

Distinguishing the Lateral Notch Sign versus a Normal Terminal Sulcus in Acute ACL Tear: A Case Report

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Abstract

Background: The lateral femoral notch sign is associated with roughly 25% of acute ACL tears with increasing incidence in younger athletes with high impact or pivot injuries. It is described as a deeper vertex than the normal terminal sulcus or exaggerated posterior extension of the terminal sulcus.

Case report: A 13 year old male athlete presented to clinic 7 days following a knee injury at football practice. His physical exam was equivocal, notable for a mild effusion and a trace lachman maneuver. Radiographs revealed a lateral notch sign, increasing suspicion for an ACL tear. Complete ACL tear was confirmed by MRI and the patient proceeded with reconstruction.

Conclusion: Radiographs should be performed on young athletes with an acute knee injury and should be scrutinized for a lateral notch sign. The presence of a pathological lateral notch should increase the clinical suspicion for an ACL tear as well as warrant further evaluation with an MRI. Distinguishing a pathological lateral notch from a normal terminal sulcus is an important skill for every clinician. In cases with an unclear physical exam and borderline measurements of the lateral notch, clinicians should consider obtaining radiographs of the contra lateral side for comparison.

Introduction

The lateral femoral notch sign is a significant radiographical finding in chronic ACL instability and acute tears. The lateral notch sign is present when the vertex of the depression exceeds 15 mm deep to the tangent line drawn from anterior to posterior boundaries of the terminal sulcus, or the vertex is located greater than 20 mm posterior to the anterior portion of Blumensaat's line [1,2]. Originally thought to be a sign of chronic ACL instability, several studies have shown a significant incidence of the lateral notch sign in plain radiographs associated with acute ACL tears [1,3]. When measured on MRI, a depth of greater than 0.9 mm at the lateral femoral condyle has been reported as having a specificity of 89% for ACL tear [2]. It has been reported that 25% of ACL tears have evidence of a lateral notch sign [3]. The lateral notch sign is increasingly found with high impact, pivot shift injuries occurring in younger male patients [1]. The purpose of this case report was to review the definition of the lateral notch sign versus a normal terminal sulcus in the context of a young athlete with an acute injury and to highlight the importance of a thorough evaluation of radiographs for indications of ligamentous injury.

Case report

A 13 year old African American male athlete presented to the sports medicine clinic 7 days following right knee injury at football practice. He planted his foot while running and was tackled causing a hyperextension, valgus, external rotation injury. He reported an effusion the same day of injury but did not feel a pop. His exam was significant for tenderness over the lateral femoral condyle and lateral joint margin [4]. He had a mild effusion. Lachman maneuver was unimpressive and pivot shift test was negative, possibly complicated by patient guarding. The knee was aspirated upon initial visit revealing 20 cc of serosanguinous fluid. Radiographs were obtained and a lateral notch sign was noted on the right knee lateral radiograph [5]. The notch measured 2 mm deep at the vertex and extended 22 mm posterior to Blumensaat's line (Figure 1).

The patient underwent surgery for ACL reconstruction. The preoperative exam under anesthesia revealed a grade 2 Bachman's compared to a trace lachman's test upon initial evaluation. There was a complete tear of the ACL but no meniscus tear or osteochondral lesion was detected by diagnostic arthroscopy. ACL reconstruction was performed using an arthroscopic technique. Post-operative examination had an improved, stable Lachman maneuver with normal pivot shift. Post-operative course and rehabilitation were uneventful (Figure 2).



Figure 1 a-b: Knee radiographs. 1a. Right knee radiograph featuring lateral notch sign. 1b. Left knee radiograph with normal terminal sulcus. Note the vertex of a normal terminal sulcus is shallow and located at the extension of Blumensaat's line compared to the pathologic lateral notch.

