Surgical treatment of lumbar spinal stenosis

FIVE-YEAR FOLLOW-UP

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We carried out a retrospective review of 155 patients with lumbar spinal stenosis who had been treated surgically and followed up regularly: 77 were evaluated at a mean of 6.5 years (5 to 8) after surgery by two independent observers. The outcome was assessed using the scoring system of Roland and Morris, and the rating system of Prolo, Oklund and Butcher. Instability was determined according to the criteria described by White and Panjabi.

A significant decrease in low back pain and disability was seen. An excellent or good outcome was noted in 79% of patients; 9% showed secondary radiological instability.

Surgical decompression is a safe and efficient procedure. In the absence of preoperative radiological evidence of instability, fusion is not required.

We have evaluated the long-term results of surgical treatment after five years or more applying established scoring systems in order to assess the quality of life, the incidence of low back pain and the functional and socioeconomic status of these patients.

We also determined the incidence of instability after surgery and its effect on the outcome.

Patients and Methods

We carried out a retrospective review of 155 consecutive patients who had decompression for lumbar spinal stenosis (LSS) at our centre between January 1990 and December 1992.

The patients assessed were undergoing primary lumbar spinal surgery, were in good general health without systemic pathology or vascular disease and had given informed consent. Patients who were participating in another simultaneous clinical study were excluded. Of the 155 patients, 22 were excluded; 15 had cardiopulmonary disorders, four had undergone previous surgery for LSS, one had rheumatoid arthritis, one had had an amputation of a lower limb, and one had bilateral osteoarthritis of the hip and was awaiting replacement surgery. Fifteen patients declined to participate, 25 died before appropriate follow-up, and 16 were lost to follow-up. Of the remaining 77 patients, four (5%) had congenital stenosis and 73 (95%) had acquired degenerative stenosis. The L4/5 level was stenotic in 86% of patients, L3/4 in 46%, L5/S1 in 35%, L2/3 in 5%, L1/2 in 3% and D12/L1 in 1%. Sixteen patients (21%) presented with concomitant degenerative spondylolisthesis, most commonly at L4/5 (12 cases). The mean age of the patients at the time of surgery was 61 years (25 to 85) and 58% were male.
Operative technique. Decompression was achieved by laminectomy, preserving the pars interarticularis. A high-speed burr was used to reduce the size of thickened laminae. The surfaces of the facets were maintained by undercutting using angled Kerisson punches. A large fenestration was performed in patients with monosegmental lateral stenosis and discectomy in those with frank extrusion or sequestration of the disc (n = 38, 49%). Sixty-five patients (84%) were decompressed at one level, nine (12%) at two levels, and three (4%) at three levels. Twelve patients with preoperative degenerative spondylolisthesis were considered to be unstable according to the criteria of White and Panjabi and underwent an associated fusion.

Follow-up. The patients were reviewed neurologically initially at six weeks. They were also asked to comment on the early subjective outcome, with regard to low back and leg pain, and their walking ability. These data were collected by an independent observer and entered into the computer-adapted protocol of Strömqvist et al, using the disability questionnaire, the pain rating scale of Roland and Morris and the anatomical economic functional rating system of Prolo et al (Table I) in which a score of 2 to 4 was poor, 5 to 6 fair, 7 to 8 good and 9 to 10 excellent.

At a mean long-term follow-up of 6.5 years (5 to 8), the patients underwent a further independent neurological evaluation and radiological studies which included standard and flexion/extension radiographs of the lumbar spine. Detailed measurements from the static (pre- and postoperative) and dynamic (postoperative) radiographs were obtained to determine the rotation of the vertebral bodies in the sagittal plane and spondylolisthesis in order to assess the instability (Table II).

Results

Quality of life. The mean score of Roland and Morris before surgery was 14 points (24, severe disability, 0, no disability), which reflects a severely compromised quality of life. The mean short-term follow-up score was five points, indicating a significant decrease in the level of disability. The mean reduction by eight points between the preoperative and long-term follow-up score confirms maintenance of this improvement (Student’s t-test, p < 0.001) (Fig. 1).

Walking ability improved in 95% of patients. Before surgery, 85% could not walk more than 0.5 km. After six weeks, 38% could walk more than 5 km, and 98% more than 0.5 km. This improvement was maintained, with 66% walking more than 5 km and 24% between 1 and 5 km at the long-term follow-up (Fig. 2).

The patients’ opinion regarding the outcome was such that at six weeks, 92% were satisfied and 8% remained
uncertain. At the long-term follow-up, 90% were still satisfied, 7% remained uncertain and 3% were dissatisfied.

**Pain.** The application of the Roland-Morris pain scale showed that relief of pain was maintained over time. A marked decrease in the intensity of low back pain was noted. Preoperatively, 84% of patients had had severe (score 5/6) or very severe (6/6) pain. At six weeks, no patient had severe pain, 35% had minor pain (2/6) and 45% no pain (1/6), with a mean decrease of 3.03 points (2.76 to 3.30). At five years, 4% had significant pain (4/6), 18% had minor pain and 64% had no pain, with a mean decrease of 3.13 points (2.82 to 3.44). For leg pain, 81% had no pain at six weeks and 82% had no pain at five years. The requirement for analgesia is summarised in Figure 3.

**Functional status.** The Prolo score was used to assess the socio-economic and functional status of the patients (Table I). At six weeks, 73% (56 patients) showed good or excellent scores (35% excellent, 38% good) and only 8% had unsatisfactory scores, with a mean decrease of 5.03 points (4.63 to 5.43). Five years after surgery, the results improved further with 51% having excellent and 28% good scores; 5% had an unsatisfactory score at five years with a mean decrease of 5.61 points (5.13 to 6.09) (Fig. 4).

