

One-year report from the Swedish National Spine Register

Swedish Society of Spinal Surgeons

Björn Strömqvist, Peter Fritzell, Olle Hägg and Bo Jönsson

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Contact addresses

Björn Strömqvist¹,
Peter Fritzell²,
Olle Hägg³,
Bo Jönsson¹

¹Department of Orthopedics,
Lund University Hospital,
SE-221 85 Lund, Sweden

²Department of Orthopedics,
Falun Hospital,
SE-791 82 Falun, Sweden

³Department of Orthopedics,
Sahlgrenska Hospital,
SE-413 45 Göteborg, Sweden

Correspondence BS: bjorn.stromqvist@med.lu.se

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Introduction

The importance of registration is increasingly evident in medicine today. Registers for hip and knee arthroplasty exist since 20 years, hip fracture registers exist and in spine surgery, the Swedish National Spine Register, the first to evolve, was initiated in 1992. In Sweden the main funding is provided by the National Board of Health and Welfare/the Swedish Association of Local Authorities and Regions (SALAR) and today economical support is given to more than 70 registers of various disciplines such as cataract, stroke and hernia registers.

Many benefits of registration are obvious such as the possibilities to document frequencies, costs and effects of treatment. They can also be used in calculation of resource consumption. Because of the differences between conditions registered, the design of different registers is very heterogeneous.

Hitherto the Swedish National Spine Register has focused on painful degenerative disorders of the lumbar spine such as disc herniation, spinal stenosis, spondylolisthesis and disc degenerative pain. The common denominator for these diseases is that the surgical treatment is mainly carried out with the aim of relieving pain and, to some extent, improving function. Thus, the content of the register focuses on reflecting these two parameters. In contrast to for example hip arthrosis and hip fractures, the problem of the individual patient is only to a limited extent described by the diagnosis and the radiological finding. A disc herniation for example can give rise to intractable sciatic pain and

permanent abolishment of function of urinary and anal sphincters, but can also be totally asymptomatic. MRI findings of disc herniations or significant protrusions in healthy subjects have been demonstrated to be prevalent in 25–40% of the younger population (Jensen et al. 1994, Boden et al. 1990). The same is true also for spinal stenosis (Kent et al. 1992) and, even more so, for isthmic spondylolisthesis and disc degeneration. The consequences of this are that when registering patients with painful spinal disorders, multiple parameters demonstrating the degree of pain and functional disturbance are required.

An important feature of a register for painful spine disorders is to determine the efficiency of spinal surgery when implemented in clinical practice. The literature on the diseases mentioned mainly consists of studies performed in specialized units and by specialized surgeons and the outcome is not necessarily the same as that obtained in clinical practice. This is even more true when new techniques are introduced.

Other registers emerging, involving spine patients, are SPORT (Birkmeyer et al. 2002) in the US and Spine Tango of the Spine Society of Europe (Aebi & Grob 2004).

This presentation includes the background and evolution of the Swedish National Spine Register, its current design, and data registered pre- per- and postoperatively during one year, 2003, and also, some parameters followed over six consecutive years.

Background

The idea to design a Swedish spine register emerged during a meeting “The degenerative lumbar spine” in Sweden in 1992, presented in *Acta Orthopaedica Scandinavica* (Suppl 1993). One important reason was the general feeling that a better prospective documentation of outcome was needed in the field. The first version of the protocol (Strömqvist & Jönsson 1993) was used in a few selected departments from 1993. The data were completed by the surgeon and transferred to a dedicated FileMaker database designed by Kaj Knutson. In spite of great enthusiasm among spine surgeons when the register was introduced and discussed at the meetings of the society, the number of departments participating in the register increased only very slowly over the first five years. To reverse this trend, some measures were taken after an analysis of the problem: The register was transferred into the ownership of the Swedish Society of Spinal Surgeons, the protocol was made almost entirely patient based, and a support function was created in order to give departments starting to register or with problems in registering advice and help by phone or by personal visits.

Table 1. Number of departments in Sweden reporting lumbar spine surgery data on yearly basis

Year	Participating departments
1996	6
1998	12
1999	27
2000	33
2003	36

These structural changes enabled us to increase participation dramatically (Table 1).

It is estimated that almost 90% of the departments performing lumbar spine surgery in Sweden today, 2005, register their operations, and more than 80% of the total number of operations for degenerative lumbar spine disorders in Sweden are included.

The register, thus, is the property of the Swedish Society for Spinal Surgery. The working and steering group consists of four spine surgeons and the funding from the National Board of Health and Welfare constitutes the economical basis for three part-time secretaries. A yearly report is presented in Swedish.

Design

Preoperative data are completed by the patient in a questionnaire on the day before surgery, surgical data are completed by the surgeon on dismissal from hospital and 1, 2, 5, and 10 year follow-up questionnaires are completed by the patients. The layout and the content of the protocol have changed somewhat over the years but have been constant since the beginning of 2003. Preoperative data completed by the patients are: Age, sex, smoking habits, working conditions, sick listing, consumption of analgesics and walking distance. Further, the patient reports back as well as leg pain on a 100 mm visual analogue scale (VAS) and completes the Oswestry, SF-36 and EuroQol questionnaires. Normally, the follow-up questionnaires are sent to the patients' home with a prepaid return envelope.

Surgical data include diagnosis for and type of operation, level and side of operation, use of implants, grafts and so on as well as antibiotic

prophylaxis. Hospitalization time and occurrence of complications and re-operations, if any, are recorded.

At follow-up the patient questionnaire includes the same questions as preoperatively plus questions on return to work, improvement of leg and back pain (in five categories from painfree to deteriorated) as well as an overall satisfaction with surgery question.

Since the beginning of 2003, the register is web based. This means that the individual departments fill their patient data directly into the database. A function which informs the individual department when it is time to perform one or two year follow-up is created and work is currently put into an online feedback report to the individual department which, however is not completed yet.

The current protocol of the register has been validated in a test-retest situation (Zanoli et al. 2005).

Results

SURGICAL PROCEDURES DURING 2003

In total 3 055 patients operated on in the lumbar spine from in total 36 departments were registered for 2003. This is a 20% increase compared to 2002 when 2 461 operations from 34 departments were registered. The diagnoses for the patients operated on during 2003 were: Disc herniation 33%, central spinal stenosis 31%, lateral spinal stenosis 7%, spondylolisthesis 6%, DDD/segmental pain 12% and others 11% (Table 2).

Below demographic data and surgical data for patients, related to diagnosis for surgery are presented.

Table 2. Diagnosis for surgery in 2003

Diagnosis	n	Percent
Disc herniation	1021	33
Central spinal stenosis	953	31
Lateral spinal stenosis	208	7
Spondylolisthesis	174	6
DDD/segmental pain	371	12
Others	328	11
Total	3055	100

Lumbar disc herniation

Demographic data

In total 1 021 operations for lumbar disc herniation were registered during 2003. Gender: 57% men and 43% women. Mean age was 43 (16–88) years, the distribution is presented in Figure 1. The proportion of smokers was 25%. For 87% of the patients the disc operation was first-time surgery while 13% had been operated on in the lumbar spine once before.

Preoperative duration of back pain was as follows: 5% had no back pain preoperatively, 17% had back pain for less than 3 months, 42% back pain for 3–12 months, 19% for 1–2 years and 17% for more than 2 years.

Corresponding figures for leg pain/sciatica were: 21% of the patients had had leg pain for less than 3

months, 46% for 3–12 months, 18% for 1–2 years and 13% for more than 2 years. The estimation of pain on the VAS scale concerning back pain was mean 45 (0–100) while mean leg pain was 64 (0–100). Distribution of back and leg pain is presented in Figures 2 and 3.

Regular consumption of analgesics was reported by 55% of the patients, intermittent consumption by 32% while 13% did not use any analgesics.

For 33% of the patients with disc herniation, the walking distance was less than 100 m, for 22% between 100 and 500 m, for 17% between 500 m and 1 km and for 28% it exceeded 1 km.

Surgical data

Conventional disc surgery was performed in 40% of the cases and microscopic disc surgery in 44%. The remaining procedures were different combinations of decompressive surgery for patients with disc herniation in a stenotic spine.

Mean hospitalization time for conventional disc surgery was 4.6 (0–52) days and for microscopic disc surgery 4.0 (0–30) days.

Central spinal stenosis

Demographic data

In total 953 operations for central spinal stenosis were registered during 2003. Gender: 44% men and 56% women. Mean age was 68 (26–90) years, the distribution is presented in Figure 4. The proportion of smokers was 17%. For 85% of the patients the stenosis operation was first-time surgery while 15% had been operated on once before.

