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Operative treatment for degenerative lumbar spinal canal stenosis

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The authors have made a retrospective study of a cohort of patients who underwent surgery for spinal stenosis. A total of 85 patients were surgically treated for spinal stenosis between 1993 and 1997, and 79 patients were available for re-evaluation. The average time of follow-up was 79 months. Twenty patients with monosegmental stenosis underwent fenestration and undercutting, 16 patients had a hemilaminectomy or laminectomy and 43 patients had an instrumented fusion after decompression. The severity of the clinical complaints, the degree of stenosis and the extent of the instability determined the method of operation used. Results were more variable when extensive decompression (hemilaminectomy or more) was needed and segmental stability was reduced by resection of large portions of the facet joints. Instability clearly worsened the results. The overall results clearly show that limited decompression is an ideal operative method, provided the indication is correct. Fusion cannot be avoided if segmental instability is present.

This retrospective study shows that satisfactory long-term results can be achieved in lumbar spinal stenosis with surgery adapted to the degree of instability and the degree of stenosis.

INTRODUCTION

Stenosis of the lumbar spinal canal due to degenerative facet hypertrophy, spondylophyte formation, hypertrophy of the ligamenta flava and degenerative spondylolisthesis is becoming an increasing problem in Western societies. Symptomatic lumbar spine degeneration is now one of the most common spinal problems, possibly also due to better diagnosis : the incidence of degenerative spinal stenosis is 1-2 % (*18*). About 80% of the population in the industrialised countries suffer from acute or chronic back problems during the course of their lives (*10*). It is still a subject of debate, whether increasing age is the determining factor in the frequency of these spinal diseases (*24*). Also, there is no consensus on when to only decompress or when to additionally use instrumentation.

PATIENTS AND METHODS

Between 1993 and 1997, 85 patients underwent surgery for degenerative lumbar spinal stenosis. The

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patients presented symptoms of diffuse leg and back pain combined with neurogenic claudication. Seventy-nine patients could be examined for this study : 43 women and 36 men. Twenty patients had undergone fenestration and undercutting, 16 patients had undergone a hemi- or full laminectomy and 43 patients had undergone an additional stabilising procedure. The average duration of follow-up was 79 months (range 61 – 110 months). The age distribution of patients in the three groups was similar : at the time of surgery, the average age of the patients was 60.5 years (range 40 – 79 years) in group I (fenestration), 64 years (range 41 – 81 years) in group II (hemi-or full laminectomy), and 62 years (45 – 86 years) in group III (additional stabilisation procedure).

After an average of three months of unsuccessful conservative treatment, a decision for decompressive surgery was made (*19, 22*). The results were compared in a retrospective study. Depending on the extent of degenerative lumbar canal stenosis and the type of the appropriate surgical procedure, patients were classified into 3 groups. Congenital stenosis (f.e. congenital short pedicle) was excluded. The operative procedure in each individual case was selected according to the degree of stenosis and instability.

Clinical evaluation included a standard spinal examination with motion analysis and an extensive neurological examination. Subjective self-assessment also followed a standard protocol. The intensity of symptoms was graded using the VAS back pain score or the VAS leg pain score (*13, 14*). The subjective state of health recording was completed with an Oswestry Low Back Pain Questionnaire (*8, 15*) and the SF – 36 Score (*20, 21*).

All patients had standard preoperative radiographs of the lumbar spine, dynamic flexion/extension films, a myelogram including flexion/extension images and a CT-myelogram. The L4-5 level was most often affected. Particular attention was directed to determining the degree of stenosis and instability. The degree of stenosis was determined on flexion/extension radiographs and flexion/extension myelograms using the Jones-Thomson Quotient (*18*). Stenosis on myelographic images was graded from minor (= slight indentation), to moderate (= clear indentation), and severe stenosis (= hourglass-shaped to complete contrast column stop). Figure 4 shows the distribution of the percentages of preoperative radiographic degree of stenosis, and the surgical procedures performed.

The degree of instability (or spondylolisthesis) was determined according to the Sim method (*7*). Translational segmental displacement was recorded. Scoliotic changes were measured according to the method of Cobb (*2, 9, 23*).

Group I had no or minor monosegmental instability (1°-2°) according to Meyerding and Sim and no increased mobility in flexion/extension imaging (*7*). These patients showed minor monosegmental stenosis,

Fig. 1a, b. — Myelogram and MRI of minor to moderate stenosis.

