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Original Research

Localization of the Lateral Retinacular Nerve for Diagnostic and Therapeutic Nerve Block for Lateral Knee Pain: A Cadaveric Study

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Abstract

Background: The lateral retinacular nerve (LRN) is a branch of the superior lateral genicular nerve (SLGN) and is believed to contribute to anterolateral knee pain. The precise anatomical pathway of the LRN, however, has not been demonstrated as it relates to the performance of targeted nerve block procedures.
Objective: To describe the anatomical landmarks for localization of the LRN to facilitate diagnostic and therapeutic nerve blocks in the treatment of chronic anterolateral knee pain.
Design: Descriptive study.
Setting: Anatomy dissection laboratory in an academic institution.
Methods: Twenty lower extremities were dissected in 12 cadavers. The sciatic nerve was identified, and its branch to the posterior aspect of the knee, the SLGN, was dissected. The SLGN dissection was continued distally to identify its first branch, the LRN. Two measurements were taken from the branch point on the lateral knee deep to the distal biceps tendon in alignment with the fibular head. A validation study completed in 4 knees was performed as follows: 1 mL of colored dye was injected at the first and second measurements. The cadaveric knee was then dissected to assess the accuracy.
Main Outcome Measurements: Localization of the branch point of the LRN from the SLGN via dissection and then direct assessment of injected dye at the measurement points via dissection.
Results: The branch point of the LRN from the SLGN was, on average, 5.5 $\pm$ 0.66 cm (with a range of 4.5-7.0 cm) proximal to the lateral tibiofemoral joint line in line with the head of the fibula and 2.6 $\pm$ 0.62 cm (2.0-4.5 cm) proximal to the tip of the lateral femoral epicondyle. On assessment of the 2 measurements, the measurement 5.5 cm proximal to the lateral joint line accurately targeted the branch point in 100% (4/4) of the knees, whereas the measurement 2.6 cm proximal the tip of the lateral femoral epicondyle accurately targeted the branch point in 75% (3/4) of the knees.
Conclusion: The results of this study provide 2 dependable landmarks and a description of the path of the LRN, making it possible to accurately target the LRN to diagnose and alleviate lateral knee pain.

Introduction

Knee pain is one of the most common reasons for referral to an outpatient musculoskeletal clinic [1]. Patellofemoral pain syndrome (PFPS) is a frequent source of anterior knee pain and is seen commonly in the young, active population [2,3]. Knee pain often is poorly localized, but the anterior aspect of the knee around the patella is a commonly cited location for pain.

In PFPS, abnormal knee mechanics and overuse, including patellofemoral malalignment, lateral patellofemoral overloading, and tight lateral patellofemoral retinaculum [2,4,5], can lead to chronically stressed peripatellar soft tissues, particularly in the lateral patellofemoral retinaculum (lateral retinaculum). The lateral retinaculum is composed of multiple fascial layers from the iliotibial tract and quadriceps tendon that converge and interdigitate on the anterolateral aspect of the patella [6]. This retinaculum is innervated by the lateral retinacular nerve (LRN), which is a branch of the superior lateral genicular nerve (SLGN). Tightness and shortening of the lateral retinaculum can lead to secondary nerve damage of the LRN resembling the histopathologic picture of interdigital neuritis (Morton neuroma) [7].

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The literature includes a broad spectrum of successful techniques in the conservative management of PFPS, including therapeutic exercises and patellar taping [8,9]; however, some patients continue to experience peripatellar pain refractory to conservative measures. In these patients, studies have shown improvement of lateral knee pain after lateral retinacular release. Interestingly, it has been shown that lateral retinacular release does not reliably result in appreciable improvement in patellofemoral contact pressure despite the improvement of pain [10-13]. Therefore, resection of the LRN is thought to be the underlying mechanism of improvement in knee pain after lateral retinacular release [12].

