

CONCLUSIONS

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- Meniscal, ligamentous, and cartilage repair procedures of the knee are increasing in prevalence as are MR imaging examinations of patients after such procedures.
- Therefore, it is important to be able to recognize the normal MR imaging appearance of the knee after the more common procedures, as well as complications associated with such procedures.
- Patients who have persistent or recurrent knee symptoms after knee surgery can be accurately assessed with MR imaging.
- Knowledge of normal ligament reconstruction techniques allows differentiation of the normal postoperative appearance from reconstruction failure and complications.
- ACL graft complications such as abnormal tunnel positioning, roof impingement, partial and complete graft tears, arthrofibrosis, tunnel synovial cysts, iliotibial band friction syndrome, hardware loosening, and infection are reliably assessed by MR imaging.
- MR imaging is the preferred imaging modality for evaluating meniscal pathology in patients who have partial meniscal resection or meniscal repair.
- MR imaging is a powerful tool for the morphologic and compositional imaging of cartilage in the knee.
- With development of more advanced MR techniques, GRE sequences are no longer considered a reference standard in the morphologic evaluation of cartilage.
- Currently, two-dimensional intermediate-weighted or T2-weighted fat-suppressed fast-spin-echo (FSE) sequences are most commonly used in clinical practice to evaluate morphologic cartilage.
- Imaging of repair cartilage is needed to determine the extent of defect filling, the degree of peripheral integration with the host tissue, the morphologic structure and signal intensity of the repair tissue, and the integrity of the host cartilage.

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PROTOCOL

مراجعة
المصدر

THE ROLE OF MAGNETIC RESONANCE IMAGING IN SYMPTOMATIC PATIENTS FOLLOWING OPERATIVE KNEE PROCEDURES FOR INTERNAL DERANGEMENT

دور الفحص بالرنين المغناطيسي عند المرضى الذين يعانون من أعراض بعد التدخل الجراحي لخلل الركبة الداخلى

Protocol of a thesis submitted
to the Faculty of Medicine
University of Alexandria
In partial fulfillment of the
requirements of the degree of
**Doctor in Radiodiagnosis and
Intervention**

خطة بحث مقدمة
لكلية الطب
جامعة الإسكندرية
إيفاء جزئياً
لشروط الحصول على درجة
دكتور فى الأشعة التشخيصية
و التدخلية

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INTRODUCTION

Internal knee derangement may occur due to affection of the articular cartilage, the anterior cruciate ligament (ACL), the posterior cruciate ligament (PCL), the medial and lateral menisci.⁽¹⁾

Magnetic resonance (MR) imaging of the knee after surgical repair is becoming more common because of the increasing number of therapeutic knee arthroscopic procedures being performed.⁽¹⁾

The most common arthroscopic repair procedures include partial meniscectomy and meniscal repair, anterior cruciate ligament reconstruction, and cartilage repair procedures.⁽¹⁾

Given the increasing number of patients undergoing ACL reconstruction, it is imperative for radiologists to be familiar with these procedures, the normal imaging findings as well as the appearances of common complications that can occur in these patients.⁽²⁾

MR signal of the ACL graft varies based on the composition and age of the graft. Contrast-enhanced MRI can non invasively monitor the serial signal intensity changes noted during the revascularization process of the ACL graft.⁽³⁾

The normal location of the femoral and tibial graft tunnels should be identified.⁽⁴⁻⁷⁾



Complications from ACL repair can be related to graft harvesting, graft placement, or the graft itself. ⁽⁸⁾

Most PCL tears are partial thickness, as opposed to full thickness, and can be treated with conservative therapy. In some cases, the partially torn PCL can be repaired directly. Metal artifact and fibrous tissue can obscure the repair site. For those injuries needing reconstruction, the materials used are similar to those for ACL reconstruction. ⁽⁹⁾

The normal appearance of the reconstructed PCL is somewhat controversial in the literature. The PCL graft likely undergoes a normal postoperative change in signal intensity similar to ACL grafts. ⁽¹⁰⁾

PCL graft failure has a similar appearance to ACL graft failure and most PCL reconstruction complications are similar to those of ACL reconstruction. ⁽¹¹⁾

Postoperative imaging of the meniscus is complicated. The standard criteria for a tear have limited diagnostic usefulness when diagnosing a tear at the site of meniscal repair or partial resection. ⁽¹¹⁻¹⁴⁾

• Therefore, imaging of the postoperative meniscus is a challenge. The character of a patient's symptoms and signs, timing of previous surgical intervention, and details of surgery are all important pieces of information that can aid in the diagnosis of a recurrent or residual meniscal tear. MRI of the symptomatic knee, after meniscal surgery, is a valuable diagnostic adjunct of not only the previously treated meniscus but the entire joint. ⁽¹⁵⁾

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Lesions that are caused by trauma or degeneration of the cartilage do not heal spontaneously and must be repaired surgically. Multiple interventional procedures have been developed for the repair of such lesions. An accurate imaging assessment of the repair tissue is necessary in order to objectively evaluate the postoperative outcome. Magnetic resonance (MR) imaging and arthroscopy provide complementary information and are especially useful for follow-up evaluation of cartilage repair in the knee. ⁽¹⁶⁾

Thus, MR imaging is crucial for evaluating the postoperative knee. The reconstructed or repaired ligament, bone, cartilage, menisci, and surrounding soft tissues all can be evaluated with this modality. ⁽¹⁷⁾

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AIM OF THE WORK

The aim of this study is to evaluate the role of MRI in symptomatic patients following operative management of internal knee derangement.



