

Conservative treatment of eminentia intercondylaris fractures of the tibia in children

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SUMMARY: Atay ÖA, Doral MN, Tetik O, Leblebicioğlu G. Conservative treatment of eminentia intercondylaris fractures of the tibia in children. Turk J Pediatr 2002; 44: 142-145.

Seventeen patients (16 children, 1 adolescent) were reviewed 31 months to 71 months after sustaining the common childhood fracture of the eminentia intercondylaris of the tibia. The aim was to assess long-term results and prognosis by clinical and radiological examination and to discover whether conservative treatment was adequate for type I and type II fractures according to Meyers and McKeever.

Early improvement occurred in all patients after conservative treatment, but long-term results were not satisfactory in displaced fractures, which were treated with closed reduction and immobilization in extension. Therefore, anatomic reduction and rigid fixation should be obtained for displaced fractures of the eminentia intercondylaris of the tibia.

Key words: fracture, pediatric, intercondylar eminence.

Avulsion fractures of the intercondylar eminence are mostly seen in children and adolescents and have been considered to be the childhood equivalent of anterior cruciate ligament (ACL) ruptures in adults¹⁻³. This mode of ACL failure is thought to occur primarily in children because of greater elasticity of the ligaments in the pediatric population⁴. Instead of a tear of the ligament, there is an obvious fracture of the tibial intercondylar eminence through the cancellous bone located immediately beneath the cortical bone at the site of the insertion of the ligament⁴.

Fractures of the intercondylar eminence of the tibia are enigmatic skeletal injuries. The mechanism of injury remains obscure, appropriate management is unclear and even the results are puzzling, especially in the pediatric age group. However, the classification bears consistency, since it relates to the degree of fragment displacement. Meyers and McKeever^{3,5} have described a classification scheme for fracture of the intercondylar eminence of the tibia. In type I fractures, the fragment is non-displaced, whereas type II fractures are partial avulsions with an intact posterior hinge. Type III fractures are completely displaced and show no bony opposition.

Treatment methods for these injuries may be guided by the classification scheme. Most authors recommend treatment of type I and II injuries with cast immobilization for four to eight weeks^{3,5-8}. A cylinder or long-leg cast may be used with the knee fully extended to maintain reduction. Type III injuries are generally treated with open or arthroscopic reduction, and internal fixation^{2,3,5-7,9-16}.

The purpose of this study was to review a group of pediatric patients who had sustained intercondylar tibial eminence fractures and were treated by conservative methods.

Material and Methods

Seventeen patients were reviewed who were treated with or without closed reduction and followed by cast immobilization of tibial intercondylar eminence fracture at our Department between October 1994 and February 1998. Sixteen were children (8-14 years), and one was an adolescent (16 years). All of the patients had a fresh injury and were seen within ten days after the trauma.

The most common complaints were an immediate and painful swelling and inability to move or walk on the injured extremity. The

findings were painful and severe effusion and lack of complete flexion and especially extension. Routine radiographs of the knees showed the fractures of the intercondylar eminence of the tibias and these were classified according to the system proposed by Meyers and McKeever, which was a three-type classification scheme based on the degree of fracture displacement^{3,5}.

Additionally, we investigated four knees using computed tomography (CT) for displacement and size of the fragment or fragments. It was not always easy using only plain radiographs to determine whether there was an intact posterior hinge or total displacement of the fracture fragments and to estimate the fragment size, which are important for choosing the type of treatment.

Afterwards, blood-stained fluid with droplets of fat was aspirated, and type I (non-displaced) fractures were treated by simple cast immobilization with the knee in slight flexion. Type II fractures, which were minimally displaced, were treated similarly to type I. Grossly displaced type II fractures were treated with closed reduction followed by cast immobilization with the knee in full extension. Hyperextension of the knee joint was avoided because of patient discomfort. The extended position of the knee joint allowed the femoral condyles to compress then fragment toward its fracture bed. All of the fractures were immobilized for a minimal of four weeks with a cast and then for at least two weeks in a long-leg hinge brace (Fig. 1a-d).

Type III and unreduced type II fractures of the intercondylar eminence, which were excluded from the study, were reduced and fixated with cannulated screws by arthroscopy.

After radiographs were taken and the fracture union was confirmed, the brace was weaned and, after 10 weeks, patients were allowed to return to their previous activities.

At the follow-up, subjective outcome was obtained using a standard questionnaire for patients regarding any knee symptoms and their level of activity. They also underwent a routine clinical examination of the knee with specific emphasis placed on objective clinical signs of ACL laxity. Clinical examination was performed by one of the authors (MND) in order to eliminate intra-observer error. All patients had anteroposterior and lateral radiographs of both knees. The height of the anterior tibial spine was measured on the lateral radiographs using a method described by Panni¹⁷. Measurement of the height of the anterior tibial spine was obtained and a ratio was determined using the other uninjured knee as a control (Fig. 2a-d). Statistical analysis of the differences in values between the two fracture type two fracture types was performed using Student's t test. Values of $P < 0.05$ were considered statistically significant. All patients were rated using the criteria established by Lysholm functional rating system; Tegner activity levels were also utilized¹⁸.