The infrapatellar branch of the saphenous nerve, a well-documented source of medial knee pain [14], is treated commonly and successfully with peripheral nerve blocks to alleviate medial knee pain [15]. Through Q3 cadaveric dissection, Yasar et al [16] recently investigated the anatomic landmarks for blocking the superior medial genicular nerve and inferior medial genicular nerve. Neurectomy of the LRN has been reported previously for intractable anterolateral knee pain [17], yet the contribution of the LRN to anterolateral knee pain is not well documented, and there is little published about nerve blocks targeting the LRN.

The objective of our cadaveric study is to examine and document the anatomical landmarks for localization of the LRN to facilitate targeting for nerve block to diagnose and treat anterolateral knee pain.

Materials and Methods

A total of 20 lower extremities were dissected in 12 embalmed cadavers from a first-year medical anatomy course (8 female, 4 male, ages 57-95 years at the time of death). Four limbs were excluded—1 because of total knee arthroplasty and 3 as the result of previous complete dissection of the patella. With the cadaver in the prone position, the lateral femoral epicondyle, lateral patella, and fibular head were identified by palpation. The iliotibial tract, the long and short heads of the biceps femoris, and the vastus lateralis muscles were cleaned and defined. The sciatic nerve was identified at the superior end of the popliteal fossa, and its branch to the posterior aspect of the knee, the SLGN, was identified. Dissection of the SLGN was continued distally to identify its first branch, the LRN. Its relationship to the lateral retinaculum was verified.

With the lower extremity in full extension, a line was drawn longitudinally through the fibular head extending superiorly along the femur to a level 4 cm superior to the tip of the lateral femoral epicondyle. Two measurements were taken along this line on the lateral knee. The first measurement was taken from the point at which the LRN branched from the SLGN to the lateral tibiofemoral knee joint line. The lateral tibiofemoral joint line correlates with the midpoint between the distal femur and the proximal tibia. The second measurement was taken from the LRN branch point off the SLGN to the tip of the lateral femoral epicondyle (Figure 1). The tip of the lateral femoral epicondyle was located by palpating the peak eminence on the femoral epicondyle as the fingers descend the lateral femur.

After we calculated the mean measurement for the first and second data points, the accuracy of the measurements was tested. One milliliter of red dye was injected at the first measurement point in each knee, and 1 mL of blue dye was injected at the second measurement point at each knee in a total of 4 undissected lower extremities. The injections were performed with the cadaver in the prone position, and a lateral-to-medial approach was used to target the branch point of the SLGN and LRN. With the subject in full knee extension, a line was drawn parallel from the fibular head extending proximally to the femur. The needle was inserted at the mean measurements to the depth of the femoral periostum. The knees of the cadavers were then dissected, and the accuracy of each respective color to the branch point of the SLGN and LRN was visualized.

Results

The SLGN most commonly branched from the sciatic nerve just proximal to its division into the tibial and common fibular nerves. In 20% of the cases (4/20), the sciatic nerve divided high in the proximal thigh and the SLGN branched from the common fibular nerve near the superior boundary of the popliteal fossa. The SLGN consistently traveled in the superolateral aspect of the popliteal fossa in a horizontal course off the sciatic nerve to reach the medial aspect of the biceps femoris tendon. It then continued distally in an oblique course to the lateral aspect of the knee, remaining deep to the biceps tendon and iliotibial tract where the SLGN branched. One branch traveled directly to the synovial surface of the lateral femoral epicondyle; the other branch, the LRN, traveled with the superior lateral genicular artery and vein along the tendons of the biceps femoris and vastus lateralis giving branches to the lateral retinaculum.

The branch point of the LRN from the SLGN was, on average, 5.5 $\pm$ 0.66 cm (with a range of 4.5-7.0 cm) proximal to the lateral tibiofemoral joint line and 2.6 $\pm$ 0.62 cm (with a range of 2.0-4.5 cm) proximal to the tip of the lateral femoral epicondyle (Figure 1).

The red dye injected at the measurement 5.5 cm proximal to the lateral joint line accurately targeted the branch point of the LRN from the SLGN in 100% (4/4) of the knees, whereas the measurement 2.6 cm proximal to the tip of the lateral femoral epicondyle accurately targeted the nerve in 75% (3/4) of the knees (Figure 2).