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SUBJECTS

The study will be conducted on 50 patients referred to the Radiodiagnosis department at Alexandria Main University Hospitals with symptomatic *knee following operative* management of internal derangement.

Inclusion criteria:

- Symptomatic patients following cruciate graft reconstructions and meniscal surgery.
- Evaluation of cartilage repair.

Exclusion criteria:

Concomitant pathology other than degenerative osteoarthropathy.



METHODS

- Each patient will be subjected to:

- History taking.
- Thorough clinical examination.
- Plain x-ray.

- High field MRI evaluation including:

- a) Routine sequences (Axial, sagittal and coronal T1, T2 and proton density with or without fat suppression as well as 3D gradient 'GRE').
- b) MR arthrography if indicated.
- c) Following cruciate ligaments reconstruction surgery: coronal oblique.
- d) Following meniscal surgery: Sagittal and coronal fat-suppressed intermediate-weighted fast SE (TE 33-60 msec), as well as sagittal fat-suppressed T2-weighted fast SE.
- e) Following articular cartilage surgery: Intermediate-weighted fast SE sequences.

- Correlation with arthroscopic findings in certain cases.

-The medical ethics will be considered: The patient should be aware of the examination; the informed consent should be taken from the patient. The economic status of the patient should be considered and the patient has to get benefit from the examination.



Ethics of Research

Research on human or human products:

- Prospective study:** informed consent will be taken from patient. In case of incompetent patient the informed consent will be from the guardians.
 - Retrospective study:** Confidentiality of record will be considered.
 - DNA/ genomic material:** informed consent for DNA/ genomic test and for research will be taken from patients. No further tests will be carried out except with further approval of committee and patients. If the samples will travel outside Egypt the researcher will be responsible for transportation and security approval.
 - All drugs used in the research are approved by the Egyptian ministry of health.
-

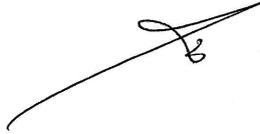
Research on animal:

- The animal species is appropriate to the test.
- After test, if the animal will suffer it will be euthanized and properly disposed.
- After operation, it will have a proper postoperative care.



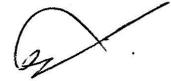
RESULTS

The results will be tabulated and analyzed, using the appropriate methods.



DISCUSSION

The results will be discussed in view of achievement of the aim and compared with other studies in the literature.



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ARABIC SUMMARY

الملخص العربي

إن التصوير بالرنين المغناطيسي له دور في تقييم الركبة عند المرضى الذين يعانون من أعراض بعد التدخل الجراحي لخلل الركبة الداخلي نتيجة إصابة في الغضروف المفصلي أو في الرباط الصليبي الأمامي والخلفي أو الغضروف الهلالي الداخلي والخارجي.

كان الهدف من هذه الدراسة هو تقييم دور التصوير بالرنين المغناطيسي عند المرضى الذين يعانون من أعراض بعد التدخل الجراحي لحالات خلل الركبة الداخلي.

اشتملت هذه الدراسة على ٥٠ مريضاً (٤١ من الذكور و ٩ من الإناث) كانوا يعانون من أعراض بعد خضوعهم لجراحة إعادة بناء الرباط الصليبي الأمامي، وجراحة الغضاريف الهلالية وجراحة إصلاح الغضروف المفصلي في الفترة بين عامي ٢٠١١ و ٢٠١٤.

تم تقسيم المرضى الخاضعين للدراسة إلى ثلاثة مجموعات وفقاً للعمليات الجراحية التي أجريت لهم. المجموعة الأولى شملت ٢٦ مريضاً كانوا قد خضعوا لإعادة بناء الرباط الصليبي الأمامي. أما المجموعة الثانية فقد احتوت على ٢٠ مريضاً خضعوا لجراحة الغضاريف الهلالية وشملت المجموعة الثالثة ٤ مرضى خضعوا لجراحة إصلاح الغضروف المفصلي.

كانت شكاوى المرضى متمثلة في ألم عند ٤٨ مريضاً (٩٦.٠ %) وعدم ثبات الركبة عند ١١ مريضاً (٢٢.٠ %) وتعليق عند ٥ مرضى (١٠.٠ %).

