

Postero-lateral spine fusion

A 1-4-year follow-up of 80 consecutive patients

We analysed 80 consecutive patients with postero-lateral spine fusion performed during the years 1972-1976. Thirty-seven were women and 43 men, the mean age being 30 (14-54) years. In 73 cases the fusion was performed because of spondylolysis and spondylolisthesis and in seven because of some other form of painful instability. Preoperatively, all patients had pain in normal activities and 63 at rest. At the 1-5-year follow-up, eight patients were pain-free, while 69 had stress pain and 35 pain at rest. The reduction of pain was significant; 51 patients considered themselves improved, 18 unchanged and 10 worse. Twelve fusions united in less than 2 months, eight after more than 4 months, and two failed to unite. Patients under 20 years did better than older patients. The result was better when the fusion united within 4 months and also when the bone transplants were properly placed. We conclude that postero-lateral spine fusion can be advocated as treatment of painful spondylolisthesis and sometimes in low-back instability in younger patients.

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Spondylolisthesis needs surgical treatment when there is persistent pain not responding to conservative treatment, progressive radiographic slip, persistent nerve root compression or symptoms of spinal compression (Newman 1976). Various surgical techniques are practised: posterior, anterior and lateral fusions as well as several combinations of these (Hibbs 1911, King 1944, Cleveland et al. 1948, McBride 1949, Bosworth 1952, Cloward 1953). The varying degree of success of the operations may depend partly on the nature of the spinal instability and partly on the choice of operative method (Rolander 1966, Rosenberg 1976). Postero-lateral fusion has been advocated as the best technique in the lumbosacral vertebrae (Campbell 1939, Davis & Merrifield 1962, Stauffer & Coventry 1972, Thompson et al. 1974, Nachemson 1976, Saunders & Jacobs 1976). We have evaluated the results of postero-lateral spine fusion.

Patients and methods

We analysed 80 consecutive patients who had had postero-lateral spine fusion in the hospital of the Invalid Foundation in Helsinki, Finland, during the

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years 1972-1976. Thirty-seven were women and 43 men. The majority of the patients were young adults, (Table 1); the mean age was 30 (14-54) years. In 73 cases the fusion was performed because of spondylolysis and spondylolisthesis (Figure 1), and in seven cases because of some other form of low-back instability with chronic pain. In nine patients the spondylolysis was located in the L III interspace, in seven in the L IV and in all the others in the L V. In 40 cases the radiographic slip was 25 per cent or less of the vertebral body; in 21 cases 26-50 per cent; in eight cases 51-75 per cent, and in two cases 76-100 per cent. In 13 patients, an unsuccessful fusion had been performed previously, and there was radiographic evidence that the graft had failed to fuse.

Cancellous bone grafts were obtained from the posterior iliac crest and placed on the transverse processes. As a rule, the vertebral body with spondylolysis was fused to its caudal neighbour. In all but two cases the fusion was performed bilaterally. In 60 patients the fusion bridged one and in the remaining 20 two or more intervertebral spaces. In addition, a partial or total laminectomy was performed in 13 patients at the same operation. Forty-four patients were allowed out of bed after 2-4 weeks, 15 after less than 2 weeks and 18 after 4-7 weeks.

At the follow-up, 4 (1-5) years postoperatively, the patients were asked to compare the pain before and after the operation, and to describe the location of the pain and need for supporting corset. At follow-up, one male patient had died. The radiographic ex-

