Case Report

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Avulsion fracture of the tibial tubercle associated with patellar ligament avulsion treated by staples

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ABSTRACT

We present a case of combined avulsion fracture of the tibial tubercle (AFTT) and avulsion of the patellar ligament in a 15-year-old boy. This injury was treated by open reduction and fixation of both lesions using staples with satisfactory results. This constellation of injury is rare but a high index of suspicion is needed when faced with a displaced AFTT. Open reduction and internal fixation should be the treatment of choice.

Key words: Avulsion fracture, patellar ligament, tibial tubercle

INTRODUCTION

Avulsion fracture of the tibial tubercle (AFTT) is an unusual injury pattern generally occurring in the adolescent male during sporting activities. This lesion is well described in terms of epidemiology, mechanism, and treatment.[1-3] It can be associated with other knee damages including injuries to collateral ligaments, menisci, cruciate ligaments, and extensor mechanism apparatus.[4] Combined AFTT and avulsion of the patellar ligament is a rare occurrence but has received special attention regarding its mechanism and anatomical characteristics since the report of the first case by Mayba[5] in 1982 and the modification of the classification of Ogden *et al*,[6] by Frankl *et al*,[7] in 1990, including this injury pattern.

In literature, most studies concerning such constellation of lesions are limited to individual case reports.[8-10] Therefore, experience about clinical presentation of cases and treatment strategies is still needed. The present article provides a recent addition.

CASE REPORT

A 15-year-old boy sustained an injury to his left knee upon landing after a high jump. He had immediate severe pain in the knee and was unable to bear weight on that limb. Rapid swelling of the knee ensued. He featured a large haemarthrosis and held the knee in semiflexion. He could not perform a straight leg raise or extend actively his knee. Radiographs demonstrated a displaced Ogden type IIB AFTT and a high riding patella [Figure 1]. Open reduction and internal fixation was performed the same day through a midline longitudinal anterior incision. The tuberosity fragment which was comminuted had maintained an attachment to the anterior tibial plateau superiorly. The patellar ligament with the periosteum was completely avulsed from the tibial tubercle distally and displaced proximally. The knee was explored and the haemarthrosis removed. The tibial tubercle and the patellar ligament were reduced and held with staples [Figure 2]. After surgery, the knee was immobilised in a full extension plaster cast. When



Figure 1: Lateral preoperative X-ray showing an Ogden type IIB fracture of the tibial tubercle

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Figure 2: Postoperative radiographs showing the staples

he was able to bear full weight on this injured leg, on the sixth day postoperatively, he was discharged home. The cast was removed at 6 weeks from the operation and intensive mobilisation started. Radiographs showed maintenance of reduction and callus formation. By 4 months postoperatively, he had full range of motion of the knee without pain and no muscle atrophy. At the final follow-up (13 months postoperative period), he had no functional impairment and radiographs showed bony union of the fracture site. The hardwares were not removed since he complained of no discomfort at the front of the anterior aspect of the tibia. No recurvatum deformity has been observed [Figure 3]. However, he has not returned to sports activities for fear of another injury.

DISCUSSION

Simultaneous knee intra-articular lesions and AFTT have been reported in the literature.[4,11] Out of 22 patients with AFTT in the series by Bauer *et al*,[4] published in 2005, eight were found to have an associated intra-articular injury, of which five were patellar ligament avulsions. Avulsion of the patellar ligament associated with AFTT is a rare event even in largest series. Besides the study by Bauer *et al*,[4] performed in two hospitals, the two recent studies conducted at a single trauma centre are those by Frey *et al*,[12] in 2008 and Mosier and Stanitski[13] in 2004. Frey *et al*,[12] came across such an injury pattern in one patient in a series made up of 19 patients with 20 AFTT, during a period of 84 months.



