

MSK Ultrasound Bites: Tips and Tricks

Diagnostic Musculoskeletal Ultrasound in the Evaluation of the Knee Lateral Collateral Ligament

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The lateral collateral ligament in the knee provides static restraint against varus-directed stress. Lateral collateral ligament injuries are much less common than those of the anterior cruciate or medial collateral ligament. When they do occur, they are more often associated with posterolateral corner injuries or meniscal injuries. A high index of suspicion is required when examining for lateral knee ligaments. An accurate diagnosis of partial tears or ruptures of the lateral collateral ligament is essential for appropriate treatment planning and optimizing patient outcomes. Diagnostic musculoskeletal ultrasound (MSKUS) offers a portable, real-time, and cost-effective alternative that is gaining traction in rehabilitation and sports medicine settings. MSKUS has emerged as a valuable, non-invasive imaging modality for evaluating ligament injuries, including sprains, partial tears, and ruptures. MSKUS is excellent at detecting changes in ligament composition and continuity. This article will review the utility of MSKUS in evaluating lateral collateral ligament injuries, including anatomy, common injury mechanisms, sonographic techniques, and clinical implications for rehabilitation professionals. Diagnosis of acute ligament injury by physical examination is often challenging and is frequently misdiagnosed. By integrating MSKUS into clinical practice, providers can improve diagnostic accuracy, enhance diagnostic confidence, monitor healing progression, and guide rehabilitation strategies to achieve optimal patient outcomes for patients with knee ligament injuries.

INTRODUCTION

Injuries to the lateral collateral ligament (LCL) of the knee (also known as the fibular collateral ligament) are rare and constitute less than 2% of all knee injuries.¹ It is not uncommon to injure the LCL in association with injuries to the anterior cruciate ligament (ACL), the posterior cruciate ligament (PCL), and the posterior lateral corner.²

ANATOMY OF THE LATERAL COLLATERAL LIGAMENT

The LCL of the knee is located on the outside of the knee and is the primary restraint to a varus-directed force. The LCL acts as a secondary restraint to anterior and posterior tibial translation when the ACL and PCL are torn.³ This ligament is cord-shaped and extra-articular, connecting the femur to the fibula on the lateral side of the knee. Its normal length is between 5.5 to 7.1 cm.⁴ The femoral attach-

ment is 1.4 mm proximal and 3.1 mm posterior to the lateral epicondyle, while the fibular attachment is at the fibular head, slightly posterior to its anterior margin.⁵

The most common mechanisms of LCL injury are a direct blow to the medial knee creating a varus stress, non-contact knee hyperextension, and non-contact varus stresses.⁶ LaPrade et al. have stated that a lateral joint opening of more than 2.7 mm suggests a LCL injury, and an opening that exceeds 4.0 mm is associated with a complete posterolateral corner injury.⁷ Sekiya et al. have reported that 10.5 mm or more of lateral joint opening will require posterolateral corner repair or reconstruction.⁸

THE ROLE OF MUSCULOSKELETAL ULTRASOUND IN LIGAMENT EVALUATION

Advantages:

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- **Real-Time Imaging:** MSKUS allows dynamic evaluation of the LCL while the knee can be manipulated through the available range of motion.
- **High-Resolution Visualization:** MSKUS provides detailed images of the LCL and the proximal and distal entheses at the lateral epicondyle and the fibular head.
- **Accessibility and Cost-Effectiveness:** MSKUS is portable, widely available, and less expensive than magnetic resonance imaging (MRI).

Limitations:

- **Operator Dependency:** MSKUS requires skill and experience for accurate interpretation of findings. The ability to sonograph musculoskeletal structures is influenced mainly by the operator, the availability of state-of-the-art equipment, and its technical considerations.
- **Artifacts and Shadows:** Bone and calcifications may create image artifacts, requiring adjustments in probe positioning and frequency.

SONOGRAPHIC TECHNIQUE FOR EVALUATING THE LATERAL COLLATERAL LIGAMENT

- **Probe Type:** Because of the superficial nature of the LCL, a standard high-frequency, linear array transducer is typically used.
- **Patient Position:** The patient is supine with the hip internally rotated and the knee in slight flexion (35-40 degrees). A bolster or towel roll can be placed under the medial knee for support. The probe is placed in either the short axis (SAX) or longitudinal axis (LAX), starting proximally near the lateral femoral epicondyle or distally at the fibular head.
- **Dynamic Assessment:** A varus stress can be applied to the knee during ultrasound assessment to evaluate for lateral knee gapping or tension being placed through the LCL.