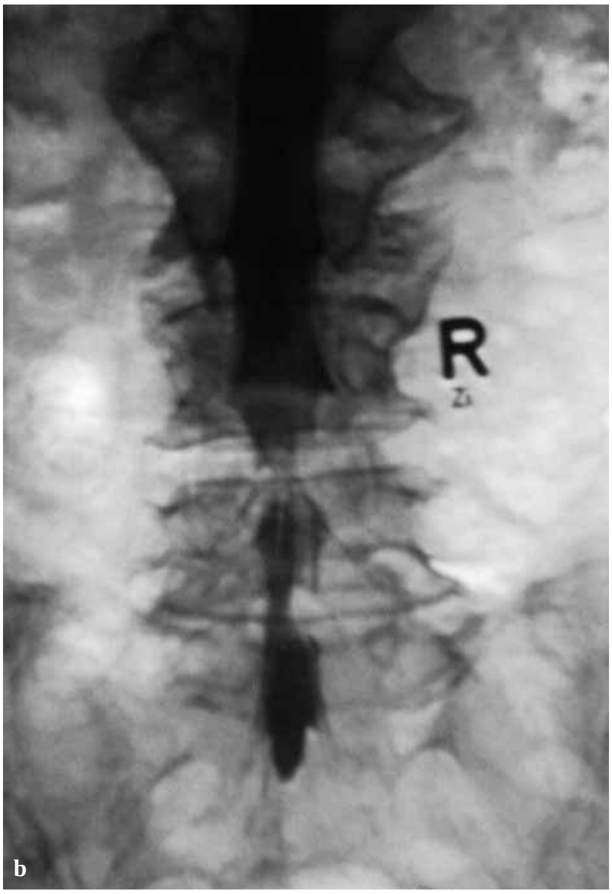

Fig. 2a, b. — Myelogram and MRI of moderate stenosis.

i.e. a slight indentation of the myelographic contrast column unchanged by flexion/extension and with the clinical sign. The intervertebral motion segment was stable during dynamic imaging. Patients in group I underwent interlaminar fenestration. The vertebral arch and the hypertrophic areas of the involved facet joints were trimmed by means of undercutting and the remaining ligamentum flavum was also resected by means of undercutting, until sufficient decompression, without causing instability, was achieved (fig 1a, b).

Group II included patients with moderate mono- or bi-segmental stenosis and clear indentation of the contrast column. In these patients the decision about the extent of decompression needed was taken intra-operatively, either hemi- or full laminectomy. The decision on whether to fuse was taken based on intra-operative testing, depending on the remaining stability provided by the facet joints (fig 2a, b). When in doubt of sufficient decompression, an intra-operative myelogram was performed. Figure 5 shows the relative frequency of preoperative and postoperative segmental instability in group II (without instrumentation).

The patients in group III had a severe stenosis with an hour glass shaped contrast column or a definite contrast stop. Also, these patients showed a mono- or multilevel instability in flexion/extension imaging (fig 3a, b). The group also included cases with obvious instability demonstrated intra-operatively after decompression as well as cases planned for fusion because of the extent of decompression required.

Figure 6 illustrates the preoperative degree of spondylolisthesis according to Sim in group III.

Statistical evaluation included the Mann-Whitney-U Test for independent samples or the Wilcoxon Test for

