The anterolateral ligament of the knee – an anatomical phantom

In 1879, Paul Segond published an article on clinically present and experimentally created bloody effusions in sprained knee joints. As an associated aggravation, he reported the formation of comminuted fractures of the lateral tibial condyle caused by avulsion of the anterolateral part of the knee joint fibrous capsule. By giving a rather poor and thus potentially misleading description of the anatomic structures involved, more than 100 years later in 1986 his article started a long lasting discussion that he should have described a definite structure for which the term “anterolateral ligament” was created. As it is generally accepted that - unique for the human body - the knee joint fibrous capsule is mainly established by the tendons of the muscles acting on the knee joint, there is neither space nor reason for the formation of an additional ligamentous structure within that layer. However, on the internal aspect of the fibrous capsule, as described by Henri-Victor Vallois in 1914, another ligamentous structure, namely the lateral meniscotibial ligament is said to be present for anchoring the lateral meniscus.

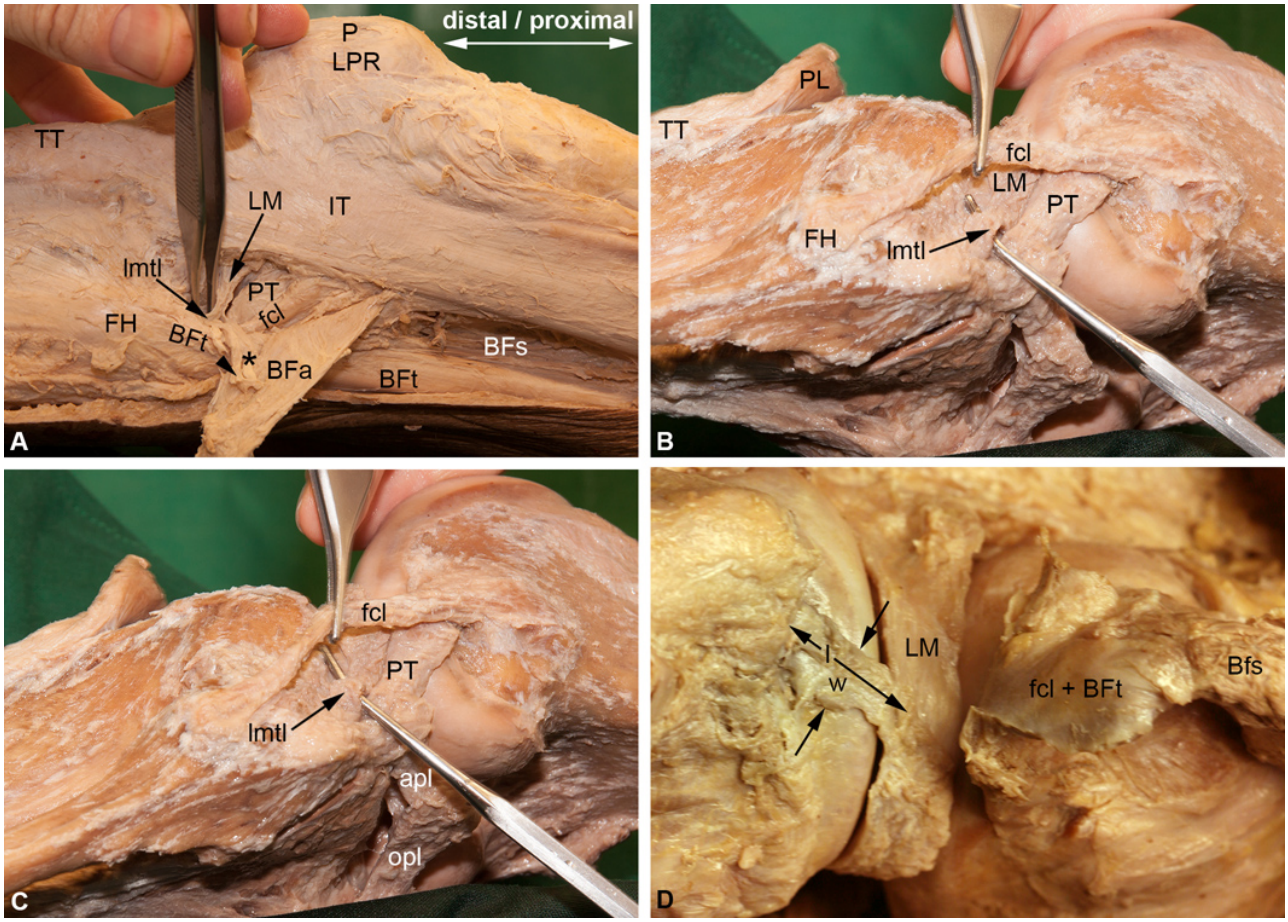

Fig. 1. Macroscopical analysis of the anterolateral part of the fibrous capsule of a left knee joint. In A, the structures establishing the fibrous capsule, i.e. the iliotibial tract (IT) and the aponeurosis of

the biceps femoris muscle (BFa) have been partly mobilized to expose the lateral meniscotibial ligament (lmtl). In B and C, its total course is shown again in a left knee. The probe is inserted between the lateral meniscus (LM) and the lateral tibial condyle. In D, the fibular collateral ligament together with the tendon of the biceps femoris muscle (fcl + BFt) have been detached from the fibular head (FH) to give a better insight on the lmtl and to show the measurements performed on the lmtl, i.e. its length (l) and width (w). Due to the lack of both supporting structures, the femur together with the LM is slightly drawn backwards. Thus, the lmtl fixed