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Introduction

The current presentation includes lumbar spine operations performed within the registry framework during 2010 and follow-ups 1, 2 and 5 years after surgery up to and including the same year. This is the 12th yearly report presented and the number of registered performed operations has increased once again, amounting to 6 992 for 2010.

The separate chapter on analysis is focused on isthmic spondylolisthesis and contains preoperative as well as outcome data.

This is the first time that basic demographic data from other diagnostic groups can be presented, so far with follow-up data only for degenerative cervical disorders as these diagnostic groups were introduced in 2008. In addition to data on degenerative cervical spine surgery, also some basic data on metastasis and fracture surgery are presented. Hopefully these data will be expanded and provide interesting data to evaluate in the future.

On behalf of the Swedish Society of Spinal Surgeons and the Register Group of Swespine

September 30, 2011

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I. Pre- and peroperative data on lumbar spine surgical procedures performed in 2010

The register contains in total 6 992 patients operated on for degenerative lumbar spine disorders from totally 36 departments in Sweden.2010. Last year's report on operations from 2009 contained 5 639 patients from 37 departments.

Indication for surgery in patients operated on in 2010 was: Disc herniation 29%, central spinal stenosis 45%, lateral spinal stenosis 7%, spondylolisthesis 5%, DDD/Segmental pain (disc degenerative disorder) 10% and others 4%, see Figure 1.

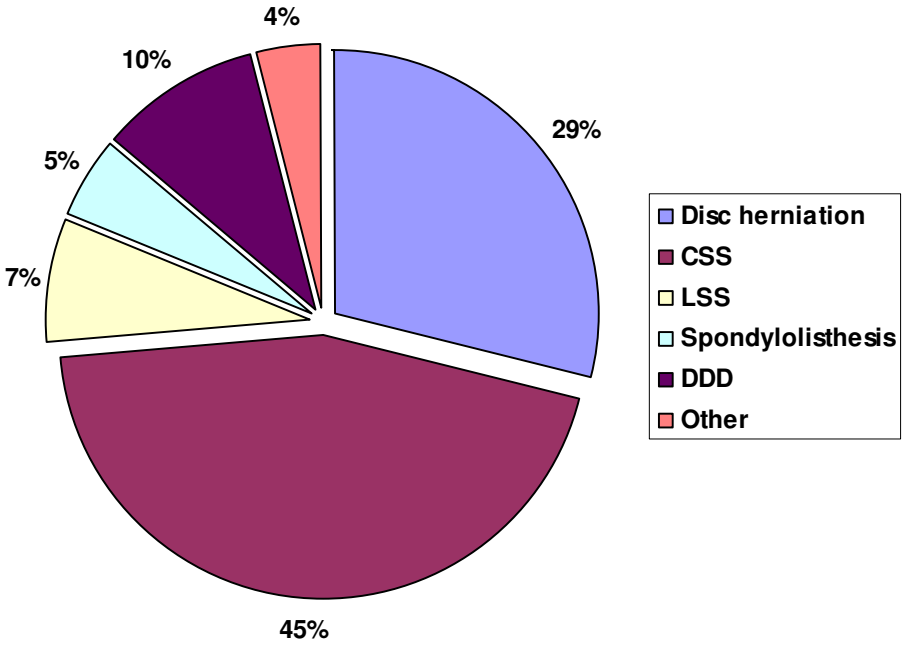

Fig 1. Indication for surgery according to diagnosis in 6 992 patients operated on in 2010.

Below are presented demographic preoperative patient reported data and surgical data for patients operated on in 2010. Every variable contains some missing data and these are not included in the percent calculations.

Lumbar disc herniation

Demographica data

For 2010, 2 027 operations for lumbar disc herniation were registered. 56% of the patients were male and 44% female. The proportion of smokers was 18%. Mean age was 44 (13–90) years. The age distribution is seen in Figure 2.

