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Selective instrumentation, reduction and repair in low-grade isthmic spondylolisthesis

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Abstract We treated 32 patients with low-grade (<30%) isthmic spondylolisthesis at L5–S1 with selective instrumentation, reduction of the slip, resection of the pseudarthrosis adding autologous bone grafting and decompressing the root canal. The ages ranged from 18 to 54 years. After a mean of 3.4 (1–7) years, we found good radiological and clinical results in 27 patients. Five patients lost correction, of whom three were asymptomatic whereas two required fusion of L5–S1. We think this technique is a useful surgical option for select patients.

Résumé Nous avons traité 32 malades avec un spondylolisthésis isthmique L5–S1 de bas degré (<30%) avec décompression radiculaire, réduction du glissement, résection de la pseudarthrose et greffe osseuse autologue. L'âge des patients variait de 18 à 54 ans. Après une moyenne de 3,4 (1–7) années nous avons trouvé de bons résultats radiologiques et cliniques pour 27 malades. Cinq malades avaient perdu la correction, trois étaient asymptomatiques alors que deux ont nécessité une fusion L5–S1. Nous pensons que cette technique est une option chirurgicale utile pour des malades sélectionnés.

Introduction

Isthmic spondylolisthesis is the most frequent type of spondylolisthesis [8] and occurs most often at the level of L5–S1 [14]. The aetiology of isthmic spondylolisthesis is not yet entirely clear. The defect of the pars interarticularis is thought to increase loading on the subjacent disc, which may lead to degeneration and subsequent slip [4, 7, 11, 12]. However, when the disc is complete, not all

spondylolytic patients develop spondylolisthesis. The disc in conjunction with the anterior and posterior longitudinal ligaments is thus an important element in stabilising the spine.

Lumbar isthmic spondylolisthesis may be present in asymptomatic individuals but is often seen in adult patients with chronic low back pain [3, 9, 11, 14]. Although several authors have reported favourable results using surgical treatment of low-grade spondylolisthesis, there is no clear consensus [1, 2, 6, 8, 10, 13].

We have used a new technique consisting of selective posterior instrumentation using pedicular screws, decompression of the canal, reduction of the slip and resection of the pseudarthrosis with the addition of autologous bone grafting.

Materials and Methods:

We treated 32 adults, 20 men and 12 women, mean age 33 (18–54) years, with isthmic spondylolisthesis of L5–S1, with 10–30% displacement (mean 17%) without concomitant pathology. Six patients had a previous trauma. All patients had received conservative treatment for at least 6 months before being included in the study. Four patients had radicular symptoms and 28 complained of low back pain. Clinical results were evaluated based on the criteria in Table 1, and pain was measured on a visual analogous scale (0 no pain and 10 intolerable pain).

Surgical technique

With the patient in a prone position, a 10-cm mid-line incision was made. The pseudarthrosis of pars interarticularis was identified and the sclerosed borders exposed. Two pedicular screws were placed on both sides of the slipped vertebra, and a previously prepared autologous bone graft (spinous process or iliac crest) was used to fill the defect. Next, the canal and foramen were examined. Fibrocartilaginous tissue and ligamentum flavum was resected bilaterally. Connectors were then placed caudally, resting on the inferior articular facets of the slip vertebra, followed by a pre-molded transverse bar within the connectors pushing against the lamina of the displaced vertebra. Guided by fluoroscopy, the system was then tightened until the spondylolisthesis was completely reduced (Fig. 1). Prophylactic antibiotics were used in all patients until discharge. The patients were fitted with a lumbosacral

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Table 1 Criteria for clinical results

Excellent	Complete relief of pain in back and lower limbs No limitation of physical activity Analgesics not used Able to squat on the floor
Good	Relief of most pain in back and lower limbs Able to return to accustomed employment Physical activities slightly limited Analgesics used only infrequently Able to squat on the floor
Fair	Partial relief of pain in back and lower limbs Able to return to accustomed employment with limitations, or return to lighter work Physical activities definitely limited Mild analgesic medication used frequently Mild limitation to squat on the floor
Poor	Little or no relief of pain in back and lower limbs Physical activities greatly limited Unable to return to accustomed employment Analgesic medication used regularly Unable to squat on the floor without support

brace for 8 weeks. Assisted ambulation was started within 24–48 h post-operatively, depending on pain intensity, and hospital discharge within 3–5 days.

Results

All patients were followed up at a mean of 3.4 (1–7) years after surgery. In two patients, the pedicular screws needed replacement due to malposition. Three patients had transient dysaesthesia of the lower limbs in the immediate post-operative period, and one patient a superficial haematoma. There were no deep infections.

At the last follow-up, 25 patients were clinically asymptomatic. According to the grading in Table 1, the clinical results were excellent or good. Radiographically, the reduction was complete (8, 12, 24, and 48 weeks), with union of the defect in pars interarticularis. In five patients, the screws and connectors were removed, confirming solid fusion of the pars interarticularis and without any complications.

In two patients, there was no radiographic consolidation or sign of screw loosening. Both patients remained asymptomatic. In five patients, there was a loss of correction by 1–3 mm. Three remained asymptomatic, while two required surgical re-intervention with postero-lateral fusion of L5–S1.

Discussion

There are several options for the surgical management of low grade spondylolisthesis. Decompression of the nerve without fusion remains controversial and has gone into disuse. Even in the presence of radicular symptoms, good results have been reported with fusion alone. Some have combined decompression and fusion in patients with radicular pain [5]. Others have demonstrated that in postero-lateral fusion instrumentation does not increase the fusion rate [8]. Anterior interbody fusion might result in indirect decompression of the nerve root through a widening of the intervertebral space, but the technique has also an increased morbidity. Postero-lateral fusion with transpedicular fixation results in direct decompression of the nerve root [5, 8]. This restricts mobility of the fused segment with increased stress on the neighbouring segments. Direct repair of the defect in pars interarticularis has been described with good fusion rate [1, 10], with long-term symptom relief and normal mobility of the lumbar spine.

We used selective instrumentation with only two pedicular screws, two connectors and a bar. Reduction of the slip and restoration of the normal biomechanical function of the lumbosacral spine was done under electromyographic monitoring. Repair of the defect was accomplished by removing the pseudarthrosis and applying an autologous bone graft.

In comparison with conservative management, the advantages of this surgical procedure are several. Pro-

Fig. 1 a Antero-posterior view of lumbosacral spine in a 30-year-old patient. Pedicular screws with connectors and bar are in place. **b** Lateral view of the lumbosacral spine

gression of the deformity is halted, it permits complete nerve-root decompression, it promotes fusion by stabilising the pars interarticularis and it preserves articular facets and normal mobility of the lumbar segment. Costs due to excessive instrumentation and prolonged hospital stay are decreased. We consider the results encouraging, although the follow-up time is relatively short and the study group was small.

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