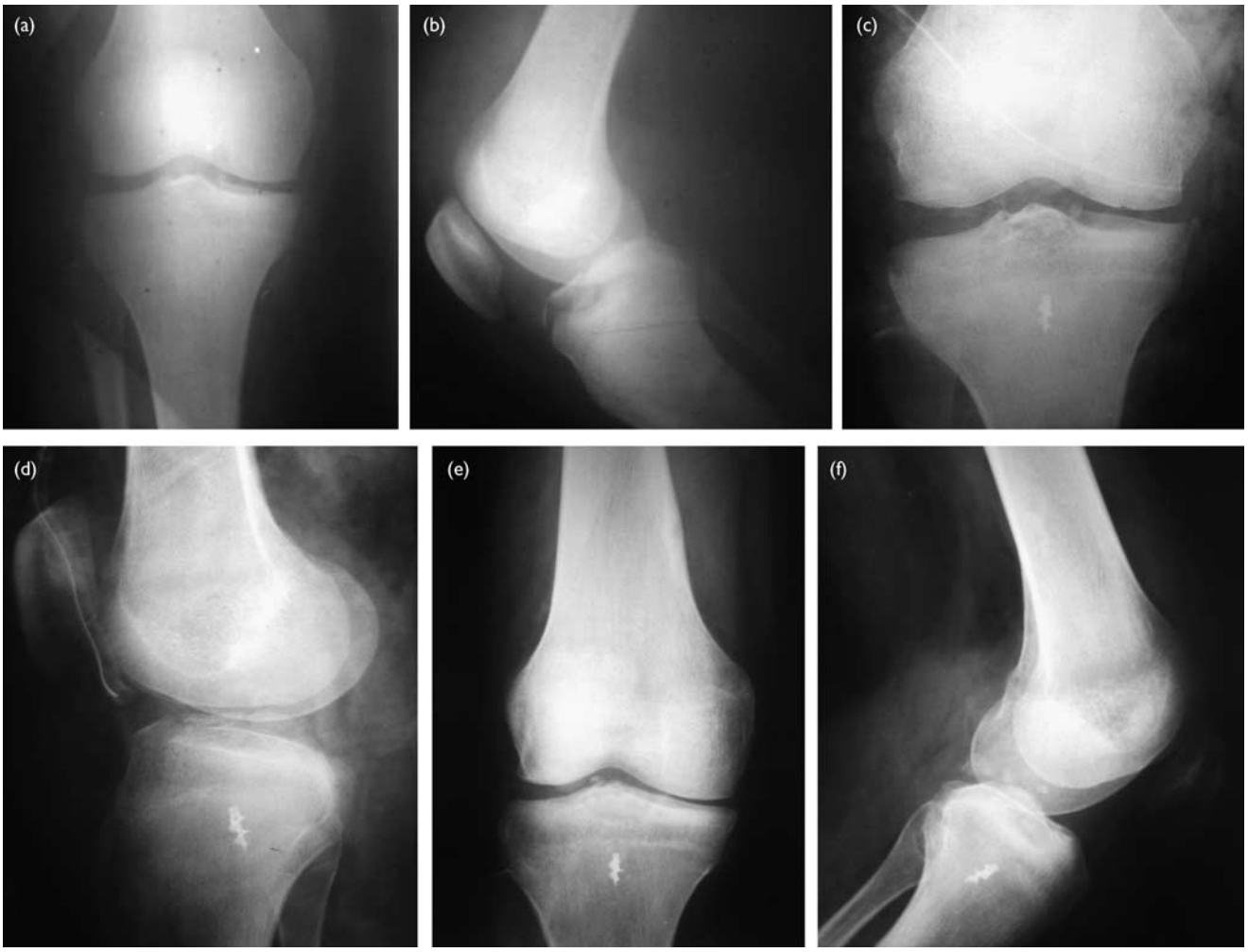
Patients and methods

In this study, 13 patients (11 men and two women) with displaced fractures of the anterior tibial spine were treated in Mansoura emergency hospital by open reduction and internal fixation using an anchor fixed to nonabsorbable sutures in the period between January 2008 and October 2009 (Fig. 1).

The average age of the patients was 24 years (range, 19–42 years). The injury was because of road traffic accidents in six patients and sports injury in seven. Patients with associated major proximal tibial fractures and children were excluded from the study. All cases were fixed within 4 days of trauma. Fastin metal self-drilling and self-tapping screwing 5 mm anchors were used.

Indication for surgery in these cases was type III and type IV fractures according to Meyers and McKeever's classification [2].

Figure 1



A 20-year-old male patient with a displaced tibial spine fracture. (a) Preoperative anteroposterior view, (b) preoperative lateral view, (c) immediate postoperative anteroposterior view after fixation with anchor suture, (d) immediate postoperative lateral view after fixation with anchor suture, (e) anteroposterior view 15 months after fixation with anchor suture, tibial spine united, (f) lateral view 15 months after fixation with anchor suture, tibial spine united.

With the patient lying supine, a tourniquet was inflated after elevation of the lower limb for 5 min. Then, through a medial parapatellar approach with a midline skin incision, the fracture site was reached and the bed was prepared. Then, the anchor was inserted deep into the bone of the bed, the sutures were tied through holes drilled into the fractured tibial spine, and passed through the ACL. A knot was then tied; a second anchor was needed in two cases as one anchor was not sufficient to provide the required stability. After wound closure, a long leg cast was applied until radiological union was achieved. Patients were allowed to partially bear weight until evidence of radiological union; then, full weight bearing was allowed.

