THE ANTEROLATERAL LIGAMENT OF THE KNEE: EMERGING INTEREST FOR RECONSTRUCTIVE SURGERY

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ABSTRACT

Background: The anterolateral ligament (ALL) originates from the lateral epicondyle of the femur and inserts on the tibia in between Gerdy's tubercle (GT) and fibula head (FH). The ALL exists as a ligamentous structure that becomes taut if tibia is rotated 30° medially. It has been suggested that the ALL of the knee has importance in limiting rotational instability, and reconstruction of the same along with anterior cruciate ligament (ACL) may prevent a continued pivot-shift following surgery. We describe our experience of cadaveric dissection with reference to other published.

Materials and Methods: This study was conducted in Department of Anatomy, D.Y.Patil Medical College, Kolhapur from 2016 to 2018. The ALL was identified in 14 Females and 16 Males cadavers, total 60 knee joints. The ALL tissue was identified with internal rotation of the tibia. Measurements were made using a digital calliper and details of the origin and insertion were recorded.

Results: The ALL was identified had mean dimensions were: length 38.06 ± 3 mm on Right side and 37.94 ± 3 mm on Left side, width 4.38 ± 0.25 mm on Right side and 4.37 ± 0.25 mm on Left side, thickness 0.9 ± 0.02 mm on Right side and 0.9 ± 0.02 mm on Left side. The femoral origin Posterior and Proximal (PP) in 23, Anterior and Distal (AD) in 29 and Femoral Lateral Epicondyle in 8 knee joint. The tibial insertion was a mean 1.79 ± 0.3 mm on Right side and 1.82 ± 0.3 mm on Left side from Gerdy's tubercle (GT) and 1.28 ± 0.03 mm on Right side and 1.25 ± 0.03 mm on Left side from the fibula head (FH).

Conclusions: Our results go along the studies describing that the ALL is a capsular thickening and has meniscal attachment. The findings will help surgeon to perform reconstructive surgery and also help them to select the appropriate graft. Further, we feel this ligament should be added in all gross anatomy book so that medical undergraduates are also aware of ALL.

KEY WORDS: Anterolateral Ligament (ALL), Anterior Cruciate Ligament (ACL), Reconstructive surgery.

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Access this Article online	Journal Information
Quick Response code DOI: 10.16965/ijar.2018.194	International Journal of Anatomy and Research ICV for 2016 90.30 ISSN (E) 2321-4287 ISSN (P) 2321-8967 https://www.ijmhr.org/ijar.htm DOI-Prefix: https://dx.doi.org/10.16965/ijar
Article Information	
Received: 21 Mar 2018 Peer Review: 21 Mar 2018 Revised: None	Accepted: 08 May 2018 Published (O): 05 Jun 2018 Published (P): 05 Jun 2018

INTRODUCTION

Paul Segond in 1879 [1] while operating for avulsion fracture, noted a band of fibrous tissue in proximal region of tibia. He described

this band to be present at anterolateral region of proximal tibia. This band later in 2012, was named as the anterolateral ligament (ALL) of the knee by Vincent [2].

Various studies conducted to enumerate structure which help knee joint to be stabilised. These studies report that Anterior Cruciate ligament (ACL) and Anterolateral ligament (ALL) play a strong role as stabilisers for rotational movements [3]. Different studies correlated injury of ACL to injury to ALL [2-7]. For performing reconstructive surgery on knee joint in cases of injury of ACL, it is important to refer biomechanical studies stating that rotational movement primary stabiliser is ACL and secondary stabiliser is ALL. To summarise if ACL is repaired along with ALL results seen in reducing tibial instability will be better [8-10].

This ligament is described by different authors as “pearly band” attached to Second fracture [1], mid-third (lateral) capsular ligament [11], anterior oblique band of lateral collateral ligament [12].

Understanding of morphology of this ALL was done through anatomical dissection [2,5,13,14] by H & E staining of this fibrous band [2,5], with help of films (x ray) [15-18]. Usually the study was conducted in association with damage to ACL [19].

In spite of papers describing ALL, there are some controversy. Some studies report presence of ALL only in 50% cases [20]. Few mentioned ALL as capsular structure with attachment to lateral meniscus [2,5]. Whereas few studies describe ALL as outside capsule structure [13].

Our goal was to identify the structure that appeared to be controlling anterolateral rotation, characterise its dimensions and attachments, and interpret them in the context of previous work.

MATERIALS AND METHODS

Dissection of sixty cadaveric knee specimens, 14 female and 16 male bodies with no evidence of surgical scars were used for this study. This study was conducted in Department of Anatomy, D.Y.Patil Medical College, and Kolhapur from 2016 to 2018. Both right and left knees with soft tissue proximal and distal to the joint line were dissected. No medical history excluding previous injuries was available.

