



Osteochondral Segond Fracture Associated with Fibular Head Avulsion Fracture – “Arcuate Sign”*

Fratura osteocondral de Segond associada a fratura avulsão da cabeça da fíbula – “Sinal do arqueado”

Frederico Silva Pimenta¹ Renata Gabriela Pereira Cunha¹ Lorrán Fabrini de Araújo Rocha¹
Arthur Ribeiro Oliveira¹ Marco Tulio Lopes Caldas¹ Thiago Saldanha Gonçalves¹

¹ Hospital Maria Amélia Lins, Belo Horizonte, MG, Brazil

Rev Bras Ortop 2021;56(4):533–536.

Address for correspondence Frederico Silva Pimenta, MSc, Rua do Campo 130, apto. 802, Vila da Serra, Nova Lima, Minas Gerais, CEP 34006-062, Brazil (e-mail: fredericopimenta86@hotmail.com).

Abstract

A deviated osteochondral fracture of the anterolateral tibia associated with fibular head avulsion in a 50-year-old patient is reported. In general, avulsion fracture of the iliotibial tract is associated with injuries in the cruciate ligament, in the meniscus and in lateral knee structures, as in the case herein reported.

Keywords

- knee injuries
- tibial fractures
- femoral fractures

Resumo

Uma fratura osteocondral desviada da tíbia anterolateral associada a avulsão da cabeça da fíbula em um paciente de 50 anos é relatada. A fratura avulsão do trato iliotibial em geral está associada a lesões do ligamento cruzado, do menisco e das estruturas laterais do joelho, como no caso em questão.

Palavras-chave

- lesões no joelho
- fraturas da tíbia
- fraturas do fêmur

Introduction

Avulsion knee fractures are due to high-energy trauma. Among these lesions, Segond fracture and the “arcuate sign” avulsion of the head of the fibula stand out. The term *Segond fracture* is used to describe an avulsion of the antero-lateral tibia, and *arcuate sign* refers to fibular head avulsion, since in these lesions there is the avulsion of the arched

complex, which consists of the fabellofibular, popliteal fibular and lateral collateral ligaments.^{1–4} The mechanism of injury involves a varus stress and internal rotation of the tibia. These lesions, if not recognized and treated, lead to chronic knee instability.

Case Report

A 50-year-old male patient, victim of a motorcycle hit-and-run presented to the emergency sector complaining of pain and increased volume in the left knee.

* Work developed at Hospital Maria Amélia Lins, Belo Horizonte, MG, Brazil.

received

September 6, 2019

accepted

November 29, 2019

published online

March 23, 2020

DOI <https://doi.org/10.1055/s-0040-1702956>.

ISSN 0102-3616.

© 2020. Sociedade Brasileira de Ortopedia e Traumatologia. All rights reserved.

This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Thieme Revinter Publicações Ltda., Rua do Matoso 170, Rio de Janeiro, RJ, CEP 20270-135, Brazil

Physical examination

The motion range of the knee was limited to 40° of flexion due to pain and joint stroke; the patient had pain at palpation of the anterolateral proximal tibia and fibular head. He presented +3 aperture in the varus stress at 0° and 30° of flexion and without opening in the valgus stress. The Lachman test was positive, and the reverse Lachman was negative, and did not present posterior tibia fall. The neurovascular examination did not present alterations.

Imaging exam

Radiographs of the knee were performed in the anteroposterior (AP) and profile incidences, and a huge opening of the lateral joint space was evidenced, with a large bone fragment of the anterolateral tibia and a small avulsion of the fibular head (►Fig. 1 A and B)

Due to knee instability, transarticular external fixation of the knee was performed in the emergency room (►Fig. 1 C)

Surgical Technique

The surgical procedure was performed twelve days after the injury, after improvement of the soft-tissue edema. After spinal anesthesia, the external fixator was removed, and a new physical examination of the knee was performed, showing positive anterior drawer and Lachman, negative posterior drawer and sag test, positive +3 varus stress at 0° and 30° of flexion, and negative valgus stress. Stress radiographs using an image intensifier were obtained, and they

revealed an enormous opening of the lateral joint space, and posterior stress drawer showed no posterior translation of the tibia (►Fig. 2 A and B).

Lateral surgical access was performed between the head of the fibula and the Gerdy tubercle towards the lateral epicondyle. A huge osteochondral fragment diverted from the anterolateral tibia was verified and inserted into the iliotibial tract, measuring 3 cm x 1.5 cm. The anterior horn and lateral meniscus body were shifted to the intercondylar eminence, and there was avulsion of the collateral ligament of the fibular head. A small bone fragment of the fibular styloid avulsed with the femoral biceps tendon (►Fig. 3 A-C). ►Figure 3 B shows the osteochondral fragment of the anterolateral tibia that was fixed after anatomical reduction with Hebert screws as described subsequently.