**Complications.** There were complications in 11 patients (14%): six (8%) had an increased motor deficit, two (3%) an increased sensory deficit, one (1%) had a sphincter disturbance, one (1%) had a dural leak and one (1%) a superficial wound infection (*Staphylococcus aureus*).

The dural leak resolved after bed rest for two days, and the superficial wound infection settled unremarkably. The sphincter weakness resolved spontaneously after two years. Only two patients experienced long-term complications with persistent motor deficit.

**Radiology.** According to the criteria of White and Panjabi\(^\text{14}\) (Table II), 12 patients (16%) had preoperative lumbar instability. They underwent a posterior instrumented fusion at the time of the decompression and did not show persistent instability at long-term follow-up. Five years after surgery, only seven patients (9%) developed a secondary lumbar instability. Two of these had decompression at one level, two at two levels, and three at three levels. The L5/S1 level became unstable in three patients, who underwent a three-level decompression. The L4/5 level was the only other level at which there was postoperative instability. None of these patients had either instability or degenerative spondylolisthesis before operation.

No patient with evidence of secondary instability was clinically symptomatic.

**Congenital lumbar stenosis.** Four patients (5%) presented with congenital stenosis, two women and two men with a mean age of 40 years (32 to 49). Three had good to excellent results at six weeks and the fourth a fair result according to the Prolo score. This outcome did not change at long-term follow-up.

**Discussion**

Our study has the deficiencies inherent in all retrospective reviews, but the variables used were selected because they are reliable and widely accepted. The quality of life, the
severity of low back pain and the functional and socio-economic status were recorded according to established scoring systems.1,11,12

In previous reports of the outcome after surgery in the treatment of spinal stenosis with a five-year follow-up, the incidence of good to excellent results has varied between 55% and 86%.3,19-22 Airaksinen et al33 recently described poor functional results in 38%. Similarly, Jonsson et al34,35 found unsatisfactory results in 35% and Atlas et al1 in 31%. Improved outcomes after decompression combined with fusion were obtained in selected patients, e.g., those with degenerative spondylolisthesis or scoliosis.26-31 In the Maine Lumbar Spine Study, Atlas et al enrolled 148 patients with LSS, of whom 81 were treated surgically and 67 conservatively. He noted an improvement of 8.4 points in the Roland-Morris score in the surgical group compared with 1.6 points in the conservatively managed group (Student’s t-test, p < 0.001). Iguchi et al22 reported an excellent or good outcome in 56.7% of 37 patients followed up for a minimum of ten years. Our results are consistent with these studies. We observed good and excellent results in 73% at six weeks and 79% at a mean follow-up of 6.5 years (5 to 8). In terms of quality of life, we recorded a mean improvement of eight points in the disability questionnaire of Roland and Morris, which is statistically significant.

There were poor and fair outcomes in 21%, which is similar to other studies. These were subjective results which could not be explained on the basis of the neurological examination at follow-up, and these patients were dissatisfied because of persistent low back pain despite the resolution of sciatica and the neurogenic claudications, and the absence of secondary instability.

Our results differed in one significant aspect from previous studies in that there was no deterioration during follow-up. Of the patients with a good or excellent short-term outcome, seven had a fair and two a poor long-term outcome, but 15 with poor or fair results at the short-term follow-up had good or excellent results at five years. The report of Herno, Airaksinen and Saari32 is the only study with better results at long-term than at medium-term follow-up, and the authors concluded that patients continued to improve during a period of 7 to 13 years after decompression. Our series shows good and excellent results of surgical treatment of LSS for 73% to 79%, with a mean long-term follow-up time of 6.5 years (p < 0.001). We believe that the facet joints should be preserved by using an undercutting technique in combination with the laminectomy, and that only in selected cases proven to be unstable radiologically should decompression be combined with a fusion.

In a meta-analysis study of the literature between 1975 and 1995, Niggemeyer, Strauss and Schultz33 stated that the least invasive surgical procedure produced the best results. In a review of 88 cases, Katz et al34 reported no significant differences in outcome between different treatment groups (laminectomy alone, laminectomy and fusion) except in some cases of degenerative spondylolisthesis.

The improvement in back pain noted in our study is somewhat surprising. However, before surgery, patients often try to relieve their claudication by bending forwards which enlarges the spinal canal. This posture increases low back pain. After decompressive surgery, the patients can again extend their lumbar spine which decreases low back pain.

A major concern after decompression is the recurrence of low back pain because of secondary instability. There is considerable variation in the reported incidence of this complication. Pappas and Sonntag37 had an incidence of 3% and Guigui et al36 of 24%. Both pre- and postoperative instability are negative predictive factors for the long-term outcome.29-31,34 Postacchini, Cinotti and Gumina37 found an incidence of secondary instability in 63% of patients who had preoperative evidence of instability after decompression. Guigui et al36 and Katz et al20 reported that secondary spondylolisthesis was twice as common among patients with unsatisfactory results after lumbar decompression.

Iguchi et al22 stated that multilevel decompression and a preoperative sagittal rotation angle of more than 10° are risk factors for poor results. Twelve patients in our study had some lumbar instability at presentation and underwent fusion at the time of decompression. None has developed instability, but there were seven patients (9%) who were considered to be radiologically stable preoperatively and who then became unstable. The radiological diagnosis did not correspond to the clinical symptoms, however, and only one patient had mild occasional low back pain. Our study has shown that decompression by laminectomy with undercutting of the facet joint is a safe procedure with a low rate of secondary instability. There is a high incidence of excellent or good long-term results.

No benefits in any form have been received or will be received from a commerical party related directly or indirectly to the subject of this article.

References


