SCOLIOSIS IN SYMPTOMATIC SPONDYLOLISTHESIS

I. B. McPhee, J. P. O'Brien

From the Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry

The association between spondylolisthesis and scoliosis was studied in 84 patients who presented during a 30-year period with symptomatic spondylolisthesis. The incidence of scoliosis was 42 per cent, the majority of cases being lumbar or thoracolumbar curves of less than 15 degrees. The incidence was highest in the group of patients with spondylolisthesis at L4–5 where all except one had scoliosis. Scoliosis was present in 47 per cent of patients with dysplastic spondylolisthesis at the lumbosacral junction; in this group, the incidence of scoliosis was greater where the displacement exceeded 25 per cent. The lowest incidence (25 per cent) was found in the group with isthmic spondylolisthesis at the lumbosacral junction. There appeared to be no relationship between excessive lumbar lordosis or tightness of the hamstrings and scoliosis.

Scoliosis which is seen in association with spondylolisthesis falls into three categories. Firstly, the scoliosis may be idiopathic thoracic or thoracolumbar and represent a separate problem unrelated to the spondylolisthesis. Rick, Winter and Moe (1974) found defects in the pars interarticularis in 6.2 per cent of cases of idiopathic scoliosis, which is only fractionally higher than the incidence in the general population. Secondly, the defect in the neural arch or hypoplasia of the facet may allow asymmetrical forward displacement resulting in a rotational shift of the vertebral body giving rise to scoliosis (Tøjner 1963; Rick et al. 1974). Finally, the scoliosis may be due to muscle spasm and therefore of a “sciatic” type.

The aetiology of the scoliosis is important in its management. Where the scoliosis is unrelated to the spondylolisthesis, each deformity is treated separately (Goldstein et al. 1976). Where the scoliosis is sciatric in type, fusion will relieve the muscle spasm in the majority of cases and spontaneously correct the defect. Persistence of the curve may be due to development of a fixed concave contracture in long-standing spasm or to structural changes (Risser and Norquist 1961).

As part of a more extensive study of spondylolisthesis, its relationship to scoliosis was analysed along with its response to treatment.

CLINICAL MATERIAL

During the years 1945 to 1974 a total of 84 patients under the age of 30 years presented to the Robert Jones and Agnes Hunt Orthopaedic Hospital with symptomatic spondylolisthesis. In 19 cases the clinical notes and radiographs were incomplete and hence we were unable to classify the spondylolisthesis in these patients. The final breakdown of the 84 patients according to classification is shown in Table I.

<table>
<thead>
<tr>
<th>Type of spondylolisthesis</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>Dysplastic, L5–S1</td>
<td>36</td>
</tr>
<tr>
<td>Isthmic, L5–S1</td>
<td>20</td>
</tr>
<tr>
<td>L4–5</td>
<td>9</td>
</tr>
<tr>
<td>Unclassified (including one L4–5)</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
</tr>
</tbody>
</table>

RESULTS

The overall incidence of scoliosis on presentation was 42 per cent (35 cases out of 84). Scoliosis was a presenting complaint in only four patients. In most cases the curvature was minor, only two curves being greaten.
than 15 degrees (Fig. 1). Only the more major curves showed any rotation. At follow-up, in only 10 patients had the scoliosis persisted, and these included the two with curves greater than 15 degrees (Fig. 2). In only one patient was there any increase in the magnitude of the deformity.

![Graph showing magnitude of scoliosis in 65 patients with spondylolisthesis.](image)

**Dysplastic spondylolisthesis, L5–S1**

Of the 36 patients classified as having dysplastic spondylolisthesis, 17 (47 per cent) had scoliosis of whom 12 were under the age of 20 years. Thirty-eight per cent (eight out of 21 cases) of the patients with Grade I spondylolisthesis had some degree of scoliosis compared with 60 per cent (nine out of 15 cases) of those with a displacement greater than 25 per cent.

The majority (70 per cent) of patients with scoliosis had a short lumbar curve while in the remainder the curve was longer and frequently thoracolumbar and more severe. All of these five thoracolumbar curves were greater than 10 degrees while one at T8-L3 was 31 degrees. This was probably the only case of idiopathic scoliosis in the series.

At follow-up, 12 patients had been treated by spinal fusion. In all, 11 of the curves had resolved with treatment and a further five were unchanged. The only one which had increased was a lumbar curve which had progressed from 13 to 22 degrees over a period of 23 years. This patient had been treated without operation and the spondylolisthesis had progressed from 54 to 75 per cent.