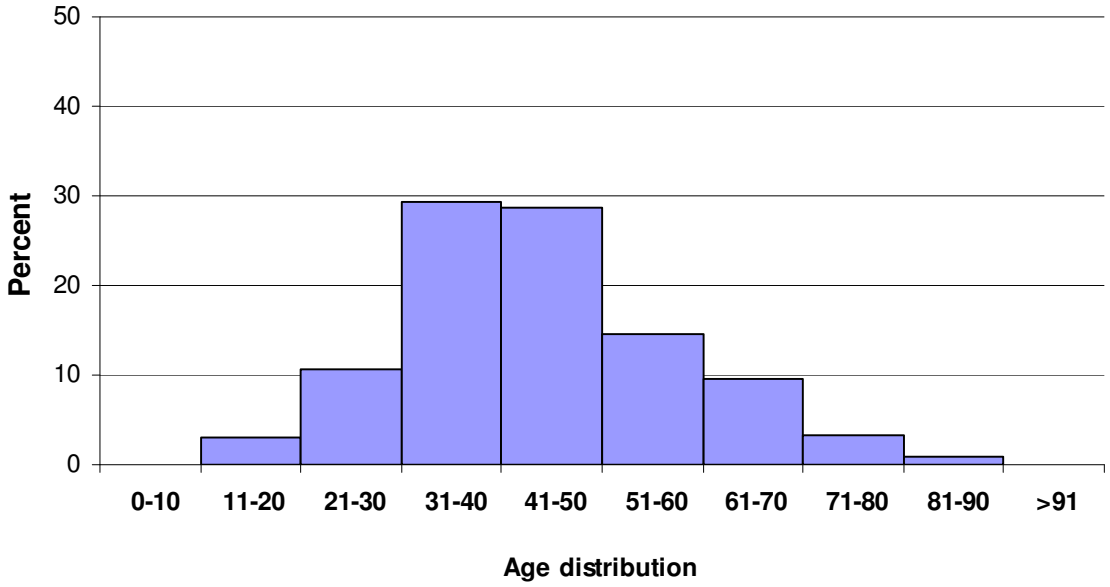

Fig 2. Age distribution for patients operated on for lumbar disc herniation, n = 2 027.

For 89% of the patients the disc herniation operation was their first lumbar spine operation while 11% had undergone spine surgery previously.

Preoperative duration of back pain was as follows: 6% had no back pain, 11% had less than 3 months duration of back pain, 49% 3-12 months, 14% 1-2 years and 21% more than 2 years. Preoperative duration of leg pain/sciatica was as follows: 1% had no leg pain, 16% had had leg pain for less than 3 months, 56% of the patients 3-12 months, 13% of the patients 1-2 years and for 14% of the patients more than 2 years at the time of surgery. Mean back pain on the VAS scale was 46 (0-100), Figure 3. Mean leg pain on the VAS scale was 66 (0–100), Figure 4.

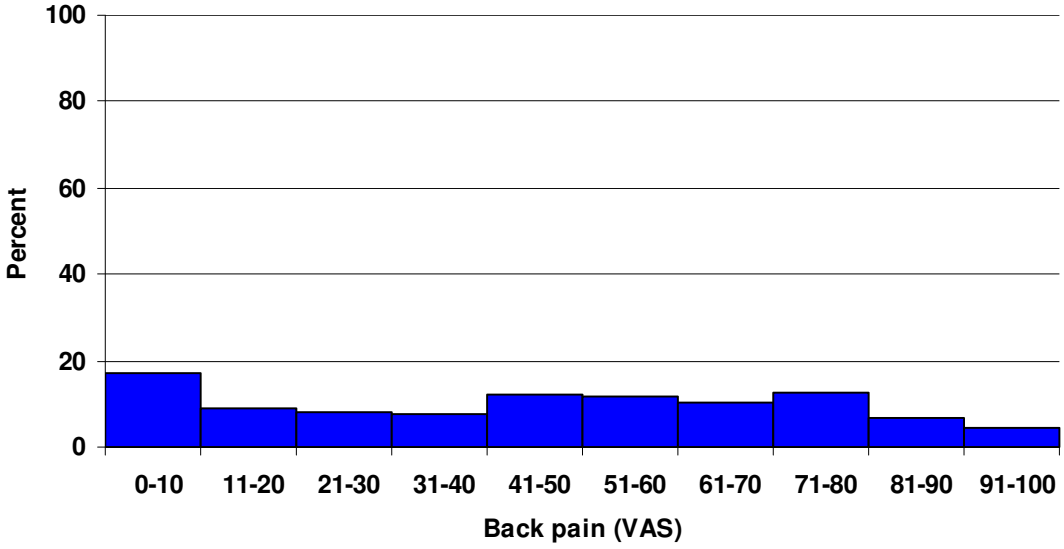

Fig 3. Back pain on the visual analog scale preoperatively in patients operated on for lumbar disc herniation (%).

