



Diagnostic concordance of meniscal injuries between imaging and arthroscopic findings using D. Stoller and ISAKOS classifications.

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Abstract

Introduction: This study aimed to establish the diagnostic concordance of meniscal lesions observed through magnetic resonance imaging via the Stoller and Isakos classifications versus the findings of knee arthroscopy.

Methods: Diagnostic tests were conducted at the Alcívar Hospital in Guayaquil, Ecuador, from January to August 2024. Records of patients with meniscus pathology who underwent magnetic nuclear resonance imaging of the knee and arthroscopy were included. The Isakos and Stoller classifications were used. The sample was nonprobabilistic. The analysis corresponds to diagnostic tests.

Results: Nineteen patients were included. Between the Isakos classification and the gold standard (Arthroscopy), a Cohen's kappa index of 0.57 was observed, corresponding to a moderate agreement. A Cohen's kappa index of 0.88 was observed for the internal meniscus injuries, corresponding to very good agreement. Regarding the diagnostic sensitivity and specificity, we can conclude that in the studied group, the Isakos classification showed higher values for both the external meniscus, with a sensitivity of 81.3% and specificity of 100%, and for the internal meniscus, with a sensitivity of 100% and specificity of 85.7%.

Conclusions: Compared with arthroscopy, the Isakos classification is more sensitive and specific for diagnosing meniscus injuries than the Stoller classification.

Keywords:

Isakos, Meniscopathy, Stoller, Arthroscopy, Diagnostic Concordance

Abbreviations

MRI: Nuclear magnetic resonance.

Additional information

No supplementary materials were declared.

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Authors' contributions

Carlos Jacinto Valle Ochoa: Conceptualization, data curation, formal analysis, funding acquisition, investigation, writing - original draft, writing - review and editing.

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All the authors read and approved the final version of the manuscript.

Financing

The authors funded the administrative costs of this research. Patients included in the study underwent surgical procedures covered by their private insurance. Surgical and imaging expenses were adjusted to the standard rates of the trauma service, reflecting the usual market prices for this type of intervention.

Availability of data and materials

The datasets used and analyzed during the present study are available from the corresponding author upon reasonable request.

Introduction

The main functions of the knee menisci include load transmission, shock absorption, joint lubrication, and stability maintenance [1]. Menisci plays an essential role in knee function [2].

Owing to physically demanding activities, the young population has been exposed to an increase in meniscal injuries in recent years [3].

The proportion of injured men to women is between 2.5:1 and 4:1. This does not include degenerative injuries that occur as patients age [4].

Arthroscopy is considered the gold standard for treating meniscopathy. To correctly indicate knee arthroscopies, patients must undergo a prior evaluation via MR images, considered the most appropriate for diagnosing meniscal injuries [5-6].

The study of menisci by MRI has been carried out for approximately 70 years with the classic work of Dr. D. Stoller, who described a classification of changes observed in patients with meniscal injuries of different types [2-8]. This classification has remained in force until recently. However, works have begun to appear that attempt to update and improve the classic descriptions of meniscal injuries to compare them with those of arthroscopy [9]. The present study addresses the ISAKOS classification (International Society of Meniscal Medicine, ISAKOS, 2008) of Arthroscopy, Knee Surgery, and Orthopedics Sports Medicine for diagnosing meniscal injuries. We compare it with the classic classification of Dr. Stoller and, in turn, with the gold standard for diagnosing meniscal injuries, which is knee arthroscopy.

This study aimed to establish a concordant diagnosis of meniscal injuries using magnetic resonance imaging, the Stoller and Isakos classification system, and knee arthroscopy findings.

Materials and methods

Study design

This observational study is analytical and diagnostically consistent. The source is retrospective.

Scenery

The study was conducted at the Diagnostic Imaging Service of the Alcívar Hospital in Guayaquil, Ecuador. The study period was from January 1 to August 31, 2024.

Participants

Records of adult patients with meniscus pathology who underwent knee magnetic resonance imaging and

arthroscopic surgery were included. No patients were eliminated or excluded.

Variables

The variables used for meniscal injuries were age, sex, Isakos classification, and Stoller classification. Arthroscopic findings.

Data sources/measurements

The source was indirect; an electronic form was filled out from the data in the medical records. Records with the following codes were included:

- (M23) Internal disorders of the knee.
- (M23.0) Cystic meniscus.
- (M23.1) Discoid meniscus (congenital).
- (M23.2) Disorder of the meniscus due to old tears or injuries.
- (M23.3) Other disorders of the meniscus.
- (M23.4) Knee flaccidity.
- (M23.5) Chronic instability of the knee.
- (M23.6) Other spontaneous ruptures of the knee ligaments.
- (M23.8) Other internal disorders of the knee.
- (M23.9) Unspecified internal disorder of the knee.

