



Instrumented *in situ* posterolateral fusion for low-grade lytic spondylolisthesis in adults

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Lytic olisthesis is an accepted cause of low back pain and may also be associated with leg pain. When conservative treatment fails, operative management with fusion and if necessary decompression is considered. Most reports regarding surgical management in the literature relate to children or adolescents. This paper reviews 75 adult cases treated by *in situ* pedicular fixation and posterolateral fusion with simultaneous decompression in 55 cases. The mean follow-up was 72 months. Ninety-six percent of the cases had a satisfactory clinical outcome, and this correlates closely with a solid fusion. This approach therefore appears to be safe and successful in the treatment of symptomatic low-grade lytic spondylolisthesis in adults.

INTRODUCTION

Lytic olisthesis is a common condition, which occurs most frequently in the lower lumbar spine. It is an accepted cause of back pain and it may also be associated with leg pain. If the symptoms justify it, the accepted management is fusion across the level of the olisthesis.

Much has been written about the surgical management in children and adolescents but much less in relation to adult cases. This may be due to the fact that the picture is complicated in adults in whom degenerative changes may also be present at contiguous levels and the pain source is less clear.

The extent of the slip (olisthesis) is usually graded using the Meyerding classification (8) in which the displacement of one vertebral body on another is divided into four equal parts. Grades I and II, which represent up to a 25% and 50% displacement and which cover the majority of cases, are referred to as low-grade slips.

The initial management of the condition is conservative. When this is deemed to have failed, surgery is considered.

On the assumption that the back pain relates to the level of the olisthesis, it is our practice to do a fusion across this level. Where, however, an MRI scan demonstrates degenerative changes in discs at contiguous levels and these levels cannot be excluded as a coincidental pain source or as a possible pain source post-fusion, these levels are also included in the fusion.

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Leg pain when present in these cases is either radicular or referred. If it is radicular, it will usually extend below the knee on the basis that the commonest sites for olisthesis in the lumbar spine is at the lowest two levels, L4 and L5. Nerve compression in these cases usually occurs subjacent to the lysis and pseudarthrosis and will thus involve either the L4 or L5 nerve roots. Surgical management in these cases involves simultaneous decompression of the involved root. By contrast, referred pain does not extend into the lower leg and resolves with stabilisation of the failed motion segment or segments. If there is any doubt, however, about whether the leg pain is radicular or referred, decompression is performed. Irrespective of whether the leg pain is unilateral or bilateral we always do a bilateral nerve root decompression and use a procedure that preserves the mid-line structures (12).

There are many ways to carry out a spinal fusion, but simpler methods carry the least complications. It is received wisdom that simultaneous instrumentation carries a greater chance of achieving fusion, and pedicular fixation is the technique most commonly used. On this basis, our operative approach involves a bilateral posterolateral fusion with pedicular fixation. The posterior approach to the spine also allows for simultaneous nerve root decompression when necessary.

The purpose of this study was to review the outcome of adopting the above rationale of surgical management.

PATIENTS AND METHODS

Between 1993 and 1998, 25 consecutive adult patients presenting with back and leg pain were treated operatively for a low-grade lytic spondylolisthesis on the basis of the philosophy outlined above. Once we had assessed the outcome in these patients, a further 50 were evaluated and operated on between 1998 and 2000 using the same surgical rationale. This study, which comes from two centers, is therefore part retrospective (n = 25) and part prospective (n = 50).

All patients were assessed with a full history and detailed clinical evaluation and had plain radiographs of the lumbar spine. Each patient also had an MRI of the

Table I. — Level of spondylolisthesis

	Level	Number of Patients
Single level	L3/4	4
	L4/5	24
	L5/S1	45
Two-level	L4/5 and L5/S1	2

lumbar spine to clarify the questions of disc degeneration and, where relevant, nerve compression.

Every patient had a history of low back pain with or without leg pain and had had persistent symptoms for at least six months despite conservative treatment. All were judged to have a significant reduction in their quality of life. All patients included in the study were diagnosed with low-grade lytic spondylolisthesis. Patients were excluded from the study if they had had previous lumbar spine surgery, were involved in medico-legal claims or had other spine or hip pathology which might have contributed to their symptoms.

There were 31 females and 44 males. The average age at surgery was 41 years (range : 21 to 63) and the average duration of symptoms prior to surgery was 23 months (range : 6 to 60). Seventy three patients had a single-level olisthesis and two patients had a two-level olisthesis (table I). The degree of slip was assessed using Meyerding's classification (8) : 58 patients were diagnosed with grade 1 and 17 with grade 2 slip.

All patients underwent *in situ* fusion using autogenous iliac graft and pedicular fixation of the level of the olisthesis. We did not attempt to reduce the slip in any case, thereby avoiding possible intra-operative neurological damage that can be secondary to this procedure. The fusion was also extended to include any contiguous level shown to be degenerative on MRI. In practice, of the 73 patients who had a one-level olisthesis, 60 (82%) had a one-level fusion, 12 (17%) a two-level fusion and one patient had a three-level fusion. Of the two cases who had a two-level olisthesis, one had a two-level fusion and one a three-level fusion. A simultaneous bilateral nerve root decompression was carried out in the 55 patients (73%) who presented with suspected or probable radicular symptoms and signs.