Preoperative duration of back pain was as follows: 3% had no back pain preoperatively, 6% had back pain for less than 3 months, 13% back pain for 3–12 months, 30% for 1–2 years and 48% for more than 2 years.

Corresponding figures for leg pain/sciatica were: 7% of the patients had had leg pain for less than 3 months, 19% for 3–12 months, 34% for 1–2 years and 38% for more than 2 years. The estimation of

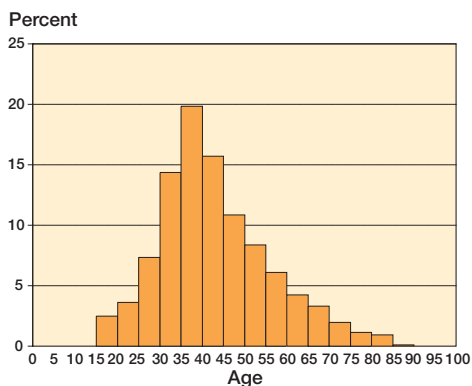


Figure 1. Age distribution, disc herniation, n = 1 021 patients.

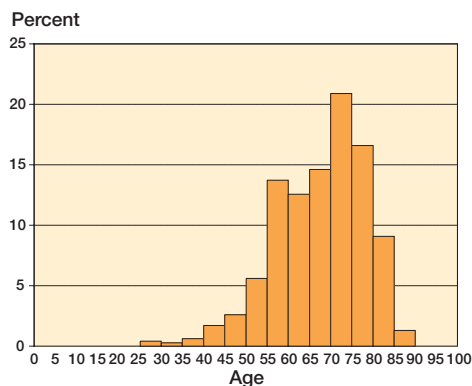


Figure 4. Age distribution, central spinal stenosis, n = 953 patients.

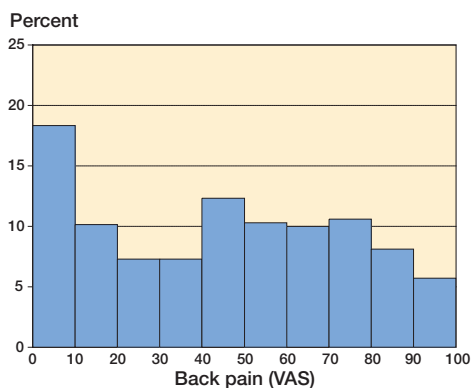


Figure 2. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from disc herniation (%).

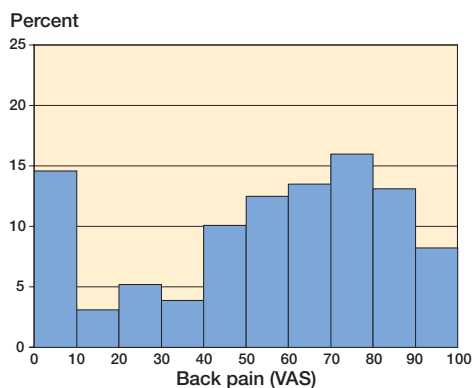


Figure 5. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from central spinal stenosis (%).

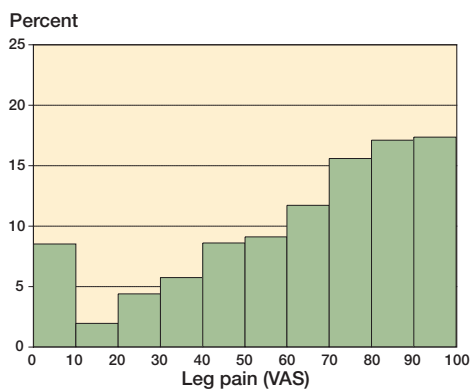


Figure 3. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from disc herniation (%).

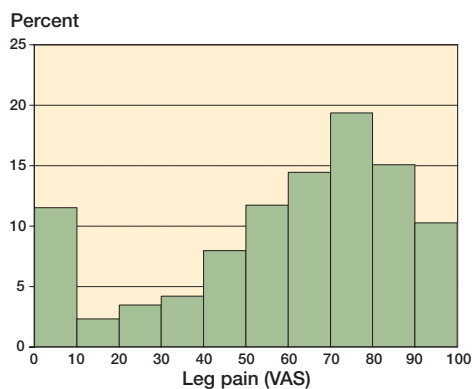


Figure 6. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from central spinal stenosis (%).

pain on the VAS scale concerning back pain was mean 55 (0–100) while mean leg pain was 61 (0–100). Distribution of back and leg pain is presented in Figures 5 and 6.

Regular consumption of analgesics was reported by 53% of the patients, intermittent consumption by 31% while 16% did not use any analgesic medication.

For 47% of the patients with central spinal stenosis, the walking distance was less than 100 m, for 33% between 100 and 500 m, for 11% between 500 m and 1 km and for 10% it exceeded 1 km.

Surgical data

Decompressive surgery was the sole procedure in 62% of the cases, in 51% without and in 11% with microscopic assistance. Decompression was combined with posterolateral instrumented fusion in 12% and with posterolateral uninstrumented fusion in 3% of the cases. 2% of the operations were decompression combined with posterior lumbar interbody fusion (PLIF) and 2% were posterior fusions with instrumentation without decompression, the remaining operations were other types.

Mean hospitalization time for decompressive surgery was 6.6 (0–70) days and for microscopic decompressive surgery 5.0 (2–13) days. When decompressive surgery was combined with fusion, the hospitalization time increased. For decompression + uninstrumented fusion 8 (3–14) days in hospital were recorded, in decompression + instrumented fusion 10 (0–41) days and in decompression + PLIF 9 (5–29) days were spent in hospital.

Lateral spinal stenosis

Demographic data

In total 208 operations for lateral spinal stenosis were registered during 2003. Gender: 48% men and 52% women. Mean age was 58 (20–87) years, the distribution is presented in Figure 7. The proportion of smokers was 36%. For 78% of the patients the stenosis operation was first-time surgery while 22% had been operated on before.

Preoperative duration of back pain was as follows: 3% had no back pain preoperatively, 6% had back pain for less than 3 months, 19% back pain for 3–12 months, 23% for 1–2 years and 50% for more than 2 years.

Corresponding figures for leg pain/sciatica were: 5% of the patients had had leg pain for less than 3 months, 22% for 3–12 months, 28% for 1–2 years and 45% for more than 2 years. The estimation of pain on the VAS scale concerning back pain was mean 56 (0–100) while mean leg pain was 64 (0–100). Distribution of back and leg pain is presented in Figures 8 and 9.

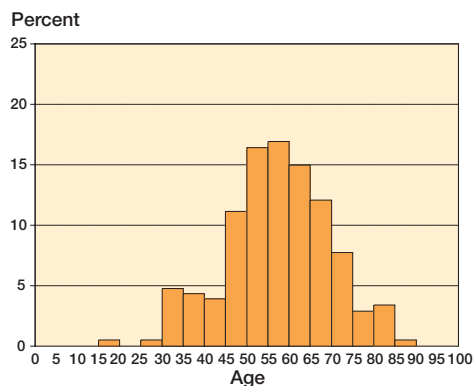


Figure 7. Age distribution, lateral spinal stenosis, n = 208 patients.

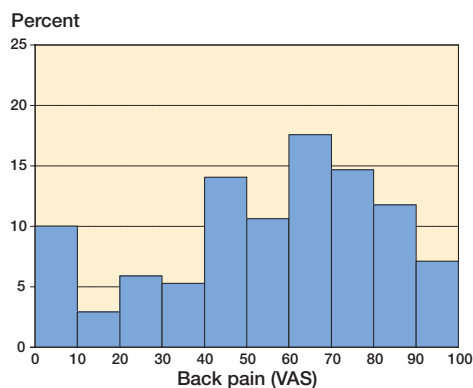


Figure 8. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from lateral spinal stenosis (%).

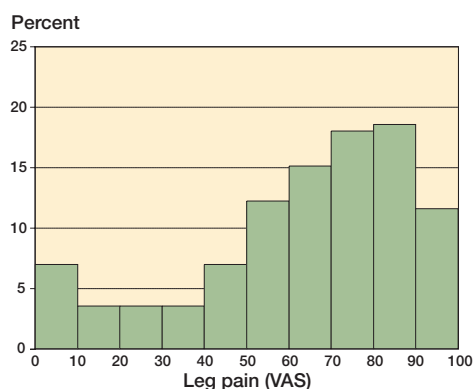


Figure 9. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from lateral spinal stenosis (%).

Regular consumption of analgesics was reported by 54% of the patients, intermittent consumption by 30% while 16% did not use any analgesic medication.

