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Cyclops-type Injury after Tibial Spine Fracture: Case report

Lesion tipo Ciclops post fractura de espinas tibiales: Reporte de caso

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Abstract

A tibial spine avulsion fracture is an intra-articular fracture of the bony insertion of the ACL on the tibial plateau, most seen in children and adolescents aged 8 to 14 years. Its incidence has been reported to be between 2% and 5% in the pediatric population, but it is rare in adults. The cyclops lesion is a fibrous proliferation of granulation tissue that forms a soft tissue nodule, limiting extension, and is one of the possible complications of the arthroscopic management of this type of fracture. We report the case of a 25-year-old patient who sustained a tibial spine avulsion fracture, underwent successful anatomical reduction arthroscopically, and subsequently developed extension loss in the postoperative period. Her MRI study revealed a cyclops lesion that required arthroscopic debridement.

Keywords
- Cyclops
- arthrofibrosis
- tibial spine avulsion fracture
- rigidity
- lost extension

Resumen

La fractura de espinas tibiales es una fractura intraarticular de la inserción ósea del LCA sobre el platillo tibial, más común en niños y adolescentes entre 8 y 14 años de edad. Su incidencia se ha reportado entre 2% y 5% en la población pediátrica, pero son raras en adultos. La lesión tipo ciclops es una proliferación fibrosa de tejido de granulación, que genera un nódulo de partes blandas que limita la extensión, siendo una de las complicaciones posibles del manejo artroscópico de este tipo de fracturas. Se reporta el caso de una paciente de 25 años que cursó con fractura de espinas tibiales, donde se realizó una reducción anatómica satisfactoria de forma artroscópica y evolucionó con pérdida de extensión en el postoperatorio. Su estudio con RNM reveló una lesión tipo ciclops que requirió desbridamiento artroscópico.

Palabras clave
- Cíclope
- artrofibrosis
- fractura por avulsión de la columna tibial
- rigidez
- extensión perdida

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Introduction

A tibial eminence fracture, also known as a tibial spine fracture, is an intra-articular injury affecting the bone insertion of the Anterior Cruciate Ligament (ACL) into the tibial plateau. This pathology is particularly common in children and adolescents aged 8 to 14 years, since the epiphyseal plate at the ACL anchorage site offers less resistance to traction forces compared to the ligament itself. The incidence of this fracture is reported in the range of 2 to 5% within the pediatric population, being unusual in the adult population.[1]

Historically, the Meyers and McKeever (MM)[2] classification system has been the standard for categorizing tibial eminence fractures, distinguishing them into Type I (non-displaced), Type II (hinged), Type III (completely displaced but not rotated), and Type III+ (completely displaced with rotation). However, with the introduction of magnetic resonance imaging, the Green and Tuca (GT) classification emerged,[3] which offers a new perspective by dividing these fractures into Grade 1 (non-displaced or minimally displaced), Grade 2 (posterior hinge), and Grade 3 (posteriorly displaced, with meniscal/intrameniscal ligament entrapment, or extension to the tibial plateaus). Both injuries classified as Type III MM and Grade 3 GT require surgical treatment, as a conservative approach carries a higher risk of nonunion, increased residual laxity, and loss of range of motion.[4]

Fixation of tibial spine fractures is usually done with screws or sutures. Sutures are the preferred option for treating small avulsions or severely comminuted fragments, while screws are reserved for larger fragments. However, the use of screws may imply the need for a second surgical intervention for their removal, which occurs in up to 66% of cases.[1]

The cyclops-type lesion, also known as localized anterior arthrofibrosis, is characterized by the fibrous proliferation of granulation tissue. This condition was first described in 1990 by Jackson and Schaefer in relation to anterior cruciate ligament reconstruction (ACLR).[5] It is a fibrotic nodule that develops at the base of the graft and, by interfering with the femoral intercondylar notch, causes loss of knee extension. According to magnetic resonance studies, the incidence of this lesion after ACLR ranges from 33.0% to 46.8%, although its symptomatic incidence is only 1.9% to 10.9%.[6] Patients who develop symptoms generally show a loss of 20° extension, with symptoms progressing over 4 months after surgery. The "bounce test" has been described as a rubbery sensation at full knee extension with a rebound into flexion.[7]

This lesion is considered a possible cause behind the limitation in knee extension after reduction and fixation of tibial spine fractures, although it is scarcely reported. MRI has a sensitivity of 85.0% and a specificity of 84.6% in the detection of these lesions; for lesions larger than 10 mm, these values improve, reaching a sensitivity of 100% and a specificity of 91%; however, only 23% of patients with positive results on MRI are symptomatic.[8]

