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Original article

# Arthroscopic treatment of intercondylar eminence fractures with intraepiphyseal screws in children and adolescents



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## ABSTRACT

**Introduction:** Tibial intercondylar eminence fracture rarely occurs in childhood. Its treatment requires anatomic reduction to provide knee stability and a rigid fixation to minimize postoperative immobilization time.

**Hypothesis:** Arthroscopy combined with fluoroscopy with intra-epiphyseal ASNIS screw fixation can meet the requirements of this treatment.

**Material and methods:** The series comprised 24 patients (mean age: 11 years) with Meyers and McKeever type II tibial intercondylar eminence fractures ( $n = 15$ ) or type III ( $n = 9$ ), operated on between 2011 and 2013. Fixation with 4-mm ASNIS screws was placed arthroscopically. The demographic data, associated lesions, radiological union, stability, functional result, and the Lysholm score were evaluated.

**Results:** With a mean follow-up of 2 years, the mean Lysholm score was 99.3 for type II and 98.6 for type III fractures. At the 6th postoperative week, range of motion in the operated knees was identical to the healthy knees. At the 12th postoperative week, there was no sign of anterior laxity. Twelve cases included meniscal entrapment, but no significant difference was observed in the functional results.

**Discussion, conclusion:** ASNIS screw fixation under arthroscopy can be successfully applied in the treatment of types II and III tibial intercondylar eminence fractures in children. This technique provides excellent stability, allows early weight-bearing, and preserves function of the knee and its growth.

**Level of evidence:** IV, retrospective study.

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## 1. Introduction

Fracture of the tibial intercondylar eminence in children is a relatively rare lesion with an incidence of 3 per 100,000 childhood fractures [1]. It corresponds to the anterior cruciate ligament (ACL) tear in adults.

In children, most often the tibial intercondylar eminence is not completely ossified and the collagen fibers of the ACL are continuous with the perichondrium of growth cartilage. This is why fewer ligament lesions and more avulsion fractures are found in children, with a high incidence between 8 and 17 years of age [1].

Meyers and McKeever published the classification of these fractures in 1959 [2]. Treatment remains orthopaedic for type I non-displaced fractures [3,4], it is surgical for type II fractures with

extension to the joint surface or in cases that show knee instability [4–6]. Type III/A fractures (displaced), type III/B (turned and displaced), and type IV (comminuted) always call for arthrotomy.

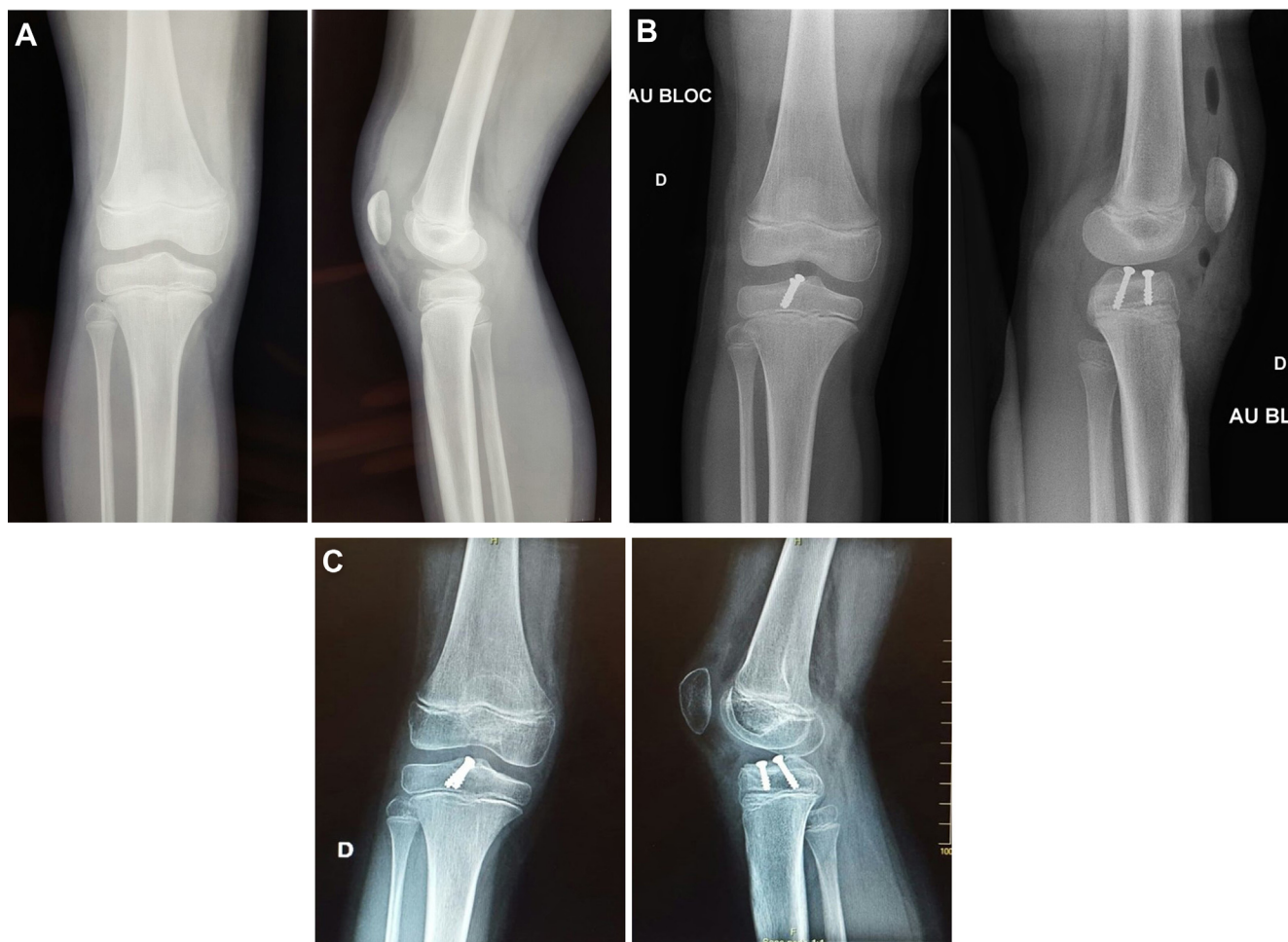
The objective of this study was to analyze and assess the results of arthroscopic intra-epiphyseal screw fixation for types II and III tibial intercondylar eminence fractures in children. We hypothesized that this technique without arthrotomy preserves sufficient stability and allows early recovery, significantly reducing the onset of stiffness and arthrofibrosis.