For 27% of the patients with lateral spinal stenosis, the walking distance was less than 100 m, for 31% between 100 and 500 m, for 21% between 500 m and 1 km and for 21% it exceeded 1 km.

Surgical data

The most common type of operation for lateral spinal stenosis was decompression. 60% of the patients had conventional decompressive surgery performed and 19% microscope assisted decompressive surgery. Decompression + fusion, mainly instrumented, was the procedure performed in the majority of the remaining cases.

Mean hospitalization time was 5 (1–32) days for conventional decompressive surgery and 5 (0–26) days for microscopic decompressive surgery.

Spondylolisthesis

Demographic data

In total 174 operations for spondylolisthesis were registered during 2003. Gender: 53% men and 47% women. Mean age was 45 (12–83) years, the distribution is presented in Figure 10. The proportion of smokers was 31%. For 93% of the patients the operation for spondylolisthesis was first-time surgery while 5% had been operated on once before and 2% two or more times before.

Preoperative duration of back pain was as follows: 4% had back pain for less than 3 months, 4% back pain for 3–12 months, 19% for 1–2 years and 74% for more than 2 years.

Corresponding figures for leg pain/sciatica were: 4% had no leg pain preoperatively, 7% of the patients had had leg pain for less than 3 months, 7% for 3–12 months, 29% for 1–2 years and 52% for more than 2 years. The estimation of pain on the VAS scale concerning back pain was mean 59 (0–100) while mean leg pain was 48 (0–99). Distribution of back and leg pain is presented in Figures 11 and 12.

Regular consumption of analgesics was reported by 40% of the patients, intermittent consumption by 31% while 29% did not use any analgesic medication.

For 15% of the patients with spondylolisthesis, the walking distance was less than 100 m, for 28% between 100 and 500 m, for 26% between 500 m and 1 km and for 30% it exceeded 1 km.

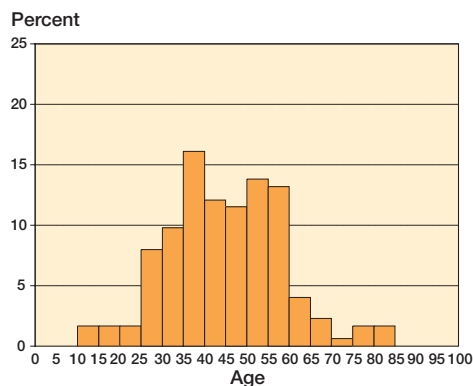


Figure 10. Age distribution, spondylolisthesis, n = 174 patients.

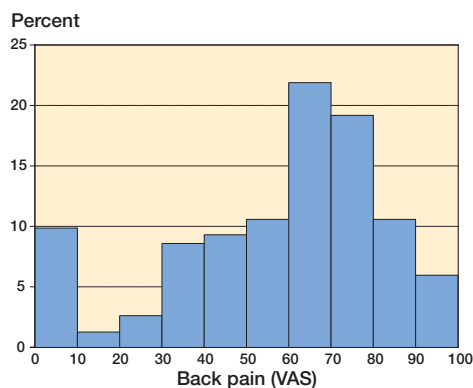


Figure 11. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from spondylolisthesis (%).

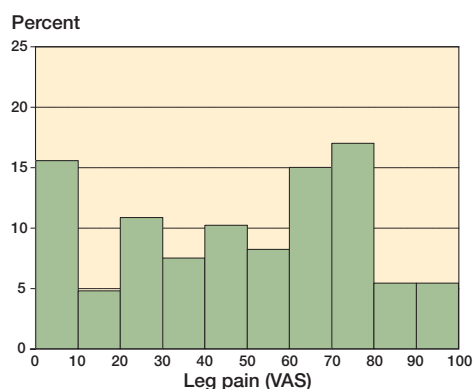


Figure 12. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from spondylolisthesis (%).

Surgical data

A wide variety of surgical techniques was used in spondylolisthesis. The following is the rate in decreasing frequency: Decompression + instru-

mented fusion 35%, posterolateral instrumented fusion 18%, anterior lumbar interbody fusion (ALIF) with or without titanium implants 14%, decompression and posterolateral uninstrumented fusion 9%, uninstrumented fusion only 9%, PLIF with or without titanium implants 9% and in a few cases decompressive operations.

Mean hospitalization time when decompression only was carried out was 4 days, 10 days for ALIF and 7–8 for the remaining procedures.

DDD/segmental pain

Demographic data

In total 371 operations for DDD/segmental pain were registered during 2003. Gender: 53% men and 47% women. Mean age was 46 (22–83) years, the distribution is presented in Figure 13. The proportion of smokers was 27%. For 66% of the patients the operation for DDD was first-time surgery while 22% had been operated on once before and 12% two or more times before.

Preoperative duration of back pain was as follows: 4% had back pain for less than 3 months, 5% back pain for 3–12 months, 19% for 1–2 years and 72% for more than 2 years.

Corresponding figures for leg pain/sciatica were: 10% had no leg pain preoperatively, 8% of the patients had had leg pain for less than 3 months, 8% for 3–12 months, 24% for 1–2 years and 50% for more than 2 years. The estimation of pain on the VAS scale concerning back pain was mean 59 (3–100) while mean leg pain was 43 (0–100). Distribution of back and leg pain is presented in Figures 14 and 15.

Regular consumption of analgesics was reported by 48% of the patients, intermittent consumption by 40% while 12% did not use any analgesic medication.

For 18% of the patients with DDD/segmental pain, the walking distance was less than 100 m, for 18% between 100 and 500 m, for 25% between 500 m and 1 km and for 39% it exceeded 1 km.

Surgical data

Also in DDD, a wide spectrum of surgical techniques was noted as follows: Posterolateral instrumented fusion 20%, ALIF with or without titanium implants 19%, PLIF with or without implants

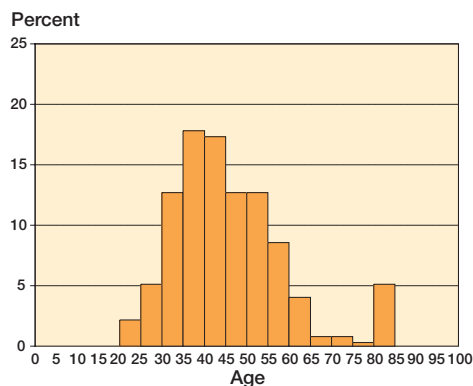


Figure 13. Age distribution, DDD/segmental pain, n = 371 patients.

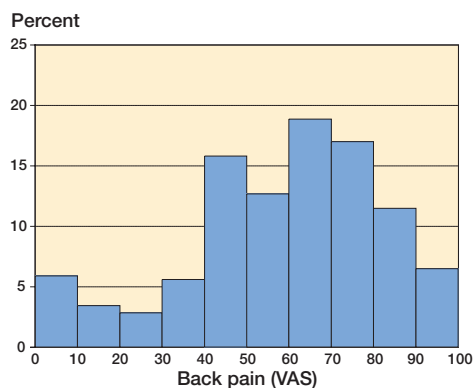


Figure 14. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from DDD/segmental pain (%).

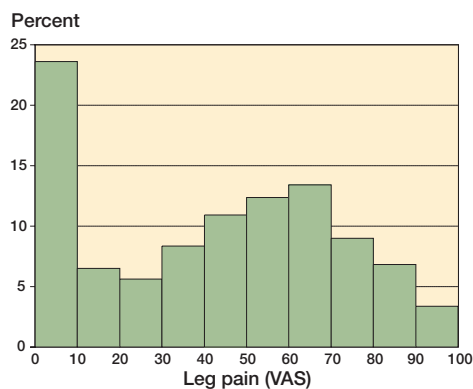


Figure 15. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from segmental pain (SRS) (%).

14%, disc prosthesis 10%, decompression + PLIF 9%, decompression + posterolateral instrumented fusion 11%, posterolateral uninstrumented fusion 7%, decompression + posterolateral uninstru-

mented fusion 2%, decompression 1% and nucleus prosthesis 0.5%.

Also in this diagnostic group, patients operated on with ALIF with or without implants had the longest hospitalization time, mean 12 days with and 9 days without implants. For other stabilizing operations, mean hospitalization time varied between 6 and 8 days and this was true also for disc and nucleus prostheses.