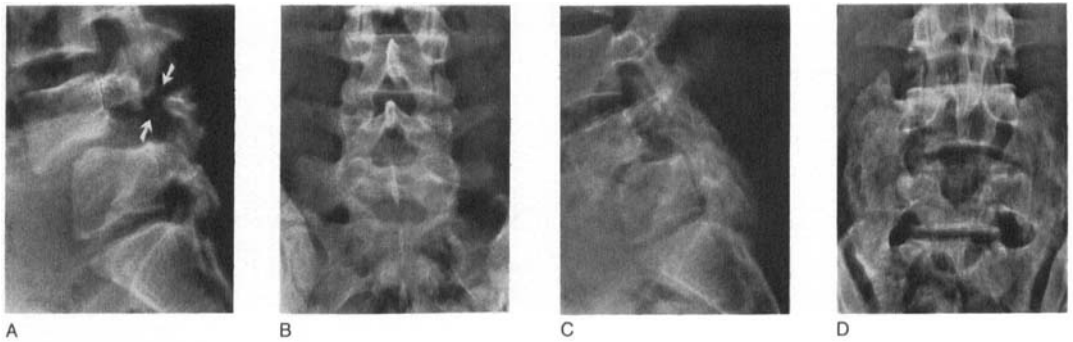


Figure 1. Spondylolysis and spondylolisthesis in a 14-year-old boy before and 2 years after posterolateral spine fusion. The grafts had united and the boy is free from any discomfort.

amination included projections in extension and flexion of the lumbosacral spine; in uncertain cases the radiographic focused tomograms were added to the examination.

Twenty-eight patients wore a lumbosacral supporting brace for 3 months or less, 16 patients for 4–5 months, and five patients used a brace permanently.

For statistical analysis, Student's *t*-test and the chi-square test were used.

Results

In 61 patients the bone grafts healed in the desired position (Figure 1) and in 19 patients unilaterally. Radiographically the grafts were ossified in 12 patients at 2 months after the operation, in 57 at 2–4 months, in eight patients more than 4 months after the operation, and two cases failed to fuse. In one patient the fusion could not be judged radiographically.

In 64 patients the grade of spondylolisthesis remained unchanged. In five patients the spondylolisthesis had increased by 1–4 mm. Two patients had reductions of the spondylolisthesis of 3 and 5 mm.

Preoperatively, all the patients had pain in normal activities and 63 had pain at rest. At the follow-up, eight patients were totally pain-free, 69 had pain at strain and 35 had pain at rest. This reduction of pain at rest was significant ($p < 0.001$). Fifty-two patients reported a general improvement in their low-back disease after the operation, while 18 patients remained unchanged and 10 patients were worse.

Of the 25 patients with preoperative pain

Table 1. Age and sex distribution, and results of spine fusion

Age (years)	♀	♂	Result			
			A	B	C	D
<20	4	7	3	7	1	0
20–29	14	19	3	17	9	4
30–39	9	10	2	8	6	3
40–59	10	7	0	12	2	3
Total	37	43	8	44	18	10

A Free from discomfort

B Improved

C Unchanged

D Worse

strictly confined to the low-back region, 18 continued to have pain after the operation. Two patients with pain preoperatively only in the lower extremities continued to have pain after the operation. Forty patients were receiving sick pay preoperatively compared to 23 at the reexamination.

The clinical end-results were best in patients younger than 20 years ($p < 0.001$) (Table 1). If the fusion had healed during the first 4 months, the results were much better ($p < 0.05$). Fusion in the desired position also gave better results ($p > 0.05$). The following parameters did not seem to affect the clinical end-result: sex, site of preoperative pain, pain at strain versus pain at rest, number of fused intervertebral spaces, duration of postoperative bed rest, previous fusion operations, length of time wearing low-back supporting brace, and additionally performed laminectomy.

Discussion

In children and adolescents, spondylolisthesis is postulated to be the commonest cause of low-back pain and sciatica (Laurent & Österman 1969). The symptoms are often severe enough to indicate operative treatment, and spinal fusion performed in the early stage has been reported to give good results in this age group. Also, in the present series the results in patients younger than 20 were better than in older patients.

The operative method used by us did not usually alter the degree of spondylolisthesis. An additional Gill's procedure should be limited to patients with spinal compression symptoms; in these cases, myelography combined with computerized tomography is diagnostically valuable.

Our patients were mobilized fairly soon, and no internal fixation was used; only two cases failed to fuse. Some authors even suggest that bony union is not needed for the patient's subjective satisfaction (Olsson et al. 1977). Conventional radiographic techniques are sometimes insufficient in judging the bony union of the fusion in the lumbo-sacral spine. Nevertheless, more specialized radiographic methods can be limited to those patients who continue to have definite discomfort after the operation.