## 2. Material and methods

This retrospective single-center study was conducted in our institution between 2012 and 2013, on children treated arthroscopically for Meyers and McKeever types II and III tibial intercondylar eminence fractures. We excluded type I fractures (non-displaced) and types II and III fractures that were treated with arthrotomy. We collected data on the different parameters on the patients' demographics, the fracture mechanism, treatment, associated lesions, and the duration of immobilization.

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**Fig. 1.** A. AP and lateral radiographs of a type II tibial intracondylar eminence fracture in an 8-year-old female after a skiing accident. B. Postoperative radiographs: arthroscopic reduction and osteosynthesis using 2 ASNIS 4-mm-diameter screws in the intraepiphyseal. C. Radiographs 6 weeks after the operation.

**Table 1**  
Associated lesions by fracture type.

	Type 2	Type 3
Entrapment of anterior horn of medial meniscus	4	3
Entrapment of intermeniscal ligament	1	3
Another lesion	1	0
No lesions	9	3

Twenty-four fractures in 24 patients (17 males, 7 females) were treated with this method and followed up for 2 years (range: 1.5–3 years). The mean age at injury was 11 years (range: 6–15 years), with 13 left sides and 11 right sides. Type II (15 cases) and type III (9 cases) fractures were defined on AP and lateral radiographs (Fig. 1A). A CT was done in 4 patients and MRI in one. The injury mechanisms were all related to sports, skiing (7 cases), rugby (7 cases), cycling (6 cases), football (2 cases), and high jump (2 cases).

Arthroscopy was carried out under general anesthetic, in the dorsal decubitus position, legs dangling, with a tourniquet at the root of the lower limb and a vice at the knee. The image intensifier was installed laterally before draping. Using standard anterolateral and anteromedial approaches, we performed hemarthrosis evacuation and abundant lavage, and the exploration of associated lesions found in 12 patients (Table 1). The fracture was identified and the surrounding area cleaned, and the recess reamed with an arthroscopic reamer so as to obtain at least anatomic reduction or even McLennan counter-sinking [7]. Through the parapatellar medial

accessory entry, the fractured fragment was reduced using a metallic cannula and a guidewire was inserted through the motorized cannula. Osteosynthesis was provided using one or two 4-mm-diameter ASNIS (Stryker) screws through the medial parapatellar approach in the intraepiphyseal position with arthroscopic and lateral radioscopic guidance (no drilling, self-boring and self-tapping ASNIS screws). In most cases, we used 12- to 20-mm-long screws with long threading in cancellous bone of the proximal epiphysis of the tibia, which is relatively flexible. The fixation was deemed satisfactory when the distal end of the screw did not reach the growth plate, whereas its proximal end was located below the joint cartilage. One case of a lesion in the posterior segment of the lateral meniscus with 2 cm in the red-white zone was repaired using two vertical FastFix sutures. One case of an osteochondral lesion related to the injury was noted, but it did not require reduction or fixation. At the end of surgery, drainage was put in place and Ropivacaine applied within the joint. Immobilization was maintained for 4 weeks with a long-leg cast for patients less than 10 years of age, in the extension position, or a Zimmer knee brace in older children. Then physical therapy was prescribed two or three times a week. Partial weightbearing was authorized at this time, which became total weight-bearing at the 6th postoperative week. Return to sports was authorized only at the 4th month. The screw was removed only if it crossed the growth plate, no earlier than the 3rd postoperative month. The patients were clinically and radiologically assessed at 6 weeks, 3 months, 6 months, and 1 year after the operation. Knee stability was confirmed by a physical examination including the Lachmann, anterior drawer, and Pivot shift

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