ONE-YEAR FOLLOW-UP OF LUMBAR SPINE SURGERY IN SWEDEN 2003

In total 7 199 patients operated on between 1998 and 2002 have answered the one-year follow-up questionnaire. Of these, 2 796 were operated on for disc herniation, 2 346 for central spinal stenosis, 540 for lateral spinal stenosis, 432 for spondylolisthesis and 671 for DDD. Patients where "other operations" were performed are not included in the presentation. In total 1.6% of the patients have had a reoperation registered before the one-year follow-up, 1% of patients with disc herniation, central and lateral stenosis and 3% of patients with spondylolisthesis and disc degenerative pain.

Lumbar disc herniation

One-year follow-up has been completed by totally 2 796 patients operated on for lumbar disc herniation. Gender: 57% men, 43% women. Mean age was 43 (13–85) years.

Preoperative mean back pain according to the visual analogue scale was 48 and corresponding value one year postoperatively 27. For leg pain the corresponding figures were: preoperatively 66, postoperatively 23. Figures 16 and 17 demonstrate the distribution of pain estimation by the patients on the visual analogue scale concerning back and leg pain.

Consumption of analgesics one year postoperatively: Regular 17%, intermittent 33%, no consumption 50%.

Walking distance one year postoperatively: <100 m 4%, 100–500 m 9%, 500 m – 1 km 16% and >1 km 71% (Figure 18).

Back pain as compared to preoperatively, expe-

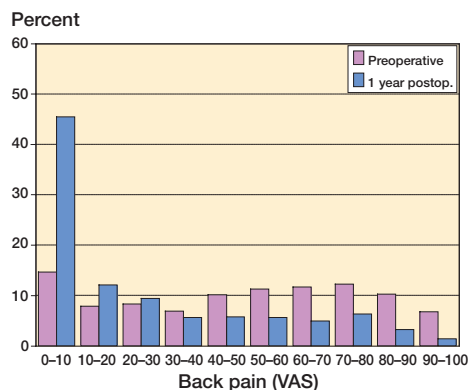


Figure 16. Back pain according to the visual analog scale (VAS) pre- and postoperatively in patients operated on for lumbar disc herniation (%).

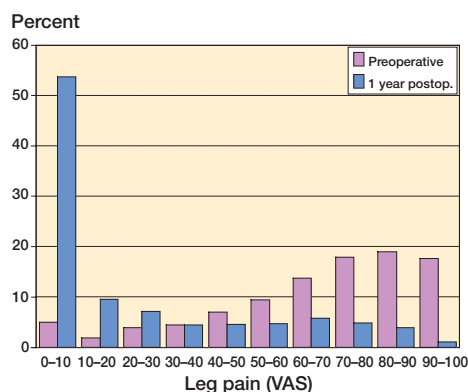


Figure 17. Leg pain according to the visual analog scale (VAS) pre- and postoperatively in patients operated on for lumbar disc herniation (%).

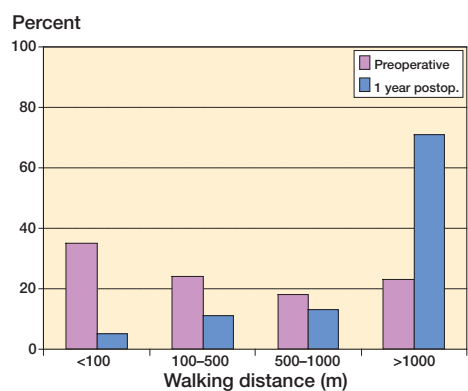


Figure 18. Walking capacity (patient estimated) before and 12 months after surgery for lumbar disc herniation.

rienced by the patients: Painfree 24%, almost painfree 48%, somewhat improved 15%, unchanged 8% and deteriorated 4%.

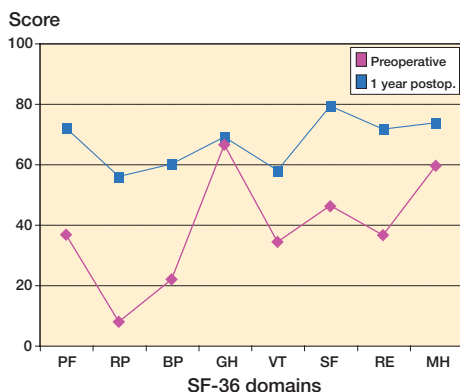


Figure 19. SF-36 scores (mean) pre- and 1 year postoperatively for patients operated on for lumbar disc herniation.

Leg pain as compared to preoperatively, experienced by the patients: Painfree 32%, almost painfree 42%, somewhat improved 18%, unchanged 5% and deteriorated 3%.

Overall patient satisfaction with outcome of surgery: Satisfied 76%, irresolute 17%, dissatisfied 7%.

In all domains of the SF-36, patients with disc herniation experienced improved health related quality of life except for general health (Figure 19). Estimation of health related quality of life according to EuroQol was as follows, EQ-5D mean preoperative value 25, mean postoperative value 70. EQ-VAS preoperatively 44, postoperatively 70.

No difference in patient satisfaction, consumption of analgesics and leg or back pain was seen between the groups of patients operated on with conventional and microscopic technique.

Correlation between preoperative back and leg pain on the VAS scale and one year outcome regarding patient satisfaction was studied. No correlation was seen (Figure 20)

Central spinal stenosis

One-year follow-up has been completed by totally 2 346 patients operated on for central spinal stenosis. Gender: 45% men, 55% women. Mean age was 68 (21–90) years. Surgical procedure: Decompression only 79%, decompression + posterolateral instrumented fusion 13%, decompression + posterolateral uninstrumented fusion 3%, posterolateral instrumented fusion only 3%.

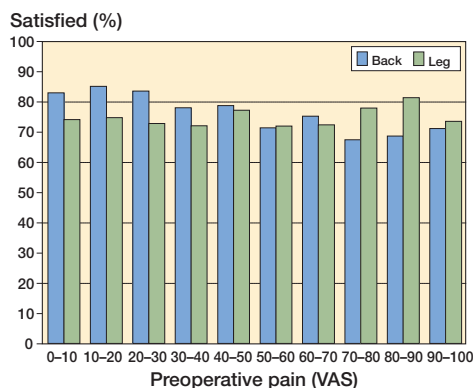


Figure 20. Correlation between preoperative back and leg pain and patient satisfaction at one year postoperatively.

Preoperative mean back pain according to the visual analogue scale was 58 and corresponding value one year postoperatively 33. For leg pain the corresponding figures were: preoperatively 64, postoperatively 32. Figures 21 and 22 demonstrate the distribution of pain estimation by the patients on the visual analogue scale concerning back and leg pain.

Consumption of analgesics one year postoperatively: Regular 27%, intermittent 40%, no consumption 33%.

Walking distance one year postoperatively: <100 m 18%, 100–500 m 25%, 500 m – 1 km 18% and >1 km 39% (Figure 23).

Back pain as compared to preoperatively, experienced by the patients: Painfree 18%, almost painfree 41%, somewhat improved 22%, unchanged 11% and deteriorated 7%.

Leg pain as compared to preoperatively, experienced by the patients: Painfree 27%, almost painfree 32%, somewhat improved 19%, unchanged 11% and deteriorated 11%.

Overall patient satisfaction with outcome of surgery: Satisfied 68%, irresolute 24%, dissatisfied 8%.

In all domains of the SF-36, patients with central spinal stenosis experienced improved health related quality of life except for general health (Figure 24). Improvement, however, is less marked than for patients with disc herniation when correlation for age is not performed. Estimation of health related quality of life according to EuroQol was as follows, EQ-5D mean preoperative value 31, mean postoperative value 59. EQ-VAS preoperatively 46, postoperatively 62.

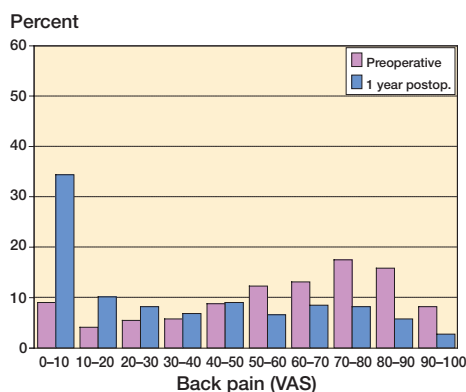


Figure 21. Back pain according to visual analog scale (VAS) pre- and postoperatively in patients operated on for central spinal stenosis (%).

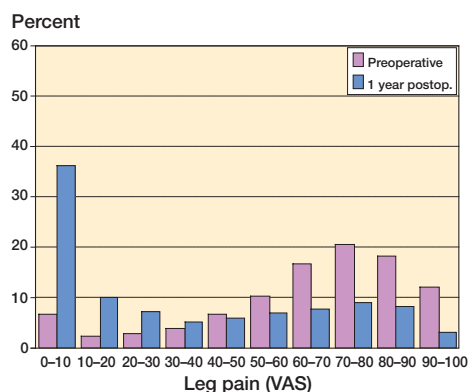


Figure 24. SF-36 scores (mean) pre- and postoperatively for patients operated on for central spinal stenosis.

