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Ramp Lesions with ACL Injuries Between MRI and Arthroscopic Evaluation

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Rezumat

Leziuni de rampă cu leziuni de LCA între RMN și evaluare artroscopică

Obiectiv: compararea acurateței artroscopiei cu RMN-ul în diagnosticarea leziunilor de rampă asociate cu leziunile de LCA.
Design: Studiu transversal.
Material şi Metode: Am inclus 100 de pacienți cu ruptură completă de LCA. Criterii de excludere: 1) ruptură parțială de LCA, 2) intervenție chirurgicală de revizie a LCA sau antecedente de chirurgie la genunchi, 3) leziune multi-ligamentară a genunchiului, 4) ruptură extensivă a meniscului medial.
Rezultate: Nouă pacienți au fost diagnosticați cu leziuni de rampă asociate LCA. Toți cei nouă prezentau semne la RMN, dar acestea nu au fost semnificative statistic (χ^2=1,884, FEp=0,348). Panta meniscală medială medie pentru pacienții cu leziuni de rampă a fost de 2,88±0,46, iar pentru cei fără leziuni de 2,47±0,55 (T=2,146, P=0,034), implicând semnificație statistică vizualizată prin artroscopie. Artroscopia este superioară în diagnosticarea leziunilor de rampă.
Concluzie: Artroscopia este superioară în diagnosticarea leziunilor de rampă datorită rentabilității, vizualizării directe şi capacității de tratament imediat. Absența semnelor RMN specifice pentru leziunile de rampă susține în continuare această concluzie.

Cuvinte cheie: LCA, leziune în rampă, artroscopie, genunchi, menisc, RMN

Abstract

Objective: To compare the accuracy of arthroscopy with MRI in diagnosing ramp lesions associated with anterior cruciate ligament (ACL) injuries.

Design: Prospective observational study.

Material and Methods: We included 100 patients with complete ACL tear. Exclusion criteria: 1) Partial ACL tear, 2) ACL revision surgery or previous knee surgery, 3) Multi-ligamentous knee injury, 4) Extensive medial meniscus tear.

Results: Nine patients were diagnosed with ACL-associated ramp lesions. All nine had magnetic resonance imaging (MRI) signs, but these were not statistically significant (χ^2=1.884, FEp=0.348). Mean medial meniscal slope for patients with ramp lesions was 2.88 ± 0.46, without was 2.47 ± 0.55 (T=2.146, P=0.034), implying statistical significance as visualized by arthroscopy. Arthroscopy is superior in diagnosing ramp lesions.

Conclusion: Arthroscopy is superior in diagnosing ramp lesions due to cost-effectiveness, direct visualization, and immediate treatment capability. The absence of specific MRI signs for ramp lesions further supports this conclusion.

Key words: ACL, ramp lesion, arthroscopy, knee, meniscus, MRI

Introduction

The knee joint consists of two menisci, medial and lateral. Each represents a crescent made of fibrocartilage (1). The medial meniscus lies between the medial femoral and medial tibial condyles with its posterior part being wider (1).

Śmigielski mentioned a five zone classification of the medial meniscus: zone one: anterior root; zone two: anteromedial zone; zone three: at the level of the medial collateral ligament; zone four: posterior horn of the medial meniscus (PHMM); zone five: posterior root (2). One of the main functions of the medial meniscus is load distribution in the medial compartment (1). The posteromedial part plays an important role in preventing anterior displacement, especially in anterior cruciate ligament (ACL) deficient knees in what's known as the "Door stopper" effect (3).

The ramp area, as defined by Strobel, is the capsular reflection, arthroscopically visible by the superior posteromedial (SPM) recess of the knee (4). Strobel also described ramp lesions as a tear of the peripheral attachment of the posterior horn of the medial meniscus (5). In about 40% of ACL injuries, ramp lesions is diagnosed (6). When associated, these patients presented with a higher amount of dynamic rotational laxity in comparison to isolated ACL lesions (7). The loss of function can lead to early osteoarthritis, pain, and decreased quality of life, proving the importance preserving meniscal function especially at the young age group (8-11).

However, even with the greater laxity, it is very difficult to clinically diagnose ramp lesions due to the lack of sensitivity or specific tests (12). While arthroscopy is the gold standard of diagnosis (13), standard anterolateral and anteromedial portals can miss ramp lesions as it lies in a blind spot (5,14). To accurately diagnose ramp lesions, intercondylar and posteromedial arthroscopic portals can be utilised, however, these are not routinely done (6,15-17).

