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Original research

STUDY OF IMAGING CHARACTERISTICS AND MAGNETIC RESONANCE IMAGING VALUE IN EVALUATING MENISCAL TEAR OF THE KNEE JOINT DUE TO KNEE TRAUMA

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ABSTRACT

Introduction: *Menisci are clinically significant due to their role in load distribution, shock absorption, and joint stability. Additionally, in patients with anterior cruciate ligament (ACL) injuries, knee joint laxity can lead to progressive meniscal tears. Treatment of meniscal tears requires accurate identification of the location and type of tear. Therefore, precise determination of the meniscal tear is crucial for subsequent management. This study aims to describe the imaging characteristics and the value of meniscal tears and associated injuries on magnetic resonance imaging (MRI).*

Methods: *A cross-sectional descriptive study was conducted on 87 patients with knee joint injuries who underwent magnetic resonance imaging before surgery and were indicated for knee surgery at Can Tho University of Medicine and Pharmacy Hospital and Can Tho Central General Hospital from 2023 to 2025.*

Results: *MRI plays a significant role in identifying the type, location, and pattern of meniscal tears. The sensitivity of MRI in diagnosing lateral meniscal injuries was 91.2%, while the specificity was 80.4%. For medial meniscal injuries, the sensitivity was 93.9% and the specificity was 75.0%. The positive predictive value and negative predictive value of MRI for lateral meniscal injuries were 75.6% and 87.5%, respectively, while for medial meniscal injuries, they were 70.5% and 95.1%. Classification of meniscal injuries according to the AJR and ISAKOS systems demonstrated high accuracy for various tear types, such as vertical/ longitudinal (sensitivity 82.8%, specificity 91.1%), horizontal (sensitivity 76.2%, specificity 90.9%), and complex (sensitivity 84.2%, specificity 96.4%). Notably, when combined with ACL tears, the sensitivity and specificity of MRI for meniscal tear types were as follows: Vertical/ longitudinal 76.9%, 85.9%; horizontal 100.0%, 86.8%; radial 50.0%, 93.1%; bucket handle (horizontal flap) 100.0%, 97.1%; vertical flap 50.0%, 96.2%; complex 77.8%, 94.9%.*

Conclusion: *MRI plays a crucial role in evaluating meniscal injuries in patients with knee trauma.*

Keywords: *magnetic resonance imaging, meniscal tear types, trauma.*

I. INTRODUCTION

Injuries to the musculoskeletal system in general, and specifically to the knee joint, are increasingly prevalent. The primary causes are traffic accidents, occupational injuries, and sports-related incidents. The meniscus is clinically significant due to its role in load distribution, shock absorption, and joint stability. Furthermore, in patients with anterior cruciate ligament (ACL) injuries, knee joint laxity can lead to progressive meniscal tears. Therefore, accurately identifying meniscal tears is crucial for subsequent management. Knee arthroscopy allows for comprehensive visualization of the knee joint and is considered the gold standard in assessing the condition of articular cartilage, ligaments, and menisci. However, due to its invasive nature, arthroscopy is only performed when there is clinical evidence of ligament or meniscal injury, supported

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by magnetic resonance imaging (MRI), and when intervention is necessary [1].

In recent years, the role of MRI in musculoskeletal imaging has evolved significantly, not only in terms of technical capabilities but also in clinical application. Advanced MRI sequences, such as fat-suppressed proton density-weighted imaging, have improved the visualization of subtle meniscal abnormalities and associated injuries, including bone contusions, ligament tears, and cartilage lesions [2]. Moreover, classifying meniscal tears based on standardized systems like AJR and ISAKOS provides a more detailed understanding of tear morphology and guides surgical planning. In cases with concomitant anterior cruciate ligament (ACL) injuries-a condition present in the majority of our study cohort-accurate detection of meniscal involvement is essential for optimal treatment and long-term joint preservation [3].