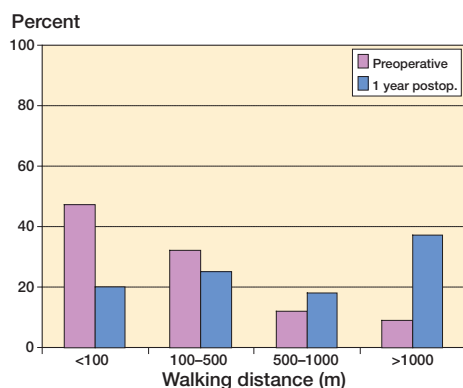


Figure 23. Walking capacity (patient estimated) before and 12 months after surgery for central spinal stenosis.

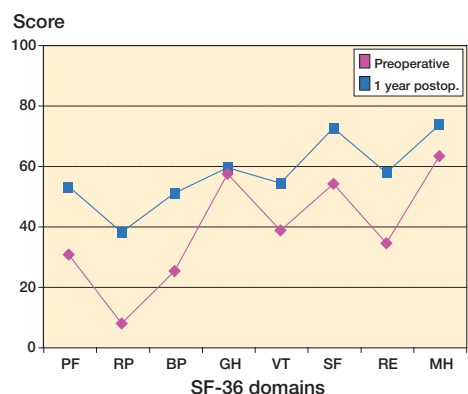


Figure 22. Leg pain according to visual analog scale (VAS) pre- and postoperatively in patients operated on for central spinal stenosis (%).

Lateral spinal stenosis

One-year follow-up has been completed by totally 540 patients operated on for lateral spinal stenosis. Gender: 52% men, 48% women. Mean age was 58 (27–89) years.

Surgical procedure: Decompression only 82%, decompression + posterior instrumented fusion 11%, decompression + posterior uninstrumented fusion 2%.

Preoperative mean back pain according to the visual analogue scale was 56 and corresponding value one year postoperatively 40. For leg pain the corresponding figures were: preoperatively 65, postoperatively 44. Figures 25 and 26 demonstrate the distribution of pain estimation by the patients on the visual analogue scale concerning back and leg pain.

Consumption of analgesics one year postoperatively: Regular 37%, intermittent 37%, no consumption 26%.

Walking distance one year postoperatively: <100 m 16%, 100–500 m 22%, 500 m – 1 km 19% and >1 km 42% (Figure 27).

Back pain as compared to preoperatively, experienced by the patients: Painfree 12%, almost pain-free 32%, somewhat improved 26%, unchanged 20% and deteriorated 7%.

Leg pain as compared to preoperatively, experienced by the patients: Painfree 15%, almost pain-free 29%, somewhat improved 19%, unchanged 21% and deteriorated 14%.

Overall patient satisfaction with outcome of surgery: Satisfied 55%, irresolute 31%, dissatisfied 14%.

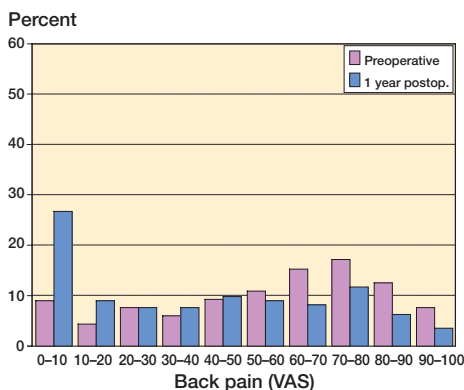


Figure 25. Back pain according to the visual analog scale (VAS) pre- and postoperatively in patients operated on for lateral spinal stenosis (%).

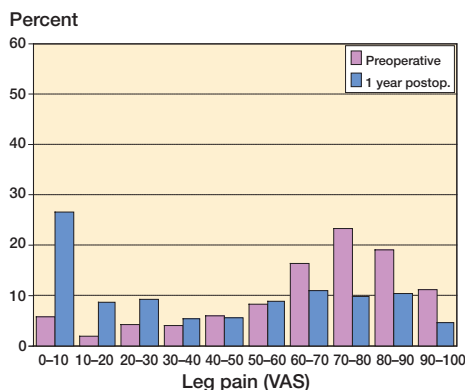


Figure 26. Leg pain according to the visual analog scale (VAS) pre- and postoperatively in patients operated on for lateral spinal stenosis (%).

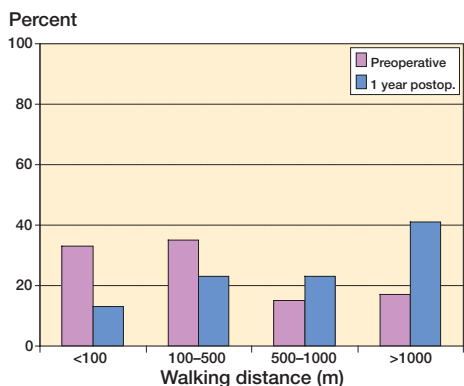


Figure 27. Walking capacity (patient estimated) before and 12 months after surgery for lateral spinal stenosis.

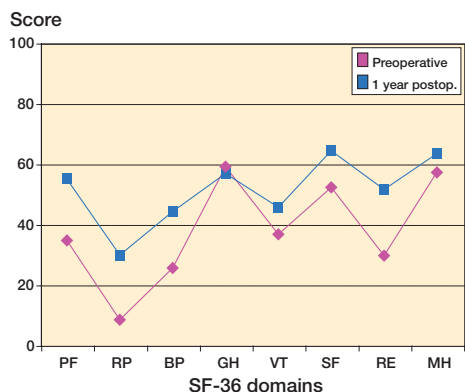


Figure 28. SF-36 scores (mean) pre- and postoperatively for patients operated on for lateral spinal stenosis.

Also the group of patients operated on for lateral spinal stenosis showed improvement in all aspects except for general health although to a less pronounced extent. In all domains of the SF-36, patients with lateral spinal stenosis experienced improved health related quality of life except for general health (Figure 28). Improvement, however, is less marked than for patients with disc herniation when correlation for age is not performed. Estimation of health related quality of life according to EuroQol was as follows, EQ-5D mean preoperative value 28, mean postoperative value 52. EQ-VAS preoperatively 49, postoperatively 58.

Spondylolisthesis

One-year follow-up has been completed by totally 432 patients operated on for spondylolisthesis.

Gender: 45% men, 55% women. Mean age was 45 (13–84) years. Surgical procedure: Decompression + posterolateral instrumented fusion 36%, posterolateral instrumented fusion only 25%, anterior fusion with implant 11%, decompression + posterior uninstrumented fusion 11%, posterior uninstrumented fusion 8%, decompression only 4%.

Preoperative mean back pain according to the visual analogue scale was 59 and corresponding value one year postoperatively 31. For leg pain the corresponding figures were: preoperatively 54, postoperatively 30. Figures 29 and 30 demonstrate the distribution of pain estimation by the patients on the visual analogue scale concerning back and leg pain.

Consumption of analgesics one year postoperatively: Regular 21%, intermittent 36%, no consumption 43%.

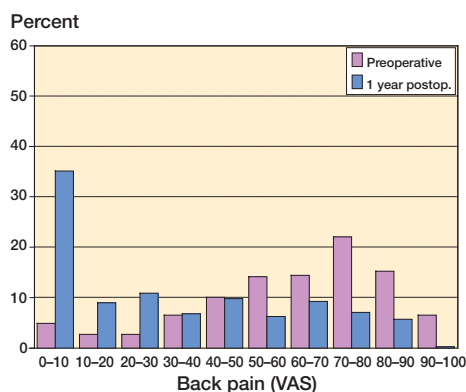


Figure 29. Back pain according to the visual analog scale (VAS) pre- and postoperatively in patients operated on for spondylolisthesis (%).

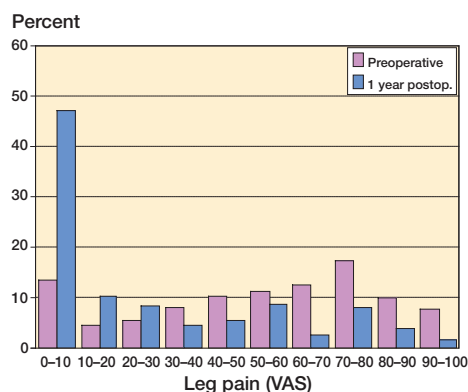


Figure 30. Leg pain according to visual analog scale (VAS) pre- and postoperatively in patients operated on for spondylolisthesis (%).

