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ANALYSIS OF OPERATED CASES WITH LUMBAR SPINAL STENOSIS

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Twenty-seven patients with spinal stenosis all diagnosed at the surgical exposure and treated with decompression are analysed.

The material is divided into three groups according to the preoperative symptoms, those with claudication, those with back and leg pains and those with mixed symptoms. All were myelographed. The radicality of the decompression varied. Excellent and good results were obtained in a total of about 60 per cent. No difference, however, was seen between the three groups.

A positive myelography (AP diameter < 11 mm) was found in all cases with excellent and good results. The postoperative extent of the decompression was studied with a CT-scanner. Here a correlation was found between the range of decompression of the lateral recess and the result of the operation. Also the results seemed to be better with a shorter duration of the symptoms preoperatively.

Key words: computerised tomography; facetectomy; laminectomy; lumbar spine; lumbar spinal stenosis; myelography; redundant nerve roots

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Narrowing of the lumbar spinal canal has been considered to give rise to pains located in the lower back, and in one or both legs. The pains in the legs are often reminiscent of those caused by a disturbance of the vascular circulation – claudication. The symptoms are, however, often bizarre, making the diagnosis difficult, a fact which is confirmed by the long time that elapses between the onset of the symptoms and the diagnosis.

Spinal stenosis cannot be diagnosed by clinical signs. The diagnosis can only be suspected and has to be confirmed by myelography. Plain X-rays are often of little or no value. On the other hand, CT-scanning and the ultrasound technique are new methods which seem to be able to confirm the presence of constricted conditions in the spinal canal.

The treatment is a decompression consisting of laminectomy, and partial or total facetectomy at the level of the narrowing.

The present paper is designed to study the correlation between the results of the decompression procedure, the preoperative X-ray including myelographic findings and the radicality of the treatment studied postoperatively with CT-scanning.

MATERIAL AND METHODS

The present study involves 27 patients (22 males and 5 females) who all underwent laminectomies and more or less extensive facetectomies, during the period 1973–1979.

At the surgical procedures, all cases showed constricted conditions with hypertrophic neural arches and

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Table 1. Clinical symptoms

	No.	Male/Female
Claudication	17	15/2
Back and leg pain	5	5/0
Mixed symptoms	5	2/3

intervertebral joints. The mean age at the time of operation was 61.3 ± 9.0 years, ranging from 48 to 80 years. The mean duration of the preoperative symptoms was 25 ± 22 months, ranging from 1 to 84 months. The mean time of observation postoperatively was 22 ± 19 months ranging from 3 to 79 months.

The preoperative symptoms were divided into three groups – claudication, back and leg pain and mixed symptoms.

In the first group the dominant symptom was leg pain appearing during walking, but relieved by resting, especially with flexion of the lumbar spine. Pain in the lower back was of less importance.

The second group was characterized by low back pains and pains radiating into one or both legs without any claudication. These symptoms were usually bizarre and suggestive of compression of more than one level of root segments.

In the third group the patients complained of a mixture of the symptoms described in groups 1 and 2 (Table 1).

Prior to the surgical intervention, all patients had a radiological examination of the lumbar spine (plain films) and a lumbar myelography using water-soluble media (in almost all cases Metrizamide). The myelographic findings are divided into complete block, partial block (AP-diameter < 11 mm) and no compression. We also looked for the presence of redundant roots.

Vascular diseases of the legs were excluded preoperatively in all cases. The pulses of the dorsal pedis were normal and no obstructive bruits were observed. In all those cases with residual symptoms postoperatively a complementary vascular study was performed using plethysmography and segmental blood pressure measurements (Gundersen 1972). Even in these studies no vascular disturbances could be seen.

In the follow-up study the patients underwent a repeat radiologic examination of the lumbar spine (plain films) and an examination of the operated region with computerized tomography (Somatom 2, Siemens). In the CT-examination, consecutive 8 mm cuts were made, covering the segments that had been subjected to laminectomy as well as a few centimeters cranial and caudal to this region (Figures 1–4).

In the review of the myelographies, the width of the spinal canal (dural sac) in the AP and lateral views was recorded. Even the tortuosity of the nerve roots was registered (Figure 5).

The results of the surgical treatment are divided into

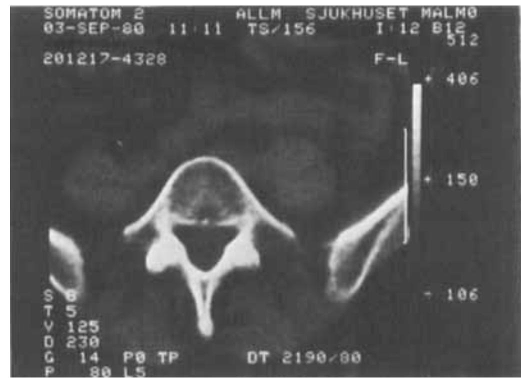

Figure 1. Normal width of the spinal canal at the LV level.

