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Clinical Case Report

Reconstruction with Mixed Technique of Tibial Spine Fracture with Anterior Cruciate Ligament Injury, about a Rare Case

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Abstract

Today children constantly gain greater sports skills compared to previous decades. Sometimes, the incorporation of sports skills occurs opportunely in the daily game, which in most cases is without the supervision of a professional in the area or without the necessary security measures. Beside the fact that it is not recommended or demonstrated by studies. Such as the meta-analysis recently reported by Neruu., et al. in Atlanta, early professional training occurs among children from 8 to 12 years of age, having serious consequences in the child patient with acute injuries that in some cases become chronic [1].

Keywords: Tibial Spine; Fracture; Anterior Cruciate Ligament; Injury

Abbreviations

According to the study of Same t and collaborators in Chicago, they report an increase in the prevalence of sports injuries in child patients, with the transition fromprepubertal to pubertal age as a risk factor for certain specific injuries due to the growing bone configuration of the patients. Among these, the most frequent were the elbow, knee and hip. The methods to reach the diagnosis depends on the type of fracture and its location [2].

One of the most common injuries secondary to both professional and non- professional physical activities in patients between 8 and 12 years of age are knee injuries globally, but between these we find a particularly rare one, which is the fracture of the tibial spine that will be described and discussed in the clinic case below.

The fracture of the tibial spine is a type of bone injury that occurs in the most of casesin children and adolescent patients, with an avulsion fracture of the tibial spine, being equivalent to damage or avulsion of the anterior cruciate ligament (LCA) in adults. This type of injury is rare, considering that every year 3 out of 100,000 children present it. Frequently, its initial study is with an Ap and Lateral R of the knee, and later it is studied with CT or with MRI to determine soft tissue damage [3].

The pathophysiology of this fracture depends of to the quality of the developing boneand its incomplete ossification. The main mechanism of action for getting this bone injury is while the knee presents a pivot-type action or with slight flexion and rapid external rotation with the leg in support then the ACL traction the tibial spine obtaining the avulsion of this last one [3].

Fractures of the tibial spine have gone through several classifications to describe theseverity of the fracture, among these we have the classification by Meyers -McKeever and Zaricznyi in which they describe the displacement and comminution ofthe fracture to guiding the treatment, with orthopedic or surgical technics. While the last classification proposal was by M. Green who, through MRI, tries to classify fractures and soft tissue damage, being the most frequent the intermeniscal ligamentinjury with its interposition into the fracture making the reduction impossible, and theless frequently damage to the anterior horn of the medial meniscus or osteochondrallesions. However, a definitive classification has not yet been made to determine thetechnique and surgical procedure of choice prior to surgery [4,5].

Once the type of fracture is defined, the treatment technic must be defined accordingto the severity, available materials and the skill of the surgeon.

As injuries involving the tibial spine have increased, there has been an increase in surgical techniques, osteosynthesis materials, and a direct or arthroscopic approach. However, in a cohort study

carried out by Callanan., *et al*. at the Boston hospital, they followed up 67 patients and determined that the best surgical methodfor the treatment of patients with tibial spine fractures is screw fixation compared tosuture although without a statistically significant difference [6].

In addition, in the review carried out by Strauss., *et al*. on arthroscopic management,principles and techniques, they exposed certain advantages and disadvantages of this procedure compared to open surgery. The most important is the fast of the patient, a decrease in hospitalization an morbidity. While in open surgery, a direct view of the fracture feature is achieved that would help the surgeon to performa more precise fixation during the procedure, reducing the margin of error in situations with complex fractures [7].

Despite all that has been described, in some cases tibial spine fractures can be verycomplex to diagnose and treat, due to the different characteristics of fractures or associated soft tissue injuries, and at the time of surgery may require maximum careand skills of the surgeon. As is the case that will be presented below, a tibial spine fracture with an associated lesion of the anterior cruciate ligament at the insertion site of more than 90%, which had not been previously described in the literature.

Clinical case

Clinic history

- **Anamnesis:** 10-year-old female patient, without morbid history, without menarche. While she skates down the slope at high speed, tries to get off without braking, shepresents a fall with knee support in external rotation and extension on the right knee.She evolves with intense pain, functional impotence, and soft tissue volume increase.

Physical exam

He is admitted stable, without respiratory distress, Glasgow 15.