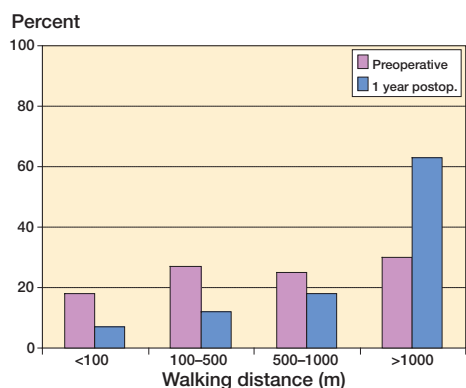


Figure 31. Walking capacity (patient estimated) before and 12 months after surgery for spondylolisthesis.

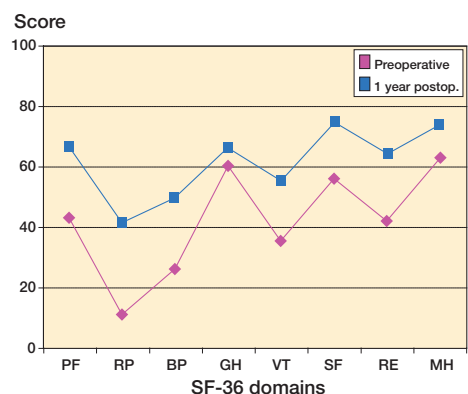


Figure 32. SF-36 scores (mean) pre- and postoperatively for patients operated on for spondylolisthesis.

Walking distance one year postoperatively: <100 m 3%, 100–500 m 11%, 500 m – 1 km 18% and >1 km 68% (Figure 31).

Back pain as compared to preoperatively, experienced by the patients: Painfree 13%, almost painfree 49%, somewhat improved 19%, unchanged 13% and deteriorated 5%.

Leg pain as compared to preoperatively, experienced by the patients: Painfree 23%, almost painfree 39%, somewhat improved 17%, unchanged 14% and deteriorated 6%.

Overall patient satisfaction with outcome of surgery: Satisfied 67%, irresolute 23%, dissatisfied 10%.

Health related quality of life according to the SF-36 score showed a pronounced improvement postoperatively for patients operated on for spondylolisthesis.

In all domains of the SF-36, patients with spondylolisthesis experienced improved health related quality of life except for general health (Figure 32). Improvement, however, is less marked than for patients with disc herniation when correlation for age is not performed. Estimation of health related quality of life according to EuroQol was as follows, EQ-5D mean preoperative value 33, mean postoperative value 57. EQ-VAS preoperatively 49, postoperatively 64.

DDD/segmental pain

One-year follow-up has been completed by totally 671 patients operated on for DDD/segmental pain. Gender: 45% men, 55% women. Mean age was 45 (21–83) years.

Surgical procedure: Posterior instrumented

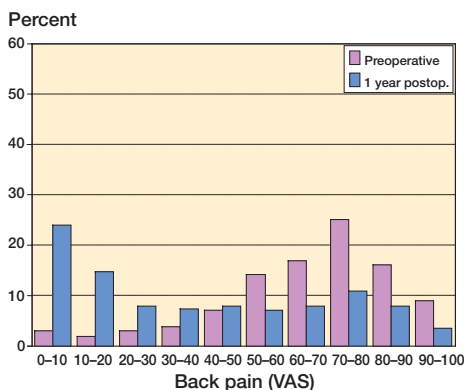


Figure 33. Back pain according to the visual analog scale (VAS) pre- and postoperatively in patients operated on for DDD/segmental pain (%).

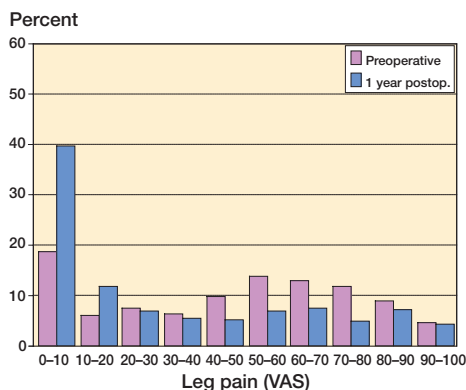


Figure 34. Leg pain according to the visual analog scale (VAS) pre- and postoperatively in patients operated on for DDD/segmental pain (%).

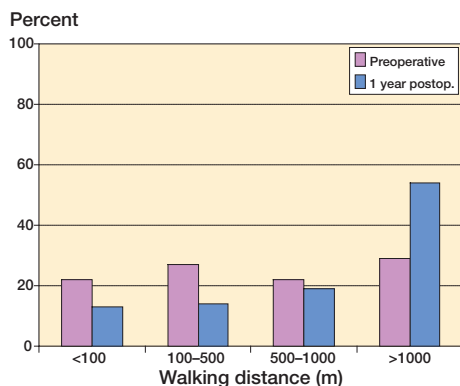


Figure 35. Walking capacity (patient estimated) before and 12 months after surgery for DDD/segmental pain.

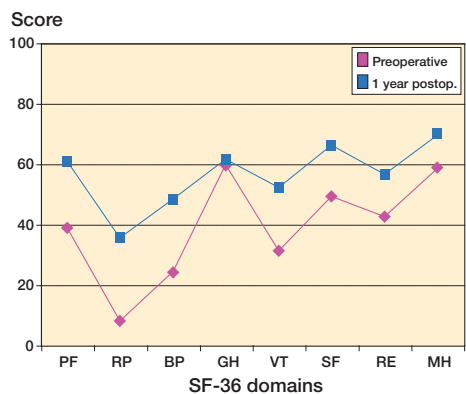


Figure 36. SF-36 scores (mean) pre- and postoperatively for patients operated on for DDD/segmental pain.

fusion 41%, anterior instrumented fusion 30%, decompression + posterior instrumented fusion 14%, anterior fusion 5%, posterior uninstrumented fusion 4%.

Preoperative mean back pain according to the visual analogue scale was 63 and corresponding value one year postoperatively 34. For leg pain the corresponding figures were: preoperatively 43, postoperatively 23. Figures 33 and 34 demonstrate the distribution of pain estimation by the patients on the visual analogue scale concerning back and leg pain.

Consumption of analgesics one year postoperatively: Regular 29%, intermittent 37%, no consumption 34%.

Walking distance one year postoperatively: <100 m 11%, 100–500 m 13%, 500 m – 1 km 15% and >1 km 61% (Figure 35).

Back pain as compared to preoperatively, experienced by the patients: Painfree 15%, almost painfree 43%, somewhat improved 20%, unchanged 14% and deteriorated 7%.

Leg pain as compared to preoperatively, experienced by the patients: Painfree 26%, almost painfree 39%, somewhat improved 14%, unchanged 10% and deteriorated 10%.

Overall patient satisfaction with outcome of surgery: Satisfied 72%, irresolute 19%, dissatisfied 9%.

The SF-36 profiles for patients with DDD/segmental pain resemble those of patients operated on for spondylolisthesis and improvement was seen in physical as well as mental domains (Figure 36).

Estimation of health related quality of life according to EuroQol was as follows, EQ-5D mean preoperative value 26, mean postoperative value 57. EQ-VAS preoperatively 42, postoperatively 61.

TWO-YEAR FOLLOW-UP OF LUMBAR SPINE SURGERY IN SWEDEN 2003

In total, two-year follow-up registration exists for 3 528 patients. Of these, 1 523 had been operated for disc herniation, 1 221 for central spinal stenosis, 290 for lateral spinal stenosis, 227 for spondylolisthesis, 267 for DDD/segmental pain and 236 for other disorders. The exact follow-up rate was difficult to estimate due to the fact that during the registration period departments left as well as joined registration. In Table 3 is presented a comparison between pre-, one- and two-year postoperative results. It is notable that changes between one- and two-year follow-up are slight and in no instances statistically significant.

For back as well as leg pain (VAS) the improvement recorded one year postoperatively was mainly retained.

For 3 out of 4 patients operated on for disc herniation the walking distance at follow-up exceeds 1 km and 5% remain at a walking distance <100 m (Table 4).

The walking distance for patients operated on for central spinal stenosis improves but not to an extent comparable to patients with disc herniation (Table 5). In lateral spinal stenosis the postoperative walking distance is slightly better than in central spinal stenosis, however, it has to be born in mind that this might reflect the age of the patients in the respective group (Table 6).

The preoperative walking distance is less afflicted in spondylolisthesis and DDD and the improvement seems to remain stable over time (Tables 7–8).