Therefore, we conducted this study to describe the characteristics and imaging value of meniscal tears and associated injuries due to knee trauma on MRI at Can Tho University of Medicine and Pharmacy Hospital and Can Tho Central General Hospital.

II. MATERIALS AND METHODS

Study subjects: All patients with knee injuries who were indicated for MRI of the knee and underwent knee surgery at Can Tho University of Medicine and Pharmacy Hospital and Can Tho Central General Hospital from June 2023 to June 2025.

Inclusion criteria: Patients with knee injuries who underwent MRI and were indicated for knee surgery for diagnosis and treatment. Surgical diagnosis results were used as the gold standard. The patient has a documented traumatic etiology in the medical record, with a horizontal tear classified as grade III (according to Quinn's classification), which is a signal line extending to the superior or inferior surface of the meniscus to exclude horizontal tears due to degeneration.

Exclusion criteria: Patients with meniscal tears or knee joint instability not due to trauma. Patients without surgical diagnosis results for the knee, incomplete medical records. Patients who had previously undergone knee surgery unrelated to the current injury.

Study design: Cross-sectional, prospective descriptive study. Convenience sampling was employed. A total of 87 patients meeting the criteria were recorded.

Data collection technique: Knee magnetic resonance imaging was performed on Siemens 1.5T and 3.0T machines using the same protocol, which included Sagittal T2-weighted imaging with fat saturation, Coronal T2-weighted imaging with fat saturation, Coronal proton density-weighted imaging with fat saturation, Sagittal proton density-weighted imaging with fat saturation, and Axial proton density-weighted imaging with fat saturation.

Research variables: Age, gender, cause of injury, MRI results classified into four types according to AJR: longitudinal, horizontal, radial, and six types according to ISAKOS: longitudinal, horizontal, radial, bucket- handle, vertical flap and complex. The results of knee arthroscopy were compared with MRI findings, from which sensitivity, specificity, negative predictive value, and positive predictive value of MRI in diagnosing meniscal tears according to both classifications, as well as the six types according to ISAKOS in patients with ACL tears, were calculated.

Data processing and analysis: We collected magnetic resonance imaging (MRI) scans from patients scheduled for knee surgery, subsequently interpreting the results according to diagnostic criteria and cross-referencing them with surgical outcomes.

III. RESULTS

Among the 87 patients participating in the study, males accounted for 75.3%, while females represented 24.7%, indicating that the number of male patients was more than double that of female patients. The average age was 34.2 ± 10.5 years, with the youngest patient being 16 years old and the oldest 54 years old. The majority of patients were aged between 20-50 years (83.9%), with the age group of 20-35 years comprising the largest proportion at 44.1%, which corresponds to the demographic most involved in traffic incidents, the leading cause of knee injuries (52.7%), followed by domestic accidents (25.8%) and sports injuries (17.2%), with occupational accidents being the least common at 4.3%, as illustrated in Figure 1.

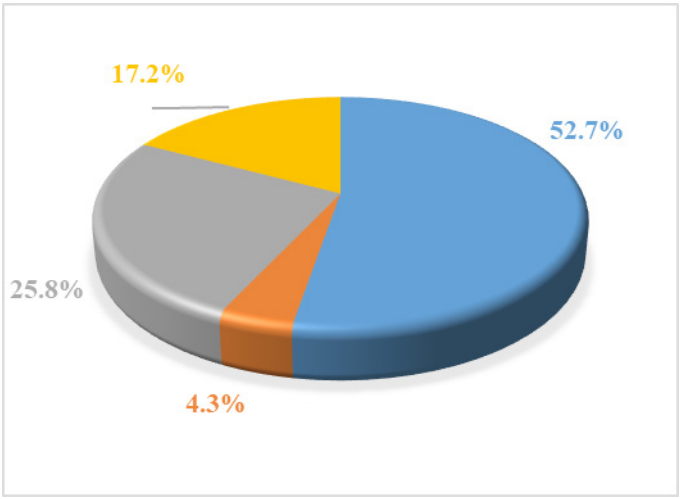

Figure 1: Distribution of injury causes (n=87)

Among the 87 patients in the study, 59.1% had injuries to the left knee, while 40.9% had injuries to the right knee. The distribution of meniscal tears showed that 36.4% of patients had tears of the medial meniscus, followed by 33.0% with tears of the lateral meniscus. The rate of tears in both menisci was 17.4% and 13.2% had no tears.

