The Essence of Clinical Practice Guidelines for Lumbar Spinal Stenosis, 2021: 2. Diagnosis and Evaluation

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Medical History and Physical Examination Findings

Summary

- In the middle-aged and elderly, if pain and numbness are experienced from the buttocks to the lower limbs and the symptoms are exacerbated when walking and standing but alleviated when in the sitting and flexed positions, lumbar spinal stenosis (LSS) is very likely. Intermittent claudication is a characteristic symptom of LSS, but it is important to differentiate it from vascular intermittent claudication.
- The "Diagnostic Support Tool for Lumbar Spinal Stenosis" is a convenient and useful tool for screening patients.

Commentary

1. Medical history

Medical history is useful for diagnosing LSS, including gluteal or lower extremity symptoms exacerbated by walking or standing, which improves or resolves with sitting or bending forward in the middle-aged and elderly. An international survey by the International Society for the Study of the Lumbar Spine Taskforce reported that the medical history for diagnosis of LSS includes the following seven items: whether the patient 1) experiences leg or buttock pain while walking, 2) flexes forward to relieve symptoms, 3) experiences relief when using a shopping cart or bicycle, 4) experiences motor or sensory disturbance while walking, 5) experiences normal and symmetric foot arterial pulses, 6) experiences lower limb muscle weakness, or 7) has low back pain[1]. Neurogenic intermittent claudication is a characteristic finding of the LSS but not an essential medical history.

2. Physical examination findings

Neurological examination findings in the lower extremities and the Kemp's test are useful but not considered highly specific for LSS. Neurogenic intermittent claudication is classified into the cauda equina type (multi-radicular disorder), nerve root type (mono-radicular disorder), and the combined type[2]. The intermittent claudication in the cauda equina type is not improved by selective nerve root block, while that in the nerve root type temporarily disappears after a block.

3. Differential diagnosis

It is important to differentiate intermittent claudication from vascular intermittent claudication. Patients with poor pulsation of the dorsalis pedis artery, low ankle brachial pressure index (ABI), and difficulty in responding to block treatment are at risk of arteriosclerosis obliterans[3]. LSS patients with peripheral arterial disease (LSSPAD) comprised 6.7%, and the factors correlated with LSSPAD were advanced age, diabetes mellitus, and histories of cerebrovascular and ischemic heart diseases[4].

4. Comorbidities and background

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Multiple studies have reported comorbidities as factors correlated with symptomatic LSS. These factors are hypertension, diabetes mellitus, advanced age, urination disorder, osteoarthritis or fracture, severe depression, and low ABI level[5-9].

Many patients with LSS experience a decline in physical functions due to decreased activity and experience great stress. The fastest 6-m walking time is useful for evaluating decreased physical abilities due to LSS[10]. Additionally, subjective stress (OR 1.69) and the load on the lower extremities and low back (OR 1.41) were associated with LSS, and patients with LSS had a low work satisfaction level[5].

5. Diagnosing foraminal stenosis

It has been reported that if leg pain is strong at rest, there is a higher possibility of foraminal stenosis than spinal canal stenosis[11]. A diagnostic support tool for symptomatic foraminal stenosis had a sensitivity of 75.5% and a specificity of 82.3% with a cutoff value of 5 points[12]. In the future, the verification of the reliability and validity of this support tool is expected.

6. Spine lesions other than the lumbar spine

Tandem spinal stenosis (TSS) is the narrowing of the spinal canal alongside the cervical and lumbar spines. A systematic review reported that TSS is present in 7.85%-60% of patients with spinal stenosis[13]. In LSS patients, the prevalence of diffuse idiopathic skeletal hyperostosis (DISH) in the middle and lower thoracic spine was 31.7%, and DISH (OR 1.65) was correlated with LSS[14].

7. Diagnostic support tool

Many physician-administered or patient self-administered diagnostic support tools for LSS that possess high sensitivity and specificity have been developed and verified the reliability and validity as follows: "Diagnostic Support Tool for Lumbar Spinal Stenosis" of the Japanese Society for Spine Surgery and Related Research[15] and "Self-administered Diagnostic Support Tool for Lumbar Spinal Stenosis" of the Tohoku Society of Lumbar Spinal Stenosis[16]. Additionally, the International Prostate Symptom Score for evaluating Neurogenic Bladder is useful for evaluating lower urinary tract disorders in lumbar degenerative disease[17]. These tools should be used for screening, detailed examination, and imaging tests for definitive diagnosis required by specialists.

Useful for Diagnosing LSS (Imaging, Electrophysiology, etc.)

Summary

Noninvasive magnetic resonance imaging (MRI) is optimal for the diagnostic imaging of LSS. However, various imaging findings, including those of MRI, do not necessarily mean that the patient is symptomatic. Therefore, symptomatology should be prioritized in diagnosing LSS, and it is necessary to fully recognize that various tests are no more than auxiliary diagnostic modalities.

Commentary

1. Imaging

1-1. Plain X-ray

A plain X-ray is a basic examination in the treatment of lumbar diseases. It is difficult to evaluate spinal stenosis using plain X-ray, but alignment evaluation has added value to the findings of MRI and contrast-enhanced CT[18-20].

1-2. Plain CT

The lumbar lordotic angle, sacral slope, and anteroposterior bony canal diameter were significantly smaller in patients with LSS than in control[21]. Three-dimensional composite images of multidetector CT (MDCT) MDCT are useful for diagnosing foraminal stenosis[22,23]. MDCT after radiculography or epidurography might be useful for diagnosing foraminal stenosis[24,25].

1-3. Myelography and CTM

Myelography and CTM have superior sensitivity to MRI as they can evaluate dynamic factors[26,27]. There is a slight difference of the measurement of the cross-sectional area of the spinal canal between MRI and CTM[28]. Further studies must investigate this difference for affecting clinical symptoms and treatment outcomes.

