

# Diagnostic accuracy of the Thessaly test, standardised clinical history and other clinical examination tests (Apley's, McMurray's and joint line tenderness) for meniscal tears in comparison with magnetic resonance imaging diagnosis

Mark Blyth,<sup>1\*</sup> Iain Anthony,<sup>1</sup> Bernard Francq,<sup>2</sup>  
Katriona Brooksbank,<sup>1</sup> Paul Downie,<sup>3</sup>  
Andrew Powell,<sup>1</sup> Bryn Jones,<sup>1</sup> Angus MacLean,<sup>1</sup>  
Alex McConnachie<sup>2</sup> and John Norrie<sup>4</sup>

<sup>1</sup>Orthopaedic Research Unit, Glasgow Royal Infirmary, Glasgow, UK

<sup>2</sup>Robertson Centre for Biostatistics, Glasgow University, Glasgow, UK

<sup>3</sup>Muirside Medical Practice, Baillieston Health Centre, Glasgow, UK

<sup>4</sup>Centre for Healthcare Randomised Trials (CHaRT), University of Aberdeen, Aberdeen, UK

\*Corresponding author

**Declared competing interests of authors:** John Norrie is a member of the National Institute for Health Research Health Technology Assessment (HTA) and Efficacy and Mechanism Evaluation Editorial Board and HTA Commissioning Board.

Published August 2015

DOI: 10.3310/hta19620

## Scientific summary

Diagnostic accuracy of clinical examination tests for meniscal tears

Health Technology Assessment 2015; Vol. 19: No. 62

DOI: 10.3310/hta19620

NIHR Journals Library [www.journalslibrary.nihr.ac.uk](http://www.journalslibrary.nihr.ac.uk)

# Scientific summary

## Background

The menisci are two semilunar, fibrocartilaginous discs located between the medial and lateral articular surfaces of the femur and tibia in each knee. The menisci play an important role in the knee providing multiple complex functions, including load bearing, stress distribution and shock absorption. Loads transmitted through the joint to the cartilage are partially borne by the menisci; hence they play an important role in both the protection of the cartilage and the subsequent development of degenerative osteoarthritis of the knee should the menisci become damaged.

Damage to the menisci commonly occurs in two different scenarios: in young active individuals during sporting activity and in older individuals as a result of long-term degeneration of the menisci.

Reliable non-invasive diagnosis of meniscal tears is difficult. Magnetic resonance imaging (MRI) is often referred to as the gold standard for non-invasive diagnosis of meniscal tears. However, incidental meniscal findings on MRI of the knee are common in the general population. These incidental findings increase with age and are often not associated with pain. The only completely accurate way to diagnose meniscal tears is to perform an arthroscopy of the knee in order to image the menisci directly. However, this is an invasive procedure and therefore carries risks for the patient.

As an alternative to imaging or surgery there are a number of physical examination tests described for the diagnosis of meniscal tears. The most commonly used physical tests include the joint line tenderness Test, McMurray's Test and Apley's Test. These tests have been in use for many years, but are widely acknowledged to have limited specificity and sensitivity, particularly in the presence of other knee pathologies such as anterior cruciate ligament rupture. More recently Karachalios *et al.* have described a new physical test to detect meniscal tears – the Thessaly Test [Karachalios T, Hantes M, Zibis AH, Zachos V, Karantanas AH, Malizos KN. Diagnostic accuracy of a new clinical test (the Thessaly test) for early detection of meniscal tears. *J Bone Joint Surg Am* 2005;**87**:955–62]. The Thessaly Test is reported to have a high sensitivity and specificity.

The aim of this prospective study was to determine the diagnostic accuracy of the Thessaly Test and to determine if the Thessaly Test (alone or in combination with other tests) can obviate the need for further investigation by MRI or arthroscopy for patients with suspected meniscal tear.

