

RELIABILITY OF WIDE CANAL SIGN IN DIFFERENTIATING BETWEEN DEGENERATIVE FROM ISTHMIC SPONDYLOLYSTHESIS

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Article Info: Received 24 January 2020; Accepted 11 February 2020

DOI: <https://doi.org/10.32553/ijmbs.v4i2.948>

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Conflict of interest: No conflict of interest.

Objective:

To determine whether a visually apparent increase in the antero-posterior diameter of the spinal canal can be used reliably to differentiate degenerative from isthmic spondylolisthesis on midline sagittal MR images. It is hypothesized that the wide canal sign would be present only in isthmic spondylolisthesis, where the vertebral ring is disrupted by defects in the pars interarticularis and absent in degenerative spondylolisthesis where there is no such defect.

Materials & Methods:

Midline sagittal MR images of the lumbar spine were reviewed in 30 patients in whom either isthmic (n = 18) or degenerative (n = 12) spondylolisthesis was present. The sagittal canal ratio, defined as the maximum antero-posterior diameter of the canal at that level divided by the diameter of the canal at L1, was calculated. The normal sagittal canal ratio was considered to be less than 1.25. A sagittal canal ratio of 1.25 or greater at the level of a spondylolisthesis was considered to represent an abnormally increased sagittal canal diameter (wide canal sign), indicating the presence of bilateral pars interarticularis defects. Using this sign alone we tried to classified the type of spondylolisthesis in subgroup of 30 age-matched adults (all more than 35 years old and with isthmic or degenerative spondylolisthesis). Then lateral images and X-rays were evaluated to confirm the diagnosis.

Results:

Of the 30 patients examined. 18 patients were having isthmic spondylolisthesis while 12 patients were having degenerative spondylolisthesis. Of the 18 patients having isthmic spondylolisthesis 17 patients had wide canal sign. Only 1 patient having isthmic spondylolisthesis did not have wide canal sign. On lateral images this patient had defect in pars interarticularis. All

12 patients of degenerative spondylolisthesis none had presence of wide canal sign.

Table 1: Clinical and radiologic characteristics of spondylolisthesis.

Variable	Isthmic type (n-18)	Degenerative (n-12)
Sex		
Male	12	5
Female	6	7
Grading		
Grade 1	12	12
Grade 2	3	0
Grade 3	2	0
Grade 4	1	0
Level		
L3/4	1	0
L4/5	6	10
L5/S1	1	2



Figure 1: Degenerative Spondylolisthesis without any spondylolysis.



Figure 2: Isthmic spondylolisthesis with wide canal sign at L5

Discussion:

Spondylolisthesis refers to anterior shift of one vertebral body on another (The segment below it). Excluding congenital dysplasias, destructive lesions, and postsurgical states, nearly all cases of lumbar spondylolisthesis result from fractures or defects in the pars interarticularis (isthmic type) or from degenerative changes in the disk, facet joints and associated ligaments (degenerative type).

Isthmic spondylolisthesis, caused by defect in pars interarticularis, results in disconnection of a vertebral body from its posterior elements, thereby allowing the vertebra to slip anteriorly (1). The posterior elements, however, remain either normally aligned or sublux posteriorly. This process increases the sagittal diameter of the spinal canal.

Severe back pain or radiculopathy accompanying isthmic spondylolisthesis can be due to an associated herniated disk, foraminal stenosis, facet hypertrophy, or nerve root encroachment by build-up of fibrocartilage at a pars pseudarthrosis.

Lysis or fracture of the pars interarticularis usually occurs between the ages of 5 and 18 years. Although some such defects heal, most remain fragmented or separated and persist into old age.

Generally oblique x-ray views are done to visualize pars interarticularity if there is spondylolisthesis. Sometimes oblique views are not helpful because marked degenerative changes may obscure pars. The cause of spondylolisthesis needs to be determined because clinical management will differ.

Degenerative spondylolisthesis is characterized by osteoarthritis and remodeling of the facet joints, disk degeneration, and ligamentous laxity, resulting in anterior slippage of a vertebral body along with an intact posterior arch (1-3). Symptoms of spinal stenosis and nerve root compression are very common in this form of spondylolisthesis. Degenerative spondylolisthesis is common in older patients and usually has less severe grade of lythesis.

Isthmic spondylolisthesis is more common in men at L5/S1 level; Degenerative spondylolisthesis is more common in women at the L4/5 level.

The criteria for wide canal sign were established by John L Umer et al (1). We used criteria described by them in determining whether canal is wide or not.

In 1969, Bryk and Rosenkranz described a "spinous process sign" on lateral radiographs that can be used to differentiate the two common types of spondylolisthesis. It describes step off of spinous process of vertebra above in isthmic spondylolisthesis and step off of spinous process of same vertebra in degenerative spondylolisthesis. However, significant degree of lythesis needed to produce this sign.

In description of MR findings in spondylolisthesis, Jenkins et al. (7) and John L Umer et al (1) noted that the sagittal diameter of the spinal canal increases in patients with spondylolysis. Our results indicate that the wide canal sign is highly reliable and effective in differentiating isthmic and degenerative spondylolisthesis on midline sagittal MR images of patients referred with lower back pain or radicular symptoms.

The wide canal sign is relatively simple because it does not require absolute canal measurements to be obtained, but only a visual estimate of their ratio to L1 {i.e., the SCR}. When the diameter of the spinal canal at the L4 OR L5 level exceeds that at L1 by 25% or more {SCR 1.25}, isthmic spondylolisthesis is virtually assured. Conversely, an SCR less than 1.25 strongly supports the diagnosis of degenerative spondylolisthesis, as was the case in all 18 patients in our study who had this condition.

It should be emphasized that the wide canal sign is intended only to supplement, not replace, diagnosis obtained by direct imaging of the pars interarticularis.

We hope that recognition of the wide canal sign will assist in the differentiation of isthmic and degenerative spondylolisthesis in difficult cases and, if applied consistently, will minimize interpretive errors in the diagnosis of this disorder. This sign could be particularly useful when degenerative sclerosis in the pars interarticularis mimics spondylolysis, when direct imaging of the pars interarticularis has not been done, or when imaging is technically inadequate.

Conclusion:

The wide canal sign on midline sagittal MR images (corresponding to a sagittal canal ratio $>$ or $= 1.25$) is a reliable predictor of the presence of defects of the pars interarticularis at the level of a spondylolisthesis. This sign could be useful for distinguishing degenerative from isthmic spondylolisthesis when degenerative sclerosis in the pars interarticularis mimics spondylolysis, when direct axial imaging of the pars interarticularis has not been done, or when imaging is technically inadequate.

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