

Anatomical study of the anterolateral ligament of the knee: prevalence in embalmed cadavers

Leif Ericksen D.O.'26, Donald Matz, Ph.D., College of Osteopathic Medicine and Department of Anatomy | Des Moines University

Abstract

The anterolateral ligament (ALL) of the knee was first referenced by a French surgeon in 1879 but was not referenced in anatomical literature until 2013. Studies on it have increased significantly the last 2 years. The ALL is a deep ligament on the lateral aspect of the knee. There is some discrepancy about its origin. Most agree that it is anteromedial to or under the origin of the lateral collateral ligament (LCL) sharing fibers on the lateral femoral epicondyle. The ligament courses obliquely in an anteromedial direction fanning anterolaterally distally. It has been described as attaching on the tibia between Gerdy's tubercle and the LCL insertion on the fibula. Along its course, the ALL has an attachment to the lateral meniscus which makes it a possibly significant structure in orthopedics. Also relevant for orthopedic surgery is the growing evidence that the ALL has a significant role as a secondary stabilizer to the anterior cruciate ligament. Since its discovery, there have been various studies that have explored the prevalence of the ALL in the general population. Cadaveric studies done in Japan, India and Belgium have found the percent prevalence of the ALL in their cadaveric studies to be over 90%. Shetty et al. from India described four different shape variations including cord, band, mixed and Y-shaped types. This study looked specifically for the cord type in 70 preserved knees. A distinct ALL in 37 knees for a prevalence of 52.86%, compared to 69.04% in the study from Shetty et al.

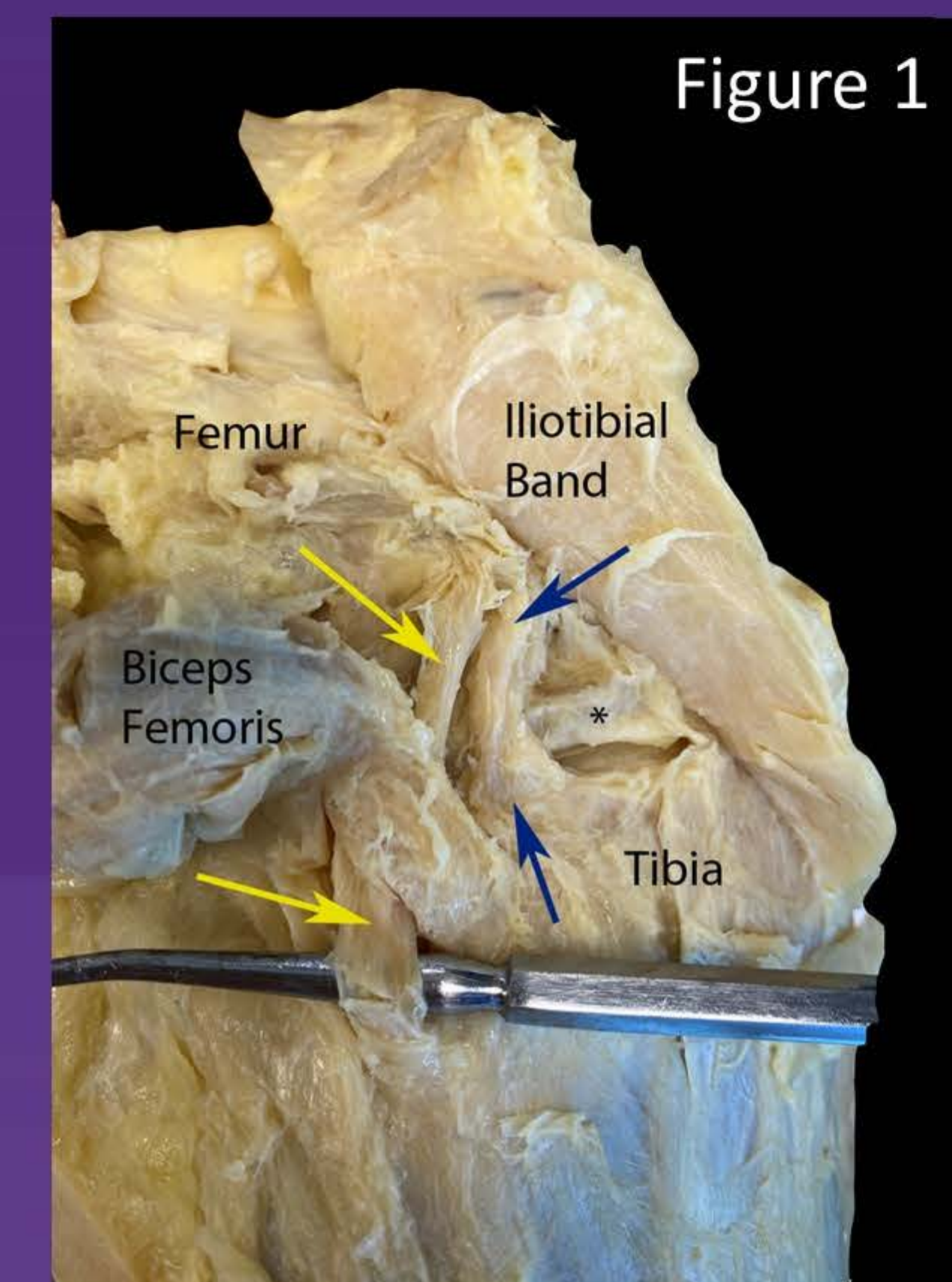
Table, Survey of Anterolateral Ligaments

