



Systematic review

Diagnostic utility of patient history and physical examination data to detect spondylolysis and spondylolisthesis in athletes with low back pain: A systematic review



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ABSTRACT

Background: In adolescent athletes, low back pain has a 1-year prevalence of 57% and causes include spondylolysis and spondylolisthesis. An accurate diagnosis enables healing, prevention of progression and return to sport.

Objective: To evaluate the diagnostic utility of patient history and physical examination data to identify spondylolysis and/or spondylolisthesis in athletes.

Design: Systematic review was undertaken according to published guidelines, and reported in line with PRISMA.

Method: Key databases were searched up to 13/11/15. Inclusion criteria: athletic population with LBP, patient history and/or physical examination accuracy data for spondylolysis and/or spondylolisthesis, any study design including raw data. Two reviewers independently assessed risk of bias (ROB) using QUADAS-2. A data extraction sheet was pre-designed. Pooling of data and investigation for heterogeneity enabled a qualitative synthesis of data across studies.

Results: Of the eight included studies, two were assessed as low ROB, one of which also had no concerns regarding applicability. Age (<20 years) demonstrated 81% sensitivity and 44% specificity and gender (male) 73% sensitivity and 57% specificity for spondylolysis. Difficulty falling asleep, waking up because of pain, pain worse with sitting and walking all have sensitivity >75% for spondylolisthesis. Step-deformity palpation demonstrated 60–88% sensitivity and 87–100% specificity for spondylolisthesis. The one-legged hyperextension test was not supported for spondylolysis (sensitivity 50–73%, specificity 0–87%).

Conclusion: No recommendations can be made utilising patient history data. Based on one low ROB study, step deformity palpation may be useful in diagnosing spondylolisthesis. No physical tests demonstrated diagnostic utility for spondylolysis. Further research is required.

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1. Introduction

Low back pain (LBP) in adolescent athletes (aged 12–20 years) has a 1 year prevalence of up to 57% (Schmidt et al., 2014), compared to the age matched broad population (10–19 years) 1 year prevalence of 23% (Hoy et al., 2012). In the adult population, disc pathology and degenerative changes are predominantly associated with LBP, whereas athletic adolescents are more predisposed

to posterior element derangements, including spondylolysis and spondylolisthesis (Micheli and Wood, 1995). Spondylolysis is an osseous defect of the pars interarticularis of a vertebral arch (Haun and Kettner, 2005); and spondylolisthesis is a translation of a vertebral body on the adjacent vertebra, most often referred to as a listhesis in the anterior direction (Haun and Kettner, 2005).

In the general population, spondylolysis is present in 4.4% of asymptomatic children and by adulthood in 6% (Fredrickson et al., 1984). Occurrence of symptomatic spondylolisthesis into adulthood has been reported as 5% (Beutler et al., 2003). The male:female ratio is 2:1 (Lonstein, 1999; Beutler et al., 2003). The prevalence of spondylolysis in the athletic population is 13.90%

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(Rossi and Dragoni, 2001), higher percentages are seen in sports like; diving 40.35% (Rossi and Dragoni, 2001), throwing sports 27% (Soler and Calderon, 2000), sailing 17.18% and gymnastics 16.64% (Rossi and Dragoni, 2001). Progression to spondylolisthesis has been reported as 47.5% (Rossi and Dragoni, 2001) and has been associated with mechanical stress related to certain sports involving repetitive lumbar hyperextension (Jackson et al., 1976). The progression of listhesis is seen to be greater in adolescence with 7% slippage and reduced to 2% slippage by the 5th decade of life (Beutler et al., 2003).