Tunturi (1979) and co-workers have published an extensive investigation of factors influencing the results of the fusion of the lumbo-sacral spine. Their statement that patients under 40 years of age derive more benefit from the operation than older patients agrees with our results, and this is confirmed by several other investigators. Further, the Tunturi group stated that a preoperative occupation involving heavy manual work impaired the results. Of those 40 patients in the present series who were preoperatively on sick pay, only 17 could return to work. Although postero-lateral spine fusion definitely has pain-reducing potential, it is less efficient in terms of rehabilitation.

We conclude that postero-lateral spine fusion may be advocated as treatment of painful spondylolisthesis and some other selected low-back instabilities, especially in younger patients. Internal fixation or external support does not seem to be necessary to achieve bony fusion of the grafts.

References

- Bosworth, D. M. (1952) Technique of spinal fusion in the lumbo-sacral region by the double clothes-pin graft and results. Instructional course lectures. *Am. Acad. Orthop. Surg.* **9**, 44–52.
- Campbell, W. C. (1939) *Operative orthopedics*. C. V. Mosby Co., St. Louis.
- Cleveland, M., Bosworth, D. M. & Thompson, F. R. (1948) Pseudoarthrosis in the lumbo-sacral spine. *J. Bone Joint Surg.* **30-A**, 302–311.
- Cloward, R. B. (1953) The treatment of ruptured lumbar intervertebral discs by vertebral body fusion. Indications, operation technique, after care. *J. Neurosurg.* **10**, 154–168.
- Davis, J. B. & Merrifield, R. C. (1962) Postero-lateral lumbo-sacral fusions for spondylolisthesis. In: Proceedings of the Western Orthopaedic Association. *J. Bone Joint Surg.* **44-A**, 1013.
- Hibbs, R. A. (1911) An operation for progressive spinal deformities. *N.Y. Med. J.* **93**, 1013–1016.
- King, D. (1944) Internal fixation for lumbo-sacral fusion. *Am. J. Surg.* **66**, 357–361.
- Laurent, L. E. & Österman, K. (1969) Spondylolisthesis in children and adolescents. A study of 173 cases. *Acta Orthop. Belg.* **35**, 717–727.
- McBride, E. D. (1949) A mortised transfacet bone block for lumbo-sacral fusion. *J. Bone Joint Surg.* **31-A**, 385–393.
- Nachemson, A. (1976) Repair of the spondylolisthetic defect and intertransverse fusion for young patients. *Clin. Orthop.* **117**, 101–105.
- Newman, P. H. (1976) Surgical treatment for spondylolisthesis in the adult. *Clin. Orthop. Rel. Res.* **117**, 106–111.
- Olsson, T. H., Selvik, G. & Willner, S. (1977) Mobility in the lumbo-sacral spine after fusion studied with the aid of roentgen stereophotogrammetry. *Clin. Orthop. Rel. Res.* **129**, 181–190.
- Rolander, S. D. (1966) Motion of the lumbar spine with special reference to the stabilizing effect of posterior fusion. *Acta Orthop. Scand.* Suppl. No. 90.
- Rosenberg, N. (1976) Degenerative spondylolisthesis. Surgical treatment. *Clin. Orthop. Rel. Res.* **117**, 112–120.
- Stauffer, R. N. & Coventry, M. B. (1972) Postero-lateral lumbar spine fusion. Analysis of Mayo Clinic Series. *J. Bone Joint Surg.* **54-A**, 1195–1204.
- Saunders, E. A. & Jacobs, R. R. (1976) The multiply operated back. Fusion of the postero-lateral spine with and without nerve root decompression. *Sth. Med. J.* **69**, 868–871.
- Thompson, W. A., Gristina, A. G. & Healy, E. A. (1974) Lumbo-sacral spine fusion. *J. Bone Joint Surg.* **56-A**, 1643–1647.
- Tunturi, T. (1979) *Posterior fusion of the lumbo-sacral spine*. Academic dissertation. University of Tampere, Finland.