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Abstract- Arthroscopic treatment for fractures of the tibial spine is supposed to afford a more accurate approach to the fracture site, decreased morbidity, earlier mobilization, and a shorter hospital stay. We report the accidental lesion of the tibiofibular branch of the popliteal artery during screw fixation of an ACL osseous avulsion using the arthroscopic assisted technique. Until now, there is no report of vascular injury during fixation of the tibial spine using this technique.

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Catastrophic Tibiofibular Trunk Injury Following Fixation of Tibial Spine Fracture

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I. Introduction

Fracture of the tibial spine is a typical lesion of subjects with an immature skeleton. The mechanism of injury comprises knee flexion, external rotation of the tibia and valgus stress. The lesion is characterized by an avulsion fracture including the insertion of the anterior cruciate ligament (ACL). Surgical treatment is required for deviated fractures and includes fixation of the fragment by a traction screw or transosseous suture after reduction undertaken by direct or arthroscopic vision. Arthroscopy is supposed to afford a more accurate approach to the fracture site, decreased morbidity, earlier mobilization, and a shorter hospital stay, compared with open reduction. However, it may be technically difficult and carries a steep learning curve. (Strauss et al. 2018).

Vascular injury is a rare complication of knee surgery, but surgeons should always consider this in patients who have undergone knee arthroscopy. (Xu et al. 2017) Pioneer studies compiling arthroscopy complications reported incidence of vascular injuries in 1% of procedures. (DeLee 1985) Veselko et al, considered arthroscopic assisted screw fixation of the ACL avulsion a simple, safe and reproducible procedure. (Veselko, Senekovic, and Tonin 1996; Senekovic and Veselko 2003).

Our aim is to report the lesion of the tibiofibular branch of the popliteal artery while screw fixation of an ACL osseous avulsion using the arthroscopic assisted technique.

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II. Case Report

A 16 year old male patient went on a motorcycle accident. He developed right knee hemarthrosis, anterior instability and an isolated avulsion fracture of the ACL tibial insertion caused by a rotational mechanism (Figure 1).

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Figure 1: Lateral x-ray and CT images showing the avulsion fracture of tibial spine. A robust anterior fragment allowed screw fixation.

Surgical planning comprised arthroscopic assisted reduction and minimally invasive fixation of the avulsed fragment by a small fragment cannulated screw and washer.

The senior surgeon (TVOC) which was maintaining the fragment reduced under arthroscopic view noticed that his assistant progressed the drill beyond the posterior tibial cortex. In addition, the x-ray evaluation of the screw's position alerted the team to the possibility of a vascular injury as the screw was aiming at the region of the tibiofibular trunk. (Figure 2)

