Systematic Review

A Review of the Anterolateral Ligament of the Knee: Current Knowledge Regarding Its Incidence, Anatomy, Biomechanics, and Surgical Dissection

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Purpose: To systematically review current literature on the anterolateral ligament (ALL) of the knee. **Methods:** We searched the PubMed/Medline database for publications specifically addressing the ALL. We excluded studies not written in English, studies not using human cadavers or subjects, and studies not specifically addressing the ALL. Data extraction related to the incidence, anatomy, morphometry, biomechanics, and histology of the ALL and its relation to the Segond fracture was performed. **Results:** The incidence of the ALL ranged from 83% to 100%, and this range occurs because of small discrepancies in the definition of the ALL's bony insertions. The ALL originates anterior and distal to the femoral attachment of the lateral collateral ligament. It spans the joint in an oblique fashion and inserts between the fibular head and Gerdy tubercle on the tibia. Exact anatomic and morphometric descriptions vary in the literature, and there are discrepancies regarding the ALL's attachment to the capsule and lateral meniscus. The ALL is a contributor to tibial internal rotation stability, and histologically, it exhibits parallel, crimped fibers consistent with a ligamentous microstructure. The footprint of the ALL has been shown to be at the exact location of the Segond fracture. **Conclusions:** The ALL is a distinct ligamentous structure at the anterolateral aspect of the knee, and it is likely involved in tibial internal rotation stability and the Segond fracture. **Level of Evidence:** Level IV, systematic review of anatomic and imaging studies.

The diagnosis and treatment of soft-tissue injuries have improved drastically in recent years. However, our understanding of the anatomy, kinematics, and injuries of the knee is not yet complete. Although the major ligaments of the knee have been thoroughly investigated, the anatomy, injury, kinematics, and treatment of the anterolateral aspect of the knee are not yet well defined. The recent resurgence of research involving the anterolateral ligament (ALL) has sparked debate and intrigue regarding its potential role in knee kinematics, injury, and repair.

The earliest account of the ALL was that of Segond[1] in 1879, who described it as a "pearly, resistant, fibrous band" at the anterolateral aspect in a study defining the avulsion fracture now termed the "Segond fracture." Further descriptive articles offered various names such as "midlateral capsular ligament," "lateral capsular ligament," "midthird lateral capsular ligament," or "capsulo-osseous layer of the iliotibial tract."[2-12] Although it is not definitively known whether these names all refer to the same soft-tissue structure, a consensus exists regarding the presence of a lateral, obliquely oriented stabilizing structure distinct from the lateral collateral ligament (LCL). However, a paucity of literature is available to accurately describe the ligament's macroanatomy, microanatomy, and incidence, as well as its involvement in native knee kinematics and injury. Furthermore, its potential role in ligamentous reconstruction procedures remains unreported. The aim of this study was to systematically review current literature on the ALL. In addition, a detailed surgical dissection is provided to describe the approach to the origin and insertion of the ALL.

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Methods

Study Inclusion Criteria

Published descriptive laboratory/anatomic studies and clinical studies assessing the anatomic, histologic, and/or biomechanical properties of the ALL of the knee were included. Clinical imaging studies and descriptive/analytic studies of the surgical management of ALL injury were also deemed appropriate.

Search Strategy

We used a text search strategy using the search string "(anterolateral ligament OR lateral capsular ligament OR anterior oblique band OR capsule-osseous layer of iliotibial tract OR mid-third lateral capsular ligament OR lateral structures of the knee OR lateral compartment of the knee OR lateral stabilizing structures OR Segond fractures) AND (injuries OR anatomy OR histology OR biomechanics OR instability)," excluding all articles not pertaining to the knee or the meniscus. Specifically, we searched the PubMed/Medline database for publications of descriptive studies of the ALL or equivalent names before and including the year 2014. We restricted studies by language, including only those published in English or those that had an English translation readily available.

