McMurray Test And Joint Line Tenderness In The Diagnosis Of Meniscus Tears

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Introduction

- Early detection and intervention for meniscus/articular cartilage injuries are important
  - Injury to them not only limits daily living or sporting activities but also predisposes to developing knee osteoarthritis [1-4]
- Diagnosis of meniscus tears
  - Gold standards: Magnetic Resonance Imaging (MRI)
  - Physical examination: Crucial to determine appropriate further plan
    - Both diagnostically & therapeutically [5,6]
    - The McMurray test & joint line tenderness are the most frequently performed manual tests for assessing meniscus lesions
- The usefulness of physical examination to diagnose meniscus or cartilage lesions in clinical practice remains controversial

Objectives

- The aim of this study was to investigate the validity and reliability of the McMurray test and joint line tenderness for diagnosing meniscus tears
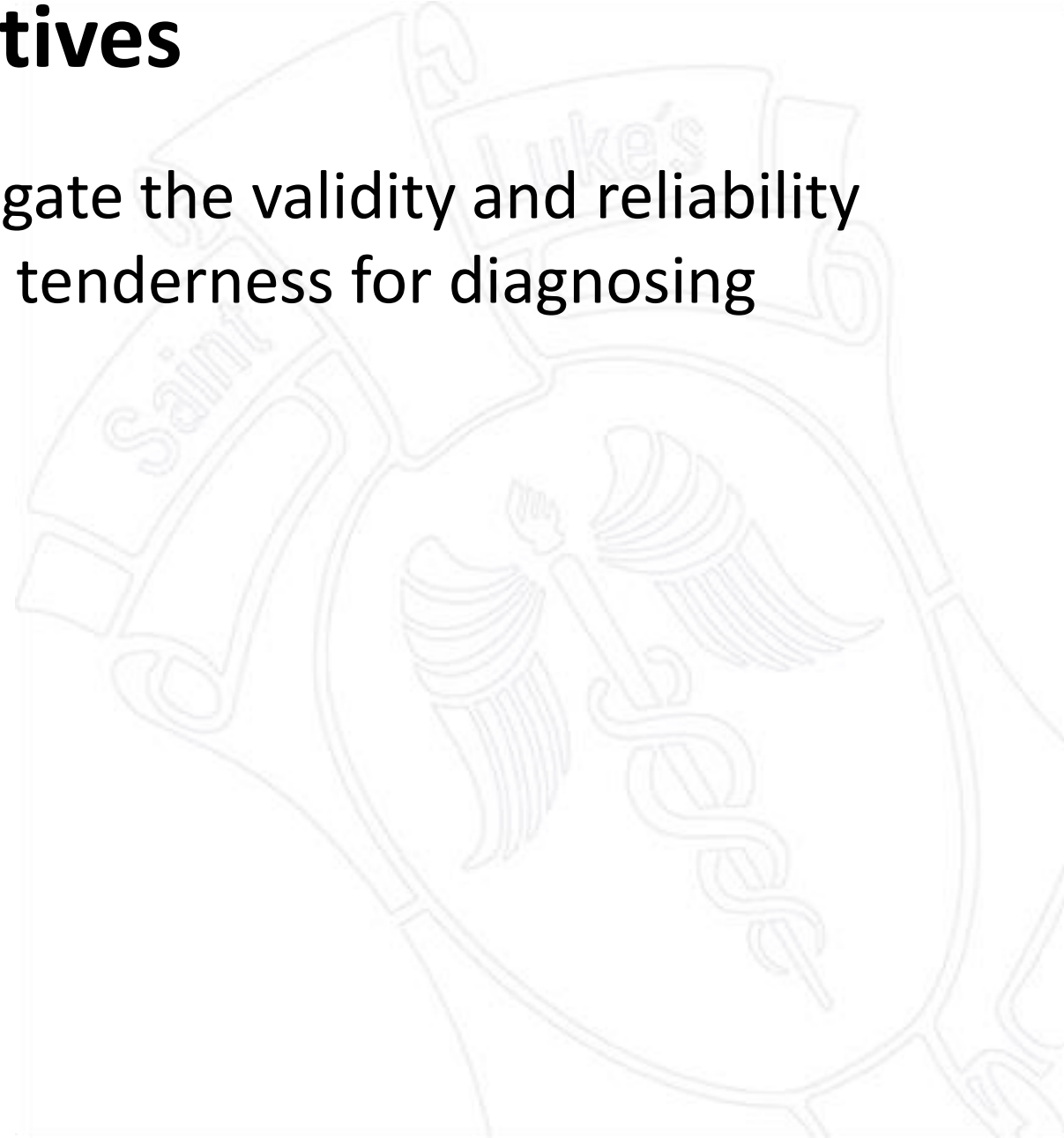
Materials & Methods