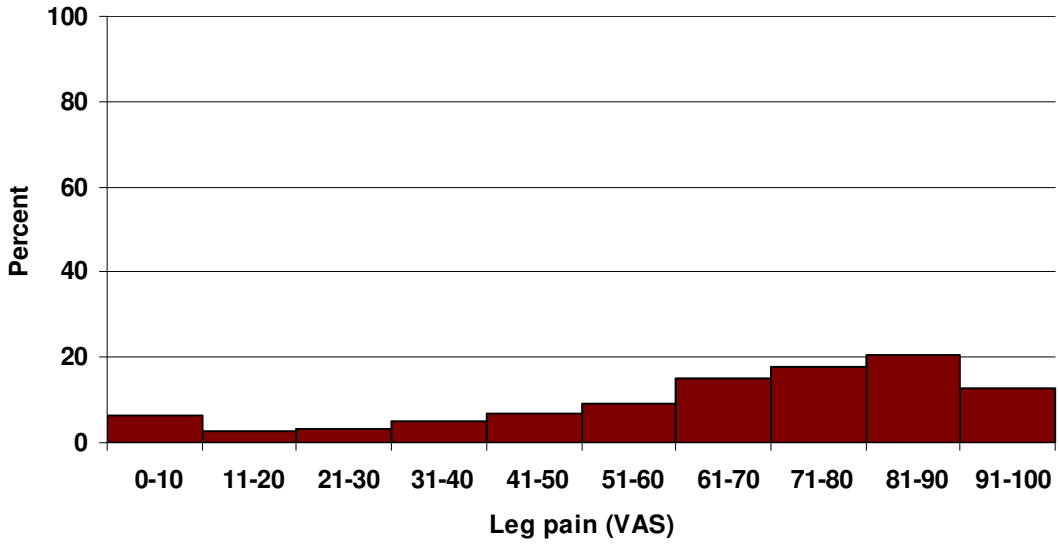

Fig 4. Leg pain on the visual analog scale preoperatively in patients operated on for lumbar disc herniation (%).

61% of the patients reported regular consumption of analgesics before surgery, intermittent consumption was reported by 28% while 12% of the patients did not consume analgesics.

Walking distance was estimated to <100 m for 31% of the patients, 100-500 m for 21% of the patients, 500 – 1000 m for 16% of the patients and 32% had a walking distance exceeding 1000 m.

Surgical data

Conventional open disc surgery was performed in 45% of the cases and microscopic disc surgery in 44%. The remaining operations consisted of different combinations of especially decompressive procedures for patients with disc herniation in a stenotic spine. Mean time for hospitalization (time from admittance to discharge) was 2.84 (0-30) days for patients for both conventional and microscopic disc surgery.

Central spinal stenosis

Demographic data

In total 3 119 operations for central spinal stenosis were registered during 2010. 45% of the patients were males and 55% females. Mean age was 68 (18-95) years. The age distribution is presented in Figure 5.

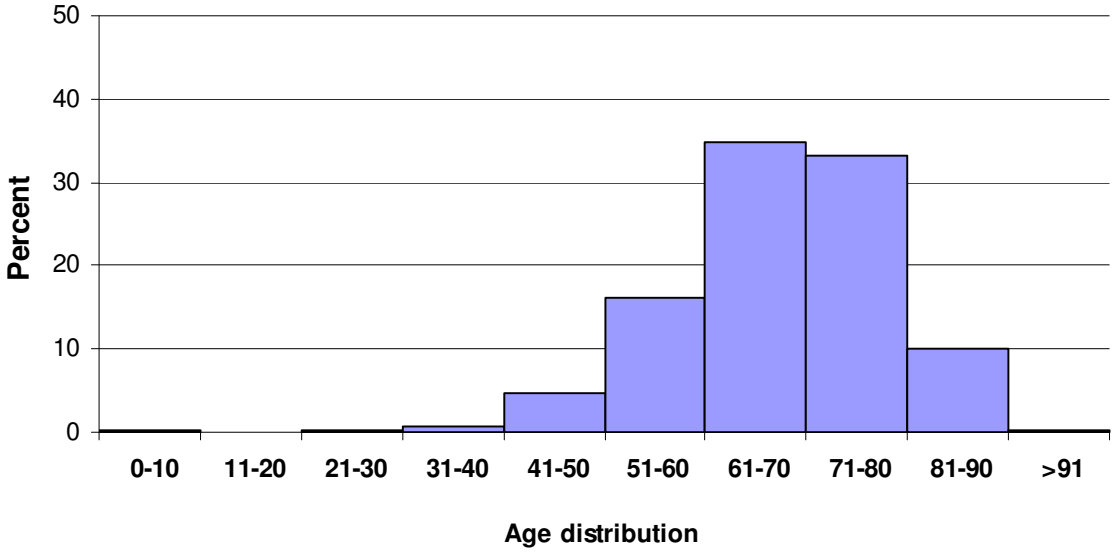

Fig 5. Age distribution for patients operated on for central spinal stenosis, n = 3 119 patients.