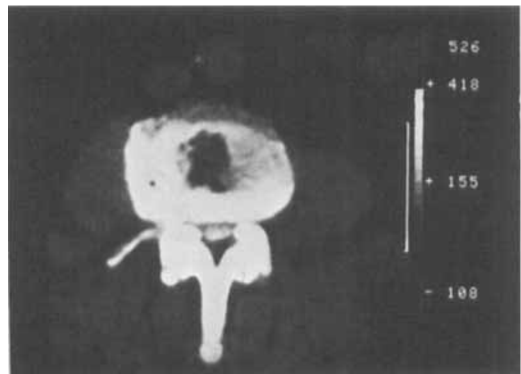

Figure 2. Narrowing of the lateral recesses at the LIV level.

excellent – completely free from symptoms in back and legs, *good* – slight residual pains in back or legs, but clearly improved walking capacity, *unchanged* – no relief of symptoms, and *worse* – increased pains postoperatively.

Walking capacity is defined as the walking distance on a level surface from start to onset of symptoms.

RESULTS

The postoperative results are shown in Table 2. Excellent and good results were encountered in a total of 59 per cent; in the group with claudication in 58 per cent, in the back and leg pain group in 80 per cent and in the mixed group in 40 per cent. Statistically, however, there is no difference between these groups.

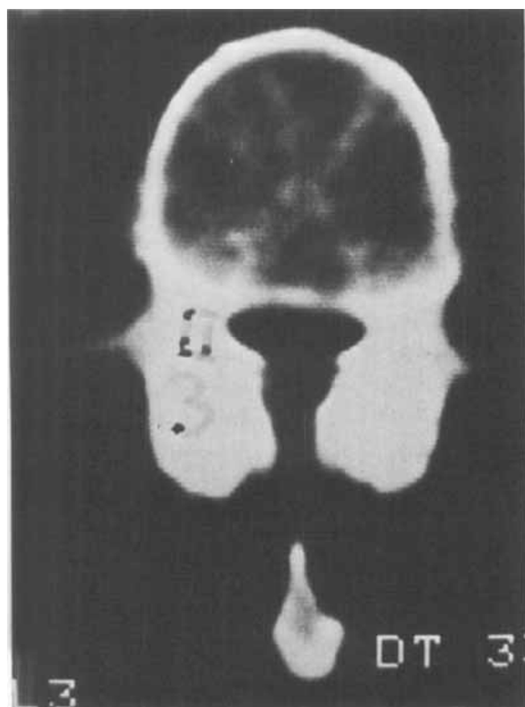

Figure 3. Laminectomy of LIII leaving the lateral recesses intact.

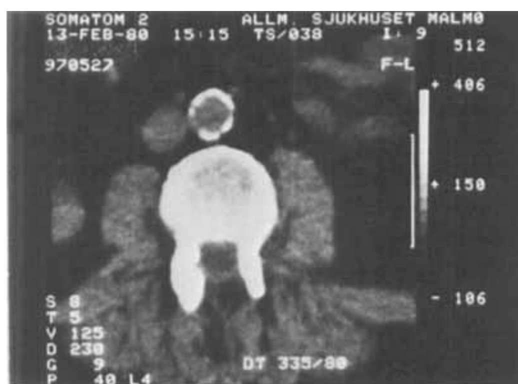

Figure 4. Total laminectomy and facetectomy at the LIV level.

The preoperative plain X-ray findings are shown in Table 3 and the preoperative myelographic findings in the three different groups of clinical symptoms in Table 4.

The correlation between the preoperative myelographic findings and the postoperative results are shown in Table 5. In the excellent and good groups a narrowing of the myelography was observed in all cases. In the "poor" groups, on the contrary, 5/11 showed normal myelographic findings. But even in these groups a complete block was seen in two cases. Redundant roots were seen in 37 per cent in the excellent and good groups and in 27 per cent in the unchanged and worse groups. No statistically significant difference was observed here.

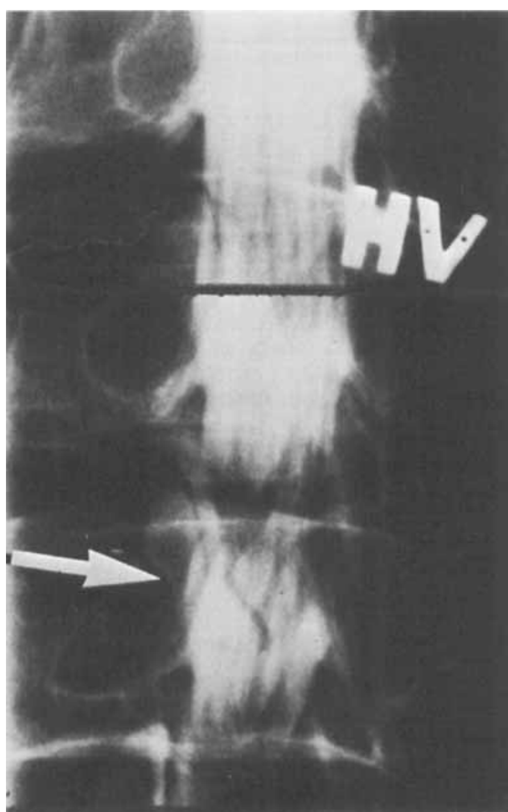

Figure 5. Redundant nerve roots.