Biases

The application of the participant selection criteria avoided observation and selection bias. The principal investigator kept the data using a guide and records approved in the research protocol to prevent interviewer, information, and memory biases. Two researchers independently analyzed each record in duplicate, and the variables were recorded in the database once their concordance was verified.

Study size

The sample was nonprobabilistic and a census type; all records were included in the study.

Quantitative variables

Descriptive statistics were used. The results are expressed as frequencies and percentages. The categorical variables were not converted into quantitative variables.

Statistical analysis

The analysis corresponds to diagnostic tests. The descriptive statistics section analyzed qualitative variables using frequency and percentages, whereas quantitative variables were described using central tendency and dispersion measures. Cohen's kappa index assessed the agreement between the diagnostic methods in the inferential statistics section. The statistical package used was Stata 18 (StataCorp.

2023. Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC.).

Results

Participants

The study included 19 cases.

Main characteristics of the study group

There were 3 cases (16%) in people under 30 years of age, 14 cases (74%) between 30 and 60 years of age, and 2 cases (10%) in people over 60 years of age. There were 13 men (68%) and six women (32%). There were 10 cases (53%) in the left knee and 9 cases (47%) in the right knee.

Concordance between classification tables and arthroscopy

[Table 1](#) presents the Isakos and Stoller meniscus injury classification tables compared with those of arthroscopy. Cohen's kappa factor weighting is presented in [Figure 1](#). The best classification table was Isakos, which was compared with arthroscopy of the lateral meniscus.

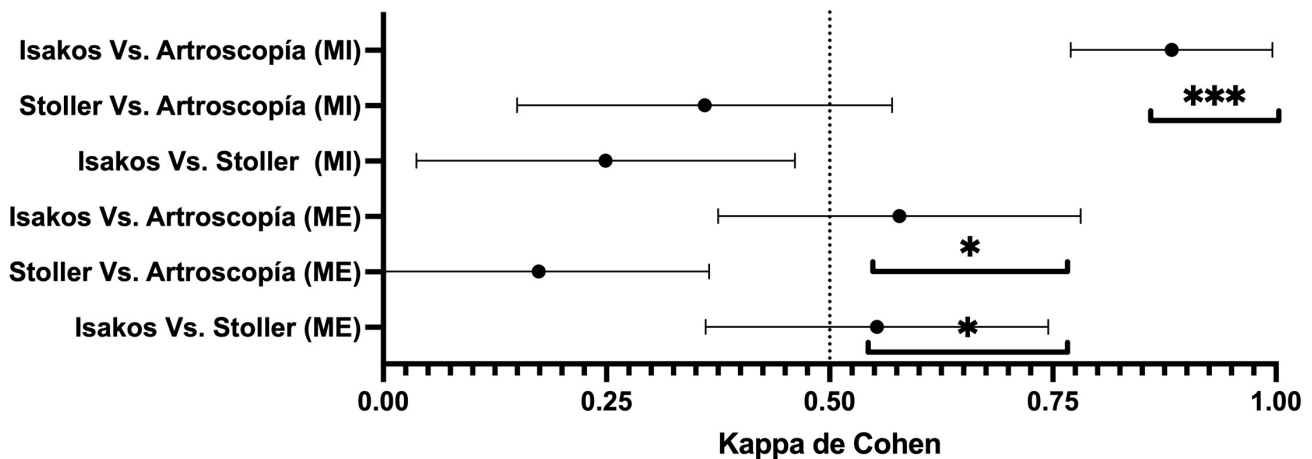
Diagnostic tests

The set of diagnostic tests is presented in [Table 2](#). The best-scored test was the Isakos classification for both external and internal menisci.

Table 1. Demographic and clinical characteristics of the study group.

External Meniscus			Cohen's Kappa	Standard error	T	P
	Tear (Stoller) n=11	No tear (Stoller) n=8				
Tear (Isakos)	10 (90.9%)	3 (37.5%)	0.553	0.192	2.473	0.013
Tear (arthroscopy) n=16			No tear (Arthroscopy) n=3			
Tear (Stoller)	10 (62.5%)	1 (33.3%)	0.174	0.191	0.939	0.348
Tear (arthroscopy) n=16			No tear (Arthroscopy) n=3			
Tear (Isakos)	13 (81.25%)	0 (0%)	0.578	0.203	2.778	0.005
Internal Meniscus			Cohen's Kappa	Standard error	T	P
	Tear (Stoller) n=10	No tear (Stoller) n=9				
Tear (Isakos)	8 (80%)	5 (55.6%)	0.249	0.212	1.145	0.252
Tear (arthroscopy) n=12			No tear (Arthroscopy) n=7			
Tear (Stoller)	8 (66.7%)	2 (28.6%)	0.360	0.210	1.604	0.109
Tear (arthroscopy) n=12			No tear (Arthroscopy) n=7			
Tear (Isakos)	12 (100%)	1 (14.3%)	0.883	0.113	3.877	<0.001

Figure 1. Cohen's Kappa index in diagnostic tests.