The proportion of smokers was 13% in patients operated on for CSS. 81% of the patients had not been subjected to spine surgery before while 19% had undergone 1-3 previous operations.

Preoperative back pain was as follows: 5% of the patients had no back pain, 1% had problems less than 3 months, 17% 3-12 months, 21% 1-2 years and 55% related back pain for more than 2 years before surgery. Corresponding figures for leg pain were: 3% had no leg pain, 2% had less than 3 months' duration of leg pain, 24% 3-12 months, 29% 1-2 years and 42% more than 2 years' duration of leg pain at the time of surgery.

Mean back pain on the VAS scale was 56 (0-100) and mean leg pain/sciatica (VAS) was 63 (0-100) The distribution regarding patient related VAS preoperative pain is presented in Figures 6 and 7.

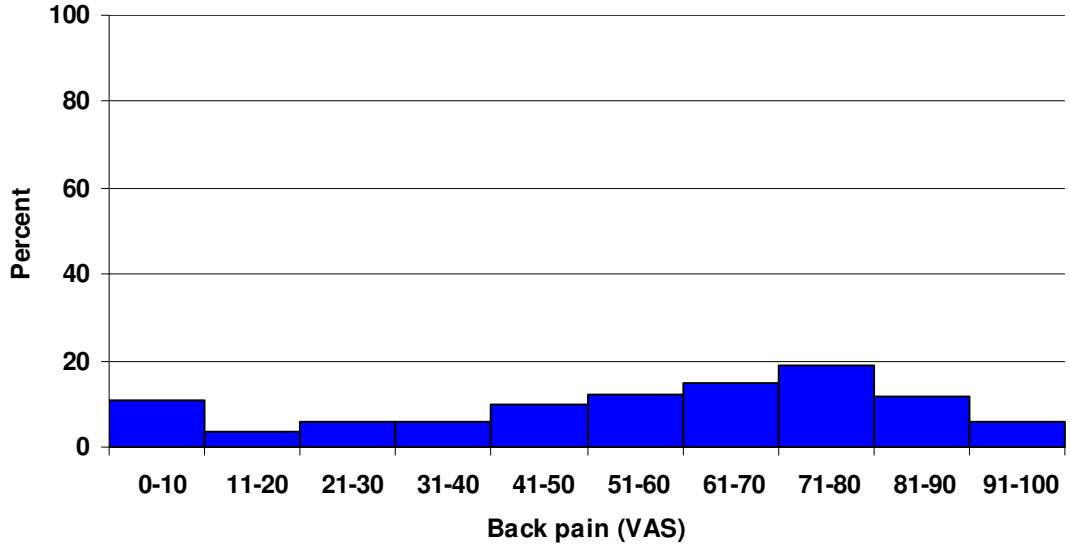

Fig 6. Back pain on the visual analog scale preoperatively in patients with central spinal stenosis (%).