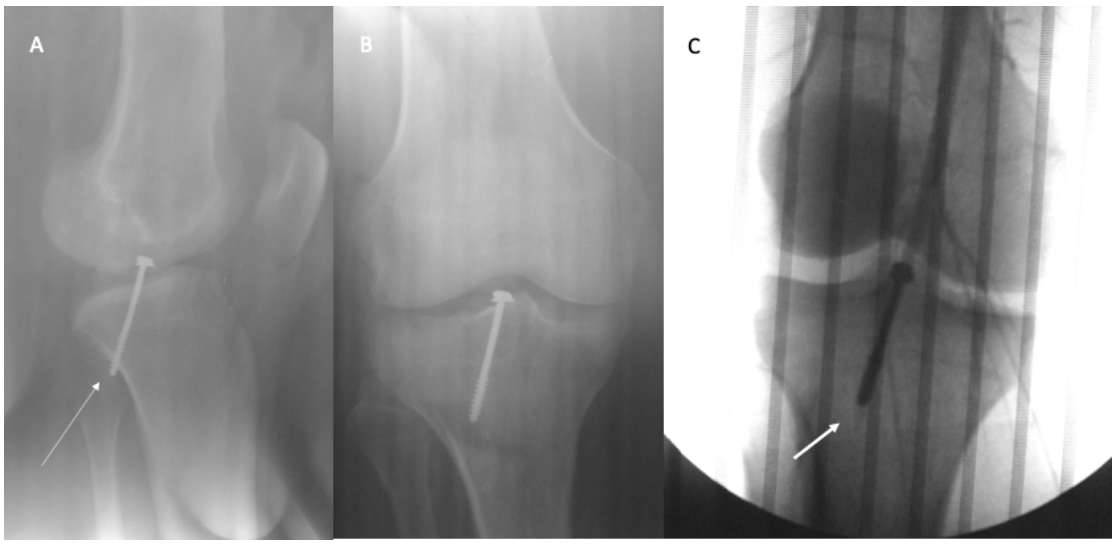


Figura 2: A and B - White arrow points to the end of the screw which crosses the posterior cortex of the tibia and goes toward the popliteal vessels. C - Arteriography shows interruption of the flow distal to the screw (white arrow).

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The tourniquet was released and the vascular status checked. There was an evident reduction in dorsalis pedis and posterior tibial artery pulses when compared to the contralateral side. Limb perfusion presented a delayed distal filling. The vascular surgeon was immediately called and an ultrasound Doppler revealed a monophasic arterial flow distal to the tibiofibular trunk. An arteriography diagnosed an interruption of contrast flow in the tibiofibular trunk, no contrast leakage and normal filling of collaterals that probably maintained the limb perfusion.

Based on arteriography, our first hypothesis was a tibiofibular trunk obstruction linked to screw distal compression. As a result a change in screw position and size reduction was attempted in order to relieve compression in the vessel wall. The measure was ineffective for restoring distal arterial flow. Thus, it was decided to make a by-pass using the great saphenous vein bridging the region of interrupted blood flow. (Figure 3)

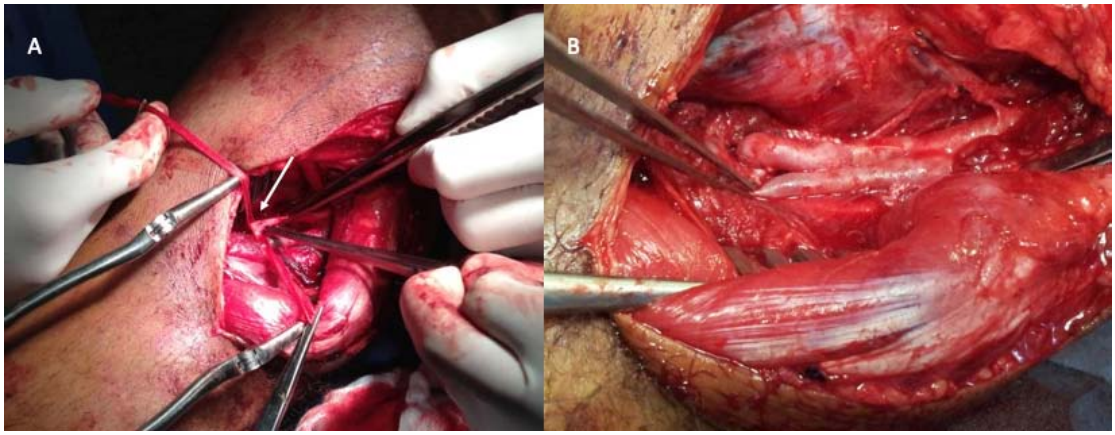


Figure 3: A - perforation of the tibiofibular trunk wall. There was no haematomaas arterial thrombosis occluded the vessel wall hole. B - Bypass with a functioning great saphenous vein.

Anticoagulant prophylaxis comprised rivaroxaban 10mg for 4 weeks. The range of movement physiotherapy exercises were delayed for 2 weeks. The patient had a 7yr follow up consultation in which it was possible to assess fracture healing and normal knee function. The patient resumed his activities as a waiter without complaint of pain or instability.

