

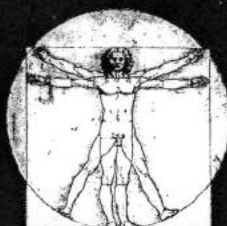
ISSN 0393-974X/2017

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Journal of
BIOLOGICAL REGULATORS
& Homeostatic Agents

JBRHA

Volume 33, No 2 (S1), March-April, 2019



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COMPARATIVE EVALUATION OF MENISCAL PATHOLOGY: MRI VS ARTHROSCOPY

F. BRUNO², R. GODERECCI¹, A. BARILE² and V. CALVISI¹¹*Department of Biotechnological and Applied clinical Sciences, University of L'Aquila;*²*MESVA Department, University of L'Aquila*

The meniscal pathology of the knee is one of the clinical realities the orthopedic surgeon must daily confront with. The diagnosis is generally both clinical and instrumental; among the different diagnostic imaging techniques, Magnetic Resonance Imaging (MRI) appears to be the most accurate method regarding sensitivity and specificity for the study of meniscal fibrocartilages and articular cartilage. In an attempt to clarify the roles of MRI and diagnostic knee arthroscopy, we performed a retrospective comparative study of the two methods to assess their sensitivity and specificity in the diagnosis of meniscal pathology. We evaluated 105 consecutive patients with a clinical diagnosis of intra-articular knee pathology who were subjected to MRI examination and subsequently to surgical arthroscopy, recording on a graphic card the surgical and radiographic findings expressed by a blinded expert radiologist. Comparison of MRI and arthroscopy data showed, for the internal meniscus, values of 98.5% sensitivity, 94.7% specificity and 93.8% "K" index for MRI compared to arthroscopy, and of 90%, 98.6% and 90.5% for the external meniscus. These results allow us to state that the diagnostic capacity of MRI appears to be very high and therefore crucial in the planning of the correct surgical treatment of individual patients, thanks to its ability to highlight even small changes affecting intra-articular structures.

The increased incidence of traumatic and degenerative lesions of meniscal fibrocartilages, associated with the greater diffusion of sports practice among young people and the tendency to gain weight among older patients, explains the high number of surgical indications for knee meniscal disease (1-3). The diagnosis is generally clinical and instrumental, with percentages of specificity and sensitivity close to 100% (4). In the preoperative planning, some authors underline the need for an MR assessment before performing a knee arthroscopy, while others show that an accurate clinical examination yields equal, if not superior, diagnostic abilities compared to MRI (5-7). In an attempt to clarify the roles of MRI and diagnostic knee arthroscopy, we performed a retrospective comparative study of the two methods to

assess their sensitivity and specificity in the diagnosis of meniscal pathology.

MATERIALS AND METHODS

From February to August 2018, surgical knee arthroscopy in 105 consecutive patients was performed, all diagnosed with intra-articular knee pathology. All patients had previously undergone an MR examination of the injured knee, following the onset of painful symptomatology and after clinical indication. The mean age of the patients was 40.3 years (range 16-75) with a male to female ratio of 2:1. All patients at the time of the admission were submitted to an objective examination, including meniscal tests according to McMurray et al, the grinding test

Key words: meniscal tear, knee, MRI, arthroscopy

Corresponding Author:

Federico Bruno, MD,
Department of Biotechnological and Applied Clinical Sciences,
University of L'Aquila
Via Vetoio 1,
67100 L'Aquila (Italy)
Tel.: +390862368512
e-mail: federico.bruno.1988@gmail.com

9(S2)

0393-974X (2019)

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and the pressure test on the affected joint space line. All arthroscopic procedures were performed by an experienced orthopedic surgeon (V.C.).