Only three of the patients with scoliosis had tight hamstrings and a further three had unilateral restriction of straight leg raising. This compared with six patients who had tight hamstrings but no scoliosis. Overall there were 12 patients with hyperlordosis of the lumbar spine of whom seven were in the scoliotic group; more significantly perhaps, six of the seven had spondylolisthesis of more than 25 per cent.

**Isthmic spondylolisthesis, L5–S1**

Five (25 per cent) of the patients in this category had measurable scoliosis. Initially in all 20 patients the displacement had been less than 25 per cent. All of the curves were less than 15 degrees and four were long thoracolumbar curves. At follow-up, all but one curve (14 degrees) had resolved with treatment of the spondylolisthesis.

Only one of the five scoliotic patients had tight hamstrings compared with two out of 15 for the remaining cases; a second patient had unilateral restriction of straight leg raising; another one of the five patients with scoliosis and five of the remaining 15 without scoliosis were hyperlordotic.

![Graph showing residual scoliosis found at follow-up.](image)

**L4–L5 spondylolisthesis**

This subdivision differed markedly from the others in that eight out of the nine patients had scoliosis. In all cases the initial displacement had been less than 25 per cent. All curves were less than 15 degrees with the exception of one which during the period of observation had progressed to 25 degrees. Five curves were thoracolumbar and three were lumbar. At subsequent review, five of the curves had resolved and the remaining three were unchanged including the 25-degree curve.

Half the number of patients with scoliosis had tight hamstrings as did the only patient without scoliosis. The anteroposterior lumbar curves were within normal limits in two patients, hyperlordotic in two and kyphotic in four.

**Unclassified spondylolisthesis**

There were 19 cases in this group, where no initial radiographs were available nor any records of follow-up. Five of this group were noted clinically to have scoliosis including a single case of L4–L5 spondylolisthesis. Two curves were described as being thoracolumbar and three lumbar. Tight hamstrings were present in one case and a further patient had unilateral restriction of straight leg raising.

**DISCUSSION**

This present series demonstrates the high incidence of scoliosis associated with symptomatic lumbar spondylolisthesis. The overall incidence of 42 per cent was comparable to the incidence of 36 per cent found by Laurent and Einola (1961) in a study of spondylolisthesis in adolescents. As with similar studies (Laurent and Einola 1961; Newman 1965; Goodman, Curtis and Hardy 1972), the scoliosis was noted to be a minor lumbar or thoracolumbar curve. In this series only two patients had curves greater than 15 degrees.

Of greater interest was the differing incidence of scoliosis according to the level and type of spondylolisthesis. The greatest incidence was seen in cases of
spondylolisthesis at the L4–5 level and presumably this might have been due to the absence of secondary stabilising ligaments such as the iliolumbar ligament. The incidence of scoliosis at the lumbosacral level was twice as common in the dysplastic type of spondylolisthesis as in the isthmic type.

In all these groups of spondylolisthesis with scoliosis the majority of curves were considered to be sciotic in type, which agreed with the findings of other investigators (Risser and Norquist 1961; Newman 1965; Ashley et al. 1969). The assumption that these curves were sciotic was made not only on the clinical and radiological evidence but also in view of their resolution in response to treatment. The higher incidence of scoliosis initially, and the higher incidence of unresolved scoliosis in the dysplastic group of lumbosacral spondylolisthesis over the isthmic group, was perhaps evidence for the existence of a group with scoliosis due to rotational asymmetry. However, some curves might have been due to fixed muscle contracture. In either instance, the finding at follow-up showed that while fusion did not result in resolution of the curve, it did prevent further progression of the scoliosis, the final result being a curve of the same magnitude as initially.

As already noted, the only curve to increase was associated with a progression of the slip during non-operative treatment. Displacements greater than 25 per cent were seen only in the dysplastic lumbosacral group. There was a markedly higher incidence of scoliosis in those patients where the displacement was greater than 25 per cent. These two observations together suggest that the incidence and magnitude of the scoliosis may increase as the displacement increases. Considering the findings so far, the evidence supports the statement of Risser and Norquist (1961), that in patients with scoliosis and symptomatic spondylolisthesis early fusion of the unstable segment is the treatment of choice.

Finally, Ashley et al. (1969) felt that tight hamstrings and flattening of the lumbar spine were features found in the patient with spondylolisthesis and scoliosis. On the other hand, Risser and Norquist (1961) felt that hyperlordosis developed secondary to the kyphotic element of the spondylolisthetic displacement. In this series, however, tight hamstrings did not appear to be a consistent feature of the syndrome. Excessive lordosis was a more consistent finding only in the dysplastic lumbosacral group and it was felt that this was related to the degree of lumbosacral kyphosis rather than the presence of scoliosis.

REFERENCES