	Total Bodies Observed	Viable Knees Observed	ALL Present	Bilateral
DO 22-23 Bodies	31	52	28/52 (53.85%)	7/22
PA Summer 23 Bodies	11	18	9/18 (50%)	4/8
Overall	42	70	37/70 (52.86%)	11/30

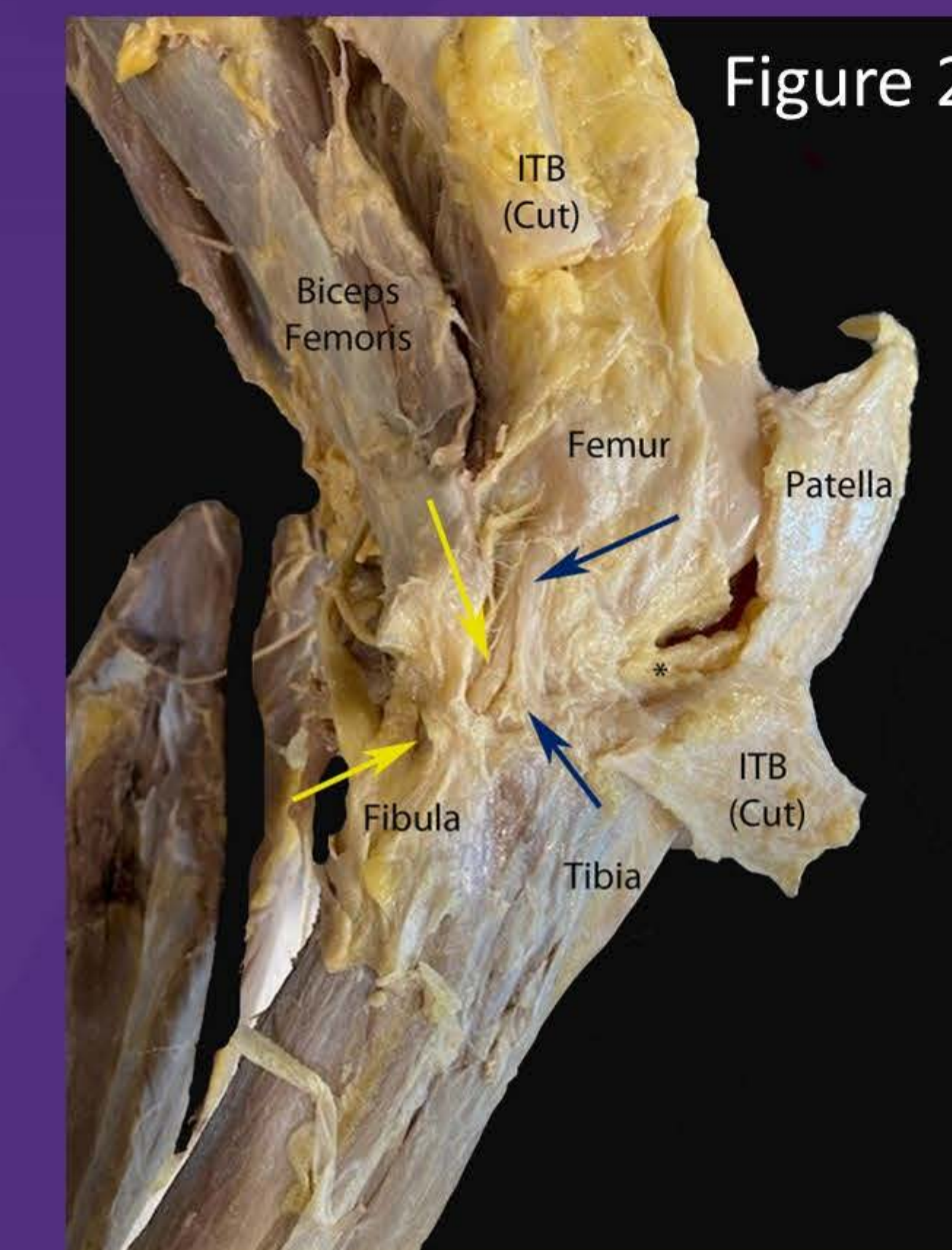
Methods

This study was a quantitative analysis of 70 preserved knees from the DMU Body Donor Program. The focus was identifying the anterolateral ligament (ALL) of the knee. Dissection of the lateral knee was performed in standard fashion. The skin was removed and then the superficial fascia was removed proximal and distal to the joint line. The muscle belly was separated from underlying tissue. The quadriceps tendon was cut proximal to the patella to facilitate flexion at the knee joint and provide access to the menisci. The iliotibial band was cut 6-7 cm proximal to its insertion on the tibia and reflected distally. The deep fascia and connective tissue were carefully separated from the lateral aspect of the knee overlying the area of the lateral collateral ligament (LCL) and anterolateral ligament (ALL). The LCL was isolated and exposed along its course from the lateral femoral epicondyle to its insertion on the fibula where it splits the tendon of the biceps femoris muscle. After exposure of the LCL, reverse scissoring was done medially to isolate the ALL from the joint capsule.

