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CASE REPORT

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Medial Segond-type fracture: cortical avulsion off the medial tibial plateau associated with tears of the posterior cruciate ligament and medial meniscus

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Abstract We describe an unusual cortical avulsion fracture off the medial tibial plateau of the knee associated with tears of the posterior cruciate ligament and the medical meniscus. This constellation of findings is the reverse of that seen with the Segond injury complex. We postulate that the plain film diagnosis of this fracture, like the Segond fracture, is a clue to the likely presence of associated ligamental and meniscal tears, and to the mechanism of injury.

Key words Segond fracture · Knee · Trauma

Introduction

A Segond fracture is a cortical avulsion off the lateral rim of the lateral tibial plateau [1]. It results from a flexed knee undergoing varus stress and internal rotation, with the fracture occurring at the capsular attachment of the lateral capsular ligament [1–5]. This mode of injury frequently results in associated tears of the anterior cruciate ligament (ACL), the lateral meniscus, or less common injuries [4–5].

We report a case of a cortical avulsion off the medial rim of the medial tibial plateau of the left knee associated with tears of the posterior cruciate ligament (PCL) and medial meniscus. This constellation of abnormalities is the reverse of that seen in the Segond injury complex. Interestingly, the patient had a simultaneous Segond fracture and injury complex in the opposite right knee.

Case report

A 24-year-old woman was struck in both knees by a car. There was presumed valgus stress to the left knee and varus stress to the right knee.

Plain radiographs of the left knee demonstrated only an effusion and an unusual cortical avulsion fracture off the medial rim of the medial tibial plateau (Fig. 1A). MR imaging of this knee demonstrated the avulsed cortical fragment off the medial tibial plateau with underlying bone contusion (Fig. 1B). This was associated with complete disruption of the PCL (Fig. 1C). There were also tears of the medial meniscus, medial collateral ligament, and a partial tear of the ACL. The lateral compartment was normal. All of these findings were confirmed at arthroscopy.

Plain radiographs of the opposite right knee demonstrated a Segond fracture off the lateral rim of the lateral tibial plateau and a second avulsion fracture off the central tibial plateau at the insertion of the ACL (Fig. 2A). MR imaging confirmed the Segond fracture and associated bone contusion/fracture of the medial tibial plateau (Fig. 2B), as well as tears of the ACL, lateral collateral ligament, and lateral meniscus. These injuries were confirmed at both arthroscopy and arthrotomy.

Discussion

Paul Segond observed that internal rotation and varus stress on a flexed knee created tension on the lateral capsule. During this maneuver the thickened portion of this capsule, the lateral capsular ligament, can cause an avulsion fracture at its insertion on the lateral tibial plateau. Segond published these observations in 1879 [1], but not until 1936 was this fracture described on radiographs [6]. It was not until the late 1970s that three reports in the orthopedic literature emphasized the clinical importance of the Segond injury complex, and it was almost a decade after this that it was first reported in radiologic journals [3–4].

