ANATOMO-IMAGISTIC AND ARTHROSCOPIC CORRELATIONS IN THE TRAUMATIC PATHOLOGY OF THE INTERNAL MENISCUS

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INTRODUCTION

The role of the meniscus is to maintain the functionality and stability of the joint. From a structural point of view, the meniscus contains a convex and thin portion in the center and a convex and thick portion to the periphery, the structure that determines a good congruence between the tibia and the femoral condyles. The medial meniscus is more commonly injured than the lateral, because it is more extended to the posterior and because its mobility is less. The insertion of the semimembranous muscle in the capsule prevents entrapment and injury of the medial meniscus during flexion of the knee by traction towards posterior. The lateral meniscus, through the tendon of the popliteal muscle, is separated behind the capsule structure, which allows a good mobility at this level. Vascularization of the meniscus helps to a good healing at this level, the meniscus consisting of a peripheral part, red, and a white part, avascular (1,2), the last one healing more heavily than the other one because of the lack of vascularization (1).

Meniscus has the role of evenly distributing the forces acting on the articular face, which is lost after total or partial removal of the meniscus. Lesions at this level are due to age-related degeneration and direct trauma (1).

Vertical ruptures are often found in people aged 20 to 30, the production mechanism involving the transmission of an axial load at the level of a rotated and extended knee or at the level of a flexed knee (1,3,4,5,6).

In terms of degenerative lesions, they occur in the elderly and are horizontal. Meniscal lesions are also associated with the laxity of the anterior cruciate ligament, especially when there are lesions of the posterior meniscal horns (1). The shock absorbing capacity of a meniscectomized knee is about 20% less than a normal one (7). Even if the meniscectomy is not considered a benign procedure (8), the coupled rotation and the anterior-posterior displacement were unaffected (9). After meniscectomy the stress acting at the knee joint was increased (10). The knee joint is protected from degenerative changes if we try to preserve the meniscal rims (11). The indications for partial meniscectomy are – the flap in flap tears, intra-substance meniscal lesions, irreducible inner edge in bucket-handle. (12). The clinical ex-
amination involves pain and mechanical locking in flexion of the knee at 30 degrees. The lesions „bucket-handle” are those that do not allow the complete extension of the knee. When blocking occurs recently after trauma, it may be the result of the contraction of ischiogambieri muscles. When the lesion involves the peripheral portion of the meniscus, knee congestion is observed due to vascularisation at this level. Meniscus lesions can be seen in association with tibial plate fractures and sprains. There are multiple causes, most often involved: quadriceps muscle hypotrophy, congenital abnormalities, genus valgum, varum, recurvatum, ruptures of cruciate ligaments (1).

Mechanisms involved in lesions are the pressure-rotation mechanism, in brutal hyper-extension or falling down. The rupture may be longitudinal, transversal, comminuted, capsular disassembly (1).

As far as paraclinical examinations are concerned, the most used are MRI and arthroscopy. The MRI exam highlights the type of lesion, especially the „bucket-handle” type, as well as the degree of meniscal lesion extension. Arthroscopy remains the gold standard for examining meniscal lesions (1), arthroscopic meniscus repair procedures being with few complications in unstable and stable knee (13). The risks of arthroscopy can be the damage of popliteal vascular structures, the peroneal nerve injuries (14) and the saphenous nerve irritation (15).

The applied treatment consists of arthroscopic surgery, conservative meniscus surgery, and tries to avoid the ablation of some parts of the meniscus. Reconstruction is performed, arthroscopic subtotal meniscectomy, meniscal transplant (1).

MATERIALS AND METHODS

We performed dissections on three corpses from the laboratory of the Anatomy Department of the Carol Davila University of Medicine and Pharmacy in Bucharest, where we highlighted the meniscus, paying special attention to details of the form and the relationship with the other structures. Some images belong to the department of anatomy. We used MRI images of meniscus, normal and pathological. We used arthroscopic images to evaluate normal and pathological internal meniscus. Practically, we performed three assessments of the internal anatomical, imaging and arthroscopic meniscus. Finally, we compared the information obtained on different methods, highlighting the criteria that ease and certify the diagnosis of traumatic pathology of the internal meniscus.