تم إجراء الفحص باستخدام جهاز رنين مغناطيسي بقوة ١.٥ تسلا باستخدام لفائف طرفية للإرسال والاستقبال. وضعت الركبة في ١٠-١٥ درجة دوران خارجي (لتوجيه الرباط الصليبي مع مستوى التصوير السهمي). طبق نفس بروتوكول الفحص لجميع المرضى باستخدام متعددات مختلفة وتشكيل مقاطع تاجية مائلة من متابعة PD السهمي.

وكانت النتائج ذات الصلة بالجراحة في المجموعة الأولى على النحو التالي: تم العثور على إشارة عالية عند ٧ مرضى (٤ منهم إشارة طبيعية بعد الجراحة و ٣ حالات تمثل اختناق)؛ تم العثور على تمزق في الرباط الصليبي المعاد تكوينه عند ١١ مريضاً منها ٣ حالات تمزق جزئي و ٨ حالات تمزق كلي. موقع خطأ للنفق بعظمة الساق عند ٦ مرضى. زحلقة أمامية لعظمة الساق عند ٦ مرضى. تكيس في نفق عظمة الساق عند مريضين. تكيس في نفق عظمة الفخذ عند ٢ مريضين. فشل المسامير المثبتة عند ٤ مرضى و حالة واحدة تليف مفصلي.

بينما كانت النتائج التي لا تتعلق بالتدخل الجراحي في المجموعة الأولى على النحو التالي: قطع في الغضروف الهلالي عند ١٧ مريضاً. تآكل الغضروف المفصلي عند ١١ مريضاً. تآكل الغضروف الرضفي عند ٥ مرضى. التواء القيد الرضفي عند مريض. و التهاب الوتر الرضفي عند مريض.

أما بالنسبة للمجموعة الثانية والتي كانت قد خضعت لجراحة إصلاح الغضاريف الهلالية فقد أظهر كل المرضى إعادة القطع في نفس الغضروف.

بينما ظهر بين الخمسة عشرة مريضاً الذين خضعوا لجراحة استئصال جزئي في الغضروف الهلالي إعادة القطع عند ٤ حالات.

في حين شملت النتائج الأخرى: تمزق الغضروف الهلالي في حالتين؛ ٥ حالات قطع في الرباط الصليبي. حالة تآكل في الرباط الصليبي. حالة تكيس في الرباط الصليبي. ١١ حالة تآكل في الغضروف المفصلي. حالتين التواء في الرباط الجانبي الأنسي. حالة التهاب في وسادة هوفما الدهنية. حالتين كيس بيكر، و حالة تآكل الغضروف المفصلي.

أما في حالات ترقيع الغضروف المفصلي والتي تكونت منها المجموعة الثالثة فقد قمنا بتقييم ما يلي: درجة إمتلاء الفجوة بالرقعة الغضروفية: ٤ حالات، واستعادة المنحنى الطبيعي للعظمة: حالتين، انفصال الرقعة الغضروفية: لا يوجد، والتكامل المحيطي للرقعة الغضروفية: ٤ حالات، وإرتشاح في الرقعة الغضروفية: حالتين.

إن الرنين المغناطيسي هو الطريقة المفضلة من بين طرق التصوير الطبي المختلفة لتقييم المرضى الذين يعانون من أعراض بعد التدخل الجراحي لحالات خلل الركبة الداخلي بدرجة عالية من الدقة أعلن عنها في معظم الدراسات و يتم ذلك باستخدام متعددة ثنائية الأبعاد متوسطة الوزن مع قمع الدهون وهي الأكثر شيوعاً حالياً من بين المتعددات المختلفة.

الملخص العربي

المشرفون

الأستاذ الدكتور/ على عبد الكريم فرحات

أستاذ الأشعة التشخيصية
كلية الطب
جامعة الإسكندرية

الأستاذ الدكتور/ محمد عماد الدين عيد

أستاذ الأشعة التشخيصية
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الأستاذ الدكتور/ طارق علي الخضراوي

أستاذ جراحة العظام و الكسور
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الدكتور/ محمد سامي بركات

أستاذ مساعد الأشعة التشخيصية
كلية الطب
جامعة الإسكندرية

دور الفحص بالرنين المغناطيسي عند المرضى الذين يعانون من
أعراض بعد التدخل الجراحي لخلل الركبة الداخلى

مقدمة من

يحيى أحمد سعد الدين الخضرى
ماجستير الأشعة التشخيصية، الإسكندرية

للحصول على درجة

الدكتوراه
فى

الأشعة التشخيصية و التدخلية

موافقون

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لجنة المناقشة والحكم على الرسالة

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دور الفحص بالرنين المغناطيسي عند المرضى الذين يعانون من
أعراض بعد التدخل الجراحي لخلل الركبة الداخلى

رسالة

مقدمة إلى كلية الطب – جامعة الإسكندرية

إيفاءً جزئياً لشروط الحصول على درجة

الدكتوراه

في

الأشعة التشخيصية و التدخلية

مقدمة من

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كلية الطب

جامعة الإسكندرية

٢٠١٥