Results

Follow-up interval ranged from 31 months to 71 months (mean 47 months). The mean age of the patients was 12 years and 3 months. Eleven patients were male and six were female. The left knee was involved in nine patients and the right in eight patients.

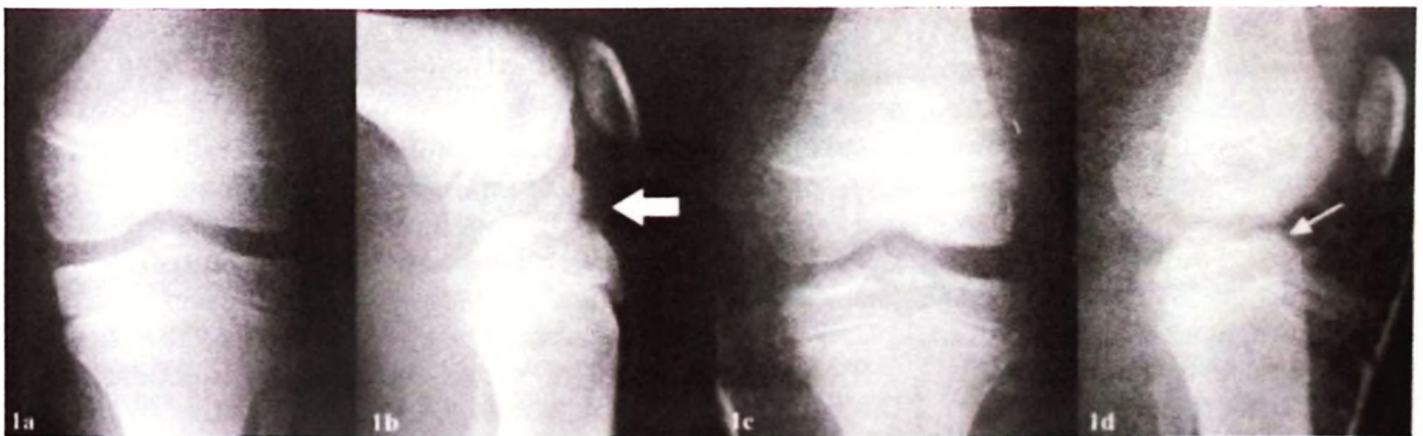


Fig. 1. Anteroposterior (a) and lateral radiographs of type II eminentia intercondylaris fracture, thick arrow revealing the displaced fracture fragment with an intact posterior hinge (b) Anteroposterior (c) and lateral radiographs with closed reduction followed by cast immobilization with the knee in full extension, thin arrow revealing the adequate reduction of the fracture fragment (d).

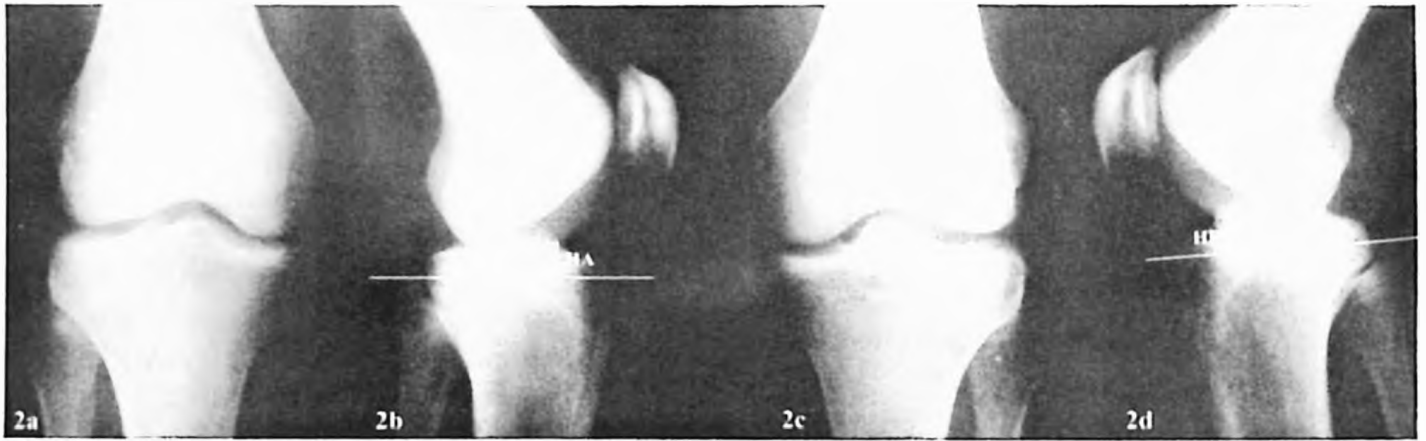


Fig. 2. Control anteroposterior and lateral radiographs of the contralateral knee (a, b) and injured knee after 59 months from the injury, showing malunion of the fracture in an elevated position and measuring the ratio (HB/HA) (c, d).