Distribution of Tear Locations According to Cooper's Classification: anterior horn, posterior horn, body. This study recorded that tears of the lateral meniscus and medial meniscus at the posterior horn accounted for the highest rates at 42.9% and 50.1%, respectively, while anterior horn tears were 22.5% for the lateral meniscus and 5.8% for the medial meniscus, with body tears at 12.3% and 17.3%, respectively, and two locations at 22.3% and 26.8%.

Meniscal Tear Types on MRI: In the group of patients with lateral meniscus tears, the highest incidence was observed in longitudinal tears at 42.1%, followed by horizontal tears at 28.1%, radial tears at 10.5%, and complex tears at 19.3%, according to the AJR classification. The highest incidence of simple longitudinal according to ISAKOS was 29.8%, with horizontal at 22.8%, bucket -handle at 12.3%, complex at 19.2%, vertical flap at 5.4%, and radial at 10.5%. In the group diagnosed with medial meniscus tears, the corresponding rates were 34.0%, 34.0%, 12.8%, and 19.2% according to the AJR classification, with the highest rates for longitudinal and horizontal tears according to ISAKOS being 8.3% for simple longitudinal and 31.3% for horizontal, bucket- handle at 25.0%, complex at 20.8%, radial at 12.5%, and vertical flap at 2.1%. The overall rates for both menisci were 19.7% for longitudinal, 26.03% for horizontal, 21.1% for bucket -handle, 3.9% for vertical flap, 11.8% for radial, and 17.1% for complex according to ISAKOS.

The value of magnetic resonance imaging (MRI) in identifying meniscal injuries: The sensitivity, specificity, positive predictive value, and negative predictive value of MRI for lateral meniscal injuries are 91.2%, 80.4%, 75.6%, and 87.5%, respectively, while for medial meniscal injuries, they are 93.9%, 75.0%, 70.5%, and 95.1%, respectively.

The sensitivity, specificity, positive predictive value, and negative predictive value of MRI for each type according to the AJR and ISAKOS classification in patients with anterior cruciate ligament (ACL) injuries.

Our study included 24 patients who underwent 1.5T MRI, yielding a sensitivity of 81.0%, specificity of 86.0%, and accuracy of 84.1%. Additionally, 63 patients underwent 3.0T MRI, resulting in a sensitivity of 84.5%, specificity of 91.5%, and accuracy of 83.3%. With a Kappa index of 0.665 and $p < 0.001$ for 1.5T MRI, and a Kappa index of 0.641 and $p < 0.001$ for 3.0T MRI, we observed that the results of the imaging techniques demonstrated a substantial agreement when compared to arthroscopy in diagnosing the extent of meniscal injury (Table 1).

Table 1: The value of magnetic resonance imaging in the diagnosis of meniscal injury

	1.5T MRI			3.0T MRI		
Sensitivity (%)	81.0%	Kappa = 0.641	p < 0.001	84.5%	Kappa = 0,665	p < 0,001
Specificity (%)	86.0%			91.5%		
Accuracy (%)	84.1%			84.3%		

For each type of tear according to the AJR classification, the MRI values are as follows: longitudinal tear sensitivity 86.2%, specificity 91.1%; horizontal tear sensitivity 76.2%, specificity 90.9%, the Kappa index = 0.613 and 0.687 indicate that MRI demonstrates substantial agreement when compared to endoscopy in diagnosing the extent of meniscal tear injury; radial tear sensitivity 55.6%, specificity 96.0%, the Kappa index = 0.567 indicates a moderate level of agreement when compared to endoscopy in diagnosing the extent of meniscal tear damage; complex tear sensitivity 80.0%, specificity 96.4%. The Kappa index of 0.823 indicates an almost perfect agreement between the results of magnetic resonance imaging and surgical findings. The accuracy of longitudinal, horizontal, circumferential/radial, and complex tears is 89.8%, 89.2%, 94.1%, and 94.6%, respectively (Table 2).

