



Case Report

Fracture of the proximal extremity of the tibia after anterior cruciate ligament reconstruction: case report[☆]



Márcio de Oliveira Carneiro, Thiago de Almeida Monteiro*,
Marcos Renato Zenovello Bueno, Jorge Luis Augustin Júnior

Faculdade de Medicina de São José do Rio Preto (FAMERP), São José do Rio Preto, SP, Brazil

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ABSTRACT

We report a rare condition that has been little described in the literature: a fracture of the proximal extremity of the tibia after anterior cruciate ligament reconstruction using an autologous patellar bone-tendon graft. In this report, we discuss the factors that predisposed toward this episode, the treatment and the evolution of the case after the surgical treatment.

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Fratura da extremidade proximal da tibia após reconstrução do ligamento cruzado anterior: relato de caso

RESUMO

Relatamos uma condição rara, pouco descrita na literatura, que é a fratura da extremidade proximal da tibia após reconstrução do ligamento cruzado anterior com enxerto autólogo osso-tendão patelar-osso. Neste relato, discutiremos fatores predisponentes ao episódio, tratamento e evolução do caso após tratamento cirúrgico.

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Introduction

Reconstruction surgery on the anterior cruciate ligament (ACL) performed arthroscopically presents a high rate of good

results.¹ More than 100,000 new cases are performed in the United States every year.² However, this procedure is not free from complications,³ with an incidence rate of between 1.8% and 24%.⁴

[☆] Work developed at the Base Hospital, Faculdade de Medicina de São José do Rio Preto (FAMERP), São José do Rio Preto, SP, Brazil.

* Corresponding author.

E-mails: thiagomonteiro33@yahoo.com.br, goianomonteiro@yahoo.com.br (T. de Almeida Monteiro).

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Fig. 1 – Frontal radiograph on knee showing fracture of proximal tibia.

The complications that have been described include: arthrofibrosis, patellar fracture, “Cyclops” lesions, synovitis, patellar tendinitis, pain in the graft donor area and osteolysis,³ among others. The commonest of these is joint stiffness.⁴ Fracturing of the proximal tibia is a serious complication that has only been described in a few cases in the literature.^{5,6} In the present report, we describe this complication.

This case consisted of a fracture of the proximal extremity of the tibia that occurred in a patient 4.5 months after an arthroscopic operation to reconstruct the ACL.

Case report

The project for this study was approved by our institution’s research ethics committee under the protocol number 5985/2011.

The patient was a 17-year-old male who was attended at our hospital, with a history of spraining his left knee after stepping into a hole in the asphalt when crossing a street. He arrived at the emergency service with a condition of pain in his left knee and leg, accompanied by functional limitation and inability to bear weight on the affected leg. He said that he had undergone ACL reconstruction surgery 4 months previously, in which a graft from the ipsilateral patellar tendon had been used. Radiographs of the knee were produced in frontal and lateral views, from which an extra-articular fracture of the proximal tibia was diagnosed. The fracture line reached the region of the anterior tibial tuberosity (ATT), which was the site from which the bone plug for the bone-patellar tendon-bone graft had been harvested (Figs. 1 and 2). The patient underwent surgical treatment in which open reduction and internal fixation using a plate and screws were performed (Figs. 3 and 4). No loosening of the tibial interference screw that had been used in the ACL reconstruction was seen. The patient presented good evolution with the treatment that had been proposed and did not present any functional alterations or any alterations in specific tests for evaluating the reconstructed ACL. Consolidation of the fracture was achieved by the end of the



Fig. 2 – Lateral radiograph on knee showing fracture of proximal tibia.



Fig. 3 – Frontal radiograph after operation.



Fig. 4 – Lateral radiograph after operation.

fourth postoperative month. The patient returned to his recreational sports activities and rated his degree of satisfaction as high. One year after the operation, the implant was removed because of local discomfort that the patient reported (Fig. 5).

Discussion

Fracturing of the tibial plateau at the site of the tibial tunnel after ACL reconstruction has only been described a few times in the literature.^{5,6} Some published studies have reported occurrences of fractures of the tibial plateau following ACL reconstruction using autografts from the gracilis and semitendinosus.^{4,5} Others have used bone-patellar-bone grafts^{6,7} and allografts from the Achilles tendon.⁸ This event is probably independent of the graft used, but there are theories stating that the bone that is drilled through in order to construct the tibial tunnel is subject to stress that leads to fatigue when torsional forces are applied during flexion.⁸ The presence of a tibial tunnel is thought to act like a cortical defect, which is a factor predisposing toward fractures.^{5,7} In this regard, when a patellar graft is used, harvesting the bone plug would increase the susceptibility of the proximal tibia to fracturing. This has been well documented, since a cortical defect diminishes bone resistance in situations of torsional forces.⁹

In the case in question, the center of the fracture was in the donor area of the bone plug. This bone defect acted synergically in association with the drilling of the tibial tunnel, thereby increasing the zone of fragility and allowed tibial fracturing due to low-energy trauma.^{7,10,11}

Concentration of stress on an anterior point of the proximal tibia caused by fixation screws that alter the bone mechanics would also be a predisposing factor.⁷ Despite the lack of specific studies, a biomechanical study by Brooks et al. found that drilled holes with diameters greater than 20% of the bone width decreased the torsional capacity by 55%.¹² One additional factor that might play a role in fracture development following ACL reconstruction is widening of the bone tunnel, which may occur in up to 68% of the cases.¹³ The factor causing this is still unknown, but it is believed to be an autoimmune phenomenon even though no research has confirmed this hypothesis.