NORMAL SONOGRAPHIC APPEARANCE

In the LAX view, depending on the probe width and size, one should start distally to visualize the hyperechoic reflection of the bony cortex of the fibular head distally and the cortex of the femoral epicondyle more proximally. If the depth is increased enough, you will also be able to visualize the bony reflection of the tibia directly below the fibular head. Usually, the LCL demonstrates a hyperechoic fibrillar pattern. The distal portion of the tendon may appear heterogeneous and thickened due to the bifurcating distal biceps femoris tendon that runs both superficial and deep to the LCL.⁹

PATHOLOGIC FINDINGS IN LATERAL COLLATERAL LIGAMENT INJURY

- Disruption of fibrillar pattern of the ligament in partial tears and ruptures.
- Associated joint effusion, presenting as anechoic regions.
- Calcifications near the entheses sites.

CLINICAL IMPLICATIONS FOR REHABILITATION PROVIDERS

MSKUS provides real-time feedback for rehabilitation professionals, facilitating early diagnosis and intervention. Key applications include:

- **Early Detection of Injury / Accurate Injury Grading:** MSKUS can quickly differentiate between a strain and a more severe ligament rupture to help guide treatment planning. Rocha de Faria and colleagues have demonstrated the ability to use MSKUS with stress to grade ligament injuries.¹⁰ They found stress MSKUS to provide a low-cost, dynamic, and reproducible method for patient examinations.
- **Dynamic Functional Testing:** Rehabilitation professionals can use MSKUS during physical therapy sessions to monitor recovery and assess ligament function dynamically. Serial MSKUS imaging aids in assessing ligament remodeling and readiness for rehabilitation progression.
- **Guided Interventions:** Ultrasound imaging assists in needling intervention and precision-guided injections, such as corticosteroids for inflammation.
- **Patient Education:** Real-time imaging serves as a visual aid to explain the nature of the injury and set realistic expectations for recovery.

LIMITATIONS AND CHALLENGES

Despite its advantages, MSKUS cannot entirely replace MRI for complex cases. Additionally, the expertise required for optimal imaging techniques limits its immediate adoption across all rehabilitation settings.

CONCLUSION

MSKUS is a valuable, dynamic, and cost-effective imaging modality for evaluating LCL injuries of the knee. Its ability to provide high-resolution, real-time visualization of ligament morphology, continuity, and surrounding soft-tissue structures makes it an excellent first-line tool in both acute and chronic settings. Ultrasound enables dynamic stress testing and comparison with the contralateral limb, providing diagnostic insights that standard static imaging techniques may not capture. While MRI remains the reference standard for complex or multi-ligamentous injuries, MSKUS offers distinct advantages in accessibility, rapid assessment, and guidance for therapeutic interventions such



Lateral Collateral Ligament (LCL)

Figure 1A: Patient Position and LCL Outline

The patient is positioned supine with a small bolster under the knee to maintain approximately 20–30 degrees of flexion. This relaxes the iliotibial band and biceps femoris while opening the lateral joint line. The lower leg is internally rotated to expose the lateral aspect of the knee. For dynamic assessment, a colleague may apply a gentle varus stress to tension the LCL (not shown).