The patients were followed up every 2 weeks until union, and then monthly until the last follow-up. The average period of follow-up was 22 months (13–32 months).

Anterior laxity in the knee joint was checked using Lachman's and anterior drawer tests; when compared with the opposite normal knee, knee function was assessed using the Lysholm knee scoring scale, with a maximum score of 100. Its main parameters are limping (5 points), support (5 points), locking (15 points), instability (25 points), pain (25points), swelling (10 points), stair climbing (10 points), and squatting (5 points), and the results were graded as excellent (91–100), good (82–90), fair (60–81), and poor (<60) [9]. A goniometer was used to record the range of motion (ROM) of the knee joint.

Preoperative and postoperative anteroposterior and lateral views were obtained for all patients and the radiographs were assessed for union of fracture and fragment displacement of the tibial eminence.

Results

Thirteen patients with displaced tibial spine fractures were treated at Mansoura emergency hospital from January 2008 to October 2009; 11 patients were men and two were women. Ten cases were type III fractures

and three were type IV fractures following Meyers and McKeever's classification [2].

The average age of the patients was 24 years (range, 19–42 years). Patients were followed up for an average period of 17 months. Mechanisms of trauma were road traffic accidents in six patients and sports injury in seven.

All cases were fixed within 4 days of trauma. Anchor sutures were used to fix the anterior tibial spine fracture, mainly the medial eminence, which is more commonly fractured.

In this study, at the last follow-up, patients had a median Lysholm knee score of 96 (range, 88–100).

At the last follow-up, two patients had a sensation of locking and only two had mild knee swelling after prolonged heavy activities.

All patients achieved radiological union in an average of 7 weeks. No patients developed displacement of the fracture. No significant difference in the ROM was found on comparing the affected and nonaffected knees.

Ten of these patients had extension lag less than 5° at the last follow-up. Three patients had mild degrees of positive anterior Drawer and Lachman tests.

Discussion

The avulsion fracture of the anterior tibial spine can easily be missed if not suspected. This injury is difficult to observed in the anteroposterior view, but can be observed more easily in the lateral view. The possibility of a fractured tibial spine should therefore be considered in all traumatized acutely swollen knees [10].

Various treatment options have been used for displaced anterior tibial spine fractures including conservative management, open or arthroscopic reduction, and internal fixation [1,11–14]. In this series, 13 displaced type III and type IV fractures were treated with open reduction and internal fixation using an anchor fixed to nonabsorbable sutures; all our patients were immobilized in a cylinder plaster cast at 0–10° of flexion until radiological union.

Five patients had pain on severe exertion, whereas the rest of the patients had no pain. No patient experienced giving way of the knee; two patients had a sensation of locking of the knee.

Although the treatment of nondisplaced tibial spine fractures is straightforward, displaced fractures may be complicated by nonunion loss of knee extension and/or instability [2,8,15–18].

In the displaced avulsions of the tibial spine, internal fixation is the treatment of choice; slight to moderate anterior instability of little functional importance may develop despite anatomical reduction, which may be attributed to ligamentous elongation at the time of the accident [19].

In case the fracture fragment is comminuted or small, sutures inserted through the substance of the ACL enable secure fixation and provide even reduction without requiring a second operation for implant removal and with less potential breakage of the bone fragment than with the use of screws [20,21].

Sharma *et al.* [10] carried out an analysis of different types of surgical fixation for displaced anterior tibial spine avulsion fractures with absorbable and nonabsorbable materials. They found that adults fixed with nonabsorbable material showed significantly better results than those fixed with absorbable material and that Herbert screws had a tendency to migrate into the bone substance, and are best avoided.

Vega *et al.* [22] carried out a study on arthroscopic fixation of displaced tibial eminence fractures using an anchor passing no absorbable braided sutures through the substance of the ACL, holding the avulsed bone fragment by tying a locking knot. They found that the anterior drawer and Lachman tests were negative. The mean Lysholm score was 94.

Fixation using anchors does not require drilling through the growth plate as it is the case in fixation with pullout sutures, thus sparing the growth plate in children [22].

Mahar *et al.* [23], in their biomechanical study, found that Ethibond pullout sutures resulted in a deformation and increased fracture separation, with a potential loss in reduction during cyclic, physiologic loads. On using anchors, the suture length is shorter, with less deformation theoretically; however, further comparative biomechanical study is required.

Rademakers *et al.* [24] carried out a long-term follow-up study of open reduction and internal fixation of tibial spine fractures. At the 1-year follow-up, the fracture had completely healed in all patients. One patient (3%) required revision of the osteosynthesis because of hardware failure and one (3%) developed a deep infection. The median knee ROM after 1 year was 125° (range 110–140°). The Lysholm score showed good to excellent results in 86% of the patients. It was concluded that open reduction and internal fixation of tibial spine fractures increases the possibility of regaining full stability of the knee joint and good long-term results with low infection rates. Knee function is adequately restored in most patients.

May *et al.* [25] carried out a retrospective study on tibial spine fractures. They studied 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.

Chen *et al.* [26] carried out a study on arthroscopic treatment of tibial spine avulsion fractures using no absorbable suture fixation without postoperative immobilization and found that the mean Lysholm score was 98.4 in cases of fresh fracture and 89.8 in cases of old fracture.

Conclusion

The use of an anchor with suture fixation for a displaced tibial spine fracture is a reliable technique with excellent functional outcomes that does not required a further operation for implant removal and with less potential breakage of the bone fragment than with the use of screws. Also, the use of screws can be avoided as they have the tendency to migrate into the bone substance.

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Conflicts of interest

There are no conflicts of interest.

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