Before proceeding to the treatment of the lesion found, video recordings of the different joint compartments were performed. The status of meniscal fibrocartilages was verified by careful palpation with a particular instrument (the probe) and by exploring the posteromedial and posterolateral recesses. At the end of the intervention, the presence of any dimorphisms or lesion of the menisci or their integrity was reported on a specific evaluation form. This form consists of an anamnestic part referred to the patient and two separate parts for the graphic recording of the surgical and radiographic findings. Specifically, the two menisci were represented by schematic drawings according to an axial and sagittal plane that allowed an easy and complete graphic interpretation of the possible lesions found and a quick comparison between the two methods. The classification of the lesions was made according to the location and the lesion plane, dividing the meniscus into the three classic portions (anterior horn, body, posterior horn), and recognizing three different cleavage planes (radial, horizontal and longitudinal). Subsequently, all the MRI images were evaluated by an expert radiologist (A.B.), blinded to the arthroscopic findings.

We excluded all patients subjected to arthroscopy after more than 6 months from the MRI examination, as we believe that the evolution of the meniscal lesions could affect the goodness of the MR vs arthroscopy comparison. At the end of the study, we re-evaluated all cases comparing the surgical and MRI reports and calculating the rate of true positives, true negatives, false positives, false negatives and thus sensitivity and diagnostic specificity, with the corresponding 95% concordance intervals, positive and negative predictive value, and "K" correlation index. For a further study of the diagnostic capabilities of MRI, we also divided our sample into age groups, creating, in this way, three groups (16-30, 31-50 and 51-70 years).

RESULTS

The results of our study showed that the total prevalence of lesion was 80.6%, with greater involvement of the internal meniscus (52.4%) compared to the external one (14.3%). In 19% of cases, both menisci were affected.

Patients presenting at arthroscopy with the integrity of meniscal fibrocartilages (14.3%), underwent surgical treatment due to intraarticular problems of different nature (chondropathy, patellar malalignment, LCA lesion, Baker pseudocyst, etc.). Among older patients in particular, we found the simultaneous presence of meniscal and cartilaginous lesions. The most frequently encountered meniscal lesion in the internal meniscus was the complex lesion (26%), followed by the flap lesion (24%), the longitudinal (17%) the radial (9%) and bucket handle tear (7.5%); rarely did we find a double bucket handle tear (2.5%) or the presence of parameniscal cysts (2.5%).

The percentage of meniscocapsular separation was 10% (Fig. 1), while we did not find horizontal lesions or a discoid dysplasia in any case. In 22% of cases, the arthroscopic examination showed the presence of a meniscal fibrotic degeneration; this finding was almost constant among patients belonging to the highest age group or in those with chronic ACL ("knee abusers").

We observed a strong association between ACL and meniscal lesions (83.7% of cases). In particular, the internal meniscus was involved in 72.2% while the external meniscus in only 16.6% of cases; in 11.1% of cases both menisci were involved; in only 7 cases (16.2%) there was an isolated functional ACL insufficiency, demonstrating the important role of the menisci in stabilizing the knee joint. As we have already pointed out, the external meniscus showed different incidence and modalities of injuries compared to the medial meniscus. The most frequent lesion was the longitudinal one (19%), followed by the complex (12.5%), flap (9.3%), radial (6%) and bucket handle (3%). The incidence of cystic degenerative lesions with the formation of parameniscal masses occurred in 3% of cases, similarly to the medial meniscus. A meniscocapsular separation was found only in 3.1% of cases, while we observed a high incidence of discoid meniscal dysplasia (19%) (Fig. 2), only half of these latter being symptomatic. Degeneration of the external meniscus was present in 31% of cases.