III. Discussion

Fracture of the tibial spine is a rare injury that occurs mainly in patients with immature skeletons. This region represents the ACL insertion site and the diagnosis is made by clinical history, physical examination, radiography, and computed tomography. Magnetic resonance imaging can identify associated lesions, mainly the lesion of the anterior horn of the lateral meniscus that may impair reduction of the fragment.

Arthroscopic reduction of the ACL fragment is less invasive and permits treatment of associated injuries. Fixation may be achieved by transosseous suture, anchor or screws that provide stability to the fragment until consolidation. In open surgery, both hands of the senior surgeon are free to perform main procedure steps. In arthroscopic surgery, one of the surgeon's hands is occupied holding the video camera. As a result, there are two options: 1) ask the assistant to create the screw tunnel or 2) do it himself while the assistant keeps the fragment reduced. In both situations, the surgeon's hand control is decreased and the risk of violation of the posterior tibial wall is increased.

Post et al, using cadaver specimens addressed the anatomic position of the popliteal vessels and tibiofibular trunk. They alert about anatomic variations that may occur, recommend knee flexion and caution while perforating the posterolateral tibial cortex. This case report alerts surgeons for an inadvertent vascular injury during fixation of ACL avulsion fracture. The direction of the drill and screw might head to the vascular bundle if they come from superomedial to inferolateral.

Palazzolo et al, reviewed uncommon complications after ACL reconstruction. They described three cases of vascular lesions. Most presented clinically by haematoma and bleeding. (Palazzolo et al. 2018) In our case, the occurrence of thrombosis at the injury site prevented the development of an expanding hematoma. Thus, suspicion was based on the presence of pulse asymmetry and changes detected in the doppler evaluation. Confirmation of the diagnosis was achieved by arteriography. The challenge is to diagnose the lesion in an anesthetized limb with preserved perfusion by the collaterals. Therefore, the suspicion may be supported by anatomical knowledge.

Keyurapan *et al*, studied the posterior region of the extended and flexed knee using magnetic

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resonance imaging. The authors concluded that knee flexion increases the distance between the neurovascular bundle and the posterior tibial wall. In addition, flexion of the joint moves the bundle to the posterolateral region. This work reinforces concern while approaching the posterolateral region of the tibia and the need to carefully assess vascular status whenever the posterior cortex is violated. Most ACL avulsion fractures are reduced by knee extension which approximates the vascular bundle and the posterior cortex. (Keyurapan, Phoemphunkunarak, and Lektrakool 2016).

The evaluation of vascular lesions around the knee may challenge even experienced surgeons. The clinical evaluation is tricky and physical exam findings may range from complete pulse absence and lack of perfusion to delayed presentation which includes swelling and unexplained pain. (Xu et al. 2017).

There is no record in the literature of vascular injury during fixation of avulsion of the tibial spine. The reports are of vascular injury during ACL reconstruction, and in all cases, the patients did not present changes in their pulses after the injury. The diagnosis was made based on the identification of an expanding hematoma or compartment syndrome in the days following the surgical procedure. In the case presented in this study, the diagnosis was precocious since knowledge about the probable path of the vascular bundle triggered the early investigation. The quickness of the diagnosis allowed the patient to have a satisfactory clinical evolution without any type of sequel. (Palazzolo et al. 2018).

IV. Conclusion

Vascular injuries can occur during fixation of the tibial spine fracture. The knowledge of anatomy allows the early identification of this type of complication and its effective treatment.

Declarations:

Conflict of interest

Authors declare that they do not have any conflict of interest related to that paper.

Funding

No funding has been provided to the institutions or authors involved in that case report

Ethical approval

As a case report, ethic approval is not required according to Brazilian ethics committee.

Informed consent

Informed consent has been obtained from the patient. He agreed to have his case description published in benefit to orthopaedic community knowledge improvement.

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Nothing to declare

Authors' contribution

Tulio Campos; Guilherme de Castro; Guilherme Moreira; Robinson Esteves; Tulio Pinho; Marco Antônio had participation in surgical field and contributed to manuscript. João Victor and Robert Schenck Jr contributed to case report and revision of the paper.

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