Consumption of analgesics preoperatively as well as reduction of consumption postoperatively

Table 3. Pain according to the VAS-scale (mean) related to diagnosis preoperatively, 1 and 2 years postoperatively

Diagnosis	Back pain (VAS)			Leg pain (VAS)		
	Pre	1 yr post	2 yrs post	Pre	1 yr post	2 yrs post
Disc herniation	50	26	27	68	23	24
Central stenosis	59	34	36	65	35	38
Lateral stenosis	57	40	41	66	42	43
Spondylolisthesis	62	32	31	53	26	26
DDD/segm. pain	66	39	45	47	32	36

Table 4. Walking distance, disc herniation (%)

Walking distance	Preop.	1 year postop.	2 years postop.
<100 m	36	5	5
100 m – 500 m	24	11	9
500 m – 1 km	18	13	12
>1 km	23	72	74

Table 5. Walking distance, central spinal stenosis (%)

Walking distance	Preop.	1 year postop.	2 years postop.
<100 m	47	20	24
100 m – 500 m	32	25	23
500 m – 1 km	12	18	17
>1 km	9	37	36

Table 6. Walking distance, lateral spinal stenosis (%)

Walking distance	Preop.	1 year postop.	2 years postop.
<100 m	33	13	15
100 m – 500 m	35	23	23
500 m – 1 km	15	22	21
>1 km	18	41	41

Table 7. Walking distance, spondylolisthesis (%)

Walking distance	Preop.	1 year postop.	2 years postop.
<100 m	18	7	7
100 m – 500 m	27	12	16
500 m – 1 km	25	18	14
>1 km	30	63	64

Table 8. Walking distance, DDD/segmental pain (%)

Walking distance	Preop.	1 year postop.	2 years postop.
<100 m	22	13	13
100 m – 500 m	27	14	19
500 m – 1 km	22	19	18
>1 km	29	54	50

Table 9. Consumption of analgesics, disc herniation (%)

Consumption of analgesics	Preop.	1 year postop.	2 years postop.
Regular	55	17	18
Intermittent	32	34	35
No consumption	13	48	47

Table 10. Consumption of analgesics, central spinal stenosis (%)

Consumption of analgesics	Preop.	1 year postop.	2 years postop.
Regular	52	29	32
Intermittent	29	38	38
No consumption	19	33	31

Table 11. Consumption of analgesics, lateral spinal stenosis (%)

Consumption of analgesics	Preop.	1 year postop.	2 years postop.
Regular	52	33	34
Intermittent	31	39	40
No consumption	17	28	26

Table 12. Consumption of analgesics, spondylolisthesis (%)

Consumption of analgesics	Preop.	1 year postop.	2 years postop.
Regular	43	17	21
Intermittent	37	42	37
No consumption	20	41	42

Table 13. Consumption of analgesics, DDD/segmental pain (%)

Consumption of analgesics	Preop.	1 year postop.	2 years postop.
Regular	59	38	46
Intermittent	32	36	36
No consumption	10	26	18

Table 14. Satisfaction with surgery 1 and 2 years postoperatively related to diagnosis (%)

	1 year postop.			2 years postop.		
	S	I	D	S	I	D
Disc herniation	75	18	7	75	17	8
Central stenosis	63	25	12	62	25	14
Lateral stenosis	58	22	20	55	26	19
Spondylolisthesis	71	21	8	69	22	9
DDD/segm. pain	61	25	14	58	25	17

S – satisfied; I – irresolute; D – dissatisfied

Table 15. EQ-5D means preoperatively, 1 and 2 years postoperatively, related to diagnosis

Diagnosis	Preop.	1 year postop.	2 years postop.
Disc herniation	23	67	67
Central stenosis	32	58	57
Lateral stenosis	31	51	53
Spondylolisthesis	34	61	67
DDD/segm. pain	24	59	56

Table 16. EQ-5D health status according to the visual analogue scale (VAS), means

Diagnosis	Preop.	1 year postop.	2 years postop.
Disc herniation	44	69	67
Central stenosis	48	62	61
Lateral stenosis	48	56	57
Spondylolisthesis	48	62	66
DDD/segm. pain	42	59	61

is to some extent diagnosis related. The decrease in consumption one year postoperatively is more or less retained at two years in all diagnostic categories (Tables 9–13).

Also patient-graded satisfaction with the outcome of surgery remains unchanged between one and two years postoperatively. The highest number of satisfied patients is seen in operations for disc surgery and the lowest number in lateral spinal stenosis (Table 14).

Quality of life using the EQ-5D instrument shows, as has been demonstrated in the previous chapter, a strong improvement one year after all

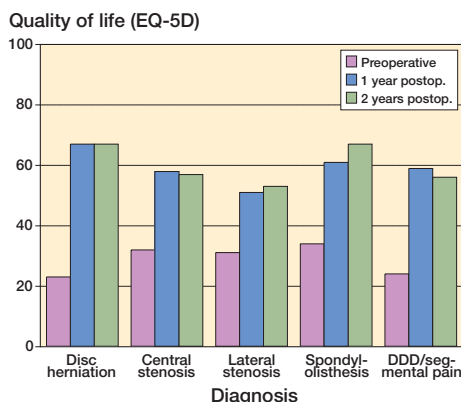


Figure 37. Quality of life pre- and postoperatively over time according to EQ-5D.

surgical procedures, most pronounced for disc herniation surgery. This improvement is maintained over time (Tables 15–16), Figure 37.

CHANGES EXPERIENCED OVER A 6-YEAR PERIOD

During the first 5 years of its existence, the register did not become widely diffused. The first year when registration was performed on a broad basis in the country was 1998, and, thus, demographic data and surgical data now can be studied over a 6-year period in order to see changes and trends. Follow-up data can be studied from the following year, 1999.

The distribution of diagnoses establishing the indication for surgery has changed over time. In 1998, 48% of the operations consisted of disc surgery, a figure which has gradually decreased to 33%. Operations for central spinal stenosis made up for 26% of the operations in 1998 as compared to 32% in recent years. Also the number of operations performed for DDD/segmental pain is slowly increasing (Figure 38).

Mean patient age has been extremely consistent over time (Figure 39), disc herniation patients form the youngest group with a mean age of 43 years and the mean age for patients with spinal stenosis has varied between 67 and 69 years over time.

Concerning gender, males have dominated disc surgery (54–58%) over the years, the figures for central spinal stenosis have been somewhat variable with a trend towards more and more females

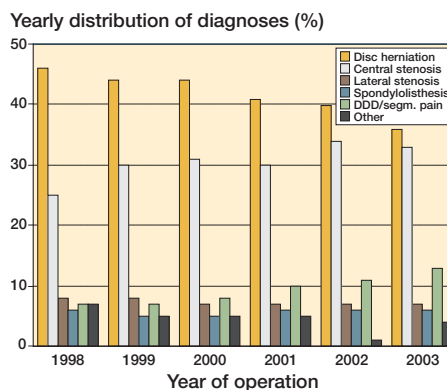


Figure 38. Diagnosis for operation over time.

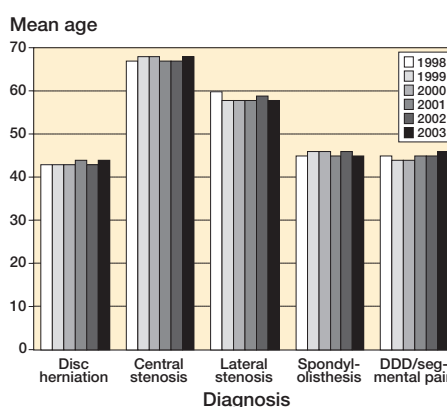


Figure 39. Mean age at the time of operation.

being operated on. Minor changes in general composition in the other diagnostic groups probably can be explained by the smaller patient number in these groups.

Smoking has decreased in Sweden over the last decade and this may be seen as reflected in the rate of smokers among the operated patients in the register. In 1998 35% of disc herniation patients were smokers, a figure which has gradually decreased to 25% in 2003. Correspondingly, a decrease from 23% to 17% among patients with central spinal stenosis has been demonstrated.

The consumption of analgesics is more or less the same over the years, but varies somewhat between the diagnostic groups. Also mean duration of leg pain at surgery is fairly constant, patients with disc herniation having a history of one year, central and lateral spinal stenosis 3 years and spondylolisthesis and DDD 4 years.