* P<0.05 *** P<0.001.

Table 2. Evidence diagnostic compared to arthroscopy as a control.

	Stroller (ME)	Stroller (MI)	Isakos (ME)	Isakos (MI)
Sensitivity	0.63	0.67	0.81	1
Specificity	0.67	0.71	1	0.86
Prevalence	0.84	0.63	0.84	0.63
Predictive value positive	0.91	0.8	1	0.92
Predictive value negative	0.25	0.56	0.50	1
Likelihood ratio for a positive test (LR+)	1.91	2.31	Infinity	7.14
Likelihood ratio for a negative test (LR -)	0.55	0.46	0.19	0
Prior Odds	5.33	1.71	5.33	1.71
Pretest probability	0.84	0.63	0.84	0.63
Post Odds +	10.19	3.96	Infinity	12.24
probability +	0.91	0.8	NaN	0.92
Post Odds -	0.09	0.17	0.03	0
Probability post test -	0.08	0.15	0.03	0

Discussion

In the present study, the age group with the highest prevalence of meniscal injuries was 30--60 years, with 74%, followed by the age group under 30 years, with 16%, and finally, the age group over 60 years, with 10%. Males were the most frequently affected, at 68%. The left knee was the most affected, at 53%.

Regarding diagnostic concordance, we can conclude that between the classification of D. Stoller and C. Isakos for external meniscus injuries, a Cohen kappa index of 0.55 was observed, corresponding to moderate concordance. A Cohen kappa index of 0.24 was observed for internal meniscus injuries, corresponding to poor concordance.

Between the D. Stoller classification and the gold standard (arthroscopy) for external meniscus injuries, a Cohen kappa index of 0.17 was observed, corresponding to a mild agreement. A Cohen kappa index of 0.36 was observed for internal meniscus injuries, corresponding to poor agreement.

Between the Isakos classification and the gold standard (arthroscopy) for external meniscus injuries, a Cohen kappa index of 0.57 was observed, corresponding to moderate concordance. A Cohen kappa index of 0.88 was observed for internal meniscus injuries, corresponding to perfect concordance.

Regarding diagnostic sensitivity and specificity, the Isakos classification yielded higher values for the external meniscus (sensitivity of 81.3%, specificity of 100%) and the internal meniscus (sensitivity of 100%, specificity of 85.7%) in the group studied. This classification was followed by the D. Stoller classification, which showed a sensitivity of 62.5%, specificity of 66.7%, and specificity of 71.4% for the external meniscus.

Test reports are scarce [1, 2] and are based on Dr. D. Stoller's classical descriptions, which remained unchanged

approximately 50 years ago. However, recent studies have shown that this type of description does not adequately agree with the arthroscopic findings considered the gold standard for this type of lesion [3], which supports the idea that the concepts of diagnoses must be updated.

On the other hand, the results of this study provide significant positive changes for the daily practice of Alcívar Hospital since they allow standardized and, therefore, more efficient communication between the Traumatology and Diagnostic Imaging services by providing a concordant, applicable, and replicable meniscal injury evaluation scheme, "the same language for both specialties," which can be used both for the description of findings in magnetic resonance studies and for surgical reports of knee arthroscopies. This feature will favor and facilitate the diagnosis and comprehensive management of meniscal injuries in this health center.

Notably, the main limitation of this study is the small sample size since, to apply it, the imaging schemes for Knee Magnetic Resonance Imaging in the Diagnostic Imaging service of the Alcívar Hospital had to be changed and adapted to the ISAKOS recommendations. This limited the sample to a small number of patients who met all the inclusion criteria of this study up to the time of implementation. However, this study can be reproduced quickly with a much larger sample by standardizing the acquisition of images and the classification criteria between the Diagnostic Imaging and Traumatology services.

Conclusions

Compared with arthroscopy, the Isakos classification is more sensitive and specific for diagnosing meniscal injuries than the Stoller classification.

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Statements

Ethics committee approval and consent to participate

This method is not required for clinical cases.

Consent to publish

The authors have written permission to publish images, radiographs, and photographs of patients who have identified them.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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