

## Radiology Case 2

# 10

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**Indication for the Exam** 27 y/o m with left knee swelling, lateral tenderness, and pain with rotational movements after a motor vehicle accident.



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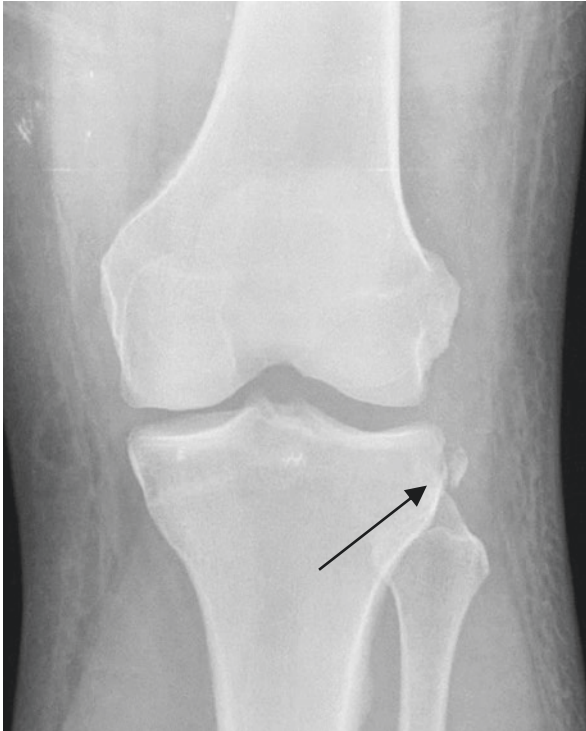
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**Radiographic Findings** AP view of the left knee demonstrating an avulsion fracture of the lateral tibia.

**Diagnosis** Segond fracture.



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## Learning Points

### Priming Questions

- What is the mechanism of injury?
- What are additional injuries associated with this fracture?
- What is the Reverse Segond fracture?
- What is the arcuate sign?

## Introduction/Background

Named after French surgeon Paul Segond in 1879, a Segond fracture is an avulsion fracture of the tibia at the insertion site of the lateral capsular ligament [1].

## Pathophysiology/Mechanism

The Segond fracture occurs from internal rotation of the knee with an external varus stress. This motion increases tension upon the lateral capsular ligament, which then causes a cortical break at its insertion on the tibia. There is a high association of lateral capsular disruption with ACL and meniscal tears. Patients will complain of pain along the lateral aspect of the tibia with lateral rotational instability [1]. Other injuries associated with a Segond fracture can include trauma to the iliotibial band and anterior oblique band of the fibular collateral ligament [2].

## Making the Diagnosis

- On AP knee radiographs, an elliptical-shaped bone fragment is seen along the lateral aspect of the tibia just below/adjacent to the lateral tibial plateau. Radiologists will often refer to this as the *lateral capsular* sign [1].
- Conspicuity of the small avulsed bone fragment is best appreciated on cross-sectional imaging; however, AP radiographs of the knee are the initial test of choice.
- It is important to note that nonemergent MRI is indicated for all patients with a Segond fracture given the strong association with anterior cruciate ligament (>70%) (2–3) and meniscal tears [1, 3].
- The *Reverse Segond Fracture* is described as an avulsion injury to the deep capsular medial collateral ligament. An elliptical bone fragment is located adjacent to the medial tibial plateau. This injury occurs with external rotation and valgus stress: the reverse mechanism of a Segond fracture [1].

## Other Injuries Associated with Segond Fractures

- ACL injury
- Meniscal Tear
- Avulsion injury of the long head of the biceps femoris ligament
- Avulsion injury of the fibular collateral ligament
- Tibial Plateau Fracture [3]

## Major Mimicker of Segond Fractures: The Arcuate Sign

- An avulsion fracture of the styloid process of the fibula where the arcuate ligament complex attaches is known to radiologists as *the arcuate sign* [4].
- This fracture is also commonly associated with cruciate ligament injury. On conventional radiograph, the osseous fragment is *displaced superiorly and medially* to the fibular donor site [4].

- Distinguishing between these two pathologies is difficult but can be accomplished by identification of the donor site (tibia for Segond Fracture and fibula for the arcuate sign), orientation of the bone fragment (generally vertical for Segond Fracture and horizontal for the arcuate sign), or via advanced imaging.

Segond Fracture vs. Arcuate Sign		
	Segond Fracture	Arcuate Sign
Donor Site	Lateral Tibia	Styloid process of the Fibula
Orientation of the bone fragment	Vertical	Horizontal
Displacement Direction	Anterior and Lateral to the Lateral Tibia	Superior and Medial to the Fibula

## Treating the Patient

In many cases, surgical intervention is eventually warranted due to the extensive ligamentous injury that may occur [2]. Due to the high instance of ligamentous injury, these patients should be treated as though they have a presumed ligamentous tear. Depending on local practice patterns, this may result in an orthopedic consultation and advanced imaging in the Emergency Department or non-weight-bearing status with urgent orthopedic specialist follow-up.

## Discussion

- Traumatic injuries to the knee can result in avulsion fractures due to the number of tendons and ligaments that attach. While radiography is typically the initial exam of choice to diagnose fracture, MRI is used to diagnose any associated soft tissue injuries.
- Understanding the appearance of imaging can help the clinician identify mechanism of injury and raise suspicion for any associated injuries. Due to the high instance of associated ligamentous injury with both Segond Fractures and The Arcuate Sign, these patients should be treated as though they have a presumed ligamentous tear.

**Disclosure Statement** The authors of this chapter report no significant disclosures.

## References

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