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CORR Insights®: Anterolateral Ligament of the Knee Shows Variable Anatomy in Pediatric Specimens

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Where Are We Now?

Shea and colleagues are not the first to recently investigate the appearance of the anterior lateral ligament (ALL) [5, 7] on MRI, but they do expand our knowledge on the frequency of its existence in the pediatric population. Although we have

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known about the ALL for more than a century, its very existence has yet to be universally accepted, and its functional role and mechanical involvement in the Segond fracture has yet to be determined.

The existence of a “pearly white band” was described by Segond more than a century ago as a lateral capsular structure associated with a tibial fracture fragment [9]. As a young surgeon, I learned that the fragment only appeared in a small percentage of ACL injuries [10] on special oblique radiographs. Its presence was a strong indicator of a corresponding ACL injury. This was the same era when my own surgical approach was an open ACL reconstruction combined with nonanatomic extracapsular reconstruction [2, 4]. Around that time, Terry and colleagues [11] examined the role of the lateral structures relative to ACL deficient knees, focusing on

concomitant lateral femoral tenderness and pathology in the deep layers of the lateral capsular-osseous connection of the iliotibial band to the femur. But rapidly developing expertise with the arthroscope, as well as questions about the value of techniques for extraarticular reconstruction, led us into an era of confining and refining our techniques for intraarticular ACL reconstructions. Consequently, interest regarding the ALL or any extraarticular tissue damage faded.

The current CT-based study gets us back to the business of filling in one of the many gaps in our knowledge regarding extraarticular structures. Shea and colleagues found that nine out of 14 specimens studied had ALL. The ALL not only exists by CT, but one can completely identify its course distally on the tibia and proximally on the femur. Van Dyck and colleagues [12] found that 46% of patients with ACL ruptures had ALL pathology demonstrated on MRI and a considerably higher incidence of lateral meniscus tears, collateral ligament, and osseous injuries in the group where the ALL was injured. This adds

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to the article by Stijak and colleagues [10] who found the ALL identifiable in 50% of adult cadavers but felt the actual dissected tissue to be unimpressive and questioned its functional value.

The road of discovery has not been smooth, and we have yet to possess sufficient data to reach a definitive picture. Velde and colleagues [13] recently reported that the ALL tightens in flexion and loosens in extension—opposite what was traditionally taught. Terry and colleagues [11] demonstrated that nonanatomic lateral extraarticular reconstructions are actually more isometric than ones that are anatomically correct. Given the current controversy, we need to revisit the lateral side of the knee to look at all of the soft-tissue structures.

Where Do We Need To Go?

We have come to the understanding that despite refined intraarticular ACL graft choice and placement, there are patients who do not gain objective static stability from intraarticular surgery alone [8]. Does this mean that there are select patients for whom we may need to revisit the role of the lateral structures of the knee including the ALL, iliotibial band, biceps, extension, and lateral collateral ligament (LCL)?

How do the former observations of Terry and colleagues [11] and the recent, sophisticated observations about the frequently observed ACL injuries that exhibit concomitant iliotibial band and lateral capsule injury [3, 12] fit into this scenario? We need more investigations into treating the unstable ACL-deficient knee. Given that the kinematics of the knee can easily be compromised, can augmentation of reattachment be done successfully?

Velde and colleagues [13] reported that the ALL stretched out in knee extension and tightened in flexion. Given that this is the opposite of what one would think, what is the mechanism by which the Second fracture would occur when the ACL ruptures? We will need better information about this mechanism of injury. Does it require a coupled motion involving a component of varus rather than valgus? Is the ALL equally prominent and important in all individuals? Are patients with hyperlax joints more or less dependent on the ACL relative to the extra capsular structures?

For those patients with Second fractures and ACL disruptions, we need good data on a larger scale. This would ideally include contralateral anatomy and involved leg pathology. We need more research-based MRI studies to check the anatomy on the lateral side of the knee including,

ALL, LCL, and biceps tendon attachment appearance of contralateral legs of patients with a Second injury. This will provide a reference for the anatomic appearance of the uninjured pearly white band.

Regarding involved leg pathology, we need to know the exact location of the lateral tissue injury. Is the injury in the ALL or in the iliotibial band or biceps tendon fibers? Should we determine if the patient with an ACL injury has tenderness on the distal lateral femur?

We also need other investigative teams to support or add to the recent biomechanical observations provided by Velde and colleagues [13] about the effectiveness of ALL repair and nonanatomic reconstructions. Is it indeed better to create the nonanatomic lateral reconstruction or repair the lateral capsular and/or iliotibial band attachments to the femur [1, 6]?

Finally, once the background information provides us sufficient understanding about pathology and individual variations, we need to develop treatment guidelines based on clinical outcome studies. What guidelines can be developed for the primary as well as revision surgeon to even consider ALL or extraarticular reconstructions? When extracapsular surgery appears indicated, how do we avoid entrapment of the knee from over constraint as a result of this

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procedure? In revision cases, are individuals with gross grades of anterior lateral rotational instability in greater need of an extracapsular augmentation of the ACL reconstruction?

How Do We Get There?

From someone who was there at the beginning of the change of focus from combined intraarticular and extraarticular ACL reconstructions to solely intraarticular procedures, it may prove that with better studies, we will finally get back around to where we were headed several decades ago. However, this time around, we will need to deploy our newly found national cooperative study capabilities, advanced imaging techniques, and modern biomechanical abilities to join interested investigators for definite and universally accepted answers that have, to date, remained elusive.

First, we should establish the frequency of existence of the ALL, as well as any variations in its size and tensile strength. Second, we should document mechanisms of every injury by history and examination (varus versus valgus and external rotation versus internal) in Segond versus non-Segond fractures to establish if and when the ligament plays a significant role.

Given the low incidence of the Segond fracture, it is time to establish a national, case-based registry of patients with ACL injuries who are and are not of skeletal maturity, both with and without concomitant Segond fractures. The required information should include: The degree of preoperative joint laxity patterns of injured and uninjured legs, demographic data on gender and age, and a standardized means of assessing the postoperative residual joint laxity after otherwise technically acceptable intraarticular ACL graft placements to determine if all or only hyperlax individuals present a different picture that also needs lateral capsular area management.

Perhaps most importantly, we should focus on the radiographic details of the pathologic anatomy in terms of the exact location of the injury in the two study groups.

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