Standard knee arthroscopy is a commonly used procedure for the excision of this type of lesions. Calvisi described a technical variant that involves more proximal displacement of the midpatellar portal. This modification would improve visibility in the coronal plane and reduce crowding of the fat pad, making the removal of this lesion easier.[9]

Extrapolating from post-LRCA lesions, it is advised not to intervene on asymptomatic lesions, while those with symptoms should be treated surgically to restore normal joint biomechanics. It is essential to accurately delineate the margins of the lesion and ensure that there is no

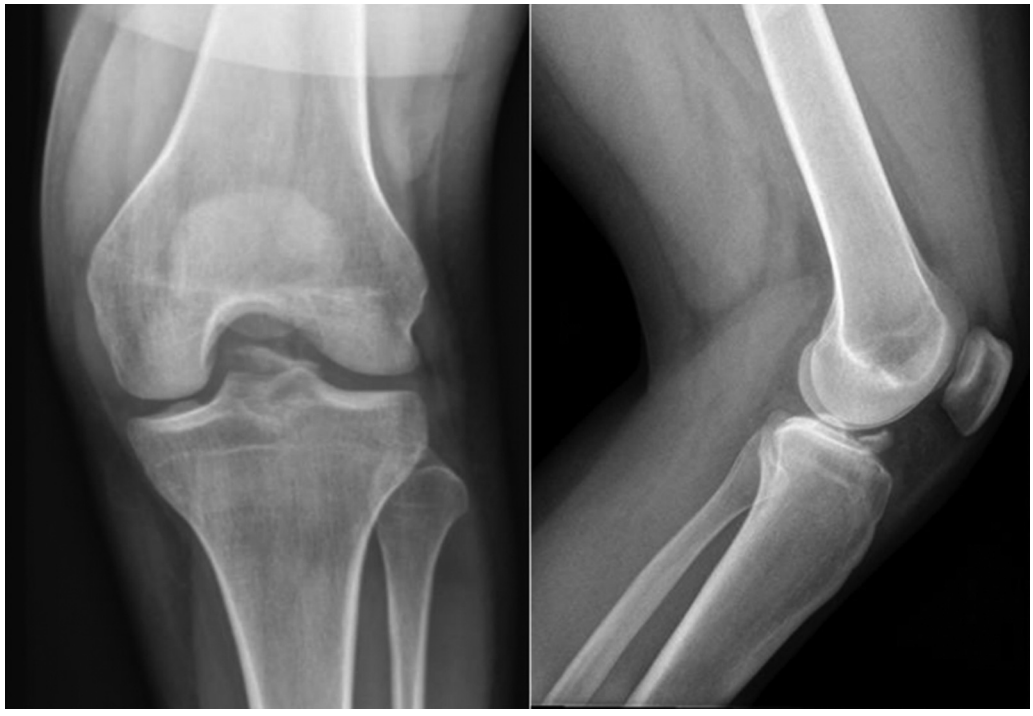

Fig. 1 Anteroposterior and lateral X-ray of the left knee showing fracture of the tibial spines, probably Meyers and McKeever type III.

Fig. 2 Coronal CT of the knee confirming fracture of the tibial spines with a large fragment and significant displacement, Meyers and McKeever type III+.

impingement during the procedure, which may include performing a "notchplasty" if required. Surgical removal of the lesion within the first 12 weeks after detection usually has favorable results, with most patients regaining full range of motion within weeks of surgery. The prognosis for these cases is generally positive, with only one recurrence reported in a study involving 33 cases.[8]

This review presents the case of a 25-year-old woman who experienced a tibial spine fracture. Treatment consisted of arthroscopic reduction and fixation using sutures and a screw. The patient subsequently developed a cyclops-type lesion as a complication.

Case Report

A 25-year-old woman with no history of previous illnesses or surgeries suffered a fall while skiing. She reported a clunky feeling, pain, effusion, and functional impotence of her left knee. Physical examination revealed significant effusion, anteroposterior instability, Lachman ++ and anterior drawer ++ tests, while pivot shift could not be assessed. Range of motion (ROM) was 0° extension to 60° flexion.