Figure 3: Lateral X-ray at follow-up

Mosier and Stanitski[13] documented two cases of associated patellar ligament avulsions in a series of 19 AFTT over a study period of 108 months. Most documented patellar ligament avulsions combined with AFTT are seen in tibial tubercle avulsions type II[2,13,14] or III.[8,10,15] Bauer *et al*,[4] have also found two cases of patellar ligament avulsions in patients with type IB AFTT. They postulate that a surgeon needs to have a high index of suspicion for associated lesions and aggressively seek them out when faced with a patient presenting an AFFT. Extensor mechanism disruption was associated with tuberosity fragment comminution as reported by some authors.[2,4,8,10,13] Whether this was causative or associated is unknown.[13] The possibility of a combined injury must be considered during the pre-operative workup and intra-operative exploration.[8] Pre-operative diagnosis of simultaneous AFTT and patellar ligament avulsion can be very difficult.[15] Palpation of the patellar ligament for gaps may not be possible due to large knee effusions.[15] Frankl *et al*,[7] report that with a combined injury, lateral radiographs of the knee in flexion and extension show increased patellar to tibial tubercle distance in flexion. These views are not routinely obtained and may cause significant patient discomfort.[15]

Pre-operative radiographic finding of multiple calcified fragments below the patella is a clue to simultaneous patellar avulsion in a patient with AFTT.[15] In recent literature, the use of pre-operative arthroscopy[11] or magnetic resonance imaging (MRI)[8,16] is advocated to rule out any combined lesions, when faced with AFTT. Generally, patellar ligament avulsion associated with AFTT is found at open reduction for the tibial tubercle lesion.[4,15,17] According to Kramer *et al*,[15] the rotation of the large tibial tubercle fragment during operation as reported by Frankl *et al*,[7] and Goodier *et al*,[14] could serve as a clue to potential patellar ligament disruption.

We have discovered the patellar ligament avulsion at operation and concur with Bauer *et al*,[4] that open reduction should be performed in all patients with

AFTT necessitating a surgical treatment. The treatment of this complete and displaced discontinuity of the extensor apparatus of the knee is by surgical means. Arthroscopic reduction and internal fixation[11,12] or closed reduction and percutaneous techniques are used in the treatment of tibial tubercle lesions.[16,18] Using closed techniques, Ozkayin and Aktuglu[16] have treated with satisfactory results two cases of AFTT Ogden type IIIA and one of type II. They have ruled out by means of MRI any intra-articular lesion requiring open surgery. Pels and Havranek[18] recommended closed reduction and cannulated screws as first choice of treatment for Ogden's type III fractures. They have operated on four patients using this technique without ruling out any associated lesions by means of arthroscopy or MRI. Results were excellent in three out of the four patients undergoing this surgery. However, most authorities recommend open reduction to manage the displaced form of tibial tubercle injury.[13,17] Open surgery allows articular inspection, systematic search for and treatment of associated injuries, especially the patellar ligament, as well as the reduction and fixation of the osseous fragments.[2,5]

Techniques used to fix the osseous fragment in the setting of simultaneous tibial tubercle lesion and patellar ligament avulsion are the same as in the case of isolated tibial tubercle avulsion.

Fixation can be achieved by transfixing pins, screws, staples, tension bands, or even direct suture. The choice of a method depends on the age of the patient, the size and the comminution of the fragment, and the surgeon's experience.[1,2,13] In less immature patients, growth disturbance can occur from hardwares crossing the proximal tibial physis.

As these injuries typically occur in maturing adolescents, there is a less potential for this complication.[1] The patellar ligament is repaired using heavy sutures[4,5,7,10,14] or staples.[9]

In our patient, close to skeletal maturity with comminution of fragment, both the osseous fragment and ligament lesion were fixed using staples. We think also that staples to fix the ligament prevent us from using tension band technique above the patella and distally in the tibia, as performed by Bauer *et al*,[4] and Schiedts *et al*,[10] who have repaired the tendon using heavy sutures. This additional procedure protects the tendon repaired by sutures until healing[4,10] and avoids postoperative immobilisation.[10] Swan and Rizio[8] have used the Krackow technique with two n°5 Ethibond sutures passed through a transverse drill hole in the tibia, just distal to the tubercle. Since MRI is not available in all hospitals and percutaneous surgery cannot be performed in most orthopaedics services, we concur with Frankl *et al*,[6] that the treatment of this combined lesion should include open reduction and internal fixation of both the avulsed osseous fragment and avulsed ligament. In most published series to date, the overall outcome of AFTT treated by open reduction and internal fixation and reparation of the associated avulsion patellar ligament is excellent.[7-9,14] Comparable satisfactory result is obtained in our patient, with a mean follow-up of 13 months.

Experience with this case and review of other case reports have allowed us to conclude that open reduction and internal fixation is the standard treatment for displaced AFTT, and associated lesions such as patellar ligament avulsion would be recognised at that time. The principal finding of this report was the use of staples to fix both the osseous and ligamentous lesions.