to the LM follows a different course from that shown in C, i.e. it courses upwards in a more posterior direction. apl: arcuate popliteal ligament; BFs: short head of the biceps femoris muscle. Asterisk – inferior lateral genicular artery; BFt: tendon of the biceps femoris muscle. fcl: fibular collateral ligament. FH: fibular head. IT: iliotibial tract. LPR: lateral patellar retinaculum. opl: oblique popliteal ligament; P: patella. PL: patellar ligament. PT: tendon of the popliteus muscle; TT: tibial tuberosity.

Thus, to clarify the nature of these two structures, we reinvestigated the formation of the anterolateral part of the knee joint fibrous capsule in a series of forty paired embalmed lower extremities taken from 20 human body donors (15 men and five women) by exact macroscopic anatomical dissection. For the detailed evaluation of the lateral meniscotibial ligament additionally 12 specially dissected joint specimens were used. In addition, the MR-appearance of these structures was studied in a series of axial cross-sections.

Our results showed that the anterolateral part of the knee joint fibrous capsule is constantly established by the iliotibial tract and the anterior arm of the aponeurosis of the biceps femoris muscle (Fig. 1A). According to their close connection and the fact that the anterolateral part of the fibrous capsule is exclusively assembled by these two aponeuroses, they do not leave any space for a distinct anterolateral ligament connecting the lateral femoral epicondyle and the lateral tibial condyle. On the other hand, the lateral meniscotibial ligament was identified as a constantly present flat, rectangular bundle reinforcing the inner aspect of the fibrous capsule (Fig. 1B-D). Following an oblique direction, it connects the lateral face of the lateral meniscus with the superolateral margin of the lateral tibial condyle. Regardless of sex and side, it measured on average 17.1 mm in longitudinal (range, 10–22 mm) and 13 mm in anteroposterior direction (range, 6–17 mm). All structures involved are also well defined in magnetic resonance images (Fig. 2).