- **Right knee:** increased volume, pain with minimal flexion and extension, impossibilityof axial load. Global joint effusion and preserved distal neurovascular.

Complementary exams

Through AP - lateral knee x-rays and CT of the knee, a fracture of the tibial spine was determined with a posterior rotation of the fragment of approximately 5 mm (Figure 1).

The first care was to immobilize the patient with the leaflet in extension and an MRIwas requested in which extensive hemarthrosis was observed, an apparent grade IIlesion of the anterior cruciate ligament (ACL), fracture of the tibial spine with posterior rotation of the fragment without soft tissue interposition associated with chondral injury of the lateral femoral condyle due to grade 1 kickback according to the International Cartilage Repair Society - (ICRS) classification (Figure 2) [8].

Figure 1

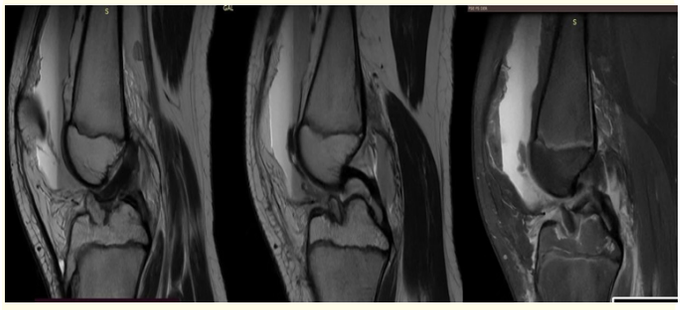

Figure 2

Initial diagnostic

Tibial spine fracture of the right knee, Meyers and McKeever IV - Green classificationI.

Treatment and evolution

A diagnostic arthroscopy was performed 12 days later, where a fracture of the tibialspine was observed with a fragment displaced posteriorly with rotation, in addition to a lesion of more than 90% of the anterior cruciate ligament insertion area, withoutthe possibility of reduction and fixation with arthroscopic technic. The surgical plan was changed, an antero-medial approach was performed, reduction and fixation under direct vision with a 3.5 cannulated screw of 25mm plus a distal reinsertion of the anterior cruciate ligament with a trans-tibial bone tunnel and fiber wire suture. (Figure 3 and Figure 4).

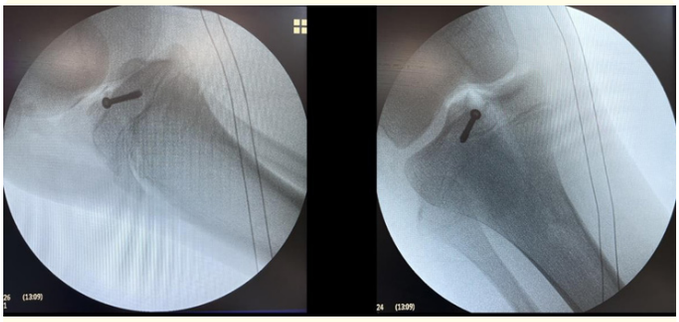

Figure 3

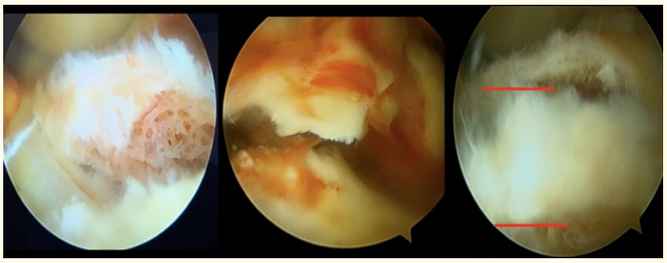

Figure 4

The procedure was performed without incidents with an adequate reduction observed by fluoroscopy. The patient was discharged the following day with a plastercast.

Weekly and monthly control with radiography was performed, maintaining thereduction with adequate signs of consolidation. A month later, an articulated knee brace was installed at 30° and rehabilitation began with assisted motorkinesiotherapy.

Discussion

In the last 3 decades, there has been an increase in the incidence of tibial spine fractures, due to causes such as sports injuries, high-impact or high-load accidents,and thanks to diagnostic progress, it has been possible to classify and treat this typeof fracture in a correct before complications appears, improving the prognosis and rapid recovery of patients [9].