X-rays (►**Fig. 1**), computed tomography (CT) (►**Fig. 2**), and magnetic resonance imaging (MRI) of the knee (►**Fig. 3**) confirmed a tibial spine fracture, classified as Type III+ MM or Grade 3 GT. It should be noted that the ACL was continuous, with a slight increase in the signal of its fibers.

Three days later, a reduction and fixation were performed arthroscopically, using a FiberWire suture with an ABS attachable button (Arthrex) assisted by Scorpion® forceps (Arthrex) and fixed to an anteromedial tibial tunnel. In addition, due to the size of the fragment, augmentation was used with a Mini-Monster® headless screw (Paragon 28®'s) of 3.5 × 30 mm (►**Figs. 4** and **5**), achieving a satisfactory anatomical reduction. The ACL and intermeniscal ligament were observed to be intact during surgery.

Initially, the patient progressed satisfactorily, with decreased soft tissue edema and progressive recovery of joint range. However, 2 months after surgery, a loss of extension of 5-10° was evident, with full flexion. Intensive physical therapy was continued until the third month after surgery, with no response. The patient was monitored with an MRI, which showed a cyclops-type fibrous scarring process in the anterior region of the ACL (►**Fig. 6**).

With this background, a diagnostic and therapeutic arthroscopy was performed, and a large fibrotic lesion anterior

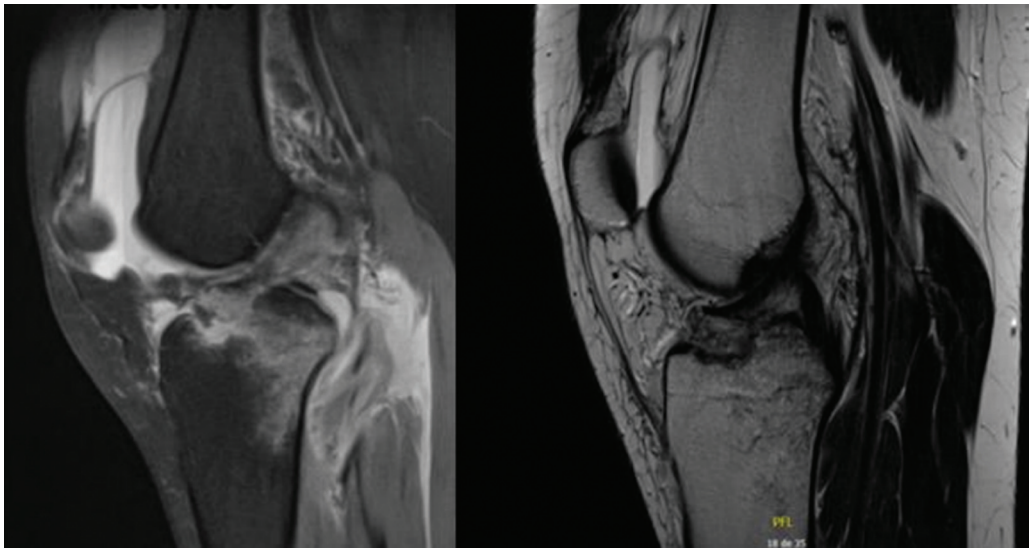

Fig. 3 Sagittal MRI projections of PD TSE FS and TSE T2 sequences showing avulsion of the tibial spines with interposition of the anterior horn of the medial meniscus. Grade 3 of the Green and Tuca classification.

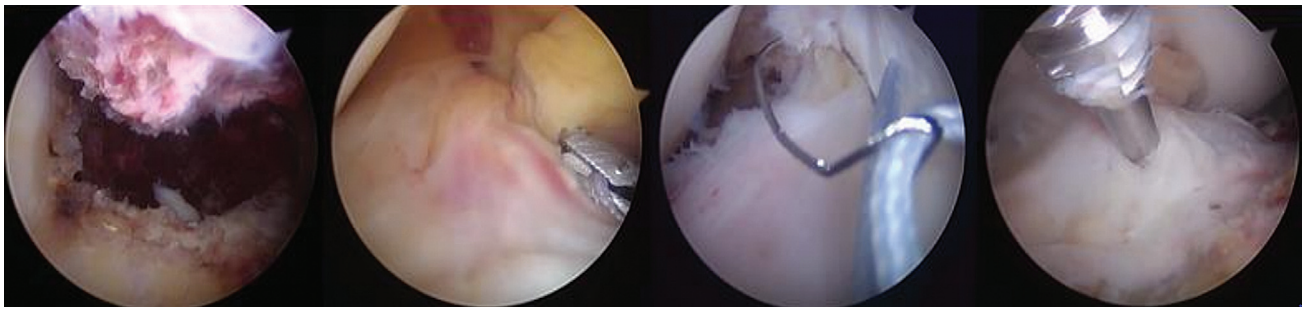

Fig. 4 Multiple intraoperative arthroscopic views, showing reduction and fixation with fiberwire and a mini monster screw.