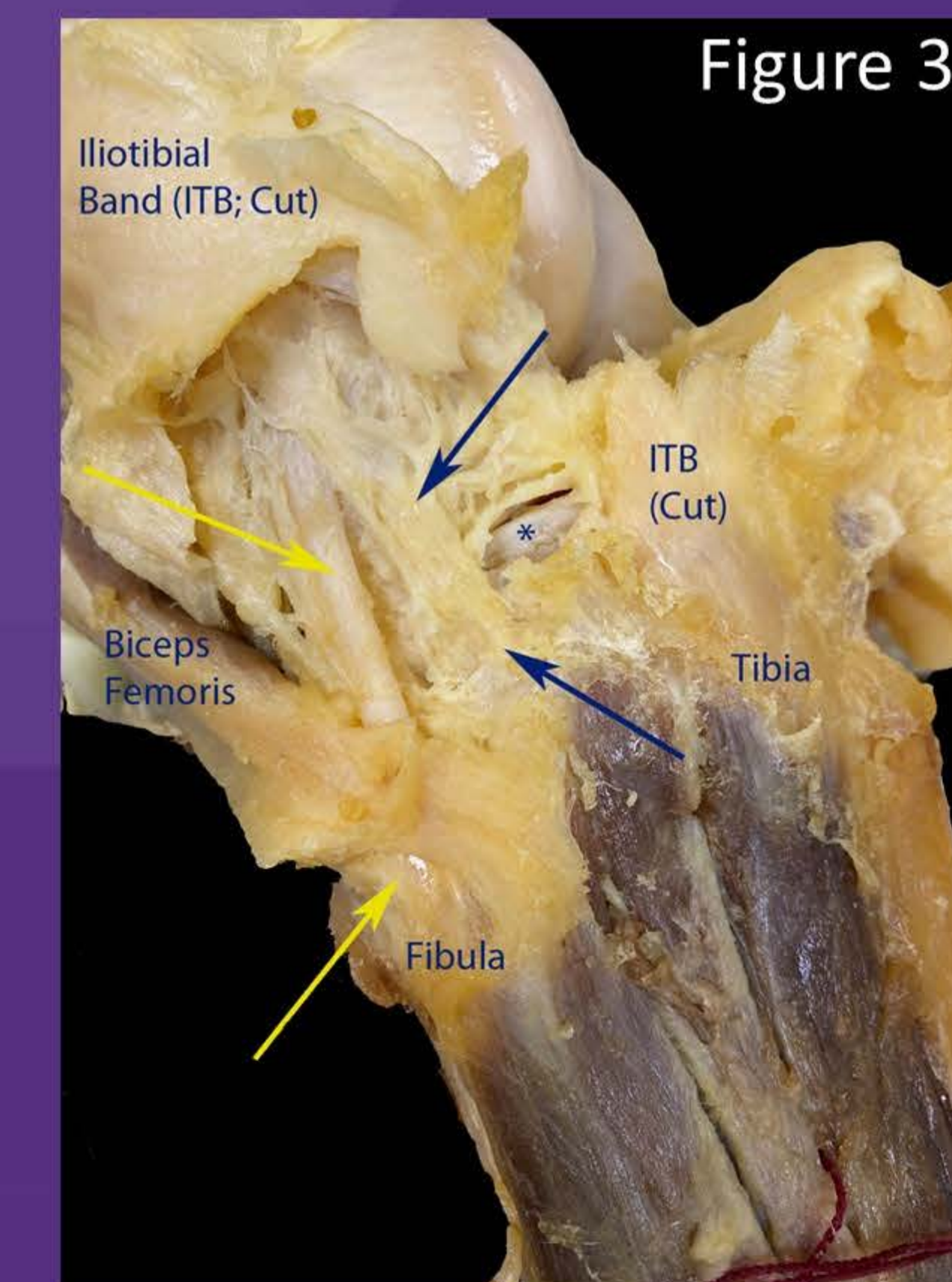
Figures



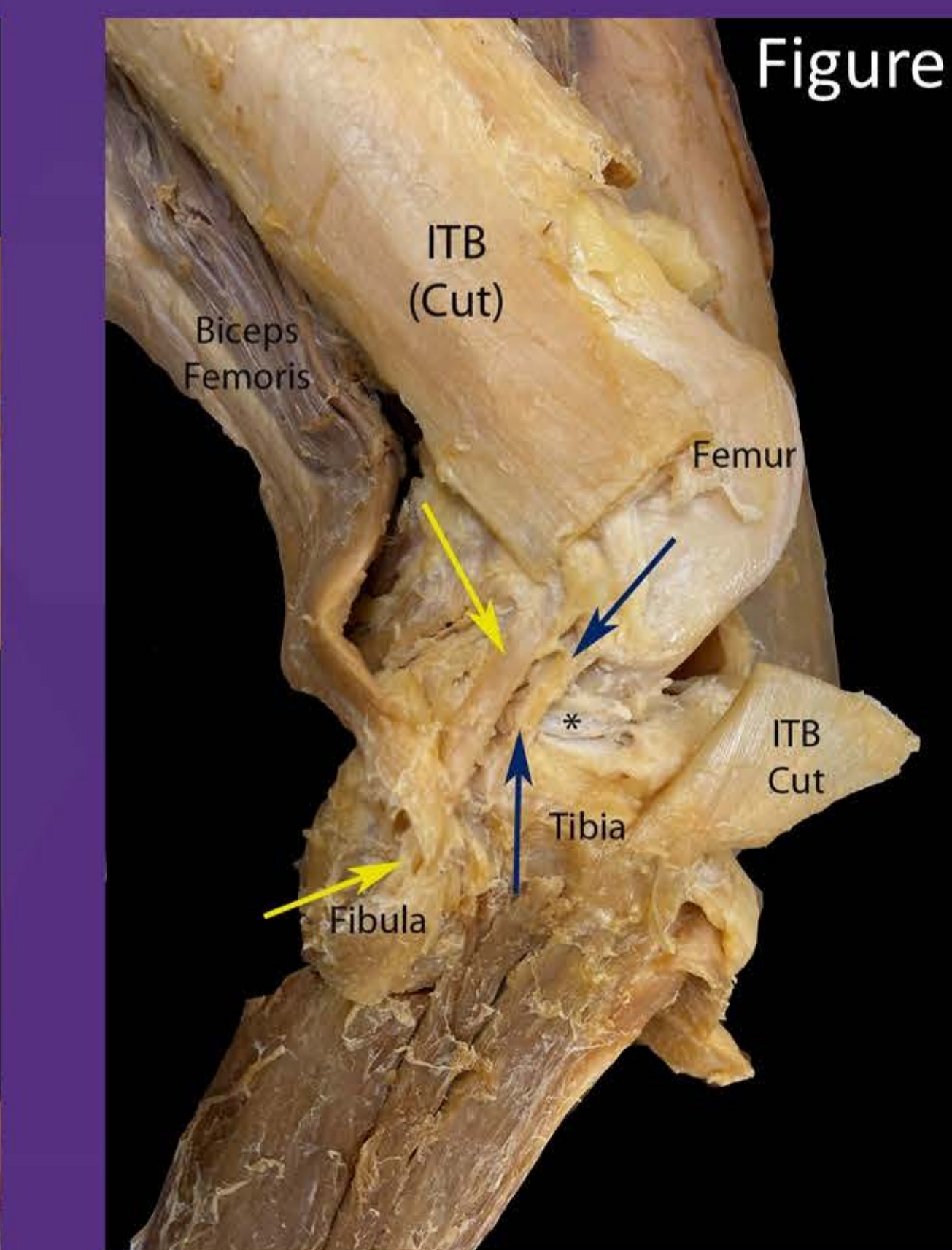
Inverted Y-shaped ALL



Cord-shaped ALL



Band-shaped ALL



Cord-shaped ALL

Figure Legend

Blue arrows, Anterolateral Ligament (ALL) of the Knee
Yellow arrows, Lateral (Fibular) Collateral Ligament
*, Lateral Meniscus of the Knee Joint

Results & Discussion

Of the 84 knees that were observed, 70 knees including 30 matched pairs were viable for study to assess for the presence of an ALL. Fourteen samples were excluded because the lateral knee joint had been compromised due to either a total knee replacement or prior dissection. Presence of the ALL was based on clearly identifying origin, insertion, and trajectory of the fibers in the appropriate area. Of the 70 knees that were studied, a distinct ALL was found in 42 specimens. The overall presence of a distinct ALL was 52.86%. In the 30 specimens where both knees were available for study, the ALL was present bilaterally in 11 for an incidence of 37%. The prevalence of a distinct ALL was lower than values reported in recent investigations. Recent studies in Japan and Belgium reported distinct ligamentous structures in the area of the ALL at 96.2% and 97% respectively.^{1,2} A study done in India in 2020 described 4 variations of the ALL. They described a cord type, band type, mixed band and cord type, and a y-shaped variant with reported prevalence rates: 69.04%, 26.20%, 2.38% and 2.38% respectively.