Fractures of the tibial spine are described as chondro-epiphyseal avulsion of the ACL insertion on the anterior tibial spine. Meyers and McKeever classified these injuries in 1959 as type I nondisplaced, partially displaced or articulating (type II) andfully displaced type III fractures. Type III fractures were subdivided into unrotated and rotated. This classification was modified by Zaricznyj to include type IV comminuted avulsion fractures [10,11].

The anterior horn of the medial and lateral meniscus, and the intermeniscal ligament,can be interposed in the fracture when there is a greater displacement, with the intermeniscal ligament being the most frequently interposed structure [10]. Type IVfractures are more difficult to reduce and fix, having problems in early rehabilitation and risk of stiffness [11].

In the year 2021, Green., *et al*. demonstrate the importance of a more reliable image,nuclear magnetic resonance to define the possible lesion or interposition of soft tissues in the fracture focus, which could indicate intraoperative difficulty [12].

In different study groups, such as Melugin., *et al*. they demonstrate the importance of early fixation and post-surgical rehabilitation in patients with tibial spine fractures,in their study published in 2018 with 42 patients comparing between 2001 and 2015.In addition to patients with tibial spine fracture versus patients with injury to the anterior cruciate ligament only, those with tibial spine fracture without lig repair.

Crossed, present more post-surgical anterior laxity and a higher rate of arthrofibrosis.However, despite a long history of time, they do not describe any patient with combined lesions of the anterior cruciate and tibial spine fracture simultaneously [13].

The case presented, a Type IV fracture of the tibial spines according to Meyers andtype II according to Green, underwent a diagnostic and possibly therapeutic arthroscopic procedure, however, as described, the anatomical structure seen underarthroscopy was different from that analyzed in the MRI, observing almost complete injury to the anterior cruciate ligament in addition to a complex fracture of the tibial spine; event not previously described in the literature. Lí., *et al*. show us that the boneanatomy of the children, the tibial spine is counted as a protective factor for major lesions of the anterior cruciate ligament, this is one of the causes of the deficiency of case reports such as the one being analyzed now [13].

But, are these images sufficient as a diagnostic method to accurately describe the lesion, surgical plan and possible new surgeries in these patients?

In this case, the arthroscopic procedure allowed a better visualization of the anatomyat the fracture site and to make better decisions about the surgical method.

It is worth mentioning that there is no literature described so far on failures in surgicalplanning - reoperations in patients with tibial spine fractures plus associated injuries,due to false negatives in the diagnostic scores used to define treatment and prognosis of injuries.

Adán., *et al*. also visualized that imaging methods such as CT and MRI can provide non-specific or incomplete data on soft tissue lesions, which can only be accurately determined under direct or arthroscopic vision [14].

Finally, observing the current evolution of the diagnosis and treatment of anterior cruciate ligament injuries in pediatric patients, it was carried out in the department of orthopedics at the University of California, San Francisco, USA; an analytical study of the 50 most cited articles on this topic to compare the impact and quality of evidence on this type of injury. As a conclusion, it was reached that even though the evidence and studies are recent, they had a low level of evidence and a poor methodological quality score. Demonstrating once again the importance of increasing the statistical base and studies on childhood traumatic knee injuries, especially in tibial spine fracture injuries and possible damage to soft structures [15,16].

In addition, it is important to describe that according to Mayo., *et al.*, in a cohort of 129 patients with tibial spine fracture, they analyze the percentage of injuries associated with the fracture. Of these, 19% of the patients had an ACL injury, of which the predominant sex was male, the fractures with the highest number of relationships with ACL damage were type II and III fractures according to Meyers and Mckeever, statistically significant data. In addition, the low sensitivity of MRI in ACL injuries concomitant to tibial spine fracture was described, some of the ACL injuries being recognized at the intraoperative moment, however they do not describe the type of complete or incomplete injury [17].

Conclusion

For this reason, researchers ask the question: is a single imaging method sufficient for the diagnosis and surgical planning of tibial spine fractures? and, is diagnostic arthroscopy necessary in all patients with Meyers and Mckeever 2 and Green 1 tibial spine fractures? Being the report of this clinical case, an important premise for possible future studies, and teaching about the importance of a new arthroscopy vision prior to decision making and defining the patient's prognosis.

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