Table 17. Back pain according to the visual analogue scale

Diagnosis	1998	1999	2000	2001	2002	2003
Disc herniation	47	50	50	49	49	45
Central stenosis	52	56	59	60	58	55
Lateral stenosis	50	60	54	57	56	56
Spondylolisthesis	53	62	60	61	59	59
DDD/segm. pain	52	67	66	66	64	59

Table 18. Leg pain according to the visual analogue scale

Diagnosis	1998	1999	2000	2001	2002	2003
Disc herniation	66	67	67	67	66	66
Central stenosis	57	60	66	67	63	63
Lateral stenosis	59	67	62	66	66	67
Spondylolisthesis	45	50	55	50	54	56
DDD/segm. pain	38	55	47	45	43	44

Preoperative back pain and leg pain according to the visual analogue scale has shown a slight

Table 19. Proportion of patients reporting no consumption of analgesics postoperatively studied over time (%)

	1999	2000	2001	2002	2003
Disc herniation	51	48	45	47	50
Central stenosis	27	35	33	33	33
Lateral stenosis	33			28	26
Spondylolisthesis	29		40	43	43
DDD/segm. pain	21		31	27	34

decrease over the years in all diagnostic categories (Table 17 and 18).

At one-year follow-up, the proportion of patients who regard themselves as improved concerning leg pain remains fairly unchanged over the years.

Consumption of analgesics probably corresponds fairly well to satisfaction with surgery. In Table 19, the proportion of patients related to diagnostic category, who report no consumption of analgesics at the one-year follow-up is demonstrated. The figure is highest for disc herniation and spondylolisthesis patients and lowest for lateral spinal stenosis patients.

Discussion

This supplementum shows some of the possibilities but also some of the problems with registration of spine surgery on a national basis (Fritzell *et al* 2005). It demonstrates the indications for surgery and the demographics for the patients selected to be fairly stable over time (1998-2003) which might illustrate a unity made possible in a small country, probably also reinforced by the Swedish Society for Spinal Surgery where most Swedish spine surgeons meet yearly and also discuss relevant topics on the web page (www.4s.nu). The number of operations for lumbar spine disorders per inhabitant is most variable throughout the world (Keller *et al.* 1999, Weinstein *et al.* 2004, Lurie *et al.* 2003), and over time (Deyo *et al.* 2005); Sweden seems to hold an intermediate position in this comparison. For the years presented in this study, between 1.7 and 2.1 persons per 10 000 inhabitants have been operated on for lumbar disc herniation, between 1.2 and 1.6 for spinal stenosis and between 0.1 and 0.2 for disc degenerative pain, DDD. In the register data, the relative proportion of surgery for disc herniation seems to decrease slowly while operations for central spinal stenosis and DDD increase in number since 1998. The preoperative duration of symptoms before surgery is notably long for Swedish spine patients. This might in part be influenced by emergency patients not being registered. Another factor that might influence this time lapse is the length of waiting time before surgery which however is not registered. A strong political priority in Sweden currently is to reduce waiting lists, the goal is a guarantee for surgery within 3 months from decision. Whether this political undertaking will affect the preoperative duration of symptoms in the future remains to be seen but certainly is an issue of high interest.

When age and gender for the patients operated on for the main diagnoses are compared with those of larger studies in the literature, similar data are registered with a mean age for disc herniation patients around 40 years (Spangfort 1972, Saruhashi *et al.* 2004, Gibson *et al.* 1999) and for spinal stenosis patients close to 70 years (Jönsson & Strömquist

1999, Jönsson *et al.* 1997, Herno *et al.* 1996). The preoperative data on pain on the VAS scale, consumption of analgesics and walking distance clearly demonstrate that this is a patient group with significant pain and reduced function. This becomes even more evident when quality of life parameters such as SF-36 and EuroQol are studied. It also confirms previous reports that self reported quality of life is very low among patients scheduled for lumbar spine surgery. When compared to other large orthopedic diagnoses for surgery such as hip arthrosis, knee arthrosis and hallux valgus, it is obvious that quality of life is much lower among spine patients, and it is specially striking that the mental domains of the SF-36 are surprisingly much lower than normative data for age and gender.

One important issue when designing a spine register is what parameters to include. In the diagnoses included in the Swedish spine register a very small number of patients are operated on for cauda equina syndrome or progressive paresis whereas the main indication for surgery for the vast majority is pain and to some extent reduced functional capacity. Therefore the parameters included have been selected to illustrate these two aspects. Further pain in the leg and in the back as described on the visual analogue scale is frequently used today and has been judged to be the best indicator for comparison over time in individual patients (Zanoli *et al.* 2001). Consumption of analgesics may also be regarded as a measure of pain level but, also perhaps it may reflect coping. The effect of spinal disorders on health related quality of life prompted us to include the SF-36 questionnaire (Ware *et al.* 1992) which today is the most used in the medical field. In later years we also included the EuroQol (EuroQol Group 1990) mainly because it gives the possibility to calculate health economics in relation to the disorders and their treatment. The organ specific Oswestry disability score (Fairbank *et al.* 1980), ODI, probably is the most sensitive measure of impact on health by a spinal disorder. It was introduced in 2003 and results are to be awaited. A good inter-correlation, however, has been demon-

strated between pain on the visual analogue scale and other pain parameters (Zanoli et al. 2001) and similar studies are made on the various domains of the SF-36 currently as well as a test-retest validation study of the protocol (Zanoli et al. 2005).

The outcome data share the obvious advantage that they are all patient rated. The figures obtained for the different disorders concerning reduction of pain and patient satisfaction with surgery reflect what can be obtained when surgery for degenerative lumbar spine disorders is implemented in clinical practice on a nation-wide basis. Satisfaction rate varies from 59% in lateral spinal stenosis to 76% in disc herniation one year after surgery and remains at the same level at the two-year follow-up. Better results in individual disorders probably can be obtained when few surgeons in super specialized departments report their outcomes (Deyo et al. 1992). Generally speaking, the results obtained at one year postoperatively do not change very much during the second postoperative year. For quality of life on the SF-36 score, it is obvious that the main improvement is seen in the physical domains (except for GH) but improvement in mental domains also is a general feature. The improvement achieved in terms of quality of life as determined by EQ-5D varies between a two- to a three-fold increase, at one year postoperatively and is maintained one year later. The improvement is most striking for disc herniation patients but, perhaps, an equally striking feature is the very low preoperative value in all 5 diagnostic categories.

An interesting finding, presented on page 17 above, is the stability over time (5–6 years) regarding patient selection parameters such as age and VAS pain and also regarding outcome parameters such as VAS pain and consumption of analgesics. Regarding gender, some variation is seen and regarding diagnosis for surgery central spinal ste-

nosis and DDD/segmental pain increase at the cost of disc herniation.

Controversy may exist whether clinical investigation can be completely left out in a register. The relative lack of importance of clinical examination has however been pointed out in recent years (Andersson & Deyo 1996); the most pronounced clinical information seems to be yielded by the SLR test pre- as well as postoperatively (Jönsson & Strömqvist 1999). The possibility to achieve a higher follow-up rate when clinical investigation is excluded, i.e. by questionnaires only, seems to compensate well for this. In clinical practice it would be more or less impossible to see disc and stenosis patients one and two years postoperatively in this large patient material, the completeness of which is very much dependent on the questionnaires being mailed and provided with prepaid return envelopes.

The task of complication analysis is a major issue in the register, however, intense work on registration completeness is required before the presentation of reliable figures.

In conclusion, a one-year report of the Swedish lumbar spine register has been presented. A high participation rate, showing the effect of lumbar spine surgery when implemented in clinical practice, has been achieved. The register gives an overview over indications and outcomes over time and may also serve in identifying areas needing more specific and deeper analysis. In all diagnostic categories, improvement in HRQoL after surgery as determined by SF-36 and EuroQoL is pronounced. At present, work is directed towards inclusion of all surgical spine procedures containing a core data set and various disease specific data (tumour, fracture, deformity, cervical etc). Further collaboration with the Spine Society of Europe register, Spine-Tango, is being negotiated.

Participating departments 2003

Borås,
Danderyd,
Eskilstuna,
Falun,
Gävle,
Göteborg,
Halmstad,
Helsingborg,
Huddinge,
Jönköping,
Kalmar,
Karlskoga,
Karlstad,
Lund,
Malmö,
Motala,
Norrköping,
Oskarshamn,
Simrishamn,
Skene,
Skövde,
S:t Görans Sjukhus AB, Stockholm,
Karolinska sjukhuset, Stockholm,
Södersjukhuset, Stockholm,
Strängnäs,
Sundsvall,
Uddevalla,
Umeå,
Stockholm Spine Center,
Upplands Väsby,
Akademiska sjukhuset, Uppsala,
Axess Elisabeth Sjukhuset AB, Uppsala,
Varberg,
Västervik,
Ängelholm,
Örebro,
Östersund

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