The difference in walking capacity before and after the surgical treatment is demonstrated in Table 6. Postoperatively improved cases showed a better walking capacity than those with unchanged or worse symptoms. But even in the latter groups an improved walking capacity was seen in some cases.

Using computerized tomography, the postoperative results are compared with the radicality

Table 2. Postoperative results

Clinical symptoms	Excellent	Good	Unchanged	Worse	No symptoms in Back	No symptoms in Leg
Claudication	8	2	3	4	9/17	9/17
Back and leg pain	1	3	–	1	2/5	3/5
Mixed symptoms	1	1	2	1	1/5	2/5

Table 3. Preoperative plain radiograph findings

	No.	Male/Female
Spondylosis	26	22/4
Disc narrowing	19	18/1
Spondylolisthesis	6	6/0
A-P diameter of the spinal canal < 15 mm	5	4/1

of the operation, i.e. the extent of the laminectomy and the facetectomy (Table 7). We found a tendency for improved results with more radical operations. In the groups with excellent and good results, laminectomy was performed at 2.5 ± 0.8 levels and in the other groups together laminectomy was performed at 2.2 ± 1.1 levels. For facetectomy, this tendency is even stronger. In the groups with good results, total facetectomy was performed in 75 per cent and in the "poor" groups in 27 per cent.

In the excellent and good groups the duration of symptoms was 13.8 ± 9 months; in the other groups 40.6 ± 27.2 months (Table 8).

DISCUSSION

Spinal stenosis is defined as a narrowing of the spinal canal caused by congenital and/or acquired factors (Arnoldi et al. 1976). The latter may be degenerative, spondylolisthetic, iatrogenic or posttraumatic in origin or may be associated with disorders such as Paget's disease. Probably most cases with spinal stenosis are a combination of the congenital and acquired types.

With increasing degeneration, the volume of the spinal canal will decrease. On the anterior border, osteophytes and disc herniation will produce this narrowing; on the posterolateral and posterior borders, degenerative changes and hypertrophy of the intervertebral joints and processes will add to this stenosis.

Whether this mechanical narrowing of the spinal canal *per se* can explain the clinical symptoms is not yet understood. Vascular disturbances and

Table 5. Comparison between the preoperative myelographic changes and postoperative results

Myelography	Excellent	Good	Unchanged	Worse
Complete block	3	2	1	1
Partial block (AP<11 mm)	7	4	3	1
No compression	0	0	1	4
Redundant roots	5	1	2	1

Table 4. Preoperative myelographic findings

Clinical symptoms	Complete block	Partial block	No compression	Redundant roots
Claudication	5	9	3	8
Back and leg pain	2	2	1	1
Mixed symptoms	0	4	1	0

Table 6. Walking capacity (m)

Postoperative results	Claudication			Back and leg pain			Mixed symptoms		
	id*	preop	postop	id*	preop	postop	id*	preop	postop
Excellent	1	0	1000	8	200	unlim.	9	50	4000
	6	30	4000						
	7	300	unlim.						
	13	200	unlim.						
	16	200	unlim.						
	19	3000	unlim.						
	23	0	unlim.						
	27	1000	200						
Good	5	100	200	2	0	500	18	200	3000
	12	200	1000	3	200	500			
				25	30	1000			
Unchanged	20	20	200				21	50	50
	24	100	1000				22	300	400
	26	100	200						
Worse	10	200	200	4	50	500	14	200	300
	11	150	300						
	15	50	50						
	17	150	500						

* identification of the patient

Table 7. Comparison between postoperative results and extent of laminectomy and facetectomy

Postoperative results	Laminectomy Number of segments				Facetectomy Number of segments							Total number of patients
	I	II	III	IV	I		II		III		None	
					Tot	Part	Tot	Part	Tot	Part		
Excellent	1	4	4	1	3	1	5	1	–	–	–	10
Good	0	3	2	1	–	–	3	–	1	–	2	6
Unchanged	2	1	1	1	1	1	1	–	–	–	2	5
Worse	1	4	0	1	–	3	1	2	–	–	–	6

Tot = total facetectomy
Part = partial facetectomy

Table 8. Comparison between postoperative results and mean duration of symptoms

Postoperative results	No. of cases	Mean±SD (months)
Excellent and good	16	13.8± 9.9 range 1–30
Unchanged and worse	11	40.6.±27.2 range 12–84

chemical changes have been suggested as intermediary factors (Murphy 1977).