- Study design
  - Single-center, retrospective study
  - Study period: April 2017 - March 2022

- Subjects
  - 220 patients underwent arthroscopic surgery for suspected meniscus tears
    - Patients with ligament injuries / osteoarthritis / previous knee surgeries were excluded

- Preoperative physical examinations
  - At the first visit following injuries, a single surgeon performed a series of physical examinations (right)
    - If the test, including the McMurray test, was not performed due to pain or other reasons, these findings were also documented

Pre-op. physical exams
ROM of the knee
Ballottement of patella
Joint line tenderness
The McMurray test
The passive knee extension test

Materials & Methods

- Intraoperative evaluation
  - ◆ Diagnostic arthroscopy was performed in a systematic fashion
    - All arthroscopic findings were photographed and registered
    - Arthroscopic findings were considered accurate and served as reference data
  - ◆ A definitive diagnosis of medial or lateral meniscus tear was made
    - Further classified into longitudinal, transverse, horizontal, degenerative, complex, and flap-shaped tears
    - Root tear and discoid meniscus were counted separately

Materials & Methods

- Statistical Analysis
  - ◆ Univariate analysis
    - Knees were divided into two groups based on the presence or absence of each injury
    - Groups were compared with age, gender, BMI and preoperative physical findings
  - ◆ Logistic regression analysis
    - Performed to evaluate factors related to injuries
  - ◆ Sensitivity, specificity, and likelihood ratios
    - Calculated for the physical findings that were deemed useful
  - ◆ Analysis of tear patterns
    - Association with physical findings was assessed

Results

- Patient demographics and findings
  - ◆ 235 knees in 220 patents were evaluated

Age (years)	40.8±17
Gender	
Male	166 (70.6%)
Female	69 (29.4%)
Height (cm)	169.5 ± 9.7
Weight (kg)	70.5 ± 15
BMI (kg/m^2)	24.3 ± 3.7

Arthroscopic findings	
Medial meniscus tear	**111 (47.2%)**
Lateral meniscus tear	**109 (46.4%)**
McMurray test	
Positive	149 (63.4%)
Negative	58 (24.7%)
Not Performed	28 (11.9%)

Results

- Results of univariate analysis

Variables (%)	Medial Meniscus Tear			Lateral Meniscus Tear		
	Negative (n=124)	Positive (n=111)	P value	Negative (n=126)	Positive (n=109)	P value
Age	33.64 (15.22)	48.88 (15.30)	**<0.001**	45.51 (15.83)	35.44 (16.84)	**<0.001**
Female Sex	37 (29.8)	32 (28.8)	0.979	34 (27.0)	35 (32.1)	0.473
Height (cm)	169.19 (9.71)	169.91 (9.65)	0.581	170.09 (9.51)	168.88 (9.85)	0.347
Weight (kg)	70.95 (15.83)	70.02 (13.94)	0.635	70.66 (13.37)	70.34 (16.63)	0.871
BMI (kg/m^2)	24.64 (4.08)	24.00 (3.13)	0.193	24.18 (3.16)	24.53 (4.20)	0.477
Knee extension	-4.35 (8.83)	-2.06 (6.46)	0.026	-2.15 (6.55)	-4.56 (9.02)	**0.019**
Knee flexion	140.32 (13.79)	147.79 (95.63)	0.391	146.07 (90.26)	141.28 (10.96)	0.583
Ballottement	35 (28.2)	40 (36.0)	0.253	50 (39.7)	25 (22.9)	0.009
Medial Joint line tenderness	18 (14.5)	91 (82.0)	**<0.001**	98 (77.8)	11 (10.1)	<0.001
Lateral Joint line tenderness	76 (61.3)	10 (9.0)	<0.001	8 (6.3)	78 (71.6)	**<0.001**
McMurray test			0.427			0.29
Negative	30 (24.2)	28 (25.2)		36 (28.6)	22 (20.2)	
Positive	76 (61.3)	73 (65.8)		77 (61.1)	72 (66.1)	
Passive knee extension test			0.209			0.703
Negative	32 (25.8)	22 (19.8)		27 (21.4)	27 (24.8)	
Positive	64 (51.6)	70 (63.1)		75 (59.5)	59 (54.1)	

