Manual Therapy 25 (2016) 27–34

Contents lists available at ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Original article

The validity of a clinical test for the diagnosis of lumbar spinal stenosis

Robert Dobbs [a], Stephen May [b, *], Philip Hope [a]

[a] Physiotherapy Department, Chesterfield Royal Hospital, Chesterfield, Derbyshire, UK
[b] 38 Collegiate Crescent, Faculty of Health and Wellbeing, Sheffield Hallam University, Sheffield S10 2BP, UK

ARTICLE INFO

Article history:
Received 11 January 2016
Received in revised form
23 May 2016
Accepted 25 May 2016

Keywords:
Lumbar
Spinal stenosis
Extension test
Diagnosis
Validity

ABSTRACT

Background: The diagnosis and management of acquired lumbar spinal stenosis (ALSS) is an area of growing interest with an increase in its prevalence and detection in the older population.
Objectives: To investigate the diagnostic accuracy of a modified extension test (MExT) for diagnosing ALSS in subjects aged fifty or over.
Methods: Symptomatic response of the bi-component MExT was evaluated and compared against magnetic resonance imaging (MRI) findings in 30 subjects. Estimates of sensitivity, specificity, likelihood ratios (LRs) and post-test probabilities were all calculated, and the capability of the test to discriminate between grade and location of stenosis was also appraised.
Results: MExT sensitivity was high at 92% (95% confidence intervals (CI), 72–99%) leading to a significant negative likelihood ratio at −LR 0.2 (95% CI, 0.03–1.36); conversely, specificity was low at 40% (95% CI, 7–82%) with only a small positive likelihood ratio of +LR 1.53 (95% CI, 0.74–3.16). All correlations between the MExT and concurrent grade, or location of stenosis appeared weak and insignificant.
Conclusions: The MExT was found to demonstrate acceptable criterion validity in relation to ruling-out a diagnosis when a negative result was observed; however, further validation appears warranted.

1. Introduction

World epidemiological projections indicate that the number of people within the population aged sixty-five or over will have increased from sixteen to twenty five per cent by the year 2040 (Population Reference Bureau, 2010; Maloney-Backstrom et al., 2011). In response to such demands, health research agendas have increasingly shifted focus towards the management of degenerative conditions proposing direct efficiency savings through enhanced examination and treatment rigour (IAGG, 2007). One such condition gaining attention is acquired lumbar spinal stenosis (ALSS). Point prevalence estimates suggest degenerative lumbar conditions may afflict up to twenty per cent of the older-aged population (Keller et al., 2003; Lyle et al., 2005). Of those individuals referred to an orthopaedic spinal specialist, approximately fourteen per cent are found to exhibit severe stenotic change requiring surgical decompression (Aalto et al., 2006; Slatis et al., 2009; Watters et al., 2008). As such, ALSS has fast become the leading cause of spinal surgery in this population (Mannion et al., 2010; Steurer et al., 2010), whilst its deleterious influence on locomotor capability and psychosocial aspects of health renders it a precursor for falls, depression and cardiovascular disease (Middleton and Fish, 2009; Kim et al., 2011).

The clinical syndrome of ALSS develops as a consequence of incremental damage to spinal tissues. Narrowing of the intervertebral disc reduces the distance between adjacent vertebrae, whilst an alteration to biomechanical force initiates arthritic change and ligamentous laxity (Fredrickson et al., 2001; Vo et al., 2005; Papadakis et al., 2011). Subsequent thickening of the ligamentum flavum, pedicles or vertebral facets diminish the space available for neural and vascular structures, with ischaemic change ensuing within the spinal canal (central stenosis), nerve root canal, or intervertebral foramina (foraminal stenosis) (Vo et al., 2005). Sufferers of ALSS present with symptoms of lower extremity pain or paraesthesia, occurring with or without back pain especially with positions of extension, which limit walking capacity secondary to neurogenic claudication (Bal et al., 2006; Malmivaara et al., 2007; Ogikubo et al., 2007).

1.1. Diagnostic methods

However no widely accepted diagnostic criterion for ALSS currently exist (Goh et al., 2004; Haig et al., 2006; Genevay et al.,

* Corresponding author. +44 (0)114 2252370.
E-mail address: s.may@shu.ac.uk (S. May).

http://dx.doi.org/10.1016/j.math.2016.05.332
1356-689X/

2010; Genevay and Atlas, 2010). Recent reviews have cited heterogeneity and unsatisfactory research standards, which prevent conclusions on the performance of diagnostic tests being drawn (De Graaf et al., 2006; Genevay and Atlas, 2010). Moreover, appraisal of these tests employed found many to be grounded in anecdotal evidence rather than robust measurement (Haig et al., 2006; Browne and Roberts, 2008; Deyo et al., 2009). For this reason supplementary analysis of all diagnostic procedures is needed.A recent review reported postural effects on symptoms to have the most useful diagnostic criteria, whereas clinical tests were less consistently useful (De Schepper et al., 2013).

With a distinctive clinical presentation initial diagnosis of ALSS is made in relation to patient report alone; however, clinical prediction rules based solely on patient report have only been done on small populations (Sugioka et al., 2008). Accurate findings from physical testing would help to validate patient report, however selection of these tests has proven problematic. Neurological examination is commonly observed to be normal (Bassewitz and Herkowitz, 2001; Genevay and Atlas, 2010), thus the most pertinent physical findings typically relate to symptomatic change in accordance with lumbar movement. Although both treadmill and bike tests have been postulated as useful when differentiating ALSS from claudication arising from peripheral vascular disease (Fritz et al., 1997; Tenhula et al., 2000; Deen et al., 2000; Yukawa et al., 2002), research findings appear inconsistent (Dong and Porter, 1989; Moon et al., 2005).

