

Segond Fracture with an Anterior Cruciate Ligament Tear

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Abstract

The “lateral capsular sign,” an elliptical-shaped skeletal fragment along the outside edge of the tibial plateau, is a characteristic of a Segond fracture usually associated with an anterior cruciate ligament (ACL) tear. Although this sign can be seen on conventional radiographs, MRI offers a more thorough evaluation of knee joint structures and verifies ACL involvement. Imaging should be used to explore for other potential injuries and diagnoses, such as the arcuate sign indicating fibular head avulsion. The best therapeutic approach requires a prompt and precise diagnosis. Surgery to correct the avulsion and ACL reconstruction are frequently used in the management of Segond fractures with ACL tears. With surgical intervention, there is a favorable prognosis.

Keywords: musculoskeletal trauma, knee, sports injury

Case Summary

A teenager presented to the orthopedic service after sustaining a knee injury playing competitive soccer. He felt a “pop” after planting his foot and trying to cut in a different direction during a play. Significant pain and swelling developed rapidly, prompting him to seek specialty care.

Imaging Findings

A Segond fracture is suggested by an elliptical or curvilinear-shaped bone fragment positioned parallel to the lateral margin of the tibial plateau just below the articular surface on a knee radiograph (Figures 1 and 2).¹ The avulsed bone fragment may be difficult to see on radiographs. CT may be necessary

for confirmation. The associated anterior cruciate ligament (ACL) tear would not be identified. The “lateral capsular sign” is the descriptive term used to describe the radiographic appearance.² On a plain radiograph, an anteroposterior view (AP) of the patellofemoral joint is the best view to see the lateral capsular sign.³

MRI is the preferred modality for full examination of the knee joint to demonstrate the extent of the injury to the ACL, the most common deep knee structure to be damaged.⁴

Diagnosis

Segond fracture with ACL tear.

The differential diagnosis is an avulsion fracture of the fibular head resulting in the arcuate sign on imaging. This sign is seen on radiographs and

cross-sectional imaging and indicates an avulsion fracture to the fibular head. The fibular head avulsion is a fracture at the insertion of the posterolateral ligaments. On AP view, one may see a linear lucency through the fibular head that generally is seen as a horizontal bone fragment. This stands in contrast with the Segond fracture, which involves the lateral capsular sign that is indicative of an avulsion fracture at the tibial head and is more vertical in position.^{1,5}

Other differential considerations include iliotibial band (ITB) avulsion, a fracture resulting from compression, occurring either in the lateral condyle of the tibia or the femoral condyle, accompanied by fragmentation, and posterolateral tibial plateau fracture. Imaging can be used to confirm one diagnosis over another. The key aspect to look for is the location of the avulsion. For instance, in ITB avulsion, the imaging would show the avulsion at the lateral condyle of the proximal tibia (Gerdy's tubercle).¹

Discussion

Segond fractures are avulsion fractures, where a bony fragment is avulsed from the

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Figure 1. Anteroposterior and lateral radiographs of the right knee showing large joint effusion (arrowhead) and linear avulsion fracture fragment of the lateral tibial cortex (arrow).

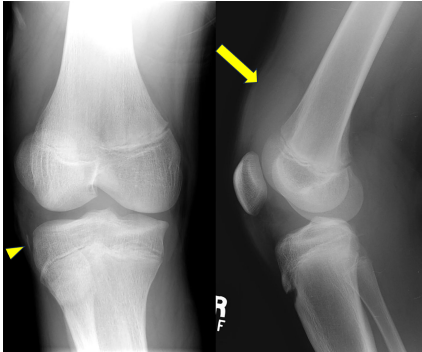


Figure 2. Sagittal T2-weighted fat-saturated MRI image showing complete tear of the anterior cruciate ligament (arrowheads) and vertical oblique tear of posterior horn of lateral meniscus (arrow).



lateral margin of the tibial plateau with an associated tear in the ACL.⁵

Segond fractures with ACL damage usually result from a traumatic event to the lateral aspect of the knee that results when there is a forceful internal rotation and varus stress on the knee.⁶

This type of fracture is associated with rupture of the ACL as well as internal derangements, particularly meniscal and collateral ligament injuries.² In adults, a Segond fracture is predictive for the presence of a torn ACL in 75-100% of cases. However, for the pediatric population, this may not be the case, as Segond fractures can occur in isolation. Segond fractures are uncommon in adolescence, with only 6% of cases of ACL repairs.³

There is currently speculation over the role played by the relatively recently discovered anterolateral ligament in the underlying structure that becomes initially compromised in a Segond fracture.²

On imaging, the curvilinear avulsed bone fragment (lateral capsular sign) is found adjacent to the proximal portion of the tibia.^{1,2} (Figure 1) Plain x-rays can make the diagnosis. The presence of the lateral capsular sign suggests the diagnosis of the Segond fracture. It is important to note, however, that an MRI is important to diagnose and define an internal derangement of the knee and the possible association of an ACL tear (Figure 2).^{1,5}

Treatment of a Segond fracture depends on the extent of the injury, especially the presence of an ACL tear or other internal derangement. The fracture itself does not usually need treatment. Initial treatment is usually conservative and supportive. Surgical repair is usually focused on the injured ACL. Follow-up 2 years after surgical repair of a Segond fracture and reconstruction of the ACL demonstrated positive outcomes with no major complications.⁷ There was no sign of deterioration of the range of motion of the knee joint in this period. It is unknown whether Segond fractures heal spontaneously or require surgical intervention.⁷

Generally, prognosis appears favorable for Segond fractures. Surgical repair is not always required to repair such a fracture. Also, Segond fractures may be able to heal without intervention. However, other associated injuries to ligaments and menisci could be a limiting factor.^{3,8} If conservative treatment is contemplated, MR examination should be considered to examine the knee joint.

Conclusion

The “lateral capsular sign,” an elliptical-shaped skeletal fragment along

the outside edge of the tibial plateau, is a characteristic of a Segond fracture usually associated with an ACL tear. Although this sign can be seen on conventional radiographs, MRI offers a more thorough evaluation of knee joint structures and verifies ACL involvement. Imaging should be used to explore for other potential injuries and diagnoses, such as the arcuate sign indicating fibular head avulsion. The best therapeutic approach requires a prompt and precise diagnosis. Surgery to correct the avulsion and ACL reconstruction are frequently used in the management of Segond fractures with ACL tears. With surgical intervention, there is a favorable prognosis.

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