Establishing an accurate diagnosis to enable healing and prevention of progression to non-union of the pars interarticularis is the primary management goal for athletes with spondylolysis (Iwamoto et al., 2010). Higher healing rates have been seen if spondylolysis is detected early (Saraste, 1986; Morita et al., 1995; Fujii et al., 2004). A recent systematic review concluded that no clinical test possessed the diagnostic utility (the diagnostic usefulness of a test) to diagnose spondylolysis, but that the lumbar spinous palpation test demonstrated diagnostic utility for diagnosing spondylolisthesis (Alqarni et al., 2015), with specificity 87–100% and sensitivity 60–88%. The review included a general, non-athletic population in their eligibility criteria; but two of the included studies (Masci et al., 2006; Gregg et al., 2009) investigated a sporting population for spondylolysis. Clinical tests that can distinguish spondylolysis from other causes of LBP in athletes have not been identified (Kujala et al., 1999; Alqarni et al., 2015). However, patient history data are strong contributors to establishing an accurate diagnosis (Peterson et al., 1992); through clinical reasoning processes (Rushton and Lindsay, 2010), and Alqarni et al. (2015) only explored physical data, searching to February 1st 2014. An updated review including patient history data is therefore required.

1.1. Objective

To identify and evaluate the diagnostic utility of patient history and physical examination data to identify spondylolysis and/or spondylolisthesis in athletes.

2. Methodology

2.1. Methods

A systematic review was conducted according to a pre-defined protocol designed according to The Cochrane Handbook for Diagnostic Test Accuracy studies (Bossuyt and Leeflang, 2008; de Vet et al., 2008; Bossuyt et al., 2013), the Centre for Reviews and Dissemination (CRD, 2009) and the Preferred Reporting Items for Systematic reviews and Meta-Analysis guidelines (Moher et al., 2009).

2.2. Search strategy

Two reviewers (LHG, MN) independently searched key bibliographic databases: MEDLINE, Cochrane Library, AMED, CINAHL, Sport Discus, Pub Med Central and Web of Science. Databases were searched from date of inception to 13th November 2015. A third reviewer (RS) mediated any disagreements. All three reviewers attended a meeting with a research assistant where the search strategies for the main databases were discussed. The following terms and combinations of them, were used: low back pain, spondylolysis, spondylolisthesis, stress fracture, pars interarticularis, stability, range of motion, test, diagnosis, diagnostic test, signs, symptoms, patient history, physical examination, accuracy, sensitivity, specificity, reliability, validity, athletes and sport. Terms

were searched for as text words and database subject headings, covering synonyms and related terms. Box 1 details the MEDLINE search strategy. Screening reference lists of included studies and relevant publications augmented the search.

2.3. Eligibility criteria

The title and abstract of identified studies were screened by two reviewers (LHG, MN) for eligibility using pre-specified inclusion criteria. Retrieved full texts were screened by the same two reviewers, and a third reviewer mediated any disagreement (RS). Inclusion criteria:

- Any study design using primary diagnostic accuracy data;
- Population with LBP with/without radiculopathy presenting with suspected spondylolysis and/or spondylolisthesis. An initial scoping search revealed few studies focused only to an athletic/young population. Therefore no age restriction was applied for study eligibility but the young/athletic population (aged 11–30 years and engaged in sport activities on a regular basis) was the focus of the analysis.
- Study investigating patient history and/or physical examination data, including specificity, sensitivity, likelihood ratios, and predictive values or presenting the raw data needed for calculation of these values.

Studies that did not compare patient history and/or physical examination data against diagnostic imaging (plain radiograph,

Box 1

MEDLINE search strategy

1. spondylolisthesis.mp. or exp Spondylolisthesis/
2. spondylolysis.mp. or exp Spondylolysis/
3. stress fracture.mp. or exp Fractures, Stress/
4. pars interarticularis.mp.
5. 1 or 2 or 3 or 4
6. physical examination.mp. or exp Physical Examination/
7. physical test.mp.
8. clinical test.mp.
9. Diagnosis/or Diagnosis, Differential/or Diagnos*.mp.
10. palpation.mp. or Palpation/
11. symptom.mp. or exp Symptom Assessment/
12. (stability or instability).mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
13. patient history.mp.
14. accuracy.mp. or exp "Sensitivity and Specificity"/
15. exp "Reproducibility of Results"/or reliability.mp.
16. exp Athletic Injuries/or extension related stress injury.mp.
17. low back pain.mp. or Back Pain/or exp Low Back Pain/or exp Lumbar Vertebrae/
18. "range of motion".mp. or exp "Range of Motion, Articular"/
19. 6 or 7 or 8 or 10 or 11 or 12 or 13
20. 9 or 14 or 15
21. 9 or 16 or 17
22. 5 and 19 and 20 and 21

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