Stenosis is roentgenographically defined as an AP diameter of the spinal canal on a plain film of < 15 mm (Epstein et al. 1962, Eisenstein 1976). Measurement on the plain X-ray is, however, uncertain as the measuring landmark on the dorsal border of the spinal canal is difficult to estimate without tomography. Therefore, in order to be able to determine the width of this space, i.e. to

diagnose the spinal stenosis, myelography has been considered necessary (Schatzker & Pennal 1968). In recent years, however, CT-scanning (Quencer et al. 1978, Postacchini et al. 1980, Ullrich et al. 1980) and the pulsed echo ultrasound technique (Porter et al. 1978) appear to be of great value in diagnosing a narrow spinal canal. A correlation between EMG-findings and a narrowing of the lumbar canal has also been discussed (Jacobson 1976).

During the surgical exposure, the presence of spinal stenosis is suspected if there is hypertrophy of the neural arches, especially of the facet joints, and a lack of dura pulsation and epidural fat. In the present material all these findings were in all cases peroperatively observed.

The purpose of this study was to see whether there is any correlation between the preoperative clinical symptoms, the myelographic findings, the radicality of the decompressive operation and the postoperative clinical results. Thus the aim was to determine which of these pre- and per-operative factors may be of importance in looking for prognostic signs to predict the possibility of obtaining a good surgical result.

The mean age of these patients is high (60 years) and males dominate (22/27 cases), which has been previously documented in several papers. The mean duration of the preoperative symptoms is 2 years. The prognosis in these cases, however, seems to be "the shorter the duration the better". This may be explained by the increased risk of obtaining irreversible lesions of the nerve roots with long-term mechanical irritation.

Preoperatively, the clinical symptoms were divided into three groups; claudication, back and leg pains and mixed symptoms. In all these groups, however, low back pain and decreased ability to walk were seen to a varying degree. The symptoms increased gradually and tended to become more chronic. Multiple nerve roots were engaged, in contrast to what is usually seen in patients with disc herniation.

Fifty-nine per cent of the material was rated as having excellent and good results. However, when comparing the postoperative results in these three groups, no difference was seen, i.e., those with classical symptoms of spinal stenosis, with claudication, did not have a better prognosis than those with more atypical signs.

Plain X-rays are of little use. On the contrary, positive myelography (AP diameter < 11 mm) seems to be an important factor in predicting the chance of obtaining a good result. In all cases with excellent and good results, a narrowing of the contrast column was seen. In the unchanged and worse cases 55 per cent showed a positive myelography.

Redundant roots seen in the contrast column as serpentine defects have been recently described by Cronqvist & Thulin (1979). These tortuous defects are seen in the neighbourhood of the myelographic defects which are seen, for instance, in spinal stenosis and are presumed to be caused by abnormal or displaced roots. Redundant roots were seen here in 37 per cent of the excellent and good groups, but also in the poor groups (27 per cent). However, redundant roots were only seen in the positive myelographies and almost exclusively in cases with claudication.

Decreased ability to walk was seen preoperatively in cases with good as well as poor results. Those with good results, however, increased their walking capacity to a greater extent than those with persistent pains.

The treatment used in the cases described was decompression of the segment showing narrowing. In the groups with excellent and good results, laminectomies were performed at 2.6 levels and in the other groups at 2.2 levels, but no statistically significant difference could be observed.

However, it seems to be of importance to make a radical decompression laterally – releasing the narrowing of the lateral recess. The lateral radicality of the operation was studied by CT-scanner. Total facetectomies were performed in 75 per cent of the excellent and good groups, but only in 27 per cent of the poor groups.

When analysing cases with persistent symptoms, the following was observed:

Of 7 cases belonging to the claudication group, 3 had a normal myelography preoperatively. Two cases with a positive myelography had not been treated with facetectomy; only a medial laminectomy was performed. In 3 cases with mixed symptoms, 1 had a negative myelography and the other 2 positive myelographies but were not radi-

cally operated on. Finally, 1 case with back and leg pains had a normal myelography.

CONCLUSIONS

The prognostically important factors for obtaining good results in patients with spinal stenosis seem to be:

1. A positive myelography.
2. Decompression of the lateral recess – radical facetectomy, not only medial laminectomy.
3. Early diagnosis of the disorder.

Prognostic factors of less importance seem to be:

1. The type of clinical preoperative symptoms.
2. The range of plain X-ray degenerative findings.
3. The finding of "spinal stenosis" during the surgical procedure.

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