

# Research Paper Review

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Diagnosis of Lumbar Spinal Stenosis: An Updated Systematic Review of the Accuracy of Diagnostic Tests

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## ABSTRACT

STUDY DESIGN:

Systematic review of diagnostic studies.

## **OBJECTIVE:**

To update our previous systematic review on the diagnostic accuracy of tests used to diagnose lumbar spinal stenosis.

## SUMMARY OF BACKGROUND DATA:

A wide range of clinical, radiological, and electrodiagnostic tests are used to diagnose lumbar spinal stenosis. An accurate diagnosis is vital, because lumbar spinal stenosis may require specific medical advice and treatment. Therefore, it is important to know the accuracy of these diagnostic tests currently available.

## Methods:

A comprehensive literature search was conducted for original diagnostic studies on lumbar spinal stenosis, in which one or more diagnostic tests were evaluated with a reference standard, and diagnostic accuracy was reported or could be calculated. Our previous systematic review included studies up to March 2004; this review is current up to March 2011. Included studies were assessed for their methodological quality using the QUADAS tool. Study characteristics and reported diagnostic accuracy were extracted.

#### Results:

Twenty-two additional articles in addition to the 24 included in the previous review met the inclusion criteria. Combined, this resulted in 20 articles concerning imaging tests, 11 articles evaluating electrodiagnostic tests, and 15 articles evaluating clinical tests. Estimates of the diagnostic accuracy of the tests differed considerably.

#### Conclusion:

There is a need for a consensus on criteria to define and classify lumbar spinal stenosis. At present, the most promising imaging test for lumbar spinal stenosis is magnetic resonance imaging, avoiding myelography because of its invasiveness and lack of superior accuracy. Electrodiagnostic studies showed no superior accuracy for conventional electrodiagnostic testing compared with magnetic resonance imaging. These tests should be considered in the context of those presenting symptoms with the highest diagnostic value, including radiating leg pain that is exacerbated while standing up, the absence of pain when seated, the improvement of symptoms when bending forward, and a wide-based gait.

#### ANALYSIS

#### Reviewed by Dr. Jeff Muir DC, (Research Review Service)

## Author's Affiliations:

Department of General Practice, Erasmus MC, University Medical Center, Rotterdam, the Netherlands; Department of Neurosurgery, Leiden University Medical Center, Leiden, the Netherlands; Department of Division of Physical Medicine and Rehabilitation, VA Boston Healthcare System, Boston, USA; Department of Physical Medicine and Rehabilitation, Harvard Medical School, Boston, USA.

## **Background Information:**

Lumbar spinal stenosis (LSS) is a term commonly used to describe patients with symptoms related to an anatomic reduction of the lumbar spinal canal size (1). The diagnosis of LSS is challenging, though, as the diagnosis refers largely to the anatomic observation and not to the myriad clinical symptoms that lead patients to seek our treatment (1). Symptomatology alone is insufficient to diagnose LSS and, as such, correlation of clinical findings with imaging is often required.

Currently there is no generally accepted 'gold standard' for diagnosis of LSS (2, 3). Clinical, imaging and electrodiagnostic tests are all currently used to aid in the diagnosis of LSS; however, the diagnostic value of these tests remains debated, as false-positive results may lead to unnecessary surgical procedures and/or expensive or invasive follow-up testing.

These authors previously published a systematic review evaluating the diagnostic accuracy of currently available tests for LSS (4). The current paper is an update of that original review, which was published in 2006.

## Pertinent Results:

Initial searches yielded a total of 818 articles, of which 63 were retrieved for full review. Twenty-two articles were ultimately deemed eligible for this review. The addition of 24 articles from the original review resulted in a total of 46 articles for the current review. The main reasons for study exclusion included: lack of reference standard, diagnostic accuracy was not reported or could not be calculated, study design was a case report or case series, inclusion of cervical or thoracic stenosis cases, and/or no separate reporting of outcomes for cases of LSS.

## Study Type

- Articles evaluating the diagnostic accuracy of imaging tests: 20
- Articles evaluating electrodiagnostic tests: 11
- Articles evaluating clinical tests: 15

# Study Quality:

Neither the time between the index test and reference test nor the inter-observer variation in the interpretation of test results was reported in the vast majority of the eligible studies. There was evidence that the majority of the imaging studies were influenced by knowledge of the results of the reference standard. More recently published studies, in general, were associated with less overall bias.