Study Eligibility and Selection

Our search strategy yielded 342 articles. Two investigators (R.P., C.S.) performed separate, manual study selection from this list. Articles not written in English, not pertaining to the knee, or not using human subjects or human cadavers were immediately excluded. Furthermore, articles not specifically addressing the ALL or directly associated structures were excluded. In addition, case studies were excluded. Discrepancies in article selection between the 2 investigators were mediated by a third investigator (T.M.).

Investigated Variables and Data Extraction

The final list of articles was reviewed to summarize the ALL's incidence, anatomy/morphometry, histology, and biomechanics, as well as its relation to Segond fractures. No other variables or properties of the ALL have been studied in detail. Extracted data were recorded in an electronic spreadsheet by 1 investigator (C.S.) and reviewed for accuracy by 2 additional investigators (R.P., T.M.). Because of the paucity of literature specifically addressing the ALL, numerical pooling and averaging of quantitative variables were not performed.

Results

Study Identification and Characteristics

The final selection process yielded 15 articles that specifically addressed the ALL (Fig 1). One of these articles was a recent technical note describing the arthroscopic identification of the ALL in a single patient,[13] which was not found to be adequate for data extraction and systematic review. Another article was a letter to the editor describing the identification of the ALL on magnetic resonance imaging (MRI),[14] which had an inadequate description of methods and, thus, was excluded. The remaining 13 articles were used in the review, and they are summarized in Table 1. Eight of the studies are descriptive anatomic studies,[3,6-8,15-18] one is a prospective clinical imaging study,[19] one is a retrospective clinical imaging study,[20] one is a laboratory-based imaging study of cadaveric specimens,[21] and two are descriptive anatomic studies of cadaveric knees with combined clinical imaging studies.[4,22] Information for this article was only obtained from the cadaveric portion of the studies. Eight studies specifically use the term "anterolateral ligament,"[8,15-18,20-22] one study uses the term "midthird ligament,"[19] one study uses the term "lateral capsular ligament,"[3] one study uses the term "anterior oblique band,"[4] and two studies use the term "capsulo-osseous layer and complex" and state that it functions as the ALL.[6,7] The mean sample size of all included studies is 40.42 ± 67.3 (range, 6 to 271). LaPrade et al.,[19] Terry and LaPrade,[6] and Johnson[3] did not provide the mean age of their patients or donors. Terry et al.[7] only provided an age range of 19 to 72 years, and Cruells Vieira et al.[8] only provided an age range of 33 to 66 years. The weighted mean of all specimens used in the remaining 8 articles is 70.54 years.

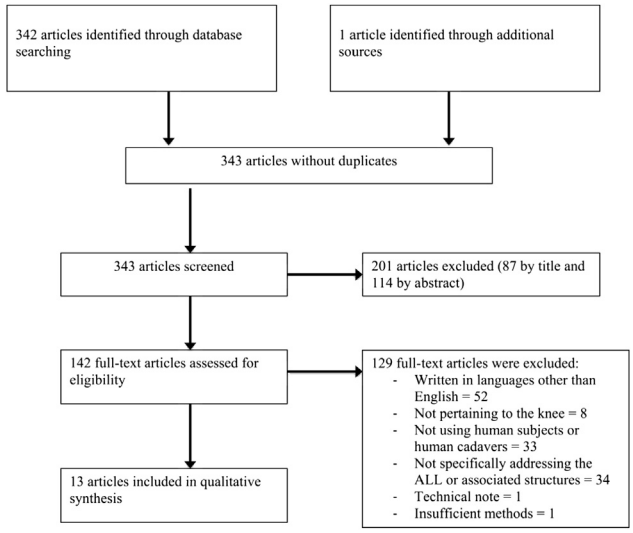

Fig 1. Search strategy results. (ALL, anterolateral ligament.)

Incidence

LaPrade et al.[19] investigated the correlation and appearance of injured and uninjured structures of the posterolateral corner of the knee using MRI. The ALL, termed the "midthird capsular ligament" in their study,