Table 2: Classification of meniscal injuries according to the AJR.

AJR	Se (sensitivity) (%)	Sp (specificity) (%)	PPV (positive predictive values) (%)	NPV (negative predictive values) (%)	P	Kappa
Longitudinal	86.2%	91.1%	64.1%	97.3%	< 0.001	0.687
Horizontal	76.2%	90.9%	51.6%	96.8%		0.613
Radial	55.6%	96.0%	41.7%	98.3%		0.567
Complex	84.2%	96.4%	72.7%	98.2%		0.823

Regarding the ISAKOS classification for meniscal tears in patients with ACL injuries, the sensitivity, specificity, positive predictive value, and negative predictive value of MRI are as follows: longitudinal 76.9%, 85.9%, 52.4%, and 95.3%; horizontal 100.0%, 86.8%, 54.6%, and 96.8%; radial 50.0%, 93.10%, 54.5%, and 91.8%; bucket-handle 100.0%, 97.1%, 45.5%, and 91.8%; vertical flap 50.0%, 96.2%, 50.0%, and 96.2%; complex 77.8%, 94.9%, 77.8%, and 93.9%. The Kappa index = 0.823 indicates an almost perfect agreement between the results of MRI of the meniscus in the bucket handle configuration and arthroscopy. The Kappa index = 0.714 in horizontal and the Kappa index = 0.717 in complex indicates a substantial agreement between the results of MRI in horizontal and complex meniscal tears with arthroscopy. The Kappa index = 0.446 in the radial pattern and the Kappa index = 0.462 in the vertical flap indicates a moderate agreement between the results of MRI in radial meniscus tears and vertical flap tears with arthroscopy. Among the 87 patients participating in the study, 96.6% had anterior cruciate ligament injuries (Table 3).

Table 3: Classification of meniscal injuries according to the ISAKOS systems in patients with ACL injuries

ISAKOS in ACL-injured knees	Sensitivity (%)	Specificity (%)	Positive predictive values (%)	Negative predictive values (%)	P	Kappa
Longitudinal	76.9%	85.9%	52.4%	95.3%	< 0.001	0.515
Horizontal	100.0%	86.8%	54.6%	96.8%		0.714

ISAKOS in ACL-injured knees	Sensitivity (%)	Specificity (%)	Positive predictive values (%)	Negative predictive values (%)	P	Kappa
Radial	50.0%	93.1%	54.5%	91.8%	< 0.001	0.446
Bucket-handle	100.0%	97.1%	45.5%	91.8%		0.926
Vertical flap	50.0%	96.2%	50.0%	96.2%		0.462
Complex	77.8%	94.9%	77.8%	93.9%		0.717

Among patients with anterior cruciate ligament (ACL) tears, the incidence of concomitant medial meniscus tears was higher than that of lateral meniscus tears, accounting for 39.3% and 36.9%, respectively. Additionally, 16.7% of patients presented with tears of both menisci alongside ACL rupture. The incidence of bone marrow edema in the tibial plateau in our study was 48.4%, while the incidence of bone marrow edema in the femoral condyle was 51.6% (Table 4).

