Quantitative and descriptive analysis of the meniscotibial ligament in human corpses

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Abstract

The meniscotibial ligaments (LMT) of humans are capsular fibers with proximal origin in the lateral border of the menisci and distal insertion in the lateral border of the tibial condyle, also called coronary ligament of the knee. However, few studies describe the presence, course and anatomical variations of this ligament. Our objective was to evaluate the LMT through quantitative and descriptive methods. Eighty-five knees were examined (42 right knees [RK] and 43 left knees [LK]), dissected, evaluated, catalogued and photographed by four examiners. Twenty knees (23.53%) presented LMT, 6 (30%) in RK and 14 (70%) in LK. In two RKs, the LMT presented proximal insertion in the medial menisci and distal insertion in medial tibial condyle; in the other ones, the LMT presented proximal insertion in the lateral menisci and distal insertion in the lateral tibial condyle. In the LK, four LMT presented proximal insertion in the medial menisci and distal insertion in the medial tibial condyle, while the other ones presented proximal insertion in the lateral menisci and distal insertion in the lateral tibial condyle. One LMT in the LK presented proximal and distal insertion in both menisci and tibial condyle. The analysis of human corpses in our study suggests that the presence of the LMT is much more common in the LK than in the RK, with more frequent insertion in the proximal region of the lateral menisci and distal insertion in the lateral tibial condyle.

Keywords: meniscotibial ligament, knee, anatomy.

1 Introduction

The menisci are fibrocartilaginous structures attached to the tibia and accommodate the femur (BRODY, LIN, HULSTYN et al., 2006; KOHN and MORENO, 1995; LaPRADE, ENGEBRETSEN, LY et al., 2007). They serve to transmit axial and tensional forces across the joint, cushion mechanical loading, limit comprehensive displacement, distribute synovial fluid, increase the surface area for femoral condylar motion and prevent synovial impingement (AMIS, BULL, GUPTE et al., 2003; GUPTE, BULL, THOMAS et al., 2003; GUPTE, BULL, THOMAS et al., 2003). Meniscocapsular ligaments, including meniscofemoral and meniscotibial components, attach the menisci to the posterior femur and tibial plateau, respectively (LaPRADE, MORGAN, WENTORF et al., 2007; NAGASAKI, OHKOSHI, YAMAMOTO et al., 2006). The meniscotibial ligaments are short, confluent ligamentous bands that attach peripherally to the body of the meniscus and serve to stabilize and maintain the meniscus in the appropriate position on the tibial plateau (LaPRADE, ENGEBRETSEN, LY et al., 2007; GOODFELLOW and O'CONNOR, 1986; GUPTE, BULL, MURRAY et al., 2007). The meniscotibial or coronary ligaments further form a portion of the third or deepest layer of the lateral joint capsule. Together, the meniscotibial and meniscofemoral ligaments also comprise the medial capsular ligament, which represents a portion of the medial joint capsule (LaPRADE, MORGAN, WENTORF et al. 2007; MERIDA-VELASCO, SANCHEZ-MONTESINOS, ESPIN-FERRA et al. 1997; SCHMEISER, HEMPFLING, BUHREN et al., 2001). The meniscotibial ligament fibers are, however, difficult to separate from the adjacent capsule and collateral ligament fibers. The meniscotibial or coronary ligaments are attached several millimeters below the articular cartilage to the tibia and occasionally result in a small synovial recess. Although this recess may be seen on an MRI, the meniscotibial ligaments themselves are rarely separately identified (BASSETT, GROVER and SEEGER 1990; ERBAGCI, YILDIRIM, KIZILKAN et al., 2002; LEE, JEE, KIM et al., 2000). Our aim here was to study meniscotibial ligaments in human corpses by descriptive methods.

2 Material and methods

This study was performed between November 2005 and May 2006 with 109 knees of human corpses from the Instituto de Anatomia da Universidade Severino Sombra (IAUSS). The knees with muscle insertion (which corre-

spond to those used for learning) were excluded from this study. A total of 24 knees, 8 right and 16 left, were excluded from the sample. Eighty-five knees, 42 right and 43 left, were dissected by an expert anatomist participant of this study, making two transverse incisions in the bone 10 cm. above the femoral condyle, saving a tendon part of the quadriceps muscle, and another incision 10 cm. from the tibial condyle. The anatomist also performed a thorough cross-section, in which the tibial collateral ligaments, fibular collateral and the joint capsules were retracted. All dissection procedures were followed by the participants of this paper. The samples were fixed in 7% formaldehyde and preserved with Glycerin. All anatomical pieces were analyzed, cataloged and photographed.

