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Original article

Rare ACL enthesis tears treated by suture in children. A report of 14 cases after a mean 15 years follow-up



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ABSTRACT

Introduction: ACL enthesis tears are rare in children and there are very few reports in the literature. Characterized by avulsion of the ligament that tears off a very thin piece of cartilage or a bone fragment at the ACL epiphyseal insertion site, we hypothesize that conservative treatment by suture could reduce the number of patients requiring later ligament reconstruction.

Materials and methods: Fourteen patients underwent surgery between 1986 and 2014 and were included in this retrospective study. Patients were selected according to the following criteria: suture failure requiring ligament reconstruction, reoperation-free survival for secondary injury and the subjective and objective IKDC scores by comparative laximetry.

Results: After almost 15 years of mean follow-up, reoperation-free survival was approximately 85%. Three patients required one or more additional surgeries; one for suture failure requiring 2 additional ligament reconstructions, one for a meniscal tear with a mechanical block requiring partial meniscectomy and one patient with secondary pain requiring arthroscopic surgery that was inconclusive.

Discussion: Rare and often misdiagnosed, ACL enthesis tears in children can be treated by suture with satisfactory results. Careful analysis of plain films and an X-ray centered on the intercondylar notch often provide the diagnosis. In case of doubt, MRI, which is now more accessible, can prevent missing this entity. Improved standard surgical techniques and careful patient selection could make conservative treatment an option once again while avoiding the risks associated with ligament reconstruction technique.

Level of evidence: 4.

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1. Introduction

Anterior cruciate ligament (ACL) injuries, largely underestimated in children in the past, are now diagnosed with increasing frequency. Despite the increasing number of intra-ligamentary injuries, intercondylar eminence fractures are the main cause of ACL tears in skeletally immature patients [1]. Indeed, ligaments are more resistant than the epiphyseal insertion sites, increasing the risk of avulsion fractures tearing a more or less large fragment of bone or cartilage.

In our practice we have managed ligament avulsion fractures that tear a thin strip of cartilage or bone at the femoral or more frequently the tibial insertion site of the ACL. These are easy to miss because of apparently normal standard emergency X-rays. Despite

improved understanding of the diagnostic features of this entity only one series [2] and a few “case reports” [3–8] have described the management and results of these rare injuries.

Although the results of primary ACL ligament reconstruction are disappointing in children and in adults [1,9], recent data suggest that more reliable results could be obtained by better patient selection [2,10–12]. We hypothesized that conservative treatment of these injuries could reduce the number of patients requiring later ligament reconstruction.

The goal of this study was to report our experience in the management of these patients using an open surgical epiphyseal suture-reinsertion technique for a period of nearly 30 years.

2. Materials and methods

This single center retrospective study in 14 patients presenting with ACL enthesis tears identified by the code of medical acts for

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Table 1
Patient characteristics during the initial injury.

Patient n°	Sex/age at surgery (years)	Side	Mechanism of injury	Delay (days)	Injuries at surgery	Additional tests	Injury visible on X-ray
1	F/12	R	Soccer	4	Distal avulsion	Radio	No
2	M/10	R	Rugby	8	Proximal avulsion + MCL	Radio	No
3	F/12	R	Domestic (pivot)	21	Proximal avulsion	Radio	No
4	M/14	L	Motor scooter	1	Distal avulsion ACL + Proximal avulsion of the PCL + MCL	Radio	Yes
5	F/10	R	Domestic (pivot)	1	Distal avulsion	Radio	Yes
6	F/11	L	Soccer	2	Distal avulsion	Radio	Yes
7	M/15	R	Motor Scooter	1	Distal avulsion	Radio	Yes
8	M/11	L	Domestic (pivot)	21	Proximal avulsion + MCL	Radio + CT	Yes
9	M/13	R	Bike	1	Distal avulsion + Tibial fracture + Patellar fracture + Medial meniscus	Radio + CT	Yes
10	M/16	L	Motor scooter	550	Distal avulsion + LCL	Radio + MRI	Yes
11	F/13	R	Track	7	Distal avulsion	Radio + CT	Yes
12	M/9	R	Ski	35	Distal avulsion	Radio + MRI	Yes
13	M/15	L	Soccer	90	Distal avulsion + Lateral meniscus	Radio + MRI	Yes
14	M/16	R	Motorcycle	150	Proximal avulsion	Radio + MRI	Yes

suture-reinsertions of injuries to the central pivot was performed between January 1, 1986 and January 1, 2014.

Patient characteristics at the initial injury are summarized in Table 1. The series included 9 boys and 5 girls, mean age at surgery 12.5 years old (9–16). Most injuries occurred during sports (7 cases), followed by motorcycle or motor scooter accidents (4 cases) then domestic accidents (3 cases). The series included 4 proximal ACL avulsion fractures and 10 distal avulsion fractures.

Radiographic results were carefully evaluated to identify a thin bone lamella at ACL insertion sites (Figs. 1 and 2). These lesions were identified in 2 cases of proximal avulsion and 9 cases of distal avulsion. Eight patients underwent preoperative CT or MRI. These tears were systematically detected when these techniques were used (Figs. 3 and 4).

Ten patients underwent surgery within three weeks after the initial injury and 4 after this. The latter patients were first immobilized for 1 to 2 months, and presented with secondary instability. An MRI was then performed to obtain a diagnosis. Three of them underwent surgery within 6 months and one within 18 months after the initial accident.

Six patients presented with several associated injuries. Two patients presented with medial collateral ligament (MCL) tears and 1 patient with a lateral collateral ligament (LCL) tear which were also reinserted by suture. One patient presented with a tear in the posterior horn of the lateral meniscus that could not be sutured but was treated by regularization. One patient presented with a distal ACL avulsion fracture, a proximal posterior cruciate ligament (PCL) avulsion fracture that was repaired by the same technique and an MCL tear. Finally, one patient presented with a complex knee injury associating a distal ACL avulsion fracture, fracture of the proximal tibial metaphysis, a patellar fracture and a full length tear of the posterior horn of the medial meniscus; the fractures were treated by internal fixation and the meniscal tear was treated by suture.

2.1. Surgical procedure

Lesions were repaired by open transosseous epiphyseal suture using absorbable sutures (2 to 4 sutures) with a U-suture at the end of the involved ACL. Intraosseous tunnels were created with a K-wire either through the lateral femoral condyle or the medial



Fig. 1. Lateral X-ray of distal avulsion ACL fracture in a 9-year-old boy.



Fig. 2. Lateral X-ray of a proximal avulsion fracture of the ACL in a 16-year-old boy.

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