1-4. MRI

MRI is the most reliable diagnostic imaging method for LSS[29,30]. Morphological parameters of MRI were associated with Oswestry Disability Index (ODI)[31], and were predictors of surgical indication[32]. Meanwhile, there was no association between the severity of spinal stenosis on MRI and clinical symptoms, such as intensity of pain, QOL, and walking distance[33-35].

1-5. Axial-loaded MRI

Standard MRI cannot evaluate the intervertebral instability associated with spondylolisthesis[36]. Axial-loaded MRI is useful for diagnosing central stenosis[37-44], and foraminal stenosis in the loaded extension position[45].

1-6. Sedimentation sign

Sedimentation sign is defined as the absence of nerve root sedimentation in cross-sectional images during imaging in the supine position. A positive sign was at a high rate in severe spinal stenosis[46,47], and was more common in patients with central stenosis or combined stenosis[48]. A meta-analysis concluded that its usefulness for diagnosing mild to moderate LSS was inconclusive[49]. Thus, the diagnostic value of the sedimentation sign remains uncertain.

1-7. Foraminal stenosis

Foraminal stenosis was considered difficult to diagnose. However, three-dimensional MRI[50-52] and Diffusion tensor imaging (DTI)[53,54] are useful for the diagnosis of foraminal stenosis. Additionally, adding paraspinal mapping improved the diagnostic sensitivity[53,55].

2. Electrophysiological examination

The electrophysiological examination is more useful than imaging tests for diagnosing foraminal stenosis[56]. Dermatomal somatosensory evoked potentials, somatosensory evoked potentials (SSEPs)[57,58] and superficial peroneal nerve sensory nerve action potentials (SPNSNAPs)[59] are useful for diagnosing nerve root disorders.

3. Others

The gait-loading test[60] and the extension-loading test[61] were useful for diagnosing responsible levels in LSS.

The potential biomarkers of LSS: 1) microRNA (miR)-29a in the plasma and intervertebral disc tissues[62], 2) phosphorylated neurofilament heavy subunits (pNfHs) in the cerebrospinal fluid[63], and 3) bone resorption marker (μ-NTx) and bone formation marker (ALP) levels[64]. However, these biomarkers for LSS are preliminary reports.

4. Problems with diagnostic imaging for LSS and current recommendations

MRI enables the understanding of the state and degree of spinal stenosis. However, there are reports of large inter-rater variability and differences in reproducibility even among evaluations by the same examiner[65-67]. It is important to recognize that LSS cannot be diagnosed by imaging findings alone, even though MRI currently remains a noninvasive examination suitable for the imaging diagnosis of LSS. It is recommended to be diagnosed with LSS by clinical symptoms and physical examination with various diagnostic methods as auxiliary examinations described in this guideline.

Appropriate Indices for Evaluating LSS

Summary

The Zurich Claudication Questionnaire (ZCQ) is useful as a disease-specific questionnaire for LSS for which surgical treatment is selected. Additionally, the Japanese Orthopaedic Association Back Pain Evaluation Questionnaire (JOABPEQ), Oswestry Disability Index (ODI), and Roland-Morris Disability Questionnaire (RDQ) are used as questionnaires for individuals with lower back pain.

Commentary

It is important for evaluating LSS to assess disease-specific characteristics, ADL/QOL, and mental aspects as multifaceted perspectives to ascertain the overall image of the patient. If necessary, evaluation by others and objective evaluations of exercise capacity would incorporate a comprehensive evaluation.

The ZCQ[68] comprises three domains (severity of symptoms, physical function, and satisfaction with surgery). The validity of the translated Japanese version of the ZCQ has been conducted for surgical patients[69]. The other questionnaires are as follows. A lumbar spinal stenosis-specific QOL scale[70] and a lumbar spinal stenosis-specific symptom scale[71,72] in Japanese have been verified in terms of reliability and validity. They can be used regardless of treatment details. The ODI, RDQ, and JOABPEQ are useful questionnaires for individuals with lower back pain. The Japanese version of RDQ shows the reference values for Japanese[73]. JOABPEQ comprises five domains (social life dysfunction, psychological disorder, lumbar spine dysfunction, gait disturbance, and pain-related disorder). Reference values of JOABPEQ for individuals with healthy[74], lower back pain[75], and lumbar spinal stenosis[76] have been established.

For a comprehensive evaluation of patients, patients' subjectivity by patient-reported outcome and objective evaluations are important. In LSS characterized by intermittent claudication, the treadmill test, six-minute walk test, gait load test, and shuttle walking test as gait tests are useful in aiding diagnosis and for evaluating gait ability[77,78]. Additionally, the "stand-up test," "two-step test," and the 25-question Geriatric Locomotive Function Scale (LOCOMO 25), used in the evaluation of the locomotive syndrome, have been used as indices for evaluating gait and movement abilities[79,80].

It is important to evaluate the psychosocial factors that coexist with LSS[81,82]. Questionnaires, such as the Hospital Anxiety and Depression Scale, the self-assessed Beck Depression Inventory (BDI-II), the self-administered Zung Self-rating Depression Scale, the Fear-Avoidance Beliefs Questionnaire (FABQ)[82,83], and the simple Brief Scale for Psychiatric Problems in Orthopaedic Patients (BS-POP)[84,85], are useful for evaluating the psychosocial factors. The Health-related QOL Score (SF-36)[86] and the EuroQol-5Dimension (EQ-5D) are useful to determine the overall image of patients. Additionally, multiple tools have been developed, such as the diagnostic support tool of the Japanese Society for Spine Surgery and Related Research to screen LSS.

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