Spondylolysis and spondylolisthesis: How to measure?

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Purpose

Definitions:

Spondylolysis: defect in the pars interarticularis

Isthmic spondylolisthesis: slip of the cranial vertebral body due to spondylolysis

Classification: Meyerding grade I to V -> slip of 25/50/75/100%

Spondylolysis and isthmic spondylolisthesis are common multi-factorial disorders. The extent of the slip of the spondylolytic vertebra is considered a major predictor for prognosis and further follow-up.

Vertebral hypoplasia is a common finding in spondylolysis.

The purpose of this study is to evaluate the incidence of hypoplastic vertebral bodies in patients with spondylolysis and in the general population and to analyse the impact of the findings on the measurement and grading of spondylolisthesis.

Methods and Materials

140 patients with 141 levels of spondylolysis or isthmic spondylolisthesis were included in this study presented from March 2006 to May 2009.

A sagittal T2 weighted scan in the sitting position was acquired.

The images were analysed digitally using a picture archiving and viewing software.

After identification of the spondylolysis, the level was noted.

If spondylolisthesis was present, the slip of the spondylolytic vertebra was measured as shown in Figure 1. The slip was recorded in millimetres.

After that the difference in length between the cranial, spondylolytic vertebra and the adjacent caudal vertebra was measured (Figure 2).

A control group of 141 patients without spondylolisthesis or spondylolysis was created. The patients who were included in the control group underwent MRI of the lumbar spine for various reasons, mostly unspecific low back pain.
The length of the lower margin of L5 was compared to the length of the upper margin of S1 (Figure 3).

The statistical hypothesis tested was that there was no difference in length between the cranial spondylolytic vertebra and the caudal vertebra in the two groups. The hypothesis could be rejected with a $p<0.001$ using the $\chi^2$-test.

**Images for this section:**

![Fig. 1:](image)

**Fig. 1:** For measurement a line was drawn on a midline sagittal image allowing a clear delineation of the bony structures connecting the upper and lower dorsal edge of the cranial vertebra (A). A second, parallel line was drawn by the viewing software after pointing to the upper dorsal edge of the caudal vertebra (B). The distance between the two lines was thought to be equivalent to the slip in millimetres (C) (Figure 1). A cut-off point of 3 mm was chosen, meaning that slips smaller than 3 mm were not taken into account. This cut-off point was chosen based on image resolution.
Fig. 2: The difference in length between the cranial, spondylolytic vertebra (A) and the adjacent caudal vertebra (B) was measured. A difference in length between the two vertebrae was recorded. Differences equal to or greater than 3 mm were retained.

Fig. 3: The difference in length between the L5 vertebra (A) and the S1 vertebra (B) was measured in a control group. A difference in length between the two vertebrae was recorded. Here too only differences equal to or greater than 3 mm were retained.
Results

140 patients with 141 levels of spondylolysis or isthmic spondylolisthesis were included in this study.

The level of spondylolysis was level L5/S1 in 122 cases, L4/5 in 14 cases, L3/4 in 4 cases and L2/3 in one case. The spondylolysis was unilateral in eight cases and bilateral in 133 cases.

Spondylolisthesis was diagnosed in 120 patients. The mean range of the slip in the midline sagittal image was 9 mm, with a range of 3 to 17 mm of slip.

In 50 patients the vertebral body of the spondylolytic vertebra was shortened in the midline sagittal image compared to the lower, adjacent vertebra. The range of such hypoplasia varied between 3 and 13 mm with a mean of 5 mm. Hypoplasia was only observed at the L5/S1 level.

No patients had a hypoplastic shortened cranial vertebra in the control group. Both vertebrae tended to be of the same size (mean difference < 1 mm).

Shortening was therefore only found in patients with a spondylolysis (p<0.001).

In 19 patients with the observed hypoplasia, the measured slip corresponded to the measured shortening

Conclusion

A shortening of the spondylolytic vertebra is common and it mimics spondylolisthesis.

In 19 patients the hypoplasia was equal to the measured slip. Hence the term ‘spondylolisthesis’ should be reserved for patients with a real difference between a shortened hypoplastic vertebra and a measured slip.

The classification of the slip should take note of the hypoplasia.

References


Frank DF, Miller JE. Hypoplasia of the lumbar vertebral body simulating spondylolisthesis. Radiology 1979;133:59-60


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