Up to now, there is no specific consensus regarding the MRI diagnosis of ramp lesions, implying that a set of criteria will help in preoperative diagnosis of ACL-associated posteromedial meniscal tears. We aim at determining the incidence of ramp lesions in cases undergoing ACL reconstruction.

Material and Methods

Eligibility Criteria

We have conducted a prospective observational study where we have included 100 patients who attended El-Hadra Orthopaedics and Traumatology University Hospital within the time frame of November 2017 to November 2019 and presented with complete ACL tear. Clinical and radiological examinations, and arthroscopic ACL reconstruction in addition to evaluation of the ramp area were done. We excluded patients with 1) Partial ACL tear; 2) ACL revision surgery or history of previous knee surgery; 3) Mult-ligamentous knee injury; 4) Extensive medial meniscus tear.

Patients of all ages and characteristics gave informed consent.

Information Sources

We registered the patients' personal data (Name, age, sex, occupation, address). Additionally, we recorded a detailed medical history regarding the injury: 1) Mechanism of injury; 2) Duration of injury (Time from injury till the day of operation); 3) Present complaint (Pain, locking (presence of a fixed flexion deformity of any degree since the time on injury), instability symptoms such as giving way of the knee with pivoting movements and swelling); 4) Past medical history; and 5) History of previous operations. The examination included: 1) Gait, 2) localized swelling, 3) deformity, 4) localized tenderness, 5) effusion, 6) range of motion, 7) special tests (Squat test, McMurray test, Anterior drawer test, Lachman test, and stress valgus and varus tests).

We submitted all included cases to two imaging techniques: Plain X-ray and Magnetic resonance imaging (MRI) Anteroposterior and lateral X-ray views were taken. However, for the MRI, the patient lay supine with the knee extended through the knee coil. We looked for MRI signs suggestive of ramp lesions: edema of the posterior capsule, irregular posterior margin of the medial meniscus, a vertical tear in the peripheral PHMM, peri-meniscal fluid, and interposed fluid in-between the PHMM and capsule margin.

Finally, we performed both the standard anteromedial & anterolateral diagnostic arthroscopy, and the seldom used intercondylar portal.

Statistical Analysis

Utilising the Statistical Program for Social Science (SPSS) V 20.0. we analysed our data. We used mean and standard deviation to represent quantitative data, and frequency and percentage to represent qualitative data. We applied the Chi-square test for categorical variables and Fishers Exact for correction of chi-square when greater than 20% of the cells have an expected count of less than four or less (i.e. tables of two by two).

Regarding distribution, we applied the student t-test for normally distributed quantitative variables and the Mann-Whitney test for abnormally distributed quantitative variables.

Results

Patients' ages ranged from 18 to 40 years, with 54% between 30 and 40 years. The cohort consisted of 94 males and 6 females, with 65% having right knee injuries and 35% left knee injuries. Twisting injuries occurred in 60%, while non-twisting injuries were reported in 40%. Forty patients presented within three months of injury, 52 between three to six months, and 8 after six months. According to the International Knee Documentation Committee (IKDC), patients were classified as level 1 (22%), level 2 (32%), level 3 (25%), and level 4 (21%).

Ramp lesions were present in 9% of patients who underwent ACL reconstruction. Patients with ramp lesions ranged in age from 19 to 39 years (mean 32.44 ± 6.37, median 35.0), whereas patients without ramp lesions were aged 18 to 40 years (mean 25.80 ± 5.98, median 24.0). The t-value was 3.163, and the P-value was 0.002, indicating age was statistically significant.

All patients with ramp lesions were males, compared to 93.4% males and 6.6% females in those without ramp lesions (Chi-square value 0.631, Fisher Exact P-value 1.000, indicating gender was not statistically significant).

The duration of injury was found to be statistically significant with longer duration the more possibility for having a ramp lesion. The mean duration of injury for patients without ramp lesions was 3.26 ± 1.99 months (median 3.0), while for patients with ramp lesions, it was 4.67 ± 2.0 months (median 5.0). The Mann Whitney test (U value) was 241.500 with a p-value of 0.040,

Eighty percent of ACL injury patients experienced giving way, compared to 55.6% of patients with ramp lesions (Chi-square value 3.694, Fisher Exact P-value 0.076).

