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## Ultrasound in Emergency Medicine

### DIAGNOSIS OF SIMULTANEOUS ACUTE RUPTURES OF THE ANTERIOR CRUCIATE LIGAMENT AND POSTERIOR CRUCIATE LIGAMENT USING POINT-OF-CARE ULTRASOUND IN THE EMERGENCY DEPARTMENT

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**Abstract—Background:** Patients with acute anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) injuries from sport-related activities are frequently seen in the emergency department (ED). However, knee instability tests are known to show variable sensitivity and specificity. These tests would also have limited functionality in patients with severe pain and swelling in the knee. **Case Report:** A 19-year-old female judo player presented to the ED with severe left knee pain. She had abruptly twisted her left knee while she was shoulder-throwing her opponent. She complained of severe pain and refused physical examination of the knee injury; as a result, evaluation of knee instability could not be performed. However, a point-of-care ultrasound helped in making a prompt and accurate diagnosis of simultaneous, complete rupture and partial ruptures of the ACL and PCL, respectively. The ultrasound findings correlated well with the magnetic resonance imaging images in the assessment of the combined ACL-PCL ruptures. The patient underwent simultaneous arthroscopic ACL and PCL reconstruction with a hamstring tendon autograft and was discharged. **Why Should an Emergency Physician Be Aware of This?:** Point-of-care ultrasound imaging of the knee in trauma patients may be helpful for diagnosis of ACL and PCL injuries by augmenting findings of physical examinations in patients with severe pain and swelling in the knee. Ultimately, it may lead to more accurate diagnosis and treatment plans in knee trauma patients. © 2017 Elsevier Inc. All rights reserved.

**Keywords—**anterior cruciate ligament; posterior cruciate ligament; knee trauma; point-of-care ultrasound; emergency department

#### INTRODUCTION

Anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) ruptures are common trauma-related injuries in the emergency department (ED) (1). Although magnetic resonance imaging (MRI) is the gold standard for evaluation of the ligament injuries in the knee, the initial diagnosis of ligament injury is usually made by thorough assessment of patient's medical history and physical examination tests. However, these tests demonstrate relatively low sensitivity along with high variability (2,3). Point-of-care musculoskeletal ultrasound is increasingly recognized for its diagnostic value in the ED setting due to its accuracy and real-time imaging capability (4). In this case report, we describe the successful and timely diagnosis of simultaneous ACL and PCL ruptures using point-of-care ultrasound in the ED in an athlete, who could not be subjected to physical examination tests due to severe pain and swelling.

## CASE REPORT

A 19-year-old female judo player was presented to the ED with acute onset of severe pain in the left knee. The young athlete had abruptly twisted her left knee while she was shoulder-throwing her opponent. Her pain was mainly localized to the anterior and posterior aspect of the left knee. Furthermore, she was unable to bear any weight on the left leg. She was not on medications.

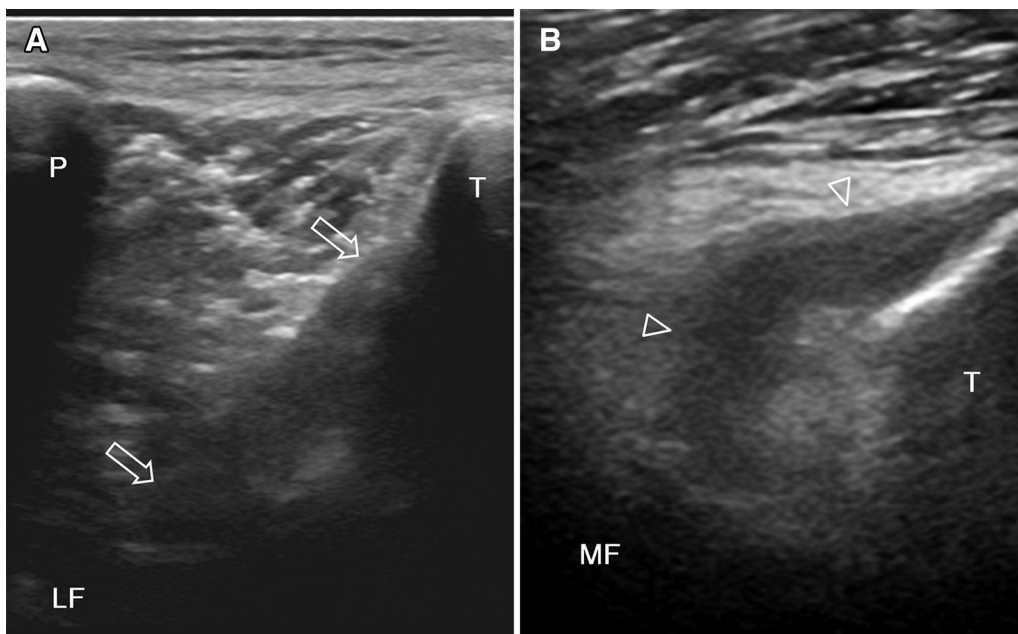
Initial physical examination revealed that the patient was in severe distress due to the pain. Mild swelling and severe tenderness were noted in the entire knee. Although there were no open wounds in the left knee, she complained of severe pain and refused to undergo any further physical examination tests of the knee for evaluation of the injury; as a result, knee instability tests such as anterior/posterior drawer, Lachman, pivot shift, and quadriceps active tests could not be performed. The plain radiographs did not reveal any acute bony abnormalities. Due to the high cost and limited availability of MRI in the ED setting, we decided to perform a point-of-care ultrasound. We used a 9–12-MHz linear array ultrasound transducer probe. The right knee was examined first for comparison (Figure 1). The knee was positioned at about 120–150 degrees flexion. The patient was positioned supine for examination of ACL and prone for PCL. The point-of-care ultrasound examination of the left knee revealed disruption at the femoral attachment site of ACL with retraction of the torn ends, consistent with complete rupture (Figures 2A and 2B). Furthermore,

the images revealed partial disruption at mid-PCL without retraction, consistent with partial rupture of the PCL (Figure 2C). The patient was admitted and subjected to preoperative knee MRI (Figures 2D–2F). The ultrasound findings correlated well with the MRI images in the assessment of the combined ACL-PCL ruptures. The patient underwent simultaneous arthroscopic ACL and PCL reconstruction with hamstring tendon autograft and was discharged.

## DISCUSSION

To date, point-of-care ultrasound imaging has been successfully applied in the diagnoses of wrist, ankle, foot, and elbow injuries (5–7). Notably, these studies were mainly focused on the detection of fractures; point-of-care ultrasound imaging for traumatic knee injuries has not been reported.

Traditionally, ACL and PCL injuries are initially evaluated by obtaining a thorough medical history and physical examination tests of the patient (2,3). For diagnosing ACL injuries, the anterior drawer, Lachman, and pivot shift tests are used. However, the three tests show variable sensitivity (anterior drawer test: 38–62%; Lachman test: 69–87%; pivot shift test: 10–61%) and specificity (anterior drawer test: 25–92%; Lachman test: 81–100%; pivot shift test: 81–99%) (3). Furthermore, previous studies demonstrate that only < 20% of the patients with ACL injuries are being diagnosed correctly, with medical history and physical examination tests, at



**Figure 1.** Point-of-care ultrasound examinations of the right knee (nontraumatic knee) of the patient. (A, B) Long-axis view of the normal right anterior cruciate ligament (arrows, A) and posterior cruciate ligament (arrowheads, B). Continuity, with well-defined hypoechoic bands, is well preserved. P = patella; T = tibia; LF = lateral femoral condyle; MF = medial femoral condyle.

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