Table 4: Meniscal tears associated with ligament ruptures (n=87)

Meniscal tear	Type of ligament injury		
	PCL n (%)	ACL n (%)	No ligament rupture n (%)
Bilateral meniscal	0 (0.0)	20 (23.8)	0 (0.0)
Lateral meniscal	1 (50.0)	31 (36.9)	1 (100.0)
Medial meniscal	1 (50.0)	33 (39.3)	0 (0.0)
Total	2 (100.0)	84 (100.0)	1 (100.0)

IV. DISCUSSION

Our study observed a predominance of male patients at 75.3%, compared to 24.7% female patients, with the majority falling within the age range of 20 to 50 years (83.9%), particularly those aged 20 to 35 years, which constituted 44.1%. The mean age was 34.2 ± 10.5 years, with the youngest patient being 16 years old and the oldest being 54 years old. These findings are consistent with several studies by other authors, such as Duong Dinh Toan, who reported that the most common age group for meniscal injuries was 20 to 35 years, accounting for 47.9%. The incidence of meniscal injuries decreases with increasing age. Additionally, Ngo Thi Thao (2024) found that patients aged 20 to 60 years comprised 82.3% of the study population, with those aged 20 to < 40 years representing the largest subgroup at 47.9%. The primary cause of injury in our study was traffic accidents, which accounted for 52.7% of cases, followed by domestic accidents at 25.8%. This result is similar to the findings of Bui Tien Si (2023), who reported that 48.72% of injuries were due to traffic accidents. Patients aged 20 to 50 years frequently engage in travel, and motorcycles are the primary mode of transportation for a significant portion of the Vietnamese population, making traffic accidents a prevalent cause of injury [1, 4-6].

In our study, we observed that 36.4% of patients had medial meniscus tears, 33.0% had lateral meniscus tears, and 17.4% had tears in both menisci. These rates are similar to those reported by Phung Anh Tuan (2022), where 54 patients participated, showing 38.2% with medial meniscus injuries,

30.4% with lateral meniscus injuries, and 6.9% with injuries to both menisci. Our study noted that patients with medial and lateral meniscus tears had the highest incidence of posterior horn tears at 42.9% and 50.1%, respectively, while anterior horn tears accounted for 22.5% of lateral meniscus injuries and 5.8% of medial meniscus injuries. The body tears were 12.3% and 17.3%, and tears involving both locations were 22.3% and 26.8%, which is consistent with the findings of Dang Thi Ngoc Anh (2020), reported that posterior horn tears accounted for 39.8%, body tears for 5.1%, and anterior horn tears for 1%. The rate of posterior horn tears was the highest at 42.9% and 50.1%, aligning with Phung Anh Tuan's (2022) study, where posterior horn tears of the medial and lateral menisci were the most prevalent at 46.7% and 45%, respectively. In our study, the accuracy rates were 84.1% and 84.3% for 1.5T and 3T MRI, respectively, indicating high diagnostic accuracy and clinical relevance in diagnosing meniscal injuries of the knee. However, 3.0T MRI of the knee did not provide significantly higher diagnostic accuracy compared to 1.5T MRI in detecting meniscal tears. This finding is not unexpected. The evaluation of meniscal pathologies with standard magnetic field strengths (≤1.5T) has generally been successful; therefore, further improvements from systems with higher magnetic field strengths may be minimal. Furthermore, our study aligns with the protocol utilizing the fat-suppressed PDWI pulse sequence, as indicated by the research of Dang Ngoc Thuan, which demonstrates a higher diagnostic performance compared to the standard PDWI pulse sequence in the assessment of meniscal tears in the knee joint, with sensitivity and specificity rates of 93.0% and 92.2%, respectively, compared to 79.1% and 87.1% [7]. Regarding the types of lateral meniscus tears classified by AJR, the highest incidence was observed in longitudinal tears at 42.1%, followed by horizontal tears at 28.1%, radial tears at 10.5%, and complex tears at 19.3%, which is similar to the study by Ngo Thi Thao involving 42 patients, with corresponding rates of 43% for longitudinal tears and 33% for horizontal tears. In terms of medial meniscus tears, among patients diagnosed with medial meniscus tears, 34.0% had longitudinal, 34.0% had horizontal, 12.8% had radial, and 19.2% had complex according to AJR classification, with the highest rates in horizontal and longitudinal. This is consistent with Dang Thi Ngoc Anh's findings, which reported 31.6% for horizontal, while the rate of longitudinal tears was higher and the rate of horizontal tears was lower compared to Jee's study involving 110 patients with meniscus tears, which included 34 longitudinal, 44 horizontal, 16 radial, and 22 complex. Our study found a low sensitivity for radial tears (55.6%) in accordance with Harper KW's research, which noted that although all cases were confirmed to have meniscal tears on MRI, the initial assessment by five radiologists specializing in musculoskeletal imaging only correctly diagnosed 37% of the circumferential/radial tears. The radial tear pattern in the body of the meniscus was not detected on MRI. Additionally, there is a potential for misinterpretation as negative when the physician misreads the tear as the attachment of the meniscofemoral ligaments to the lateral meniscus. However, the author also noted that the inter-reader agreement for diagnosing tear types was relatively low. In this study, the rates of tear types across both menisci were 19.7% for longitudinal tears, 26.03% for horizontal tears, 21.1% for radial tears, 3.9% for flap tears, 11.8% for complex tears, and 17.1% for other types according to ISAKOS classification. Some of these rates were comparable and others were not when compared to Jay Shah's (2020) study on 81 menisci, where the corresponding rates were 19.75%, 2.5%, 16.05%, 19.75%, 6.17%, and 35.8%. The rates were similar for longitudinal, radial, and vertical flap, but lower for complex, and higher for horizontal tears. In Jay Shah's study, the average age was younger, suggesting that in individuals over 30 years of age, the quality of the meniscus begins to deteriorate, leading to horizontal tear patterns. The sensitivity, specificity, positive predictive value, and negative predictive value of magnetic resonance imaging for lateral meniscus injuries were 91.2%, 80.4%, 75.6%, and 87.5%, respectively, while for medial meniscus injuries,