Analyzing lesion localization, we found that in most cases tears occur at the level of the posterior horn in both menisci; localizations to the body of the meniscus are rare and ones to the anterior horn even rarer, both for the internal and external meniscus. The MRI sensitivity values in the diagnosis of the meniscal lesions were 98.5% for the internal meniscus and 90%

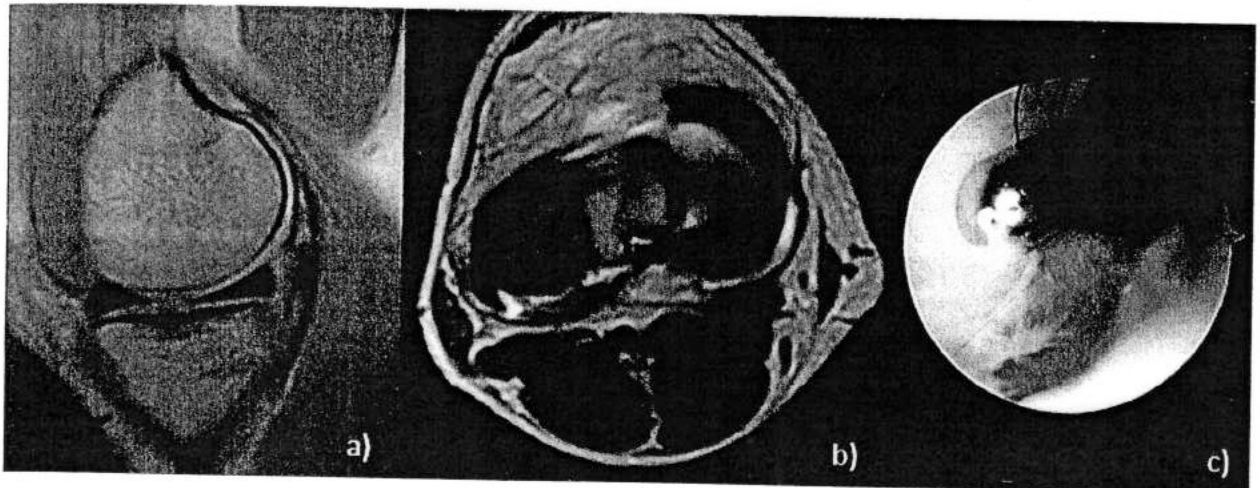


Fig 1. Sagittal PD (a) and axial T2 (b) weighted MRI images showing meniscocapsular separation of the posterior horn of the medial meniscus. Arthroscopic findings (c).

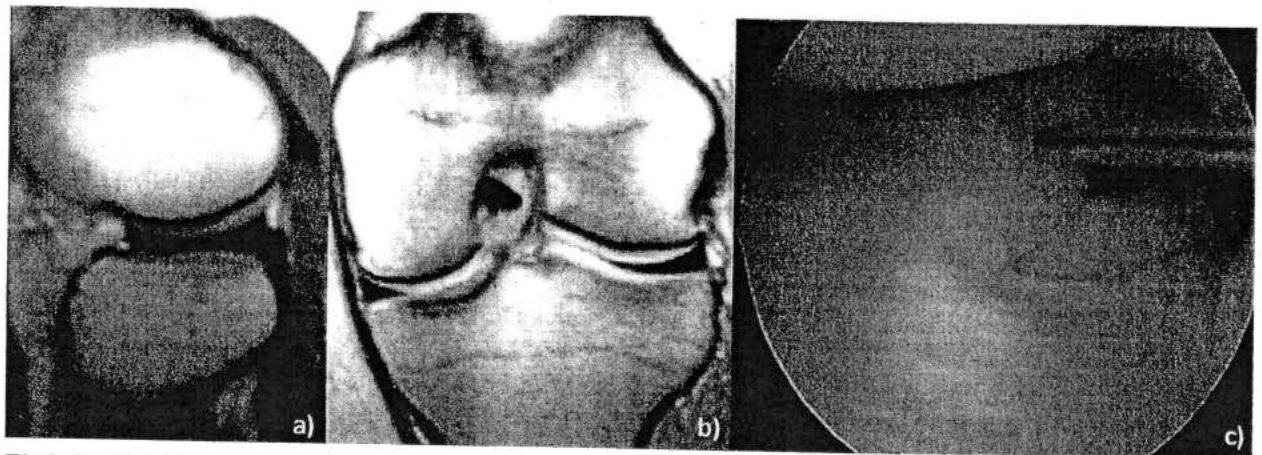


Fig 2. Sagittal (a) and coronal (b) images showing discoid dysplasia of the external meniscus, confirmed at arthroscopy (c).

for the external meniscus with 95% confidence intervals calculated between 95% and 100% and between 79% and 100% respectively.