Although the primary purpose of the study was to evaluate whether or not the Thessaly Test is of use to primary care clinicians in the diagnosis of meniscal tears, the study was actually conducted in a secondary care setting. The rationale for this was that any one individual general practitioner (GP) is likely to see only a very small number of patients with a meniscal tear in the course of an average year. In order to avoid the need for a large network of primary care clinicians who would contribute only relatively small numbers of patients, the study was designed to be undertaken in secondary care, where large numbers of the target patient group are available. Primary care clinicians were brought in to the secondary care setting to evaluate patients. This pragmatic design enhanced the efficiency of the study and provided an opportunity to compare the diagnostic accuracy of the Thessaly Test when utilised by both primary care clinicians and secondary care specialist musculoskeletal clinicians.

## Objectives

- To determine the diagnostic accuracy of the Thessaly Test for meniscal tears in the knee and whether or not this test can obviate the need for further investigation by arthroscopy or MRI.
- To determine how the Thessaly Test compares with clinical history and to other commonly used physical examinations (McMurray's Test, Apley's Test and the joint line tenderness Test) in diagnosing meniscal tears.
- To determine if the presence of arthritis or other knee pathologies influences the accuracy of the Thessaly Test.
- To determine if the use of combinations of physical tests (such as the Thessaly Test, McMurray's Test, Apley's Test and the joint line tenderness Test) provides better specificity and sensitivity than a single test alone in the diagnosis of meniscal tears.
- To determine the ability of non-specialist GPs to use the Thessaly Test in comparison with specialist knee clinicians.

## Methods

This was a single-centre study undertaken at Glasgow Royal Infirmary between 2013 and 2014, study registration number ISRCTN43527822. A total of 367 patients were recruited (covering all age ranges) – 292 patients with suspected knee pathology, 75 patients with no knee pathology.

### *Knee pathology group*

#### Inclusion criteria

- Patients referred to the knee clinic at Glasgow Royal Infirmary.

#### Exclusion criteria

- Age < 18 years.
- Unable to give informed consent.
- Previous knee replacement surgery.

### *Control group*

#### Inclusion criteria

- Patients attending the hand clinic at Glasgow Royal Infirmary or responding to advertisement posters placed within Glasgow Royal Infirmary.

#### Exclusion criteria

- Age < 18 years.
- Unable to give informed consent.
- Previous knee replacement surgery.
- A history of knee pain in the last 6 months.
- Osteoarthritis.
- Rheumatoid arthritis.

A subgroup of knee pathology patients were recruited directly from a single GP practice. The purpose of this was to allow comparison with the main study group recruited in secondary care to ensure that the demographics of the main group matched those that would be expected to present to a typical GP practice.

Independent assessments of patients knees were carried out by orthopaedic musculoskeletal specialists ( $n = 11$ ) and primary care clinicians ( $n = 12$ ). Each clinician undertook the following diagnostics tests for meniscal tears: the Thessaly Test, McMurray's Test, Apley's Test and the joint line tenderness Test. In addition, each clinician made a diagnosis based on a standardised clinical history. In order to avoid bias the order in which each test was performed was randomised.

Magnetic resonance imaging scans were performed as a 'gold standard' for diagnosing meniscal tear in 282 patients (239 knee pathology and 43 controls). The accuracy of MRI diagnosis was further validated in 77 patients who required arthroscopy of the knee. Knee radiography were performed to determine presence of osteoarthritis in 264 patients (all knee pathology patients).

For each diagnostic test we calculated the sensitivity, specificity, negative and positive predictive value, likelihood ratio, odds ratio and diagnostic accuracy.

Multivariate logistic regression and stepwise logistic regression models were used to test whether or not combinations of physical tests were predictive of MRI diagnosis.

## Results

Fifty-six per cent of patients in the knee pathology group had a meniscal tear diagnosed on a MRI scan, compared with just 12% in the control group. All patients in the control group were asymptomatic. The medial meniscus was more commonly affected (71.4%). In the knee pathology group 18.3% of patients had a concomitant anterior cruciate ligament injury and 27% of patients had osteoarthritis grade II or higher on the Kellgren and Lawrence scale.

When the Thessaly Test was utilised by primary care clinicians it had a sensitivity of 0.66, a specificity of 0.39 and a diagnostic accuracy of 54%. Similar diagnostic accuracy was achieved for the other tests: McMurray's Test 54%, Apley's Test 53%, joint line tenderness Test 54% and clinical history 55%.