All patients were followed up clinically and assessed using the criteria reported in 1995 by Ricciardi *et al* (10). This involves an assessment of the presence or absence of symptoms, use of analgesics, patients' level of function and radiological evidence of fusion. On this basis,

the postoperative results were graded as poor, fair, good or excellent. The radiological results were also assessed separately using the criteria reported by Lenke *et al* (7) for posterolateral fusion. Four grades designated A, B, C and D are described in which, depending on the radiological appearance, A and B equate to a solid fusion. Grade C represents a questionable fusion and D a pseudarthrosis.

Patients were seen routinely at three, six, nine, twelve months and then yearly following their surgery. The minimum postoperative follow-up was three years, apart from two patients who were lost to follow-up one year post-surgery. The mean follow-up was 72 months (range : 3 to 9 years).

RESULTS

The mean operating time was 2.5 hours (range : 2 to 4) and the mean external blood loss was 850 ml (range : 300 to 2,300). The mean hospital stay was 8 days (range : 5 to 16).

There were no intra-operative problems and no neurological complications. Two patients developed postoperative superficial wound infections, which resolved with antibiotics alone, and one had a deep wound infection which resolved after treatment with antibiotics and debridement of the wound.

Using the Ricciardi criteria for clinical outcome (10), 51 cases were graded as excellent, 21 as good, one patient as fair and two as poor. Considering excellent and good results to be satisfactory, 72 of the cases (96%) were adjudged to have a satisfactory clinical outcome. Assessing the fusion using the criteria reported by Lenke *et al* (7), 71 of the 75 cases (95%) were assessed to be Grade A or B, in other words consistent with a solid fusion. The remaining four cases were assessed as Grade D, that is to say they had a pseudarthrosis.

Case Study

A 21-year-old electrician presented with a two-year history of worsening low back pain, without leg pain, unresponsive to conservative treatment. Plain radiographs revealed a Grade I lytic olisthesis of L5 (fig 1). An MRI scan of his lumbar spine showed disc degeneration at the L5/S1 level only



Fig. 1. — Pre-operative radiograph shows a Grade I lytic olisthesis of L5.

(fig 2). He had an *in situ* bilateral posterolateral (alar transverse) fusion with pedicular fixation. At last follow-up, he was judged to have an excellent clinical outcome which correlated with a solid fusion (fig 3 a , b).

DISCUSSION

We have shown in this series that 82% of cases involved fusion of only the level of the olisthesis, and all but one of the others had a two-level fusion. These figures add credence to the notion that the principal pain source in these cases relates to the level of the olisthesis. Regardless of the problems of dealing with coincidental degenerative levels, the decision in the majority of cases about the level of fusion is straightforward. Other reports have made the case for fusion in low back pain (2) and for fusion in the management of a lytic olisthesis (9).



Fig. 2. — An MRI scan shows disc degeneration at the L5/S1 level only.

In cases of spondylolisthesis presenting also with radiculopathy, a simultaneous nerve root decompression is advocated (1, 3, 4). The incidence of a simultaneous decompression in 73% of our cases is probably of a high order. This relates to the inclusion of cases in which root irritation/compression could not be excluded and it was deemed prudent to add a decompression at the time of operation rather than regret its exclusion at subsequent follow-up. As the decompression was not associated in any case with neurological problems, there would seem to be no contra-indication to this approach even if its adoption was unnecessary in some cases.

Another surgical option which includes a supplemental posterior lumbar interbody fusion (PLIF) has been used in the treatment of patients diagnosed with lytic spondylolisthesis. The



Fig. 3. — a and b) Postoperative radiographs (2.5 years post-surgery) show a solid bilateral alar transverse fusion.

advantages of adopting this procedure are believed to be related to the support provided to the anterior column by the interbody graft, which may then improve the fusion rate and endurance of the construct. In a recent comparative study the clinical, functional, and radiographic outcomes of thirty-five consecutive patients diagnosed with lytic spondylolisthesis were assessed following either a posterolateral instrumented fusion (18 patients) or posterior lumbar interbody fusion (17 patients). No statistical differences were demonstrated in terms of neurological improvement, or functional outcome, or in terms of fusion rate (6). A posterior lumbar interbody fusion is, however, a more demanding procedure and increases costs and risks of the intervention.

The comparison of the clinical outcome scores with the assessment of a radiological fusion is of interest. Of the 75 cases, 72 were judged to have a satisfactory outcome (excellent or good results) and three an unsatisfactory outcome (one fair and two poor). Radiologically there were non-unions in four patients. All three cases with an unsatisfactory clinical outcome had a non-union. This finally shows a nice correlation of clinical outcome with a solid fusion.

Of the four cases of non-union, two subsequently had revision posterior surgery with re-instrumentation and fusion and both proceeded to fusion with a good clinical outcome. One of the non-union cases had a good clinical outcome and therefore had no further surgery. The fourth case with an unsatisfactory clinical outcome elected to live with his remaining symptoms.

We believe that the results reported here compare very favourably with the best reported in the literature (5, 10, 11). On this basis we would advocate the approach laid out here as a satisfactory and

safe way of dealing with a symptomatic, low-grade adult lytic spondylolisthesis.

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