In regards to specificity, values were 94.7% for the internal and 98.6% for the external meniscus, with concordance intervals calculated at 95% respectively between 87% and 100% and between 96% and 100%. The correlation "K" indices between the two methods were 93.8% for the internal meniscus and 90.5% for the external meniscus. However, when describing the type of lesion, MRI showed different sensitivity and specificity values; notably, the sensitivity and specificity values for the internal meniscus were respectively 71.4% and 94.9% for meniscocapsular separation, 57.1% and 100% for the bucket handle tears, 0% and

of 100% for the radial injury, 68.42% and 96.51% for the complex lesion, and 60% and of 93.6% for the longitudinal lesion.

The results for the external meniscus were as follows: sensitivity and specificity respectively 60% and 100% for the discoid-type dysplasia, 0% and 100% for the bucket-handle tears, 40% and 100% for complex lesions, and 50% and 97% for longitudinal lesions (Fig. 3). The total amount of false negatives and false positives for site and type of meniscal lesion at the MRI evaluation was 15 cases, 10 for the internal meniscus and 5 for the external meniscus.

By classifying these patients by age group, we observed a higher frequency of error among younger patients; 9 cases between 16-30 years of age (average

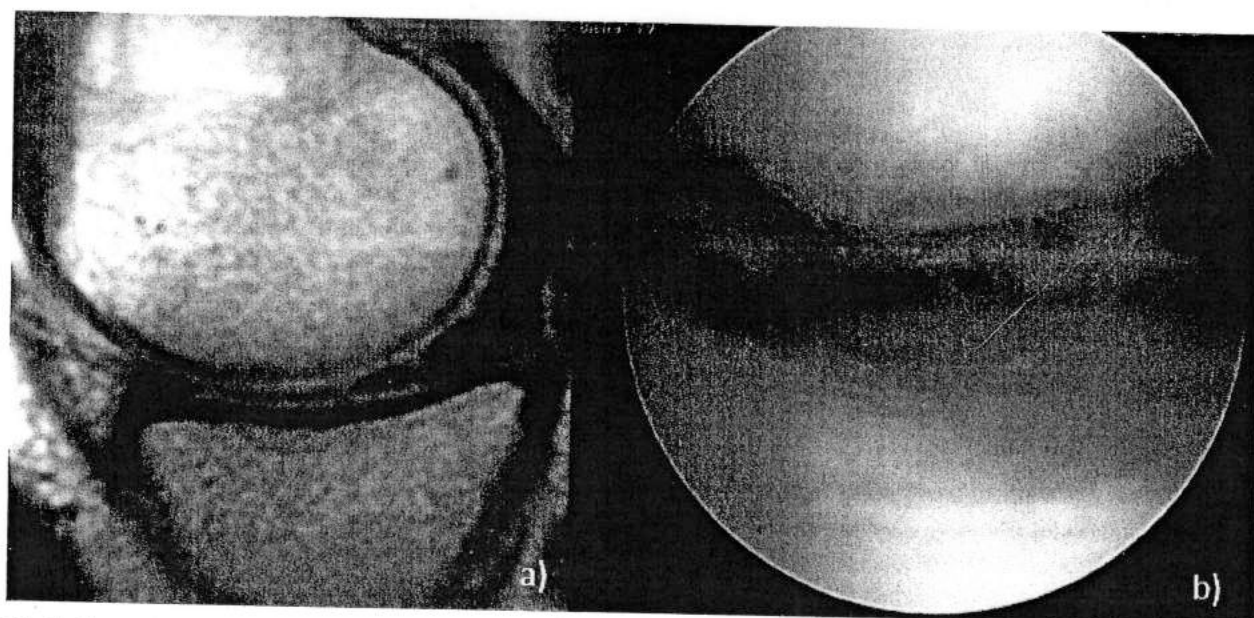


Fig 3. Sagittal (a) MRI findings of longitudinal degenerative lesion of the posterior horn of the medial meniscus, and corresponding arthroscopic findings in (b).