In 13 patients, the fracture had been caused by falling of a bicycle, in two by sports (while playing soccer) and in two in pedestrian-car collisions. In all cases the presentation had been with a painful hemarthrosis associated with decreased range of motion. In clinical examination lack of extension was revealed between 10-35° (mean, 24°).

In all patients, the avulsion fracture of the intercondylar eminence was the only injury to the knee. All of the fractures were diagnosed on initial radiographs and were classified according to Meyers and McKeever, but in four cases a definite decision could only be achieved using CT, which upgraded for type I minimally displaced fractures to type II^{3,5}. In total, seven type I and to type II (four minimally displaced, six displaced) fractures were shown with radiologic evaluation.

Radiographic controls showed healing of the fractures within six to eight weeks for all patients. All of them had returned to regular activity and recovery seemed to be complete with no disability.

At the follow-up examination, no patients complained of residual pain but six patients who were displaced type II fractures, reported a history of giving-way episodes of anterior instability. Eleven patients were able to return to recreational sports. All patients regained the full flexion, but three patients who were displaced type II fractures had at least 5° of extension deficit; arthroscopic notchplasty was recommended to these patients²⁵. All of the patients, other than six displaced type II fractures, exhibited a solid end point on the Lachman test with no positive pivot-shift tests. Six patients had moderate (grade II) Lachman tests and one had an obvious positive pivot-shift test, revealing a

gross functional instability. Anterior cruciate ligament reconstruction was recommended near skeletal maturity for this case.

Follow-up radiographs showed union in all cases. Radiographical examination of the height of the anterior tibial spine showed a statistically significant difference ($P < 0.05$) between type I (mean 0.13 ± 0.02) and type II fractures (mean 0.26 ± 0.06).

Functional assessment using the Lysholm scale was 92 (85-96) and 89 (86-93) for types I and minimally displaced type II, respectively. However, Lysholm functional scale was 78 (72-83) for displaced type II fractures of the eminentia intercondylaris. Tegner activity level was 9 in type I fractures and in four minimally displaced type II fractures, but was 6 in six displaced type II fractures.

Discussion

Most of the patients in this study were children under 14 years of age who had fractured the intercondylar eminence by falling off a bicycle. Our results in children agree with previous reports regarding the most frequent causes of the fracture and the rarity of associated injuries^{1,3,5,10,12,19-21}.

There is no agreement in the literature about the treatment of these fractures. Some authors were in favor of operative treatment^{1,2,10,13-16,19,22}, whereas others advocated a more conservative approach^{7,11}. Meyers and McKeever³ stated in their classic article that the key to the choice of treatment should be based on a classification system. However, in clinical practice an accurate assessment of the fragment was not easy and the distinction between various grades of fracture was not always radiologically possible. In our study, CT proved to be a useful diagnostic tool

in distinguishing type II fractures. In four of our cases initially diagnosed as type I fractures, CT revealed the displacement of the avulsed fragment. We believe that the classification system described by Meyers and McKeever is complicated; it was often difficult to make a distinction between major types as well as between subgroups of the major type. We agree with the suggestion of Chandler and Miller²³ that the classification of the fractures could be simplified: displaced versus non-displaced.

The small number of reports of neglected fractures of the intercondylar eminence suggested that the untreated natural history of this injury either caused knee laxity and/or a loss of motion^{1,9,11,12,15,21,24}. In our study, even if we performed conservative treatment, the results of obviously displaced type II fractures were nearly similar to neglected ones. Conservatively treated displaced type II fractures, even if successful closed reduction was performed, healed in a malunited. Malunion of the fracture in an elevated position of eminentia could (interfere with) knee extension, which was seen three patients, and could also be associated with ACL laxity (seen in six patients)²⁵. In the present study, statistical analysis showed that the height of the tibial spine in the knees with a deficit extension and ACL laxity was significantly greater than that of the other knees. We found that especially in the displaced eminentia fractures, closed reduction and immobilization could not prevent unsatisfactory results such as ACL laxity and/or loss of motion of the knee.

Therefore, we recommend that non-displaced or minimally displaced fractures can be treated conservatively. For cases of an obviously displaced fragment, however, arthroscopic anatomic reduction and rigid fixation should be obtained instead of closed reduction and immobilization at extension.

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