ORIGINAL ARTICLE

**MAGNETIC RESONANCE IMAGING VERSUS ARTHROSCOPY IN
EVALUATION OF ANTERIOR CRUCIATE LIGAMENT LESIONS****Gabriela Soare^{1,2}, C.C. Baciu^{1,2}, A. Vișoianu^{1,2}, G.I. Popescu^{1,2}, G.A. Barbilian^{2,3}**¹Clinical Emergency Hospital Bucharest²“Carol Davila” University of Medicine and Pharmacy, Bucharest³“Dr. Carol Davila” University Emergency Central Military Hospital, Bucharest

Corresponding author: Gabriela Soare

Phone no.: 0040723.508.437

E-mail: soare.gabriela@gmail.com

Abstract

The knee joint is one of the most commonly injured joints, as an isolated injury or as a frequent component in a multiple trauma patient. Injury to the ligaments and menisci affects the stability and normal mechanics of the knee joint, resulting in an impairing unstable knee. Magnetic resonance imaging (MRI) is a useful diagnostic tool in the assessment of injuries to the knee joint, while anterior cruciate reconstruction is a common orthopedic procedure. We set to find in this paper the concordance between MRI and arthroscopic findings. We performed a retrospective analysis of 57 patients who underwent both MRI and arthroscopic intervention, in order to see the accuracy of the imagistic evaluation in anterior cruciate ligament (ACL) lesions. Our findings show that MRI and arthroscopy were in complete agreement in 94.7% of the cases. We also found 2 cases that had normal ACL on MRI, but intraoperatory we found a partial tear of the anterior cruciate ligament. In only one case we found an intact ACL at arthroscopy although it looked ruptured on MRI. For the assessment of ligamentous and meniscal injuries MRI is accurate and non-invasive modality. It can be used as a first line investigation, but arthroscopy remains the gold standard for definitive and accurate diagnostic for ACL and meniscal injuries.

Keywords: ACL, reconstruction, MRI, arthroscopy**Introduction**

Anterior cruciate ligament (ACL) ruptures is one of the most common injuries in sport trauma. For example, in the United States of America, there are between 100,000 and 200,000 cases per year [1].

ACL is involved in the stability of the knee, controlling mainly the anterior translation of the tibia, but also acts as a secondary restraint to tibial rotation and valgus and varus stress.

The ACL tear can be the result of both contact and noncontact maneuvers, studies

shown that 70% of the injuries are noncontact as a result of sudden change of direction, slow down or land from a jump.

Usually, the evaluation of ACL is performed immediately after the injury. Because of the swelling and the pain, the tests are performed with difficulty. The knee examination is very sensitive for ACL injury, Lachman test being the most accurate test. For further information about the lesion and for the cases where the examination is nonconclusive, magnetic resonance imaging is the primary study used to diagnose ACL injury.

Magnetic resonance imaging (MRI) is a very often used method in evaluating the knee. It is non-invasive, with a good spatial resolution, and can offer valuable information about the site of the injury, the size of the damage and more other information about the other structures in the knee [2].

Of course, everything can be better seen by direct visualization and that's why arthroscopy is considered the gold standard for evaluation of internal disorders and other lesions of the knee [3]. It's true that arthroscopy has its limits, not being useful in evaluating the extracapsular tissues, and being an invasive and expensive examination [4].

A meta analysis for showing the accuracy of magnetic resonance imaging for anterior cruciate ligament [5], shows that the overuse of the MRI in the diagnosis of ACL injuries leads to misdiagnosis (approximately 47 %), especially in a chronic incomplete tear which might be due to the special sensitivity to the hydrogen atom and could be associated with volume effects and synovial hyperplasia [6].

The sensitivity and specificity of MRI in evaluating ACL ruptures ranges from 63.6% [7] to 100% [8].

The accuracy of MRI depends also on the scanning technique and the experience of the radiologist [9]. Smith et al. (2016) proved that there is no evidence that 3T scanners had superior diagnostic efficacy for ACL injury when compared with 1.5T machines [10].

Materials and Methods

We performed a retrospective analysis of 57 patients who underwent both MRI and arthroscopic intervention, in order to see the accuracy of the imagistic evaluation in ACL lesions.