these values were 93.9%, 75.0%, 70.5%, and 95.1%. In the study of medial meniscus injuries by Ngo Thi Thao (2024), the specificity of MRI was reported to be 82.2%. For lateral meniscus injuries, Porter (2021) reported sensitivity and specificity of MRI in diagnosis as 79.8% and 70.4%, respectively [8]. The accuracy rates for longitudinal, horizontal, radial, and complex tears were 89.8%, 89.2%, 94.1%, and 94.6%, respectively, with the lowest accuracy for horizontal tears due to false positives when detecting horizontal tears, which may be confused with degenerative changes in the meniscus that present with high signal intensity. According to ISAKOS classification, the sensitivity, specificity, positive predictive value, and negative predictive value of MRI for meniscus tears in patients with anterior cruciate ligament injuries were as follows: longitudinal 76.9%, 85.9%, 52.4%, and 95.3%; horizontal 100.0%, 86.8%, 54.6%, and 96.8%; radial 50.0%, 93.1%, 54.4%, and 91.8%; vertical flap 100.0%, 97.1%, 45.5%, and 91.8%; and complex 77.8%, 94.9%, 77.8%, and 93.9%. These findings are consistent with Vo Thanh Toan's study, which reported sensitivity and specificity for longitudinal at 80% and 88.4%, horizontal at 100% and 91.9%, radial at 50% and 97.9%, horizontal flap at 100% and 97.8%, vertical flap at 50% and 97.7%, and complex at 72.7% and 93.8%. Bone marrow edema signs in the tibial plateau were observed in 48.4% of cases, while bone marrow edema signs in the femoral condyle were noted in 51.6%, which are commonly encountered in knee joint injuries [5, 6, 8-12].