MRI indicated 84% of patients had positive signs, with no statistical significance between those with and without ramp lesions (Chi-square value 1.884, FE P-value 0.348). Perimeniscal fluid was significantly more prevalent among patients with ramp lesions (Chi-square value 5.019, FE P-value 0.039).

The medial meniscal slope was found to be statistically significant, with patients with ramp lesions having a mean of 2.88 ± 0.46 (median 3.0), compared to those without ramp lesions (mean 2.47 ± 0.55, median 2.50; T-value 2.146, P-value 0.034).

Discussion

The incidence of ramp lesions associated with ACL injuries was nine percent in our sample. Balazs GC (18) also mentioned in a 2019 study that in patients operated for ACL injuries, the incidence of ramp lesions was 42 %.

Regarding our study, the higher the age of patients, duration of injury, and medial meniscal slope, and presence of peri meniscal fluid on MRI, the higher the incidence of ramp lesions. However, peri meniscal fluid on MRI should only be considered a predictive feature and not a diagnostic feature.

Additionally, Alexander Bumberger (13) systematically reviewed 27 studies regarding ramp lesions and concluded an incidence of 9 to 24% with a higher suspicion in patients with an increased meniscal slope and prolonged duration of injury, supporting the results of our cross-sectional study.

On the contrary, gender, side impacted, mode of injury, locking and giving away, level of activity, and the following MRI signs: completely interposed fluid, oedema of posterior capsule, irregular posterior margin of meniscus, vertical tear in peripheral PHMM, and posteromedial bruising had a weak correlation with ramp lesions and were of no statistical significance.

Nonetheless, Yeo Y (19) in a 2018 retrospective study stated that completely interposed fluid and irregular posterior margin of the meniscus were the most sensitive MRI signs in diagnosis of ramp lesions. It was also found that posteromedial bone marrow oedema during MRI predicted the presence of ramp lesions on arthroscopic assessment in a 2019 study (18).

Amin in a 2019 (20) study also stated that needle arthroscopy is cost-effective in comparison to MRI.

Arthroscopy is also better regarding evaluation as it allows for direct visualisation and immediate treatment of ramp lesions (21).

Study Strengths and Limitations

We included patients of different ages, duration of injury, impacted side, mode of injury, levels of activity, and presence of different MRI signs and complaints representing a focused examination procedure. Our study also has a prospective design, allowing for systematic data collection and analysis. This significantly reduces the probability of bias attributed to retrospective studies.

However, our study was limited by the small sample size, single centre, and use of only three arthroscopic views, excluding the posteromedial portal.

Conclusion

We found that arthroscopic evaluation is the gold standard in diagnosis when compared to

MRI, especially if the intercondylar and posteromedial portals are used in addition to the standard portals, A part of our reasoning is the cost-effectiveness of arthroscopy and the ability to immediately treat ramp lesions on diagnosis. We also deduced that age, duration of injury, and medial meniscal slope strongly correlated to ramp lesions. However, MRI is still a feasible tool for diagnosis of ramp lesions, taking into consideration that signs were not statistically significant with the exception of peri-meniscal fluid that only predicted the presence of ramp lesion on arthroscopic assessment.

Author's Contributions

Samir M: data collection, paper writing; Aliedlin E: paper writing, paper editing, facilitating publishing; Waly A, Elkhadrawy T. editors.

Conflicts of Interest and Source of Funding

No conflict of interests.

Ethics of Approval

Ethical approval was obtained from the ethical committee of faculty of medicine – Alexandria University, with IRB no.: 00012098.