Gross anatomic dissection was performed, after removal of skin and subcutaneous tissue,

the iliotibial band was dissected from the Gerdy's tubercle (GT) from distal to proximal. The Iliotibial tract was cut proximal to its insertion and care was taken to elevate this without damaging the deep structures. The attachments of the short and long heads of the biceps femoris muscle were released from the femoral origin and reflected distally, allowing for a visualization of the lateral collateral ligament. The tibia was internally rotated, throughout the dissection, to identify structures under tension. The lateral collateral ligament (LCL) was defined (as an easily identifiable structure) and dissection proceeded anteriorly to isolate the tight structure (the ALL) as shown in Figure 1. Further dissection was then performed to demonstrate any attachments to the capsule and lateral meniscus. The presence of the ACL was then determined intra-articularly. Once isolated, the attachments of the ALL were taken in relation to the centre of the fibula head (FH) and GT. The dimensions of the ALL were recorded using a digital calliper (capacity = 150 mm, accuracy 0.01 mm).

RESULTS AND DISCUSSION

Fig. 1: Right Knee Joint.

ALL – Anterolateral Ligament, LCL- Lateral Collateral Ligament, GT- Gerdy's Tubercle, FH- Fibula Head

Table 1: Tibial insertion of Anterolateral ligament.

Tibial Insertion from Gerdy's Tubercle		Tibial Insertion from Fibula Head	
Right	Left	Right	Left
1.79±0.3 mm	1.82± 0.3mm	1.28±0.03mm	1.25 ±0.03mm

Table 2: Femoral origin of Anterolateral ligament.

Femoral Origin	Number
Posterior and Proximal (PP)	23
Anterior and Distal (AD)	29
Femoral Lateral Epicondyle	8

Table 3: Dimensions of Anterolateral ligament.

Length		Width		Thickness	
Right	Left	Right	Left	Right	Left
38.06±3mm	37.94±3mm	4.38±0.25mm	4.37±0.25mm	0.9±0.02mm	0.9±0.02mm

The ALL was identified in 14 Females and 16 Males cadavers, total 60 knee joints. We found in our cadaveric study presence of ALL in all 60 specimens of Knee joint, in all of these ACL was also present. With review from previous cadaveric studies our findings correlate with many studies [5,13,14,20,21,22]

Our findings demonstrated capsular thickening at Anterolateral region of Knee joint, which on internal rotation became taut. These mimic the findings by various authors [2, 5,21,22].

In our study the Tibial attachment was 1.8 ± 0.3 mm from GT and 1.2 ± 0.03 mm from FH as shown in Table 1. These results makes it obvious that the tibial attachment of ALL was more towards FH.

The femoral origin of ALL in our study as shown in Table 2 were almost same like Catherine et al. We described femoral origin in three groups from centre of femoral lateral epicondyle, Posterior and Proximal to Femoral epicondyle and Anterior and Distal to Femoral epicondyle. All of these femoral attachments in relation to centre of lateral femoral epicondyle exist on same line passing through these structures.

In cases with PP attachment of LCL, it was noted that ALL was superficial to the LCL. Similar results are reported by other authors [13,21].

If we compare our study dimensions of ALL to majority of studies, the results are comparable [5, 20, 26, 27]. Table 3 shows results of our study, length of 38 ± 3 mm, a width of 4.37 ± 0.25 mm and thickness of average of 0.9 ± 0.02 mm.

CONCLUSION

In summary, our study suggest that the ALL represents a capsular thickening at anterolateral region of knee joint. The dimensions of our specimen were same as these group [5,16,21,22]. The tibial attachment is found to

lie between GT and the FH, with the femoral origin as described by Catherine et al. [21], was lying around the LCL attachment to the lateral femoral epicondyle at or PP or AD.

This study has added to the current literature regarding the morphology of the ALL. This is important basic knowledge useful in reconstructive surgery. While reconstruction of ACL, to prevent post-operative instability reconstruction of the ALL should be considered. Looking at structure of ALL, it is logical that it plays in restricting abnormal movements of Knee joint. The directions of fibres of ALL and tightening of this structure during internal rotation of the tibia helps us to understand the function of ALL.

Autograft or Allograft used for reconstruction of ALL are from the iliotibial tract, gracilis tendon, and semitendinosus tendon. While reconstructing ALL recreating to the lateral meniscus may be of advantage and also selecting a graft tissue of a similar thickness may prevent complications [23]. During reconstruction surgery the angle of fixation mentioned are different ranging from 60° to 90° of flexion to full knee extension [24]. Further, we feel this ligament should be added in all gross anatomy book so 1st year M.B.B.S students are also aware of ALL.

ABBREVIATIONS

ALL – Anterolateral Ligament
ACL- Anterior Cruciate Ligament
LCL- Lateral Collateral Ligament
GT- Gerdy's Tubercle
FH- Fibula Head
PP- Posterior and Proximal
AD- Anterior and Distal

ACKNOWLEDGEMENTS

We are really grateful to all cadaveric donors for wilful donated their bodies. We will like to thanks family members of donors as well.

Conflicts of Interests: None

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How to cite this article:

Anita Rahul Gune, Dhanaji T Wagh, Vasudha R Nikam. THE ANTEROLATERAL LIGAMENT OF THE KNEE: EMERGING INTEREST FOR RECONSTRUCTIVE SURGERY. *Int J Anat Res* 2018;6(2.3):5316-5319. DOI: 10.16965/ijar.2018.194