V. CONCLUSION

This study emphasizes the significant role of magnetic resonance imaging (MRI) in assessing meniscal injuries in patients with trauma. MRI not only aids in accurately identifying the type and location of meniscal tears but also proves valuable in detecting associated injuries, particularly in conjunction with anterior cruciate ligament (ACL) tears. Metrics such as sensitivity, specificity, and positive and negative predictive values of MRI in diagnosing meniscal tears have yielded favorable results. The article asserts that MRI is a non-invasive, highly effective tool that is essential in evaluating knee injuries due to trauma, thereby supporting surgical and treatment decisions for patients.

Ethical considerations

The study was approved by the Ethics Committee of Can Tho University of Medicine and Pharmacy under number 23.404.HV/PCT-HĐĐĐ, which involved the examination of data from medical records, ensuring the confidentiality of personal identities and all data.

Conflict of interest

The authors have no conflicts of interest to declare.

REFERENCES

1. Sĩ BT, Quân NPB. Giá trị của cộng hưởng từ trong chẩn đoán tổn thương dây chằng chéo khớp gối tại Bệnh viện Trường Đại học Y Dược Cần Thơ năm 2020-2022. Tạp chí Y Dược học Cần Thơ. 2023(56): 45-51.
2. Porter M, Shadbolt B. Accuracy of standard magnetic resonance imaging sequences for meniscal and chondral lesions versus knee arthroscopy. A prospective case-controlled study of 719 cases. ANZ J Surg. 2021; 91(6): 1284-1289.
3. Chhabra A, Ashikyan O, Hlis R, Cai A, Planchard K, Xi Y, et al. The International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine classification of knee meniscus tears: three-dimensional MRI and arthroscopy correlation. Eur Radiol. 2019; 29(11): 6372-6384.
4. Toàn DĐ. Dấu hiệu lâm sàng, hình ảnh mri và tổn thương trong mổ của rách sụn chêm khớp gối do chấn thương tại bệnh viện Hữu Nghị Việt Đức. Tạp chí Y học Việt Nam. 2021: 501.
5. Thảo NT. Nghiên cứu vai trò cộng hưởng từ 3.0 tesla trong đánh giá tổn thương sụn chêm khớp gối do chấn thương. Tạp Chí Y học Việt Nam. 2024: 536.
6. Tuấn PA, Minh HTX. Giá trị của cộng hưởng từ trong đánh giá rách sụn chêm khớp gối do chấn thương. Tạp chí Y học Việt Nam. 2022; 521(2).
7. Thuận ĐN. So sánh độ nhạy chuỗi xung cộng hưởng từ Proton Density (pdwi) và fat suppressed Proton Density (pdwi fs) trong phát hiện rách sụn chêm khớp gối. Tạp chí

Y Dược học Cần Thơ. 2023(65): 8-14.

8. Mark P, Bruce S. Accuracy of standard magnetic resonance imaging sequences for meniscal and chondral lesions versus knee arthroscopy. A prospective case-controlled study of 719 cases. ANZ journal of surgery. 2021; 91(6): 1284-1289.
9. Anh ĐTN. Nghiên cứu đặc điểm hình ảnh và giá trị của cộng hưởng từ 1.5 tesla trong chấn thương dây chằng, sụn chêm khớp gối. Tạp chí Điện quang & Y học hạt nhân Việt Nam. 2022(41): 86-92.
10. Jee WH MT, Kim JM, Jun DJ, Lee YJ, Choi BG, Choi KH. Meniscal tear configurations: categorization with MR imaging. AJR Am J Roentgenol. 2003 Jan. 180(1): 93-7.
11. Jay S, Rocco H, Oganes A, Anthony C, Kyle P, Christopher M, et al. Correlation of meniscus tears on MRI and arthroscopy using the ISAKOS classification provides satisfactory intermethod and inter-rater reliability. Journal of ISAKOS. 2020; 5(4): 201-207.
12. Thanh VT, Thien ND. Evaluation of meniscal injury on magnetic resonance imaging and knee arthroscopy in patient with anterior cruciate ligament tear. SICOT-J. 2024; 10: 56.