Results

- ## Results of univariate analysis (continued)

Variables (%)	Medial Meniscus Tear			Lateral Meniscus Tear		
	Negative (n=124)	Positive (n=111)	P value	Negative (n=126)	Positive (n=109)	P value
Pain on McMurray test			0.404			0.499
Negative	36 (29.0)	32 (28.8)		40 (31.7)	28 (25.7)	
Positive	70 (56.5)	69 (62.2)		73 (57.9)	66 (60.6)	
Click on McMurray test			<0.001			**<0.001**
Negative	57 (46.0)	79 (71.2)		91 (72.2)	45 (41.3)	
Positive	49 (39.5)	22 (19.8)		22 (17.5)	49 (45.0)	

- ## Logistic regression analysis

		OR (95%CI)	P value
MM Tear	Age	1.06 (1.03-1.09)	**<0.001**
	Medial JLT	24.4 (11.8-54.1)	**<0.001**
LM Tear	Age	0.97 (0.95-1.00)	**0.025**
	Loss of extension	2.01 (0.76-5.22)	0.153
	Lateral JLT	30.6 (12.7-86.6)	**<0.001**
	Click on McMurray	2.74 (1.20-3.28)	**0.016**

- ## Diagnostic parameters of the tests

		Sensitivity	Specificity	LR (+)	LR (-)
MM Tear	Medial JLT	81.1%	85.5%	5.58	0.22
LM Tear	Lateral JLT	71.6%	93.7%	11.3	0.30
	Click on McMurray	52.1%	80.5%	2.68	0.59

*MM, medial meniscus; LM, lateral meniscus; JLT, joint line tenderness; LR, likelihood ratio

Results

- The analysis of tear patterns

Type of tear	Location (n)	Click on McMurray (True positive rate)	McMurray not performed
Longitudinal	MM (17)	**4/13 (30.8%)**	4
	LM (28)	7/24 (29.2%)	4
Transverse	MM (28)	8/27 (29.6%)	1
	LM (18)	8/16 (50.0%)	2
Horizontal	MM (62)	14/60 (23.3%)	2
	LM (28)	16/26 (61.5%)	2
Degenerative	MM (39)	9/38 (23.7%)	1
	LM (23)	12/20 (60.0%)	3
Complex	MM (34)	9/33 (27.3%)	1
	LM (14)	**9/13 (69.2%)**	1
Flap-shaped	MM (32)	7/31 (22.6%)	1
	LM (24)	14/21 (66.7%)	3

Type of tear	Location (n)	Click on McMurray (True positive rate)	McMurray not performed
Root tear	MM (4)	0/3 (0%)	1
	LM (0)	NA	NA
Discoid	MM (0)	NA	NA
	LM (37)	14/29 (48.3%)	8

Discussion

- The McMurray test is useful for LM tear when a click is present, although its usefulness for MM tear is limited
  - Knee is anatomically and kinematically different between medial and lateral sides
    - LM is more mobile than MM [7]
    - Medial compartment of the knee receives more constraint during flexion (medial pivot motion) [8,9]
  - True positive rate of the McMurray test varied widely among the tear patterns

- Joint line tenderness has a high diagnostic value
  - Easier to perform, regardless of pain / limitation of joint motion
  - Should be used in a standard manner to screen meniscus tears

Conclusion

- The joint line tenderness is the most useful clinical sign of meniscus tears

- The McMurray test is useful in diagnosing the LM tear when a click is present during the test, although its usefulness in diagnosing the MM tear is limited

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