Thus postural tests gauging the symptomatic response to lumbar extension appears pertinent to the initial physical examination. Studies have exhibited the extension movement to narrow spinal space by up to twenty per cent (Panjabi et al., 1983; Inufusa et al., 1996; Fritz et al., 1998), with percentages substantially increasing when coupled with degenerative changes (Westergaard et al., 2009; Kishner et al., 2010; Schronstrom and Willen, 2011). Regardless of a strong theoretical foundation, only one study by Katz et al. (1995) is frequently cited by other authors when appraising validity (Fritz et al., 1998; Lurie, 2005; Vo et al., 2005; Westergaard et al., 2009). Evaluating a range of physical components this study observed a small positive likelihood ratio of 1.6 with 30-s of lumbar extension and provocation of at least thigh pain. Positive findings on coupled quadrant movements of extension and side-flexion is recognised as ‘Kemps sign’ (Jenis and Howard, 2000), and is stated to occur frequently in foraminal stenosis (Watanabe et al., 2014; Eguchi et al., 2010). Thus further evaluation of 'Kemps sign' or combined extension and side-flexion movement seems warranted, as it would be a simple and straightforward test to employ in the examination of those with suspected ALSS, because of age and findings from the history.

1.2. Aims

The aim of this study was to prospectively evaluate the validity of the ‘Modified Extension Test’ (MExT) an extension-based test proposed by the authors. This test gauges the symptomatic response to lumbar movement, and is postulated to support the diagnosis of ALSS whether located centrally or foraminally. Moreover, no consistent information currently exists regarding whether symptoms occur more rapidly following the commencement of extension in those with severe stenotic change. Such discernments would support the identification of those individuals more likely to require surgical consideration (Amundsen et al., 2000; Slatis et al., 2009; Watters et al., 2008), and hence, was selected for subanalysis despite the inconsistencies that there was such a link in previous literature (Wang et al., 2008; Haig and Tomkins, 2010; Kishner et al., 2010).

2. Methods

2.1. Sample

Subjects aged fifty or over were recruited from Chesterfield Royal Hospital (CRH) over a six-month period. Consecutive patients attending either the Extended Scope Practitioner (ESP) or musculoskeletal (MSK) physiotherapy clinic were screened, and where deemed eligible were invited to participate. Recruitment was based on presenting symptoms, with inclusion criterion requiring subjective report of unilateral or bilateral pain or paraesthesia radiating below the glutaeal fold. In accordance with guidelines for magnetic resonance imaging (MRI) scan referral, symptoms were required to have been present for a minimum of six weeks (Bussieres et al., 2008). Patients who had a lack of mental capacity to provide informed consent, or were unable to understand English, or there was a pre-existing diagnosis of peripheral vascular disease, or of ankylosing spondylitis were excluded. A STARD flowchart is provided in Fig. 1.

In the absence of a defined ‘true’ diagnostic gold standard, Magnetic Resonance Imaging (MRI) was selected as the reference test upon which to evaluate the index test's (MExT) validity. Whilst concern has been documented regarding the relative inconsistency between clinical symptoms and degree of observed radiographic change (Wang et al., 2008; Haig and Tomkins, 2010; Kishner et al., 2010), clinical guidelines recommend its use as a primary tool in ALSS diagnosis (Watters et al., 2008). MRI has demonstrated both significant positive likelihood ratios (between 8.1 and 16.2), and negative likelihood ratios (between 0.3 and 0.19) establishing its usefulness for ruling in or out a diagnosis (Fritz et al., 1998). Moreover, the reliability of image interpretation for ALSS has been established with Lurie et al. (2008) observing Kappa scores of (0.82) and (0.83) for inter-rater and intra-rater reliability respectively. The definitions used are in Tables 1 and 2.

2.2. Procedure

The investigation was undertaken at CRH with subjects assessed by an ESP of more than twenty years' experience. The primary researcher obtained informed consent before key demographic and clinical findings were recorded. Prior to MExT testing a neurological examination was carried out that included dermatomes, myotomes, reflexes, and straight leg raise test as described by Petty (2006).

Prior to MExT commencement the order in which the constituent test component would be administered was predetermined through random allocation. The randomisation process comprised a blinded independent therapist selecting from thirty coloured balls concealed within a box (fifteen blue and fifteen red). When a blue ball was selected component one (extension) was to be undertaken first; conversely, when a red ball was selected component two (extension/side-flexion) was the initial test component.

Each subject received the MExT (Fig. 2), whilst an independent rater timed each component up to the 60 s cut-off point. The result of the MExT was documented against each component, and when positive, the associated time for symptoms to occur was recorded. A positive test was deemed to be when pain below the glutaeal fold was exacerbated or produced with one or both components of the test; exacerbation or production of back pain alone did not count. The participant was subsequently monitored for 10 min and advised on what measures should be undertaken in the event of adverse effects. In order to limit partial verification bias each participant was referred for an MRI scan irrespective of MExT result (Pewsner et al., 2004; Whiting et al., 2004). The subsequent lumbar