## Diagnostic Accuracy of Imaging Tests:

All imaging studies used an anatomic reference standard. No superior accuracy for myelography compared with CT, MRI, or three-dimensional magnetic resonance myelography (3D-MRM) was noted, with MRI and 3D-MRM showing the highest sensitivity. Three-sequence MRI was more sensitive than single-sequence MRI. Diagnostic accuracy was comparable in CT versus ultrasound. Only one study evaluated the nerve root sedimentation sign, indicating 94% sensitivity and 100% specificity.

## Diagnostic Accuracy of Electrodiagnostic Tests:

Electrodiagnostic tests consisted of conventional electromyography and nerve conduction studies, dermatomal somatosensory-evoked potentials, and the assessment of caudal motor conduction time (CMCT) with magnetic stimulation. Of the studies evaluating electrodiagnostic tests, four separate studies described the same patient population, although different reference standards (expert opinion based on a combination of clinical, radiological, and other diagnostic tests; MRI or CT; surgery and myelography) and study designs were used. Overall, the diagnostic accuracy of electrodiagnostic testing was only modest for most tests studied.

In 2 studies, paraspinal mapping showed high specificity and may increase the likelihood of LSS when using a reference standard of expert opinion on the basis of clinical and radiological data (5, 6). The diagnostic accuracy of dermatomal somatosensory-evoked potentials and magnetic stimulation CMCT remains unclear.

# Diagnostic Accuracy of Clinical Tests:

Clinical tests evaluated included: questionnaires, standardized history and physical examination, gait analyses, treadmill tests, and pain drawings analyzed in 3 different ways, but in the same study population (7-9). Analysis indicated that radiating leg pain, thigh pain, and pain that is exacerbated while standing up were all symptoms that showed the highest sensitivity for LSS. Bilateral buttock or leg pain, the absence of pain when seated, the improvement of symptoms when bending forward, and a wide-based gait were generally the most useful clinical findings for ruling in the diagnosis of LSS. The clinical findings of symptoms related to cauda equina syndrome and urinary disturbances were, in contrast, highly specific but insensitive for LSS. Overall, physical examination tests were less helpful than was symptomatology.

# Clinical Application & Conclusions:

The lack of diagnostic standards for LSS represents a significant gap in the management of, and research into, this increasingly common condition. The authors suggest that, given the current literature, MRI is the most promising imaging test for LSS. Electrodiagnostics were not superior regarding accuracy compared with MRI (it is amazing how many patients are referred for both!). The authors recommend these advanced and expensive tests be considered in close concert with presenting

symptoms with the highest diagnostic value, such as radiating leg pain that is exacerbated while standing up, the absence of pain when seated, the improvement of symptoms when bending forward, and a wide-based gait. These are aspects of a patient's condition that can be gleaned easily from clinical questioning or even simple observation!

## Study Methods:

## Search Strategy:

The 24 articles included in the previous review (4), concluded in March 2004, were included in this study. A new literature search, limited to publications between March 2004 and March 2011, was performed in MEDLINE and EMBASE.

## Selection Criteria:

- The study investigated the diagnostic accuracy of imaging, clinical examination, and other tests in detecting LSS in an adult study population,
- 1 or more different diagnostic tests as well as a reference test were included within the design,
- diagnostic accuracy was reported or could be calculated,
- if the results concerned a subgroup of patients with LSS, these were analyzed separately in the same article, and
- the article was written in English, German, French, or Dutch.

## Study Quality:

The methodological quality of individual studies was assessed using the Quality Assessment of Diagnostic Accuracy Studies (QUADAS tool) (10), consisting of 11 items referring to internal validity. The authors added 4 items related to the criteria to diagnose LSS, the interobserver variation, and the index test.

## Data Analysis:

Reported diagnostic outcomes were recalculated by the authors and where not reported, were calculated from the data provided, if sufficient. In cases where sensitivity and specificity were not reported, alternate values such as positive predictive value and negative predictive value were used.

## Reference Standard:

A distinction was made between studies that utilized a clinical reference standard (e.g. expert clinical opinion) versus an anatomic reference standard (imaging and/or surgery).

## Study Strengths / Weaknesses

## Limitations:

- The heterogeneity of techniques utilized limited pooling of data.
- The authors could not guarantee that every relevant study was found using their search criteria.

## Strengths:

• A comprehensive search strategy was employed.

• Study methodology was subjected to rigorous evaluation.

## Additional References:

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