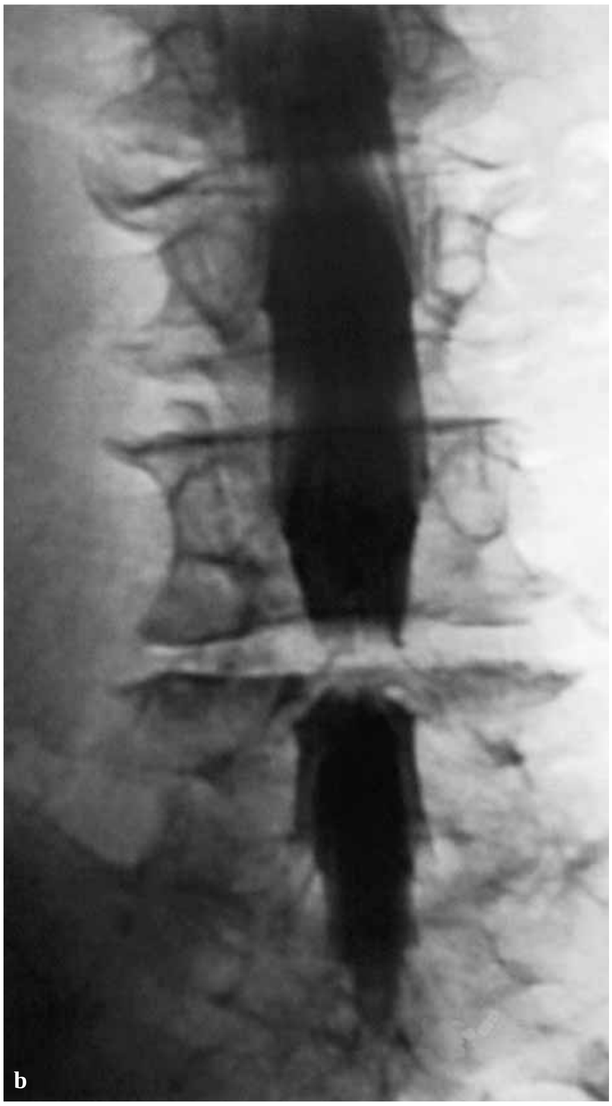

Fig. 3a, b. — Myelogram and CT of severe stenosis

related samples. In order to prevent uncontrolled increase of the Alpha-error, the results of statistical evaluation were corrected by means of a Bonferroni estimate. Median, standard deviation, and percentage distribution of the data were determined.

RESULTS

The distribution of the different procedures performed in our series of patients with spinal stenosis was comparable to other publications (*1, 3, 5, 6, 11, 15, 17, 21*).

Table I gives an overview of subjective improvement after surgery.

The overall subjective improvement (VAS) of patients in groups I and II did not differ greatly and was more than 35% on average. The average postoperative improvement according to the Oswestry Disability Questionnaire was 29% with limited decompression (fenestration and undercutting), 21.9% with extensive decompression and 15.2% in the group of patients that underwent instrumented fusion.

The results in group III with severe stenosis were generally worse with an average improvement of 10%. These results are comparable with those published by Grob, Cornefjord, Little, Airaksinen, and others (*1, 4, 8, 11, 12, 16*). In 12 cases (15%), the preoperative surgical planning had to be reconsidered intra-operatively due to a higher degree of instability than expected, and a more extensive surgical procedure was performed.

Eighty-two percent of the patients in group I and II stated that they would have the operation again, versus 50% in group III. This means that a timely decompression with moderate stenosis achieves the best long-term results.

The treadmill distance could not be improved as a whole in any of the three groups.

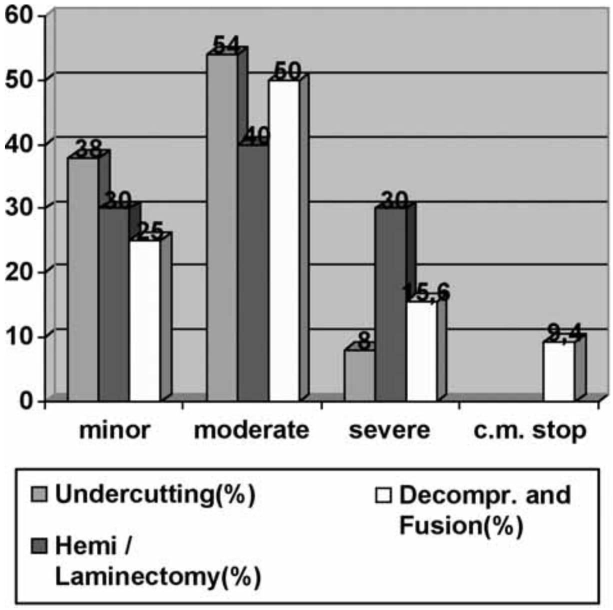

Fig. 4. — Proportional distribution of the spinal stenosis of all patients (c.m. = contrast medium).

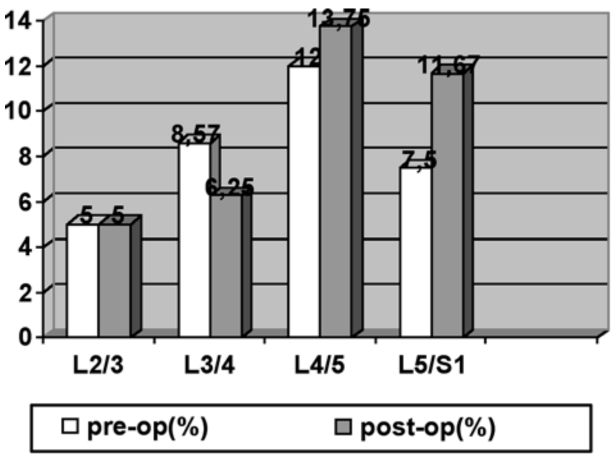

Fig. 5. — Topographic distribution of pre- and postoperative segmental instability (Group II).

The development of instability in the operated segments and the connecting segments after decompression was evaluated in the three different groups (fig 5).

One patient in group I developed postoperative instability in the decompressed segment (using Sim's criteria) without clinical symptoms (less than 10%).