When used by musculoskeletal clinicians the Thessaly Test had a sensitivity of 0.62, a specificity of 0.55 and diagnostic accuracy of 59%. The diagnostic accuracy of the other tests was McMurray's Test 63%, Apley's Test 58%, joint line tenderness Test 64% and clinical history 69%.

Sensitivity of the Thessaly Test was influenced by age and the presence of other knee pathologies when used by primary care clinicians and by the presence of other knee pathologies when used by musculoskeletal clinicians.

Multivariable logistic regression with all factors included and stepwise logistic regression was performed to identify factors predictive of MRI diagnosis. For primary care clinicians, age and past history of osteoarthritis were both significant predictors of MRI diagnosis of meniscal tear. For musculoskeletal clinicians, age and a positive diagnosis of meniscal tear on clinical history taking were significant predictors of MRI diagnosis. No physical tests were predictive in our models for either group of clinicians.

The specificity of MRI diagnosis was tested in subgroup of patients who went on to have a knee arthroscopy. The specificity was 0.53 [95% confidence interval (CI) 0.28 to 0.77] and 0.6 (95% CI 0.32 to 0.84) after patients who had previously had knee surgery were removed from the analysis. The sensitivity of MRI compared with arthroscopy was 1.0.

## Conclusions

The data generated by this study suggests that the Thessaly Test is no better at diagnosing meniscal tears than other established physical tests. We found that neither the Thessaly Test alone or in combination with other physical tests could be reliably used by primary care clinicians as an alternative, or surrogate, for MRI scanning to diagnose meniscal tears in the knee.

We have also found that MRI diagnosis of meniscal tears in comparison with arthroscopic diagnosis was less accurate than is commonly reported in the literature. This is particularly true when MRI is used indiscriminately rather than in targeted populations of patients with specific 'suspected' knee pathologies. Further well-defined studies are required to determine the true accuracy of MRI for meniscal tear.

The findings of this study have implications for primary care clinicians who may wish to consider referral of patients with significant knee pain and injuries to a specialist clinician for assessment and treatment rather than automatic referral for MRI imaging of the knee. This approach is likely to maximise the benefit from MRI imaging and minimise the cost of unnecessary or inappropriate imaging.

## Trial registration

This trial is registered as ISRCTN43527822.

## Funding

Funding for this study was provided by the Health Technology Assessment programme of the National Institute for Health Research.



ISSN 1366-5278 (Print)

ISSN 2046-4924 (Online)

Impact factor: 5.116

*Health Technology Assessment* is indexed in MEDLINE, CINAHL, EMBASE, The Cochrane Library and the ISI Science Citation Index.

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) ([www.publicationethics.org/](http://www.publicationethics.org/)).

Editorial contact: [nhredit@southampton.ac.uk](mailto:nhredit@southampton.ac.uk)

The full HTA archive is freely available to view online at [www.journalslibrary.nihr.ac.uk/hta](http://www.journalslibrary.nihr.ac.uk/hta). Print-on-demand copies can be purchased from the report pages of the NIHR Journals Library website: [www.journalslibrary.nihr.ac.uk](http://www.journalslibrary.nihr.ac.uk)

## Criteria for inclusion in the *Health Technology Assessment* journal

Reports are published in *Health Technology Assessment* (HTA) if (1) they have resulted from work for the HTA programme, and (2) they are of a sufficiently high scientific quality as assessed by the reviewers and editors.

Reviews in *Health Technology Assessment* are termed 'systematic' when the account of the search appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

## HTA programme

The HTA programme, part of the National Institute for Health Research (NIHR), was set up in 1993. It produces high-quality research information on the effectiveness, costs and broader impact of health technologies for those who use, manage and provide care in the NHS. 'Health technologies' are broadly defined as all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care.

The journal is indexed in NHS Evidence via its abstracts included in MEDLINE and its Technology Assessment Reports inform National Institute for Health and Care Excellence (NICE) guidance. HTA research is also an important source of evidence for National Screening Committee (NSC) policy decisions.