The fixation of the osteochondral fragment of the anterolateral tibia was performed with three Hebert screws; the lateral meniscus was sutured and the lateral collateral ligament and the femoral biceps tendon were reinserted into the fibula with two anchors. Lateral retinaculum was repaired (►Fig. 4 A-D).

After surgery, the support was removed for six weeks, and we used an unarticulated brace that was removed daily to enable knee movement restricted to 90° of flexion in the first 4 weeks. After six months of surgery, the patient is without complaints to perform his daily life and work activities, with a range of motion from 0° to 120°, without opening in the knee varus stress. We decided not to reconstruct the anterior cruciate ligament in the first surgical period due to the increased possibility of postoperative joint stiffness. Reconstruction of this ligament will be performed in the second

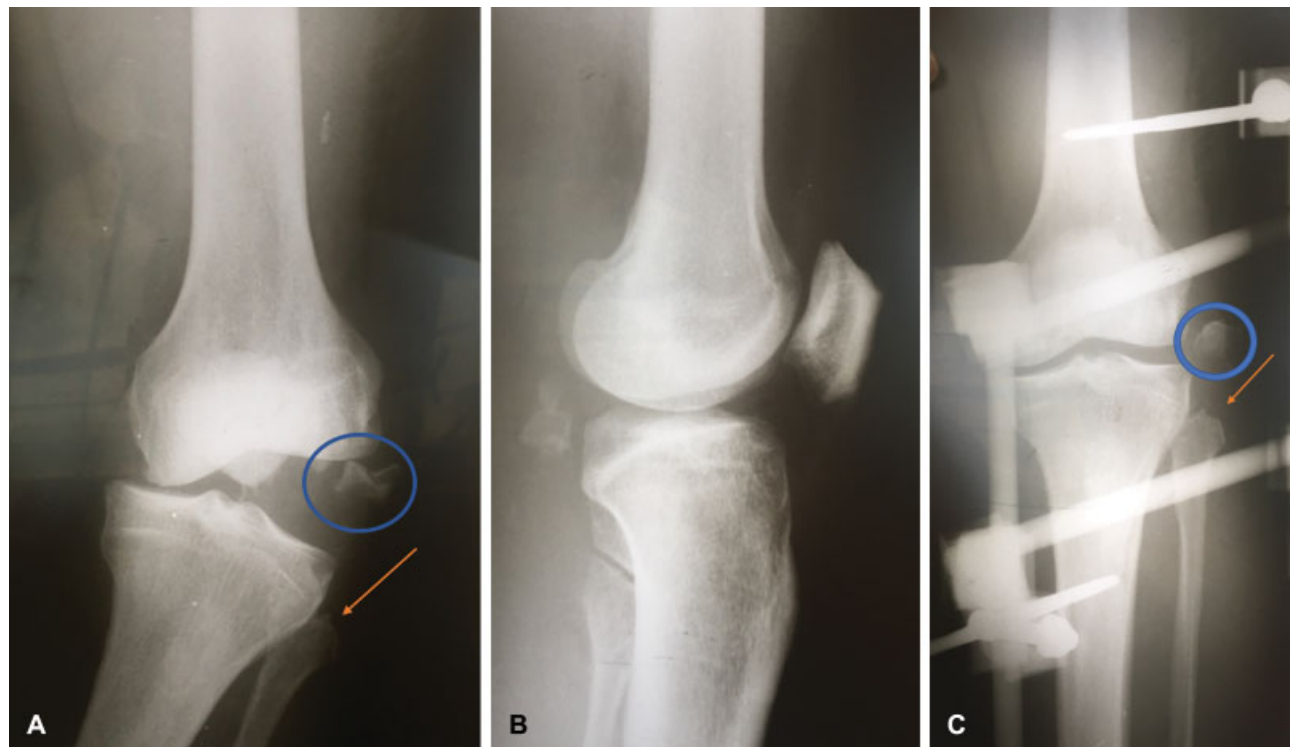


Fig. 1 (A) Anteroposterior (AP) radiograph of the opening of the lateral joint space and bone fragment of the anterolateral tibia (circle) and avulsion of the head of the fibula (arrow). (B) Profile radiograph. (C) Radiograph after transarticular external fixation.