We included both men and women (42 men and 15 women, Figure 1), with a mean age of 30.6 years old.

All patients that presented to the clinic following a trauma that raised the suspicion of an ACL tear were clinically examined, the rupture of ACL was assessed using the anterior drawer and Lachman tests. Those patients that had positive clinical tests had an MRI investigation performed, in a 1.5 Tesla system.

For concordance between examinations, a standardized MR imaging protocol was used, consisting of sagittal, coronal and axial sequences, with a 3 mm thickness of the sections.

Figure 1- Patient distribution by sex

We established an imaging protocol for diagnosis as follows: ACL normal when it appeared as a band of tensioned fibers on sagittal and coronal images, with a low to intermediate signal; a partial torn in the ACL was considered when confronted with abnormal signal in the thickness of the ligament or when the fibers of the ACL appeared wavy on sagittal and coronal images. A complete torn of the ACL was acknowledged when there was disruption noted in all fibers or if the ligament was absent within the intercondylar notch.

Out of all the patients diagnosed clinically and through magnetic resonance with an ACL lesion, only 70% underwent an arthroscopy within the next 12 months, thus allowing us to keep them in our study.

Results

Our findings show that MRI and arthroscopy were in complete agreement in 94.7% of the cases (Table 1, Figure 2).

	MRI	ARTHROSCOPY
Intact ACL	2	1
ACL lesion	55	56
TOTAL	57	57

Table 1 – Concordance between investigations

Figure 2 – Concordance between MRI and arthroscopy

We also found that 2 cases that had normal ACL on MRI, which may be explained by the partial tear of the anterior cruciate ligament identified at arthroscopy.

In only 1 case we found an intact ACL at arthroscopy although it looked ruptured on MRI (Figure 3).

Figure 3 – Same patient MRI showing absence of ACL with intraoperative image of intact ACL

Discussions

Although our study found a concordance of 94,7 % between MRI and arthroscopic visualization and diagnosis of an ACL tear, we consider that this result was also influenced by our direct interpretation of the magnetic resonance imaging. We believe that results can also be influenced by the imagist, thus appearing the risk for a false positive or even false negative result. We do consider that the MR images should be interpreted by the surgeon together with the imagist, as these do influence their decision, and a false positive report could lead to unnecessary surgical procedure.

Arthroscopic view of the ACL allows for a strong reliable evaluation of the extent of ACL injury, but it does mean performing an invasive investigation. Also, it requires an experienced surgeon. What the MRI allows is an evaluation

of all structures around the knee, preventing unnecessary surgical procedures.

The distribution of the age in the study is explained by the fact that anterior cruciate ligament lesions is usually found in the young, active population.

MRI accuracy was 94,7% in diagnosing ACL lesions which made us say that this type of investigation is very useful. But, even though is a noninvasive method of evaluation of internal knee derangement, the routine use of preoperative MRI is not recommended and the clinical examination of the knee should be performed first. It's true that it can be used as an effective screening study in those with uncertain indications for arthroscopic surgery [11].

We identified 2 cases of partial tear of ACL that were diagnosed as intact ligament on magnetic resonance imaging.

Partial tears of the ACL can be diagnosed using MRI, but the imaging investigation lacks the capacity to make a functional assessment of the remaining portions, which is possible during the arthroscopic procedure [12]. As we found in the literature, there are authors that praise the need for specific slices, for example axial and perpendicular views, in order to make a distinction between partial and complete tears, making the MRI diagnosis more accurate [13].

We identified arthroscopic 1 case of an intact ACL which was previously been diagnosed on MRI as ruptured. This can be explained maybe because of the interference with the fat tissue surrounding the ligament or because of the inflammation within the structures.

Conclusions

For the assessment of ligamentous injuries MRI is an accurate and non-invasive modality. It can be used as a first line investigation, but the decision to undertake a reconstruction of the ACL should not be based on imaging alone, it should also incorporate clinical symptoms and physical findings. Arthroscopy remains the gold standard for definitive and accurate diagnostic for anterior cruciate ligament injuries and should be used to confirm the diagnosis before reconstruction.

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