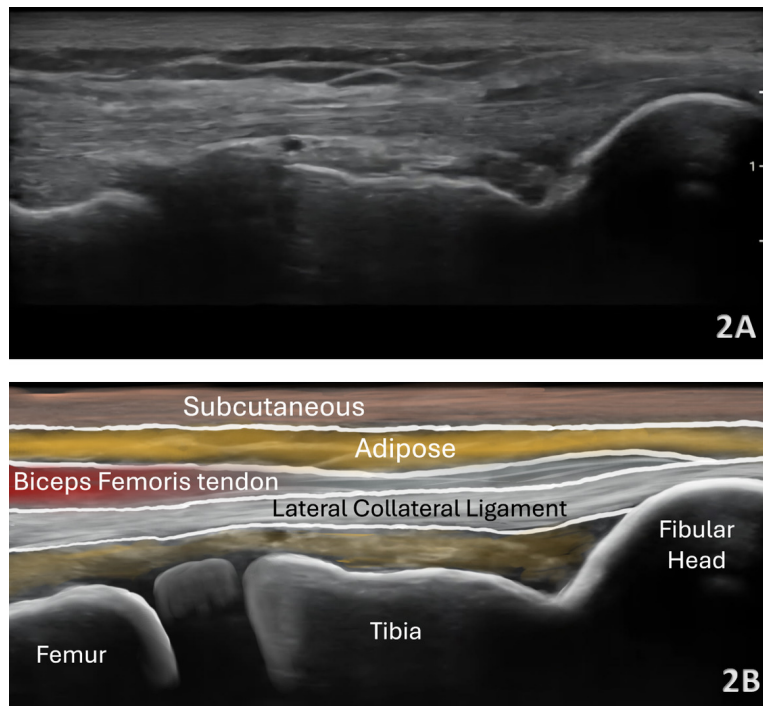
Figure 1B: Long Axis Transducer Placement

To image the LCL, begin by palpating and locating the fibular head on the lateral knee. Place the transducer directly over the fibular head in a long-axis orientation aligned with the fibular shaft. Confirm the fibular head on ultrasound by identifying its bright, curved cortical surface as this anchors the distal attachment of the LCL. From this landmark, sweep the transducer proximally while maintaining long-axis alignment to follow the LCL as it travels toward the lateral femoral epicondyle. Because the ligament is cord-like, small heel-to-toe adjustments help reduce anisotropy and keep the fibrillar pattern clear. Continue making slight anterior or posterior adjustments until the ligament appears as a taut, hyperechoic band along its full length.

as injections or rehabilitation monitoring. Incorporating MSKUS into physical therapists' clinical practice enhances diagnostic accuracy, supports timely decision-making, and ultimately improves patient outcomes in cases of suspected lateral collateral ligament injury.

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Normal View in LAX

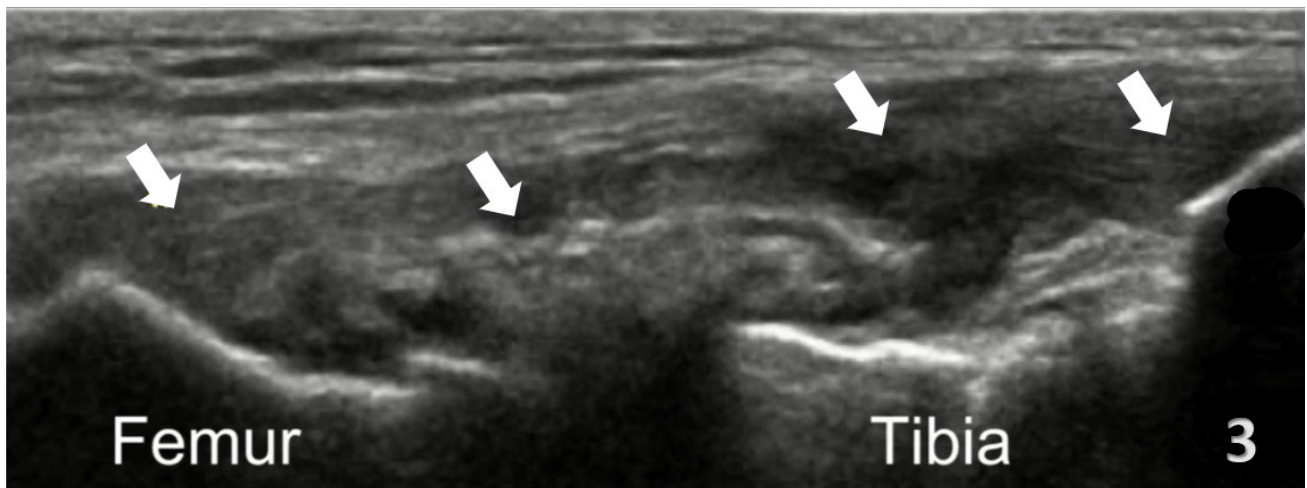
Figures 2A and 2B LAX View:

The LCL is a strong, extracapsular ligament that presents as a compact, hyperechoic, fibrillar band when visualized correctly. It runs superficial to the popliteus tendon and does not attach to the lateral meniscus (unlike the MCL's deep fibers).