³ Based on their finding that the cord type is the predominant variant, presence of a cord variant was the primary focus in this study (figures 2 & 4). We also observed a band type (figure 3) and a Y-shaped variant (figure 1), but we also found the cord type to be the most common variant. A study done on a specifically Caucasian population of preserved knees from 2022 reported a prevalence rate of 80%.⁴ We believe stricter criteria for classification of the ALL as well as solely looking for the cord type resulted in lower prevalence rates than prior studies. Interest in the presence and anatomy of the ALL is particularly relevant due to an increasing focus in clinical orthopedics. There is speculation that the ALL plays a role in knee stability after anterior cruciate ligament (ACL) tears. Studies have indicated the ALL functions as a secondary stabilizer to the ACL with specific contribution to rotational stability of the knee. Orthopedic focused studies have been conducted in recent years to determine the role the ALL plays in stability of tibial internal rotation in ACL tears. There is evidence that an intact or reconstructed ALL plays a role in concert with the iliotibial band to improve rotational stability after an ACL reconstruction.⁵ Studies have shown that the ALL is damaged in a large majority of ACL tears and graft reconstruction of both the ACL and ALL leads to a lower incidence of rotational instability compared to an isolated ACL reconstruction.⁶

The Des Moines University Body Donation Program and the individuals that voluntarily donate their body and tissues have, by application, permitted the program to utilize their human remains for novel research publications and presentations.

1. Anatomical variation in the anterolateral ligament of the knee and a new dissection technique for embalmed cadaveric specimens by Matthew Parker and Heather F Smith, DOI: 10.1007/s12565-016-0386-2
2. Anatomy of the anterolateral ligament of the knee joint by Jun-Gu Park, Seung-Beom Han, Hye Chang Rhim, Ok Hee Jeon, Ki-Mo Jang, DOI: 10.12998/wjcc.v10.i21.7215
3. Lateral collateral ligament and anterolateral ligament of the knee - A morphological analysis with orthopedic significance by Ashwija Shetty, Sushma Prabhat, Kurian Alappatt, Lalu Krishna Kn, Nandini Bhat, Suhani Sumalatha, DOI: 10.1016/j.knee.2020.12.002
4. Anterolateral ligament of the knee-Cadaver study in a Caucasian population, DOI: 10.1016/j.recot.2022.12.006
5. Anatomy, Biomechanics, and Reconstruction of the Anterolateral Ligament of the Knee Joint by Jun-Gu Park, Seung-Beom Han, Chul-Soo Lee, Ok Hee Jeon, Ki-Mo Jang, DOI: 10.3390/medicina58060786
6. Role of anterolateral reconstruction in patients undergoing anterior cruciate ligament reconstruction, DOI: 10.1016/j.otsr.2017.03.031