

Sideline Power Doppler Ultrasonography in Early Diagnosis and Management of ACL Injury in Athletes

Power Doppler Ultrasonography can quickly and effectively corroborate a diagnosis of ACL tear, common among athletes, to lead to the early recognition and treatment associated with better outcomes.

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Abstract

Real-time diagnosis of acute knee injury in the fast-paced setting of contact sports can be hindered by vague patient history and inability of the patient to relax during a physical exam. We present a case where sideline Power Doppler ultrasonography was used to visualize an acute, high-flow effusion in the suprapatellar recess in order to corroborate a presumed diagnosis of ACL tear in the context of further patient history and presentation. This led to rapid commencement of the pre-surgical “pre-hab” process for assumed subsequent ACL surgery, and suggests that sideline Power Doppler ultrasonography may have utility in real-time diagnosis and management of ACL tears.

Introduction

Knee injury is one of the most common injuries in organized sports, resulting in around 60% of sports-related surgeries among high school athletes.^{1,2} Incidence of anterior cruciate ligament (ACL) injury varies by sport, sex, and character of exposure, but typically at least half of all knee injuries across sports are ACL injuries.^{2,3} While magnetic resonance imaging (MRI) is typically considered the gold-standard for diagnostic imaging of an ACL tear, retrospective analysis has shown that ultrasonography may have a sensitivity of 90% (95% CI: 77%–96%) and specificity of 97% (95% CI: 90%–99%) in diagnosis of complete ACL tears.⁴ We present an example case in which ultrasound with Power Doppler was used to help identify an acute suprapatellar recess effusion, highly suggestive of an ACL rupture.

PubMed and EMBASE were searched using the key-terms “ACL tear”, “diagnosis”, and “ultrasound” for studies regarding the utility of sideline ultrasonography in the early diagnosis and management of ACL tears. One case study indicated the utility of ultrasonography in the diagnosis of combination ACL and posterior cruciate ligament (PCL) tear for patients in the Emergency Department setting.⁵ A systematic review provided statistical data on the efficacy of ultrasound in the diagnosis of ACL tears via ultrasonography.⁴ No previous articles regarding the benefit of using sideline ultrasound in early diagnosis and management of ACL injury were identified.

Case Report

A 17-year-old American-football offensive lineman presented to the sideline sports medicine physician after his foot became caught in the grass turf while running forward during the previous play. He attested to lateral pain in his left knee and difficulty ambulating. Lachman's and Lever's tests were performed but were difficult to assess due to guarding. For these reasons, evaluation via portable Power Doppler ultrasonography was performed.

presentation, ACL damage was suspected, and the patient's left leg was immediately immobilized and placed in a Game-Ready sleeve, and the patient was instructed to ambulate via crutch. Two hours after the end of the game, the patient's knee was reassessed with ultrasound. Complex fluid was noted in the full suprapatellar recess, which was suspected to be blood. No further flow was noted on Power Doppler imaging.

An MRI was subsequently performed, and the patient was found to have a near full-thickness ACL tear with a lateral tibial plateau impaction injury. No meniscal injury was noted.



Fig 1. High hemodynamic flow in suprapatellar recess.

Power Doppler ultrasonography revealed a normal patellar tendon and a normal medial patellofemoral ligament. However, a high flow rate of fluid into the suprapatellar recess was noted with Power Doppler imaging (see: Figure 1). Based on ultrasonography and

Discussion

The case presented in this report is unique and the first to our knowledge to describe the use of sideline ultrasonographic imaging to highly suggest a diagnosis of an ACL tear in spite of a lack of clear visualization of the ACL. Rather than direct visualization of the ACL, the diagnosis of ACL tear was made based on acute high flow into the suprapatellar recess in the context of patient presentation. While visualization of the ACL itself is inherently difficult via ultrasound, visualization of acute, post-traumatic hemarthrosis of the knee via Power Doppler ultrasonography should not be difficult for an ultrasonographer.

The early report of a non-contact injury, difficulty ambulating, and lateral knee pain and tenderness suggested an ACL injury, despite the patient not yet having a clear effusion. Acute high flow into the suprapatellar recess with immediate subsequent Power Doppler imaging suggested an arterial vascular injury. Previous analysis demonstrates that ACL injury may be responsible for around 70% of acute, post-traumatic hemarthroses of the knee, with patellar dislocation and meniscal tear being responsible for the majority of other cases.⁶ Notably, around half of meniscal tears occur in conjunction with ACL injury.⁷ In this case, due to patient history and presentation suggesting ACL injury, the acute effusion was suspected to be secondary to damage to the middle genicular artery.

Because sideline Doppler ultrasound was available, the patient did not have to wait for MRI confirmation before treatment was initiated. The combination of history, exam, and doppler ultrasound visualization of an acute effusion led the sports medicine team to

promptly begin the pre-surgical “pre-hab” process for ACL tear management immediately.

Additionally, although there is early research suggesting similar sensitivity and specificity between ultrasound and MRI in diagnosis of ACL tear,^{1,8} it is still prudent to check an x-ray and MRI to evaluate for other deep knee injuries, leg injuries, and to appropriately plan surgical intervention. In this case, the patient did not have a concomitant meniscus injury, but this could have only been thoroughly evaluated with MRI or arthroscopy.

In conclusion, this is the first case describing the visualization of a high-flow suprapatellar recess effusion after an ACL injury in a high school football player. Patient-provided history can be vague when attempting to elicit information in the aftermath of injury in a fast-moving, contact sport, and sideline knee examination can be challenging if the patient is not relaxed. The use of point-of-care sideline ultrasound with Power Doppler can demonstrate a high-flow effusion development in the suprapatellar recess, and can therefore be strongly suggestive of an acute ACL tear, especially in the context of further suggestive patient presentation. Utilizing ultrasonographic findings to rapidly corroborate an early diagnosis of ACL tear can result in prompt treatment, early surgery, and quicker return to play.

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