RESULTS AND DISCUSSIONS

1. Anatomical study

Fig. 1. Knee in the embryonic stage. We can notice the internal femoral condyle (red arrow), internal meniscus (black arrow), and tibial plate (blue arrow). It can be noticed that in the early stages of development, the joint has an embryonic mesenchymal aspect. At this stage the tissues undergo individual differentiations and evolutions.
Fig. 2. Image of the knee dissection, we can see the lateral meniscus (blue arrow), the medial meniscus (red arrow), the fibrous layer of the knee joint (black arrow). Clearly, the medial edges are free and mobile. The lateral meniscus horns were always inserted inwards from the medial horns of the meniscus. The convex edge of the meniscus is adherent to the joint capsule. In this way, the meniscus divides the articular cavity into a supra-meniscal and an infra-meniscal layer. At the anterior part of the intercondylar eminence are the following: anterior horn of the medial meniscus, anterior horn of the lateral meniscus, insertion of the anterior cruciate ligament. In the intercondylar fossa, overlap from the posterior to the anterior the posterior horn of the internal meniscus, that of the external meniscus and the insertion of the posterior cruciate ligament.

Fig. 3. Image of the knee dissection, we can notice the anterior cruciate ligament (red arrow), the posterior cruciate ligament (blue arrow) and the lateral meniscus (black arrow). The medial meniscus is covered by the joint capsule. The anterior horn is visible in relation to the tibial plate. The anterior horns of the two meniscus are solidarized by the fibers of the interlemniscal ligament. We note the tight contact of the two cruciate ligaments and their relative torsion.

Fig. 4. Image of knee dissection, we can notice the internal femoral condyle (blue arrow), the internal meniscus (black arrow) adherent to the posterior horn, outer edge, to the articular joint and the collateral tibial ligament (red arrow). We notice that both the meniscus and the ligament adhere to the articular capsule. Overlapping is achieved: the ligament, the capsule, the meniscal convex edge. This overlapping and solidarity make changes in knee biomechanics. Under certain conditions, all three structures may be affected at the same time.
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2. The imaging study

Fig. 5. RMN image, sagittal view of a normal knee, we can notice the internal meniscus without lesions (blue arrow). The arrow demonstrates the horn and its relationship with the articular capsule.

Fig. 6. RMN view, sagittal view, we can notice a lesion (third degree) of the posterior horn of the internal meniscus (blue arrow). Comparing with the anatomical images of fig. 2 and 3, we notice that the appearance on MRI results from a mixed, capsular and meniscal lesion.

Fig. 7. RMN image: “bucket-handle” lesion of the internal meniscus (blue arrow). The appearance is characterized by an antero-posterior meniscal lesion with the migration of a meniscal fragment to the intercondylar fossa. By comparing with the anatomical images we understand that a cruciate ligament lesion can easily be associated.

Fig. 8. RMN image, sagittal view, “bucket-handle” lesion of the internal meniscus. Comparing with FIG. 2 it was observed that the meniscal fragments were detached from the tibial plate with edema under the hyaline cartilage.
3. Arthroscopic study

![Fig. 9. Arthroscopic image of the internal meniscus base, internal meniscus intermediate body, highlighting the lemniscal vasculature (arrow).](image)

![Fig. 10. Arthroscopic image: internal dislocated meniscus (black arrow), femoral condyle (red arrow), tibial plate (blue arrow). The black arrow indicates the location of the meniscal lesion. The lesion allowed the meniscus to migrate to the intercondylar fossa.](image)

![Fig. 11. Arthroscopic image: internal meniscus, intercondylar herniated. Evidence of the convex edge making the appearance of “bucket-handle” lesion (blue arrow), tibial plate (red arrow), internal femoral condyle (black arrow)](image)

![Fig. 12. Arthroscopic image: internal meniscus “bucket-handle” lesion (blue arrow)](image)

![Fig. 13. Arthroscopic image: tibial plate (red arrow), internal meniscus lesion (black arrow), femoral condyle (blue arrow).](image)

CONCLUSIONS

- The overlapping of some anatomical structures can sometimes not be radiologically intuited, and the aspect of the lesions on the MRI examinations is a summative aspect.
- Because the meniscal topography extends transversely, the radiographic sagittal images are different depending on the separation from the median plane.
- The intercondylar phase is a preformed route in which the detached meniscal fragment can migrate.
- The report of meniscal horns of the internal meniscus with the insertions of the cruciate ligaments explains the possibility of mixed...
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ligament-lemniscal damage within the same traumatic mechanism.
- The anatomical study represents a good support for establishing the imaging diagnosis represented by RMN images and arthroscopy.

BIBLIOGRAPHY


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