3 Results

The meniscotibial ligament was present in 20 knees (23.5%) out of 85 knees examined. Among the 20 knees that presented meniscotibial ligaments, 6 knees were on the right side (30%) and 14 were on the left side (70%). In 42 right knees out of 85 analyzed, the meniscotibial ligament was observed in 6; while the ligament was observed in 14 out of the 43 left knees analyzed (Table 1). In two right knees, the localization of the meniscotibial ligament for the proximal insertion was in the medial meniscus, and for distal insertion in the medial condyle of the tibia. The localization of the meniscotibial ligament in four right knees for the proximal insertion was in the lateral meniscus and for distal insertion in the lateral condyle of the tibia. The localization of the meniscotibial ligament in four left knees for the proximal insertion was in the medial meniscus and for distal insertion in the medial condyle of the tibia (Figure 1). The localization of the meniscotibial ligament in nine left knees for the proximal insertion was in the lateral meniscus and for distal insertion in the lateral condyle of the tibia (Figure 2). A meniscotibial ligament presented proximal and distal insertion in both meniscus and condyles of the tibia.

4 Conclusion

The format of the medial meniscus is the same as a declining line with a larger basis for inclusion of anterior and posterior horns through meniscotibial ligaments (BRODY, LIN, HULSTYN et al., 2006; LaPRADE, ENGEBRETSEN, LY et al., 2007; CHO, KO and WOO, 2006; NAIK, RAO and RAO, 2007). The coronary ligament is located under the articular capsule, and its action is to fix the meniscus in the articular surface, giving it the designation of meniscotibial ligament as the result of the structures with which it is in contact (De MAESENEER, LENCHIK, STAROK et al., 1998; LaPRADE, 1997). The function of meniscotibial ligaments to attach the meniscus to the tibial condyle was also reported (GUPTE, BULL, THOMAS et al., 2003; GUPTE,

Table 1. The distribution of knees for side and presence of meniscotibial ligament.

Analysis of knees dissected and assessed at the IAUSS*		
Samples	**Knees analyzed**	**Presence of MTL****
Right knees	42	6
Left knees	43	14
Total	85	20

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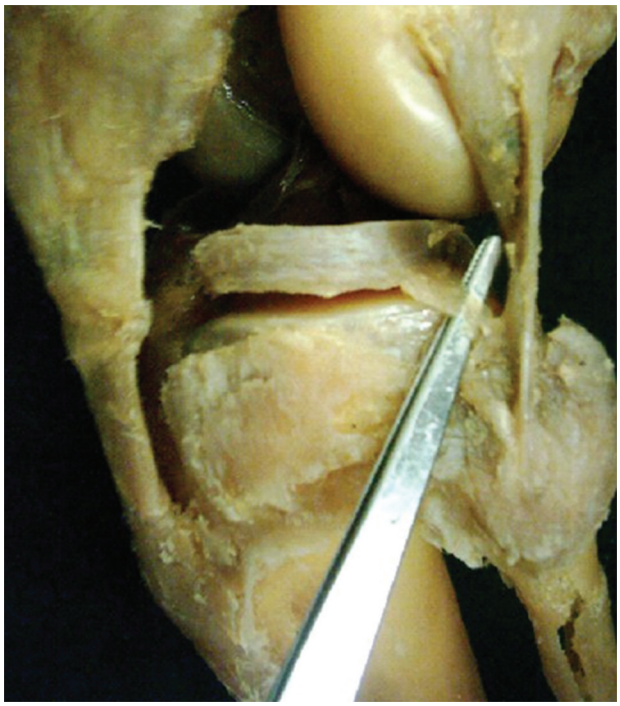

Figure 1. Meniscotibial ligament from left knee with medial proximal and distal insertion.

Figure 2. Meniscotibial ligament from left knee with lateral proximal and distal insertion.

BULL, THOMAS et al., 2003; CHO, KO, WOO, 2006; MORAN, POYNTON, MORAN et al., 2006). Finally, the development of the meniscotibial ligament may be due to the growth of peripheral junctions between the tibial plateau and the perimeter of both menisci (MERIDA-VELASCO, SANCHEZ-MONTESINOS, ESPIN-FERRA et al., 1997; DUFF, 1985). However, other anatomists consider the same ligament as capsular segments of the menisci bordering the tibial superior segment (edge of tibial condyles) (LaPRADE, 1997; HUNTER, MARASCALCO, HUGHSTON, 1983).

In our study we observed the meniscotibial ligament with two different insertions. The proximal and distal insertion of the meniscotibial ligament was more frequent in the lateral surface than in the medial surface. Only one knee presented proximal and distal insertion in both medial and lateral surfaces. Although few pieces present meniscotibial ligaments, we believe there is a functional importance for this ligament. This function could be better analyzed by imaging exams (BASSETT, GROVER, SEEGER, 1990; ERBAGCI, YILDIRIM, KIZILKAN et al., 2002; LEE, JEE, KIM et al., 2000; De ABREU, CHUNG, TRUDELL et al., 2007; HASSINE, FERON, HENRY-FEUGEAS et al., 1992; PARK, JACOBSON, JAMADAR et al., 2007). Moreover, the differences in the pieces with meniscotibial ligaments may be due to anatomical developments of other structures such as muscles, articular capsules and other ligaments. Few reports about meniscotibial ligaments were found in literature. Our study points out the incidence and localization of the meniscotibial ligament and shows a major frequency in the left knee. More studies are necessary to describe, analyze and characterize meniscotibial ligament function, structure and incidence.

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