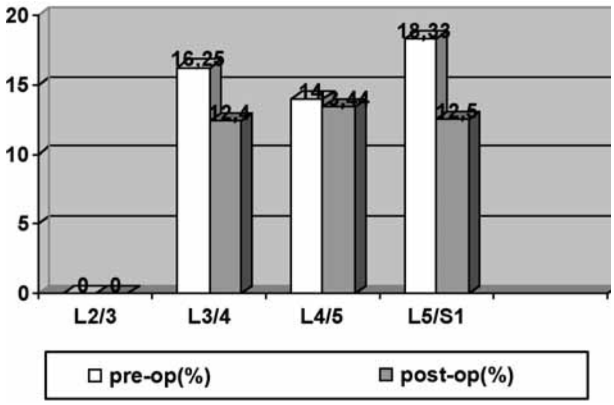

Fig. 6. — Topographic distribution of pre- and postoperative spondylolisthesis after fusion (Group III).

In group II the preoperative percentage of translation of 12% (range 10-15%,) – most frequently located at the L4/5 level (n = 8) – rose to 13.7% (range 5-20%) at follow-up. In group II, 6 out of 16 patients without instrumentation exhibited translational displacement of up to 5 mm preoperatively, and 7 postoperatively.

In Group III the number of instabilities (degree of olisthesis according to Sim) declined as demonstrated in fig 6. In a total of 30 cases, instrumentation reduced translation in Group III from 19 to 12%. However, in 17 cases, early instability developed at adjacent levels (table II). Of these, two cases were clinically symptomatic and had to be re-operated.

Table II gives an overview of peri- and postoperative complications documented.

In 3 cases from group II and in 2 cases from group III, repeat operations were necessary during the 5-year follow-up.

SUMMARY

The best subjective results and the most consistent outcomes were obtained with limited, stability-preserving decompressions in moderate segmental stenosis in the absence of hypermobility.

When stability is jeopardised after hemilaminectomy or laminectomy, the decision to fuse must be taken intra-operatively on an individual, case-to-case basis. The integrity of the facet joints can be

Table I. — Pre- and postoperative clinical scores in groups I to III and in the various subgroups.

Score %	Group I	Group I minor stenosis	Group I moderate stenosis	Group I severe stenosis	Group II	Group II minor stenosis	Group II moderate stenosis	Group II severe stenosis	Group III	Group III minor stenosis	Group III moderate stenosis	Group III severe stenosis
VAS back pain preop	67.7	68.03	69.2	68.9	73.25	77.67	63.0	90	81.79	91.29	82.69	89
VAS back pain postop	32	32.2	36	40.8	42	36.67	21	45	46.06	51.29	50.31	54
Diff.	35.7	35.83	33.2	28.1	31.25	41	42	45	35.73	40	32.38	35
VAS leg pain preop	56.3	54.6	53.9	55.8	72.05	88.33	73.33	90.67	66.47	75.14	67.77	75
VAS leg pain postop	23.9	24.7	24.8	27.9	40.75	38.33	58.33	56.67	49.70	56	50	37.5
Diff.	32.4	29.9	29.1	27.9	31.30	50	15	34	16.77	19.14	17.77	37.15
SF-36 preop	37.8	32.7	40.05	36.8	40.29	41.53	37.93	31.43	33.32	37.75	35.71	21.77
SF-36 postop	39.9	36.8	48.2	42.8	50.77	59.7	34.44	34.7	44.23	44.53	44.23	31.18
Diff.	2.1	4.1	8.15	6	10.48	18.17	3.49	3.27	10.91	6.78	8.52	9,41
Oswestry preop	43.4	46.5	51.2	49.8	64.55	72	66	68.67	61.15	64.57	60.46	65
Oswestry postop	19	17.5	23.4	33.8	42.60	50.67	54	50	45.96	48.86	47.38	55
Diff.	24.4	29	27.8	16	21.93	21.33	12	18.67	15.19	15.71	13.08	10

Table II. — Overview of complications

Complication	Undercutting Group I (n = 20)	Hemi/Laminectomy Group II (n = 16)	Decompression and Fusion Group III (n = 43)
Wound infection	–	2	5
Haematoma	1	1	–
Meningeal irritation	–	–	1
Cystitis	–	1	–
Implant failure (Screws)	–	–	2
Preop/postop degenerative scoliosis	–	6/7	25/22
Postop instability in operated segment	1	12	–
Postop instability in adjacent segment	–	1	17

decisive. However, a significant number of patients in group II with extensive decompression without fusion will develop radiological lumbar segment instability.

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