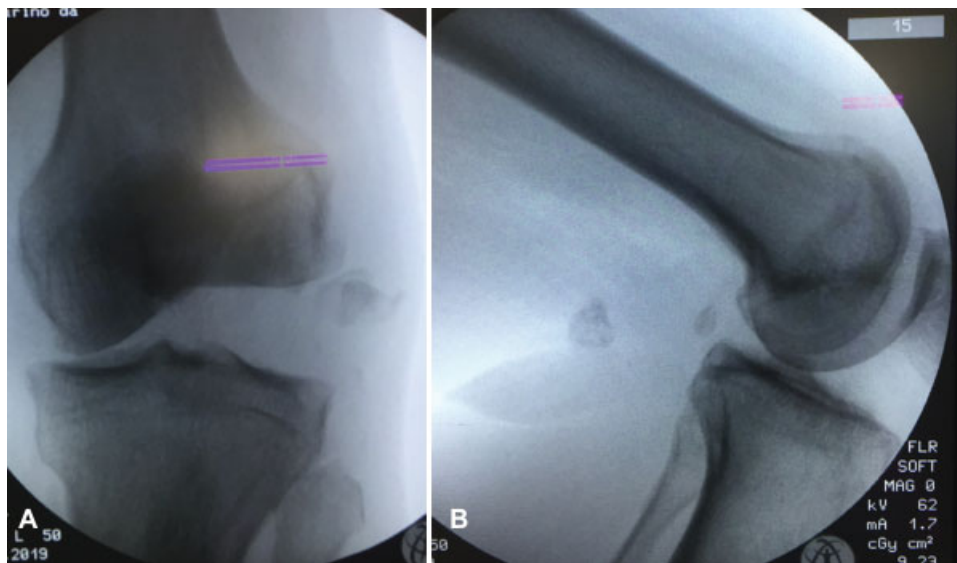


Fig. 2 (A) Imaging exam under varus stress showing an enormous opening of the lateral joint space and in (B) the posterior drawer under stress without posterior translation of the tibia.

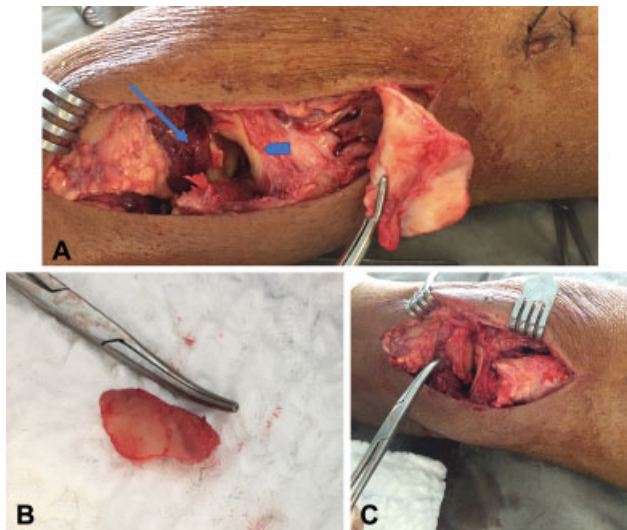


Fig. 3 (A) Osteochondral fragment inserted into the iliotibial tract and (B) osteochondral fragment of the anterolateral tibia. (C) Fragment repositioned on the tibial plateau. The arrow indicates a bone defect on the tibial plateau, and the arrowhead indicates the lateral meniscus.

half of the treatment if the patient complains of knee instability.

Discussion

The present article reports a rare event that is a large osteochondral fragment of the diverted anterolateral tibia, Second fracture, associated with avulsion fracture of the head of the fibula, arcuate sign, which led to enormous knee-joint instability.

The iliotibial tract, the lateral collateral ligament, the femoral biceps tendon, and the joint capsule are responsible for lateral-knee stability. The term *Second fracture* is used to describe an avulsion of the anterolateral tibia into which iliotibial-tract fibers and the anterolateral ligament are