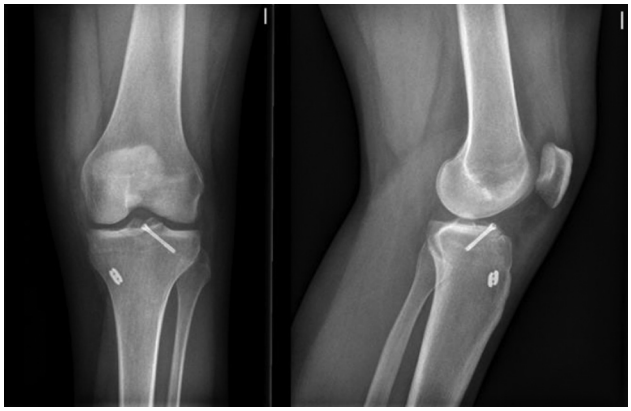

Fig. 5 Anteroposterior and lateral X-ray of the left knee. Control on the first postoperative day, showing an anatomic reduction of the fracture and correct position of the fixation elements.

to the ACL was found, joined to Hoffa fat and the anterior capsular region, measuring 35 × 50mm (►**Fig. 7**). A complete arthroscopic resection was performed, and the patient was mobilized under anesthesia, and finally 80mg depomedrol was injected intra-articularly (►**Fig. 8**). The intensive rehabilitation process was reactivated with intravenous analgesia and continuous passive mobilization from the first postoperative day, recovering full extension one month after surgery, and she was discharged with full ROM 6 months after this second surgery.

Discussion

The incidence of cyclops-type injury following surgical reduction and internal fixation of tibial spine avulsion is unclear and has rarely been reported. The incidence of arthrofibrosis is mainly reported and varies considerably. In the largest published case series, consisting of 205 patients treated arthroscopically with transepiphyseal sutures or screws, this study by Vander Have estimated that 10% developed arthrofibrosis, which was defined as a lack of 10° of extension and/or less than 90° of flexion at 3 months postoperatively.[10] Gans in 2013 reported the development of arthrofibrosis in 7.1% of Meyers and Mckeever type I and II tibial spine fractures and 14.2% of type III and IV fractures.[11] A 2007 study by Park, involving arthroscopic follow-up in 10 patients with arthroscopically treated tibial spine fractures, found that 2 patients had a decreased ability to extend the knee by 5 to 10° due to a cyclops-type injury.[8]

Despite multiple studies in published studies, no single predictive risk factor for cyclops-type injury has been identified, and therefore a multifactorial etiology seems likely. Risk factors described for this injury include: female sex due to narrow notch, bony avulsion of the ACL from the tibia or femur, increased graft volume relative to notch size, anterior placement of the tibial tunnel, double-bundle ACL reconstruction, cruciate-retaining arthroplasty due to ACL injury, and hamstring contracture; age, early RLCA, duration of partial weight-bearing, concomitant meniscal