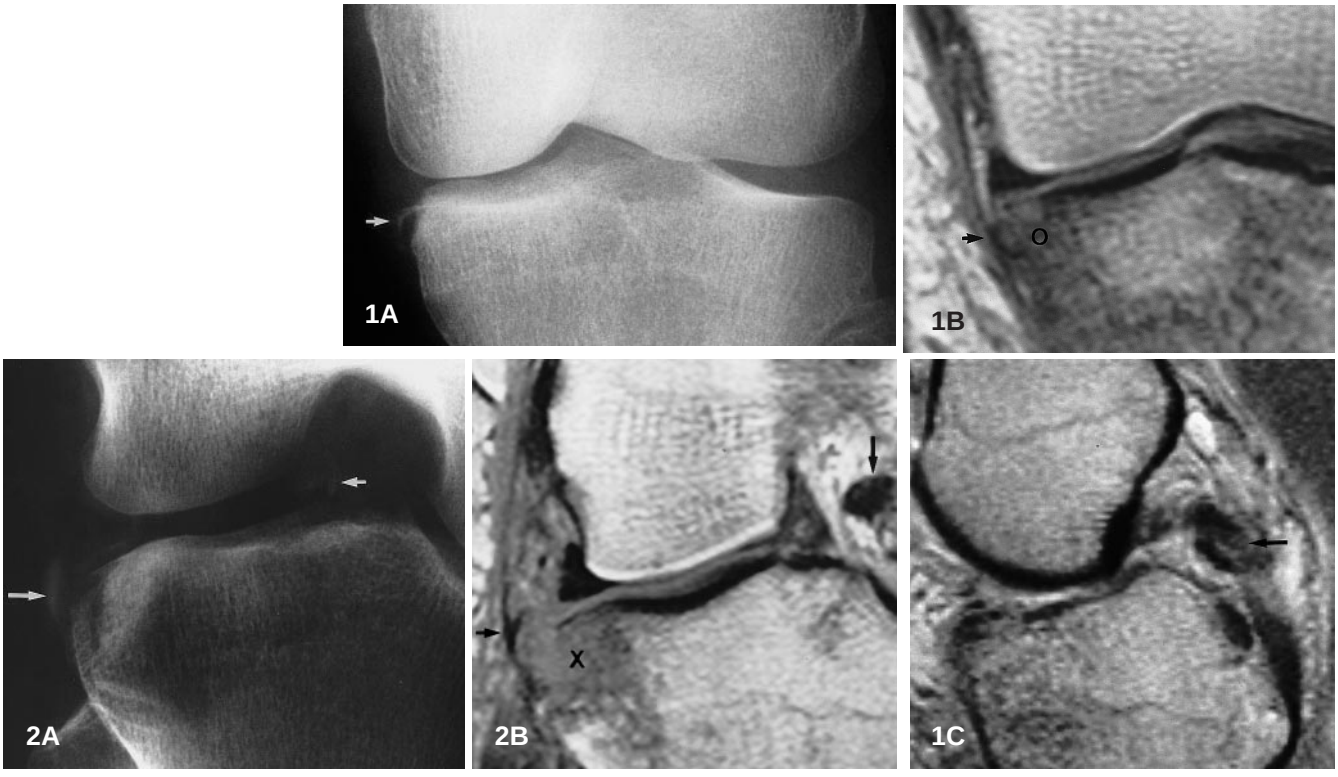

Fig. 1A–C Medial Segond-type fracture and injury complex of the left knee. **A** Anteroposterior plain radiograph of the left knee demonstrates a small cortical avulsion fracture off the medial rim of the medial tibial plateau (*arrow*). Aside from this fracture and an effusion, the plain knee radiographs were normal. **B** Coronal T1-weighted MR image of the left knee demonstrates the avulsed cortical fragment off the medial tibial plateau (*arrow*) with a contusion and equivocal fracture of the contiguous trabecular bone (*O*). The medial meniscus is normal on this single view, but was torn on other images, as was the medial collateral ligament. **C** Sagittal paramidline T1-weighted MR image of the left knee demonstrates disruption of the posterior cruciate ligament (PCL) (*arrow*)

Fig. 2A, B Segond fracture and injury complex of the opposite right knee. **A** Anteroposterior right knee film demonstrates a cortical avulsion fracture (*small arrow*) off the lateral rim of the lateral tibial plateau (*arrow*). There is also a fracture of the tibial plateau at the site of insertion of the anterior cruciate ligament (ACL) (*small arrow*). **B** Coronal T1-weighted MR image of the right knee demonstrates a Segond cortical avulsion fracture off the lateral tibial plateau (*small arrow*) with a contusion and possible fracture of the contiguous trabecular bone (*X*). The ACL (poorly visualized on this image) was torn, but the PCL (*large arrow*) is intact

The importance of the plain-film finding of a Segond fracture relates to its association with an injury complex: 75–100% of patients with this fracture have an associated ACL tear, and approximately 35% have a lateral meniscal tear [4–5]. These internal injuries and the associated anterolateral rotatory instability may not be clinically evident, particularly at the time of injury.

We believe that the medial or reverse Segond-type avulsion fracture described in this report is caused by a mechanism of injury, valgus stress and external rotation of a flexed knee, which is the reverse of that causing the classic Segond fracture [7–8]. We assume that this fracture and the associated tears of the PCL and medial meniscus represent an injury complex, but we cannot prove this because this combination of injuries has not, to our knowledge, been previously described. However, this assumption is bolstered by the fact that the injuries we describe are the exact opposite of those seen with the Segond injury complex and because, if our patient was struck simultaneously in both knees by the car, it is logical that she might experience opposite stresses on the two knees. The rare medial tibial plateau fracture we describe might be overlooked, or its significance unappreciated, in the face of accompanying major internal joint derangement. Certainly many of us overlooked or dismissed the significance of the Segond fracture until it was described and popularized in the radiologic literature in the late 1980s [3–4]. Finally, it is evident that a medial tibial plateau avulsion fracture is far less common than the corresponding Segond fracture.

If this injury complex of the knee is confirmed by others, its importance, like that of the corresponding lateral Segond fracture, will probably be as a plain-film clue to the mechanism of injury, and to the likely presence of associated ligamental and meniscal tears.

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