References

1. Fox AJ, Wanivenhaus F, Burge AJ, Warren RF, Rodeo SA. The human meniscus: a review of anatomy, function, injury, and advances in treatment. Clin Anat. 2015;28(2):269-87.
2. Smigielski R, Becker R, Zdanowicz U, Ciszek B. Medial meniscus anatomy-from basic science to treatment. Knee Surg Sports Traumatol Arthrosc. 2015;23(1):8-14.
3. Caterine S, Litchfield R, Johnson M, Chronik B, Getgood A. A cadaveric study of the anterolateral ligament: re-introducing the lateral capsular ligament. Knee Surg Sports Traumatol Arthrosc. 2015;23(11):3186-95.
4. Kongmalai P, Chernchujit B. Posterior horn of medial meniscal peripheral capsular lesion: the arthroscopic repair technique working in the posterior compartment. Arthrosc Tech. 2016;5(4):e763-e767.
5. Strobel MJ. Manual of arthroscopic surgery. Springer Science & Business Media, 2013.
6. Di Francia R, Nicolas Q, Quintin-Roué I, Le Henaff G, Gunepin F-X, Dubrana F. Ramp lesions of the posterior segment of the medial meniscus: What is repaired? A qualitative histological study of the meniscocapsular and meniscotibial attachments. Clin Orthop Relat Res. 2020; 478(12):2912-2918.
7. Mouton C, Magosch A, Pape D, Hoffmann A, Nührenbörger C, Seil. Ramp lesions of the medial meniscus are associated with a higher grade of dynamic rotatory laxity in ACL-injured patients in comparison to patients with an isolated injury. Knee Surg Sports Traumatol Arthrosc. 2020;28(4): 1023-1028.
8. D'Ambrosi R, Meena A, Raj A, Giorgino R, Ursino N, Mangiavini L, et al. Good results after treatment of RAMP lesions in association with ACL reconstruction: a systematic review. Knee Surg Sports Traumatol Arthrosc. 2023;31(1):358-371.
9. Kopf S, Beaufils P, Hirschmann MT, Rotigliano N, Ollivier M, Pereira H, et al. Management of traumatic meniscus tears: the 2019 ESSKA meniscus consensus. Knee Surg Sports Traumatol Arthrosc. 2020;28(4):1177-1194.
10. Sedgwick MJ, Saunders C, Getgood AMJ. Systematic review and meta-analysis of clinical outcomes following meniscus repair in patients 40 years and older. Orthop J Sports Med. 2024;12(8):23259671241258974.
11. Poulsen E, Goncalves GH, Bricca A, Roos EM, Thorlund JB, Juhl CB. Knee osteoarthritis risk is increased 4-6 fold after knee injury–a systematic review and meta-analysis. Br J Sports Med. 2019;53(23):1454-1463.
12. Pfeiffer TP, Murphy CI, Arner JW, Musahl V. Identification and treatment of RAMP lesions in anterior cruciate ligament-injured knees. Ann Joint 2017;2:17.
13. Bumberger A, Koller U, Hofbauer M, Tiefenboeck TM, Hajdu S, Windhager R, et al. Ramp lesions are frequently missed in ACL-deficient knees and should be repaired in case of instability. Knee Surg Sports Traumatol Arthrosc. 2020;28(3):840-854.
14. Arner JW, Herbst E, Burnham JM, Soni A, Naendrup JH, Popchak A, et al. MRI can accurately detect meniscal ramp lesions of the knee. Knee Surg Sports Traumatol Arthrosc. 2017; 25(12):3955-3960.
15. Hatayama K, Terauchi M, Saito K, Aoki J, Nonaka S, Higuchi H. Magnetic resonance imaging diagnosis of medial meniscal ramp lesions in patients with anterior cruciate ligament injuries. Arthroscopy. 2018;34(5):1631-1637.
16. Alencar Neto JB, Cardoso AB, Munhoz GS, Pinto Neto LH, Clazzer R, de Lima DA. Medial meniscotibial ligament of the knee: A step-by-step dissection. Rev Bras Ortop (Sao Paulo). 2023;58(5):e755-e759.
17. Fayard JM, Guimaraes TM, Jan N, Murphy CG, Sonnery-Cottet B: Classification and surgical repair of ramp lesions of the medial meniscus. Arthroscopy techniques. 2016, 5:e871-e875.
18. Balazs GC, Greditzer IV HG, Wang D, Marom N, Potter HG, Marx RG, et al. Ramp lesions of the medial meniscus in patients undergoing primary and revision ACL reconstruction: prevalence and risk factors. Orthop J Sports Med. 2019; 7(5):2325967119843509.
19. Yeo Y, Ahn JM, Kim H, Kang Y, Lee E, Lee JW, et al. MR evaluation of the meniscal ramp lesion in patients with anterior cruciate ligament tear. Skeletal Radiol. 2018;47(12):1683-1689.
20. Amin N, McIntyre L, Carter T, Xerogeanes J, Voigt J. Cost-effectiveness analysis of needle arthroscopy versus magnetic resonance imaging in the diagnosis and treatment of meniscal tears of the knee. Arthroscopy. 2019; 35(2):554-562.e13.
21. Robert H Brophy 1, Yale A Fillingham. AAOS Clinical Practice Guideline Summary: Management of Osteoarthritis of the Knee (Nonarthroplasty), Third Edition. J Am Acad Orthop Surg. 2022;30(9):e721-e729.