REFERENCES

1. Medvecky M, Noonan B. Fractures about the knee in children and adolescents: Tibial spine and tibial tuberosity fractures. Tech Orthop 2009;24:204-10.
2. Zrig M, Annabi H, Ammari T, Trabelsi M, Mbarck M, Ben Hassine H. Acute tibial tubercle avulsion fractures in the sporting adolescent. Arch Orthop Trauma Surg 2008;128:1437-42.
3. Zionts LE. Fractures around the knee in children. J Am Acad Orthop Surg 2002;10:345-55.
4. Bauer T, Milet A, Odent T, Padovani JP, Glorion C. Avulsion fracture of the tibial tubercle in adolescents: 22 cases and review of literature. Rev Chir Orthop Reparatrice Appar Mot 2005;91:758-67.
5. Mayba II. Avulsion fracture of the tibial tubercle apophysis with avulsion of patellar ligament. J Pediatr Orthop 1982;2:303-5.
6. Ogden JA, Tross RB, Murphy MJ. Fracture of the tibial tuberosity in adolescent. J Bone Joint Surg 1980;62a:205-15.
7. Frankl U, Walesilewski A, Healy WL. Aulsion fracture of the tibial tubercle with avulsion of the patellar ligament. J Bone Joint Surg 1990;72A:1411-3.
8. Swan K Jr, Rizio L. Combined avulsion fracture of the tibial tubercle and avulsion of the patellar ligament. Orthopedics 2007;30:571-2.
9. Kaneko K, Miyazaki H, Yamaguchi T. Avulsion fracture of the tibial tubercle with avulsion of the patellar ligament in an adolescent female athlete. Clin J Sport Med 2000;10:144-5.
10. Schiedts D, Mukisi M, Bastaraud H. Avulsion fracture of the tibial tubercle associated to an avulsion of the patellar ligament. Rev Chir Orthop Reparatrice Appar Mot 1995;81:635-8.
11. Choi NH, Kim NM. Tibial tuberosity avulsion fracture combined with meniscal tear. Arthroscopy 1999;15:766-9.
12. Frey S, Hosalkar H, Cameron DB, Heath A, Horn BD, Ganley TJ. Tibial tuberosity fractures in adolescents. J Child Orthop 2008;2:469-74.
13. Mosier SM, Stanitski CL. Acute tibial tubercle avulsion fractures. J Pediatr Orthop 2004;24:181-4.
14. Goodier D, Maffulli N, Good J. Tibial tuberosity avulsion associated with patellar tendon avulsion. Acta Orthop Belg 1994;60:235-7.
15. Kramer DE, Chang TL, Miller NH, Sponseller PD. Tibial tubercle

fragmentation: A clue to simultaneous patellar ligament avulsion in pediatric tibial tubercle fractures. Orthopedics 2008;31:501.
16. Ozkayin N, Aktuglu K. Avulsion fractures of the tibial tuberosity in adolescents: Treatment with closed reduction and percutaneous screwing, using MRI to identify combined intra-articular lesions. Saudi Med J 2005;26:1636-9.
17. Chow SP, Lam JJ, Leong JC. Fracture of the tibial tubercle in adolescent. J Bone Joint Surg 1990;72B:231-4.
18. Pesl T, Havranek P. Acute tibial tubercle avulsion fractures in children: Selective use of the closed reduction and internal fixation method. J Child Orthop 2008;2:353-6.

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Erratum

The name of AN Ocheke, one of the authors of "A 10-year audit of gynaecological surgeries performed in the paediatric age group at the Jos University Teaching Hospital", published in African Journal of Paediatric Surgery, on page 178-180, September-December 2010 [African Journal of Paediatric Surgery 2010 | Volume : 7 | Issue : 3 | Page : 178-180], was wrongly written as **AA Ocheke** instead of **AN Ocheke**.

Corrected:

A 10-year audit of gynaecological surgeries performed in the paediatric age group at the Jos University Teaching Hospital: CC Ekwempu, **AN Ocheke**, FA Uba. [African Journal of Paediatric Surgery, 2010 | Volume : 7 | Issue : 3 | Page : 178-180]

The error is regretted.

Editor, African Journal of Paediatric Surgery