age 20.4), 4 cases between 31-50 years of age (average age 33.2) and 2 cases between 51-70 years of age (mean age 62.5). The most frequently misdiagnosed MRI lesion was the meniscocapsular separation of the body-posterior horn and the radial lesion in both menisci.

DISCUSSION

In general, and in agreement with many authors in recent studies, our results showed high sensitivity and specificity (8) of the MRI in the diagnosis of internal meniscus lesions. We have also found that these values are directly related to the type of meniscal lesion being very high for complex lesions, bucket handle tears, longitudinal tears and for meniscocapsular separation, but being extremely insensitive in the detection of radial type lesions (5, 9, 10). The latter data still generates controversy today; some authors, with whom we feel in agreement, argue that at the base of this phenomenon there is the characteristic pattern of meniscal lesion, challenging to highlight in the three standard scanning planes (11). However, very recent studies state that by integrating all scan planes, mainly the axial, every type of meniscal injury, including radial injury, can be diagnosed with the same accuracy (4, 8, 12, 13).

The analysis of the results obtained from the radiographic and arthroscopic evaluation of the external meniscus allows us to state that the diagnostic capacity of MRI, unlike what is reported by several authors in the literature is very high, with values lower than those for the medial meniscus (14). Also for the external meniscus, as well as for the internal meniscus, the highest percentages of error occurred in the diagnosis of radial lesions with sensitivity values equal to 0%; the same value was found for bucket handle lesions. The phenomenon, in our opinion, is to be correlated with the sample size we studied with only 2 cases of radial lesions and 3 cases of bucket handle lesions that had a negative influence on the results of the statistical survey.

Sample analysis by age groups showed a higher incidence of MRI diagnostic errors in young patients; this phenomenon, particularly evident for the menisci, is likely to be related to the etiopathogenesis of the same lesion. In fact, at the base of these meniscal tears in young sporting patients, there is almost always a high energy trauma that determines at the same time involvement of all the articular structures with the formation of perilesional edema, which appears to be hyperintense like meniscal lesions.

Although arthroscopy represents the "gold-

standard" for the diagnosis and treatment of meniscal pathology, MRI has proved to be important in the choice of the correct operative treatment of individual patients, thanks to its ability to highlight even small signal intensity changes (7, 15-18). This was very evident in cases of femoral and patellar chondromalacia, in cases of clinically silent Baker pseudocysts and in cases of osteochondritis dissecans that probably without the specific information of the method would have gone unnoticed by arthroscopy.

The use of this diagnostic method also allows us to evaluate the quality of the meniscal parenchyma, useful information for therapeutic purposes but difficult to assess even through careful arthroscopic examination.

Given those reason, and also because even minimally invasive arthroscopy presents the traditional and specific risks of surgical trauma, the clinical indication to arthroscopy should always be based on a thorough anamnestic and objective examination, with the integration of the information obtained from the MRI (19).

Therefore, we believe that, although arthroscopy represents the gold standard for the diagnosis of meniscal lesions, MRI, thanks to the high sensitivity and specificity demonstrated in the present study, represents a valid aid to the orthopedic surgeon for the solution of clinical-diagnostic problems. Preoperative imaging instrumental evaluation may provide the possibility to choose the best treatment option (meniscectomy vs meniscal suture), giving the opportunity to know the quality of the meniscal tissue that is going to be treated.

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