Segond fracture after anterior cruciate ligament reconstruction

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The authors report a case of a 19-year-old man with a Segond fracture with knee effusion after an acute injury, in addition to findings of prior anterior cruciate ligament (ACL) reconstruction. This case illustrates the predictive nature of Segond fracture for further acute meniscoligamentous injury, even after previous ACL reconstruction.

Introduction

Avulsion fracture involving the proximal tibia just distal to the lateral plateau, known as a Segond fracture, was described in cadaver experiments by Paul Segond in 1879 (1). This cortical avulsion of the tibia at the site of insertion of some fibers of the lateral collateral ligament complex results from excessive internal rotation and varus stress of the flexed knee (2) and is nearly always associated with other lesions, such as ACL tear, meniscal tear, and damage to the structures of the posterolateral corner of the knee.

Case report

We describe a case of a 19-year-old man who had an ACL reconstruction of his right knee in 2005 (four years prior) and was doing well, despite occasional feelings of instability. One week prior to presentation, he was skateboarding, jumped off his skateboard, and injured his right knee, during which he felt his knee “pop,” with subsequent pain and swelling. By the time of presentation, his pain and swelling had diminished and his primary complaint was a feeling of instability.

Orthopedic examination of his right knee showed a 2+ knee effusion and a 2+ Lachman test. Guarding and effusion prevented accurate pivot-shift testing. There was no medial, lateral, or posterior instability, and no joint-line or patellar tenderness.

Radiographs demonstrated evidence of prior ACL reconstruction and a joint effusion. A small osseous fragment adjacent to the lateral tibial plateau compatible with a Segond fracture (arrow, Fig. 1A,B) was noted.

While awaiting comparison radiographs, magnetic resonance imaging (MRI) demonstrated that the lateral capsular avulsion fragment was associated with edema in the lateral aspect of the tibial plateau, indicating an acute injury. MRI also showed ACL graft tear by the absence of low signal intensity expected in the region of ACL (Fig. 2). For comparison, the MRI after the original injury (Fig. 3) shows no capsular insertion damage, while it does show the original ACL tear.

Upon followup with orthopedics, the patient declined reconstructive surgery, at least temporarily, preferring to be managed conservatively for the time being.

To the authors’ knowledge, this is the first reported case of a Segond fracture as an indicator of an ACL graft tear.

Discussion

Avulsion fracture involving the proximal tibia just distal to the lateral plateau is known as a Segond fracture. It was first described in 1879 after cadaver experiments by Paul Segond as a cortical avulsion of the tibia at the site of insertion of the middle third of the lateral capsular ligament (1). Currently, however, opinion varies about the precise components involved on the Segond fracture. Some authors, like Segond, believe that the avulsed fragment occurs at the insertion site of the lateral capsular ligament; others believe that it occurs at the insertion site of the iliotibial tract (ITT).
(3); still others believe that it occurs at the insertion site of the anterior oblique band (AOB), which is a component of the fibular collateral ligament (4); and finally, some believe that both ITT and AOB insertions are involved (5).

The characteristic radiographic appearance of an acute Segond fracture is that of a small avulsion fragment adjacent to the lateral tibial plateau (arrow), compatible with a Segond fracture or lateral capsular avulsion.

Figure 1A. 19-year-old male with Segond fracture. Anteroposterior radiograph shows femoral and tibial tunnels from prior ACL reconstruction. A small osseous fragment is adjacent to the lateral tibial plateau (arrow), compatible with a Segond fracture or lateral capsular avulsion.

with the appearance of an osteophyte. This particular appearance should alert the radiologist to significant remote internal derangement (7).

Segond fractures likely result from excessive internal rotation and varus stress of a flexed knee (8, 5, 1). They are associated with anterolateral rotatory instability, which may be chronic and disabling if the fracture is not recognized and the correct treatment provided (6).

There is an important association with significant soft-tissue injuries, including ACL tears, lateral and medial meniscal tears, damage to the structures of the posterolateral corner of the knee, and bone contusions, mainly in the lateral tibial plateau and femoral condyle (5, 9, 10). Association with ACL tears is quite high, reported to occur in 75% to 100% of Segond fractures; meniscal tears occurred 66% to 75% of the time (5). The association with ACL tear may result from forces attempting to anteriorly sublux the lateral tibial plateau being stabilized by the ACL. Therefore, those forces are not transmitted to the lateral capsular ligament/ITT/AOB until the ACL is disrupted (2).

The clinical diagnosis in the acute stage may be difficult due to pain with guarding, as in our case, or muscle spasm, hemarthrosis, or edema (5).

MR imaging can demonstrate abnormal bone marrow edema, especially at the lateral aspect of the tibia (8, 5). The fracture fragment itself may not be seen on MRI, even

Figure 1B. 19-year-old male with Segond fracture. Lateral radiograph shows femoral and tibial tunnels from prior ACL reconstruction.
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Figure 2. 19-year-old male with Segond fracture. Proton-density images with fat saturation after most recent injury. Top: The lateral capsular avulsion can be observed on the coronal image (arrow). The edema in the lateral tibial plateau indicates that this is an acute injury. Above: The absence of normal low signal intensity at the ACL graft is evident in the sagittal image, showing tear of the ACL graft (arrow).

Figure 3. 19-year-old male with Segond fracture. Proton-density images with fat saturation at the time of original injury four years prior. Top: The disruption of the ACL is evident on the sagittal image (arrow). Above: The lateral capsular insertion (arrow) is normal on the coronal image.
when it has been shown to be present on radiographs (5). Therefore, when bone edema of the lateral tibial plateau is noted on MRI, a Segond fracture and associated injuries should be suspected.

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