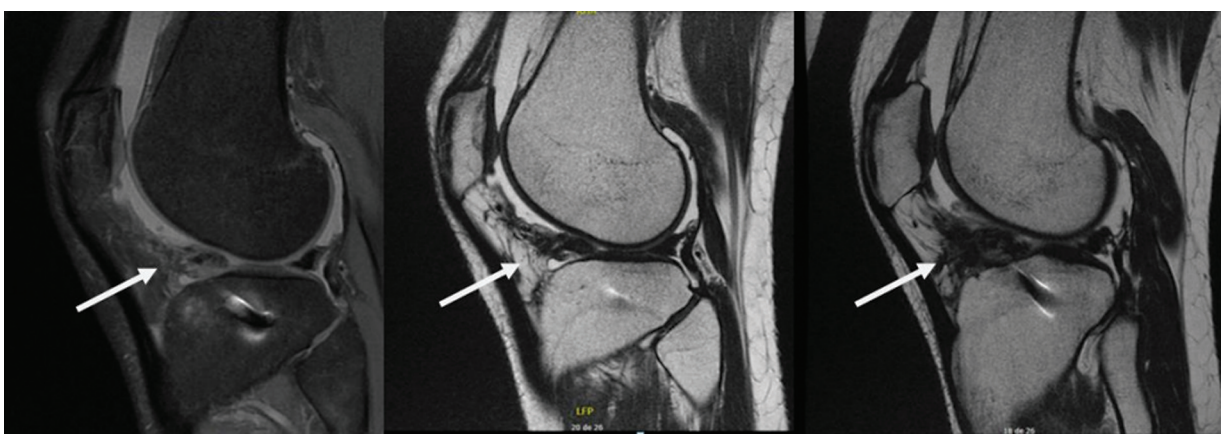

Fig. 6 Multiple MRI sections showing fibrotic process anterior to the ACL. No prominent osteosynthesis or poor reduction is observed.

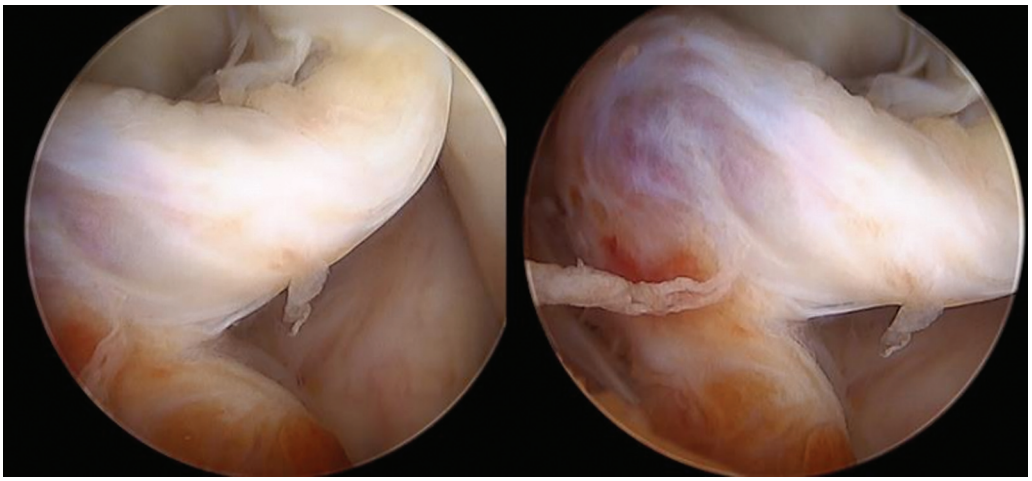

Fig. 7 Large fibrotic process anterior to the ACL compatible with a cyclops-type injury.

Fig. 8 Arthroscopic resection of the fibrotic process and complete release of the ACL without intercondylar impingement. No prominent osteosynthesis or poor reduction is observed.

surgery, or collateral ligament injury did not influence the results.[7]

Park suggests that these injuries may be due to drilling residue, use of Kirschner wires, or non-absorbable sutures, which cause synovitis, and his group removes the non-absorbable suture considering it a foreign body, observing local synovitis at the base of the ACL and in the tibial fracture.[8]

On the other hand, possibly in patients with poor reduction of the fracture of the spines, the impingement of the native ACL against the intercondylar notch could lead to repeated microtraumas with tearing of its fibers and the formation of a cyclops-type lesion.[7]

Conclusion

In those patients who develop extension deficits after reduction and fixation of a tibial spine fractures despite an adequate rehabilitation program and an anatomic reduction of the fracture, cyclops should be suspected as a mechanical cause of the extension deficit and should be studied with an MRI.

In our case, our patient presented the following risk factors: female sex and bone avulsion. In addition, the non-absorbable screw and suture could have generated repeated microtrauma against the intercondylar notch, generating inflammation and the development of the nodule. We believe it is of utmost importance to achieve an anatomic reduction and thoroughly corroborate that there is no impingement in the notch of both the ACL and our osteosynthesis material. In addition, we believe that, despite the little evidence in this regard, we should leave the least amount of residue from the perforations and traumatize the local tissue as little as possible during our reduction and fixation, avoiding too much local inflammation.

Extrapolating from the results of arthroscopic treatment of cyclops-type lesions after ACLR, and based on our experience, we believe that patients with symptomatic cyclops-type lesions should undergo arthroscopic treatment to resolve the problem within 12 weeks of detection. A more proximal midpatellar portal, as described by Calvisi may or may not be used, but the most important thing is to completely remove the lesion.

Conflict of Interest
None declared.

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