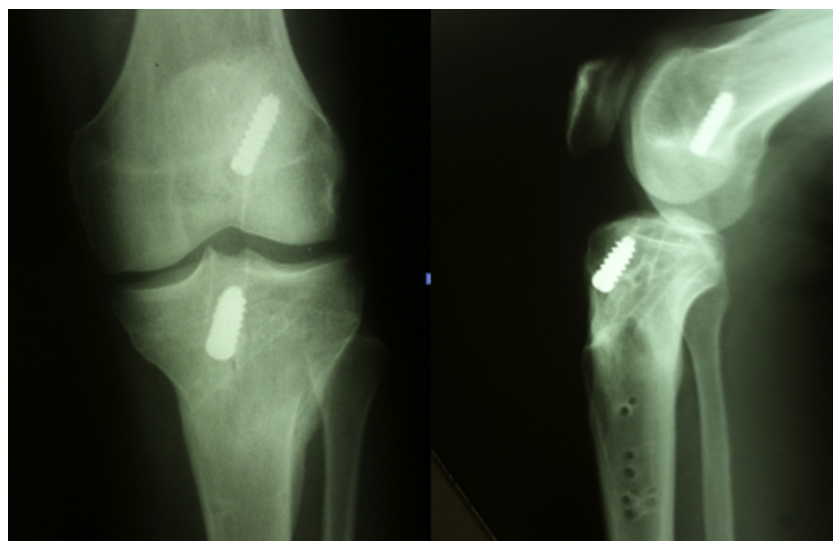


Fig. 5 – Twelve months after operation, after removal of synthesis material.

Most authors have opted to perform surgical treatment on these fractures, with open reduction and fixation using plates of a variety of models, even though this is a difficult surgical procedure secondary to a surgical complication. Most of the cases described evolved well through the treatment.

In the case reported here, surgical treatment was also chosen, with medial access to the proximal tibia and positioning of an L-shaped support plate. The patient evolved without immediate or late complications and presented full range of motion and consolidation of the fracture 4 months after the treatment.

Fracturing of the tibial plateau after arthroscopic ACL reconstruction is a rare complication that is still little described in the literature. Studies have shown good evolution of this complication following surgical treatment, even though the procedure has a high degree of technical difficulty. In the case reported here, the patient evolved satisfactorily after the operation, with consolidation of the fracture of the left tibial plateau, achievement of full range of motion of the knee joint, a return to work activities and even a return to recreational soccer practice.

Conflicts of interest

The authors declare no conflicts of interest.

REFERENCES

1. Anderson AF, Snyder RB, Lipscomb AB Jr. Anterior cruciate ligament reconstruction. A prospective randomized study of three surgical methods. *Am J Sports Med.* 2001;29(3):272-9.
2. Owings MF, Kozak LJ. Ambulatory and inpatient procedures in the United States, 1996. *Vital Health Stat 13.* 1998;(139):1-119.
3. Graf B, Uhr F. Complications of intra-articular anterior cruciate reconstruction. *Clin Sports Med.* 1988;7(4):835-48.
4. Wiener DF, Siliski JM. Distal femoral shaft fracture: a complication of endoscopic anterior cruciate ligament reconstruction. A case report. *Am J Sports Med.* 1996;24(2):244-7.
5. Sundaram RO, Cohen D, Barton-Hanson N. Tibial plateau fracture following gracilis-semitendinosus anterior cruciate ligament reconstruction: the tibial tunnel stress-riser. *Knee.* 2006;13(3):238-40.
6. Delcogliano A, Chiossi S, Caporaso A, Franzese S, Menghi A. Tibial plateau fracture after arthroscopic anterior cruciate ligament reconstruction. *Arthroscopy.* 2001;17(4):E16.
7. Mithöfer K, Gill TJ, Vrahas MS. Tibial plateau fracture following anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc.* 2004;12(4):325-8.
8. El-Hage ZM, Mohammed A, Griffiths D, Richardson JB. Tibial plateau fracture following allograft anterior cruciate ligament (ACL) reconstruction. *Injury.* 1998;29(1):73-4.
9. Johnson BA, Fallat LM. The effect of screw holes on bone strength. *J Foot Ankle Surg.* 1997;36(6):446-51.
10. Morgan E, Steensen RN. Traumatic proximal tibial fracture following anterior cruciate ligament reconstruction. *Am J Knee Surg.* 1998;11(3):193-4.
11. Moen KY, Boynton MD, Raasch WG. Fracture of the proximal tibia after anterior cruciate ligament reconstruction: a case report. *Am J Orthop (Belle Mead NJ).* 1998;27(9):629-30.
12. Brooks DB, Burstein AH, Frankel VH. The biomechanics of torsional fractures. The stress concentration effect of a drill hole. *J Bone Joint Surg Am.* 1970;52(3):507-14.
13. Webster KE, Feller JA, Hameister KA. Bone tunnel enlargement following anterior cruciate ligament reconstruction: a randomised comparison of hamstring and patellar tendon grafts with 2-year follow-up. *Knee Surg Sports Traumatol Arthrosc.* 2001;9(2):86-91.