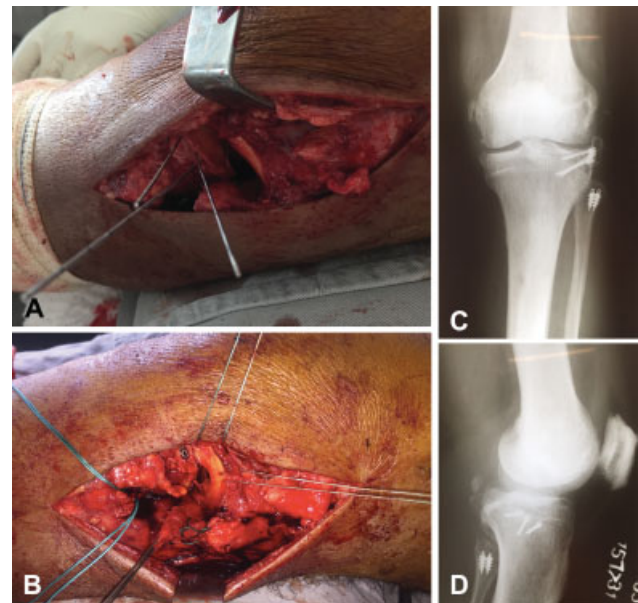


Fig. 4 (A) Fixation of the osteochondral fragment with Hebert screws. (B) Repair of the lateral meniscus, of the lateral collateral ligament, and of the femoral biceps tendon. (C and D) Postoperative AP and profile radiographs.

inserted. The arcuate sign describes an avulsion fracture of the proximal fibula into which the popliteal fibular, fabello-fibular and lateral collateral ligaments are inserted. The mechanism of injury involves varus stress and internal rotation of the tibia.⁵⁻⁸ These lesions, if not recognized and treated, lead to chronic knee instability.

The isolated lesion of the iliotibial tract is rare because it involves a mechanism in which only forces in varus are acting, and it is known that, during trauma, multidirectional forces are responsible for the injury. Second fractures are more frequently associated with injuries in the cruciate ligament, in the meniscus and in lateral knee structures, as in the case in question.⁹

No studies were found in the literature that revealed an association of Segond fracture and avulsion fracture of the head of the fibula. Fay et al¹⁰ reported a case of a deviated Segond fracture associated with anterior cruciate ligament injury and proximal insertion injury of the lateral collateral ligament without arcuate sign, but the postoperative follow-up period or follow-up radiographs were not performed.

A case of deviated Segond fracture associated with fibula avulsion fracture was herein reported. The recognition and treatment of these lesions in the acute phase leads to good functional results.

Financial Support

There was no financial support from public, commercial, or non-profit sources.

Conflict of Interests

The authors have no conflict of interests to declare.

References

- 1 Gottsegen CJ, Eyer BA, White EA, Learch TJ, Forrester D. Avulsion fractures of the knee: imaging findings and clinical significance. *Radiographics* 2008;28(06):1755–1770
- 2 Haims AH, Medvecky MJ, Pavlovich R Jr, Katz LD. MR imaging of the anatomy of and injuries to the lateral and posterolateral aspects of the knee. *AJR Am J Roentgenol* 2003;180(03):647–653
- 3 Juhng SK, Lee JK, Choi SS, Yoon KH, Roh BS, Won JJ. MR evaluation of the “arcuate” sign of posterolateral knee instability. *AJR Am J Roentgenol* 2002;178(03):583–588
- 4 Campos JC, Chung CB, Lektrakul N, et al. Pathogenesis of the Segond fracture: anatomic and MR imaging evidence of an iliotibial tract or anterior oblique band avulsion. *Radiology* 2001;219(02):381–386
- 5 Tei K, Kubo S, Matsumoto T, et al. Combined osteochondral fracture of the posterolateral tibial plateau and Segond fracture with anterior cruciate ligament injury in a skeletally immature patient. *Knee Surg Sports Traumatol Arthrosc* 2012;20(02):252–255
- 6 Kühle J, Südkamp NP, Niemeyer P. [Osteochondral fractures at the knee joint]. *Unfallchirurg* 2015;118(07):621–632
- 7 Nawata K, Teshima R, Suzuki T. Osseous lesions associated with anterior cruciate ligament injuries. Assessment by magnetic resonance imaging at various periods after injuries. *Arch Orthop Trauma Surg* 1993;113(01):1–4
- 8 LaPrade RF, Ly TV, Wentorf FA, Engebretsen L. The posterolateral attachments of the knee: a qualitative and quantitative morphologic analysis of the fibular collateral ligament, popliteus tendon, popliteofibular ligament, and lateral gastrocnemius tendon. *Am J Sports Med* 2003;31(06):854–860
- 9 Shaikh H, Herbst E, Rahnamai-Azar AA, et al. The Segond Fracture Is an Avulsion of the Anterolateral Complex. *Am J Sports Med* 2017;45(10):2247–2252
- 10 Fay K, Mannem R, Baynes K, Sarin D, DuBois M. Iliotibial band avulsion fracture: a case report with differential diagnosis. *Emerg Radiol* 2016;23(01):93–96