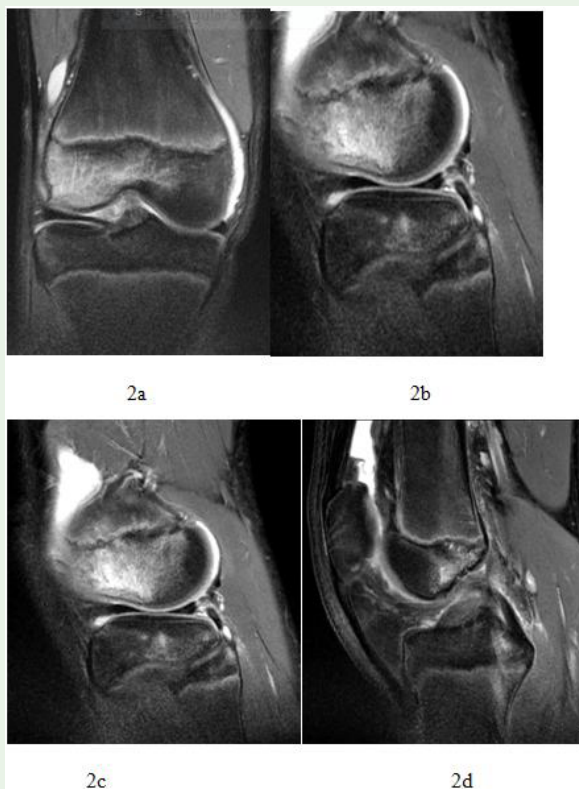


Figure 2 a-d: Knee magnetic resonance imaging. Figure 2a. Coronal image revealing signal hyper intensity of lateral condyle consistent with significant bone contusion. Figure 2b-2c. Sagittal images revealing bone edema at location of pathological lateral notch seen on radiographs. Figure 2d. Sagittal view showing ACL tear.

Discussion

In a large number of acute ACL tears, diagnosis is evident by a good history and physical exam, which is then further evaluated by MRI to confirm ACL tear and investigate potential concomitant pathology. In some patients, the physical exam may not reveal an obvious injury

due to guarding or pain. In all cases of an acute injury, radiographic evaluation is indicated to look for the presence of fractures, avulsions, or indications of ligamentous injury. The presence of a lateral notch is a useful tool in diagnosing acute ACL tears due to the high specificity of the lateral notch sign. When examining the lateral radiograph for the presence of a lateral notch sign, it is extremely important to be able to differentiate a normal terminal sulcus from a pathological lateral notch sign. A normal terminal sulcus is a depression with maximal depth less than 1.5 mm and located close to the anterior extension of Blumensaat's line [6,7]. A pathological lateral notch has been defined as a maximal depth of greater than 1.5 or 2 mm, depending on publication, or a depression that extends greater than 20mm posterior to the extension of Blumensaat's line [1-7]. For this reason, it can be very useful to compare radiographs of the injured and non-injured extremity. The absence of a lateral notch does not indicate the absence of ACL injury, but the presence of a lateral notch should increase the provider's clinical suspicion.

Conclusion

Radiographs should be performed on young athletes with an acute knee injury and should be scrutinized for a lateral notch sign. A lateral notch sign can be defined as a depression with a vertex greater than 15mm or located 20mm posterior to the extension of Blumensaat's line. Due to its high specificity, the presence of a pathological lateral notch should increase the clinical suspicion for an ACL tear as well as warrant further evaluation with an MRI. Differentiating a normal terminal sulcus from a pathological notch on radiograph is an important skill. Recognizing a lateral notch sign can allow practitioners to recognize injuries earlier, expedite further evaluation, and prevent missed injuries. However, it is important to understand and recognize the difference between a normal terminal sulcus and a pathologic lateral notch to prevent ordering advanced imaging when not indicated and therefore increase healthcare cost unnecessarily. In clinical scenarios with an acute injury, unclear physical exam, and borderline depression measurements, one should consider obtaining contra lateral knee films for comparison.

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