A full evaluation includes:

- Sweeping proximal to distal, following the ligament between the femoral epicondyle and fibular head.
- Rocking the transducer to minimize anisotropy, which commonly produces false hypoechoic regions.
- Identifying adjacent structures such as the biceps femoris tendon, iliotibial band, and lateral joint capsule.

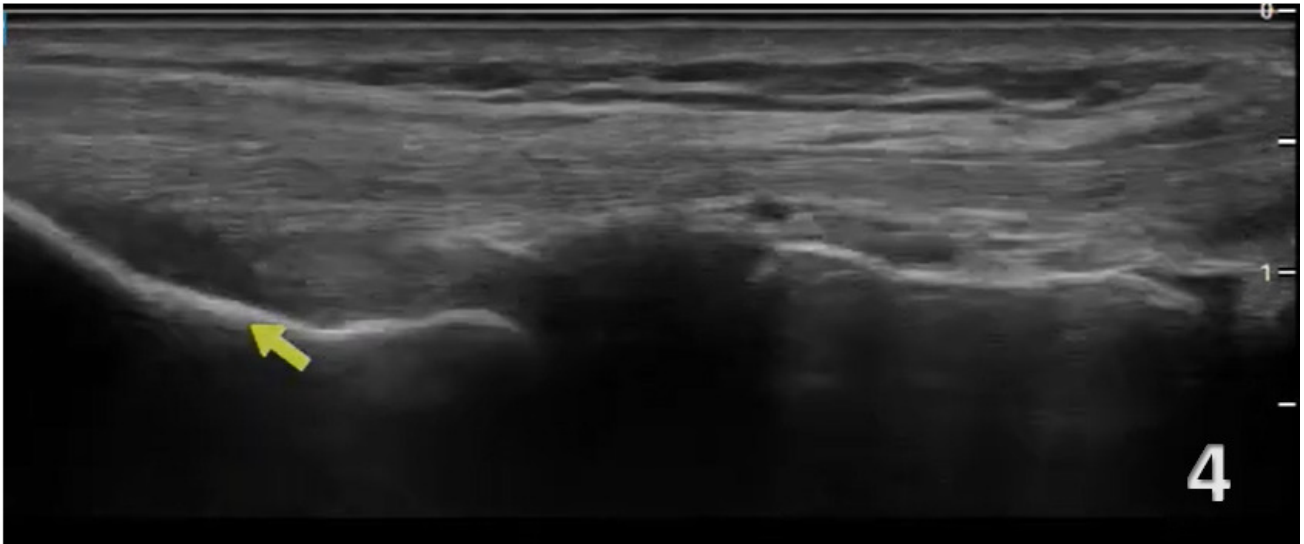
Vascular structures on the lateral knee are less prominent than the medial geniculate system seen with MCL imaging, reducing false-positive interpretation of vascular pulsation.



LCL Pathology

Figure 3: LCL Sprain

Sprains of the LCL typically present on ultrasound with disruption of the normal fibrillar architecture and surrounding hypoechoic edema. Figure 3A illustrates both distal and proximal LCL sprains, characterized by hypoechoic swelling and a loss of normal ligament tension near each insertion. Partial-thickness tears may be visualized as localized anechoic defects or gaps within the ligament fibers. Adjacent soft-tissue edema is common, particularly when there is associated involvement of the joint capsule or the biceps femoris bursa. Application of gentle varus stress during imaging can accentuate fiber gapping and increases diagnostic confidence when distinguishing low-grade sprains from partial-thickness or complete ruptures.



Proximal LCL Tear

Figure 4: Proximal LCL Tear

A hypoechoic interruption or discontinuity near the lateral femoral epicondyle indicates a proximal LCL tear. Because the LCL is extra-articular and cord-like, these tears often retract slightly and can be visualized as localized fiber discontinuity surrounded by edema or hematoma. The LCL normally maintains a taut, well-defined contour—any irregularity or sagging contour suggests structural compromise. It is also common to see a calcification formation at the proximal portion of the LCL tear as it inserts on the lateral epicondyle. This is seen in older, chronic tears that may not be symptomatic.



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