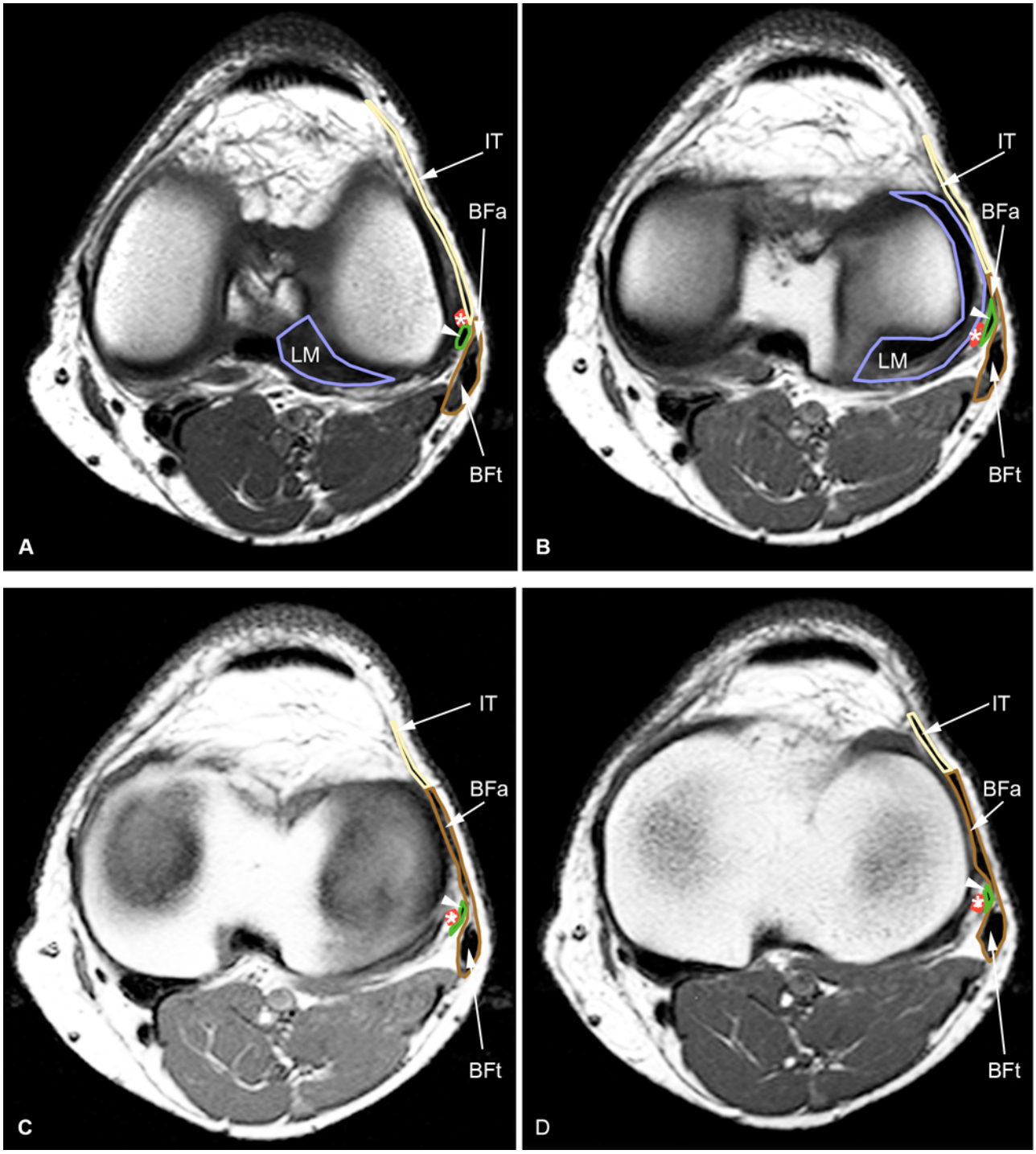

Fig. 2. Axial T1-weighted MR-images of the left knee showing the formation of the anterolateral part of the fibrous capsule by the iliotibial tract (IT) and the aponeurotic insertion of the biceps femoris muscle (BFa) as well as the course of the lateral meniscotibial ligament (asterisk) and its correlation to the adjoining fibular collateral ligament (arrowhead). The figures are arranged in proximodistal sequence with A being the most proximal and D the most distal cross-section. BFt: Biceps femoris tendon. LM: lateral meniscus.

In conclusion, according to our results the so-called anterolateral ligament is represented in any case by one of the aponeuroses establishing the anterolateral part of the knee joint fibrous capsule. The still existing proverbial babel in defining it has already been initiated by Paul Segond in 1879 providing an inconsistent description. Thus, based on his text, the structure named anterolateral ligament is constituted by the iliotibial tract whereas his rather crude drawing suggests that it is formed by the most anterior fibers of the anterior arm of the short head of the biceps femoris muscle. As the anterolateral part of the fibrous capsule acts as one entity including an artificially isolated anterolateral ligament, we propose –like others – to name it the anterolateral aponeurotic complex of the knee joint. Nevertheless, this complex is constantly augmented by the lateral meniscotibial ligament which is apparently able to limit the voluntary rotation of the flexed knee by restraining backward gliding of the lateral meniscus against the tibial condyle. Thus, it is a small and hitherto almost unrecognized, but functionally important structure.

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