For more information about the HTA programme please visit the website: <http://www.nets.nihr.ac.uk/programmes/hta>

## This report

The research reported in this issue of the journal was funded by the HTA programme as project number 09/163/02. The contractual start date was in September 2012. The draft report began editorial review in July 2014 and was accepted for publication in March 2015. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

This report presents independent research funded by the National Institute for Health Research (NIHR). The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, NETSCC, the HTA programme or the Department of Health. If there are verbatim quotations included in this publication the views and opinions expressed by the interviewees are those of the interviewees and do not necessarily reflect those of the authors, those of the NHS, the NIHR, NETSCC, the HTA programme or the Department of Health.

© Queen's Printer and Controller of HMSO 2015. This work was produced by Blyth *et al.* under the terms of a commissioning contract issued by the Secretary of State for Health. This issue may be freely reproduced for the purposes of private research and study and extracts (or indeed, the full report) may be included in professional journals provided that suitable acknowledgement is made and the reproduction is not associated with any form of advertising. Applications for commercial reproduction should be addressed to: NIHR Journals Library, National Institute for Health Research, Evaluation, Trials and Studies Coordinating Centre, Alpha House, University of Southampton Science Park, Southampton SO16 7NS, UK.

Published by the NIHR Journals Library ([www.journalslibrary.nihr.ac.uk](http://www.journalslibrary.nihr.ac.uk)), produced by Prepress Projects Ltd, Perth, Scotland ([www.prepress-projects.co.uk](http://www.prepress-projects.co.uk)).

## Editor-in-Chief of *Health Technology Assessment* and NIHR Journals Library

**Professor Tom Walley** Director, NIHR Evaluation, Trials and Studies and Director of the HTA Programme, UK

### NIHR Journals Library Editors

**Professor Ken Stein** Chair of HTA Editorial Board and Professor of Public Health, University of Exeter Medical School, UK

**Professor Andree Le May** Chair of NIHR Journals Library Editorial Group (EME, HS&DR, PGfAR, PHR journals)

**Dr Martin Ashton-Key** Consultant in Public Health Medicine/Consultant Advisor, NETSCC, UK

**Professor Matthias Beck** Chair in Public Sector Management and Subject Leader (Management Group), Queen's University Management School, Queen's University Belfast, UK

**Professor Aileen Clarke** Professor of Public Health and Health Services Research, Warwick Medical School, University of Warwick, UK

**Dr Tessa Crilly** Director, Crystal Blue Consulting Ltd, UK

**Dr Peter Davidson** Director of NETSCC, HTA, UK

**Ms Tara Lamont** Scientific Advisor, NETSCC, UK

**Professor Elaine McColl** Director, Newcastle Clinical Trials Unit, Institute of Health and Society, Newcastle University, UK

**Professor William McGuire** Professor of Child Health, Hull York Medical School, University of York, UK

**Professor Geoffrey Meads** Professor of Health Sciences Research, Faculty of Education, University of Winchester, UK

**Professor John Norrie** Health Services Research Unit, University of Aberdeen, UK

**Professor John Powell** Consultant Clinical Adviser, National Institute for Health and Care Excellence (NICE), UK

**Professor James Raftery** Professor of Health Technology Assessment, Wessex Institute, Faculty of Medicine, University of Southampton, UK

**Dr Rob Riemsma** Reviews Manager, Kleijnen Systematic Reviews Ltd, UK

**Professor Helen Roberts** Professor of Child Health Research, UCL Institute of Child Health, UK

**Professor Helen Snooks** Professor of Health Services Research, Institute of Life Science, College of Medicine, Swansea University, UK

**Professor Jim Thornton** Professor of Obstetrics and Gynaecology, Faculty of Medicine and Health Sciences, University of Nottingham, UK

Please visit the website for a list of members of the NIHR Journals Library Board:  
[www.journalslibrary.nihr.ac.uk/about/editors](http://www.journalslibrary.nihr.ac.uk/about/editors)

**Editorial contact:** [nihredit@southampton.ac.uk](mailto:nihredit@southampton.ac.uk)