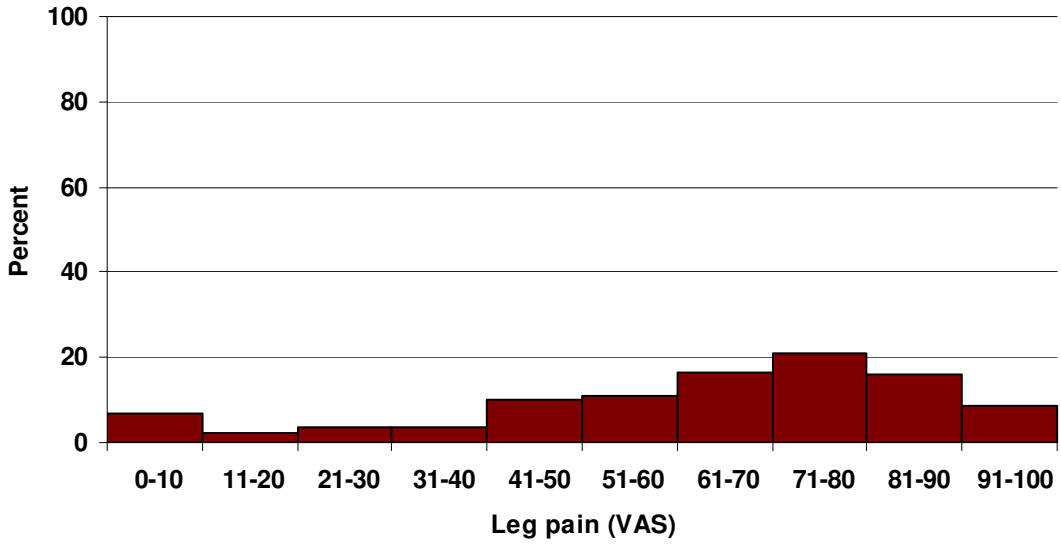

Fig 7. Leg pain on the visual analog scale preoperatively in patients with central spinal stenosis (%).

55% of the patients with central spinal stenosis consumed analgesics regularly preoperatively, 29% intermittently and 16% did not consume analgesics.

The walking distance was less than 100 m for 43% of the patients, 100-500 m for 31% of the patients, 500-1000 m for 14% of the patients and only 13% had a walking distance exceeding 1000 m.

Surgical data

For 68% of the patients decompressive surgery was the sole procedure, 48% of which were operated on with conventional open surgery and 19% microscopically. Decompression combined with posterior instrumented fusion constituted 24% of the operations, decompression combined with posterior non-instrumented fusion 3% and decompression + TLIF 1% of the operations. For 5% of the patients other procedures were utilized.

Mean time of hospitalization was 4.7 (0-30) days.

Lateral spinal stenosis

Demographic data

In total 518 patients operated on for lateral spinal stenosis were registered for 2010. 50% of the patients were males and 50% females. 20% of the patients were smokers.

The mean age was 61 (26–88) years. Age distribution is presented in Figure 8.

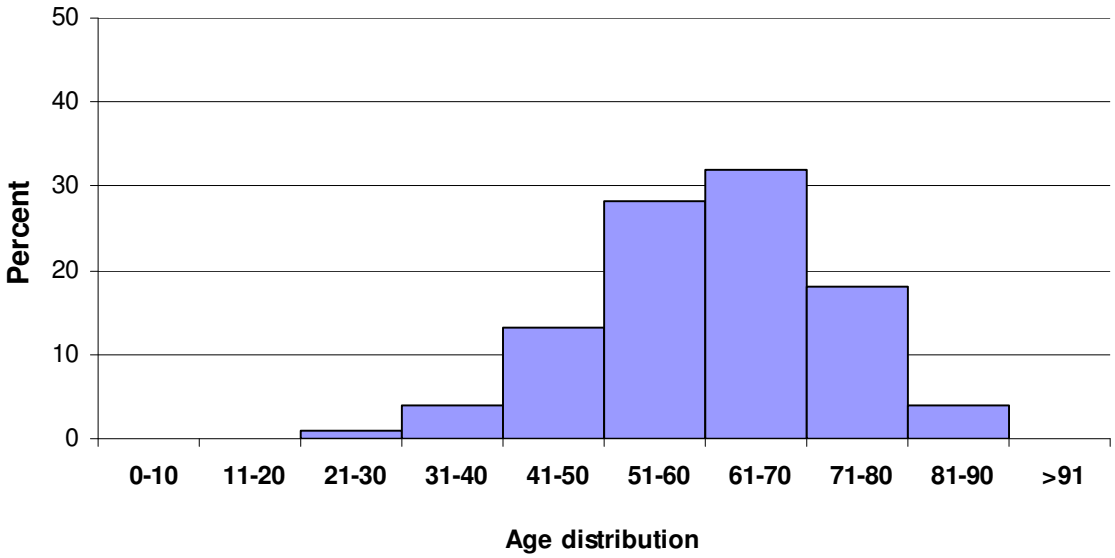

Fig 8. Age distribution for patients operated on for lateral spinal stenosis, n = 518 patients.

The majority of patients with lateral spinal stenosis, 75%, had had no previous spine surgery while 25% had been operated on one or more times before the current procedure.

Preoperative duration of back pain was as follows: 7% denied back pain, 1% had had back pain for less than 3 months, 17% for 3-12 months, 22% for 1-2 years and 53% had had back pain exceeding 2 years before surgery. Corresponding figures for leg pain/sciatica were: 2% had no leg pain, 2% had less than 3 months duration of leg pain, 23% 3-12 months, 30% 1-2 years and 42% more than 2 years duration of leg pain at the time of surgery. Mean back pain on the VAS scale was 53 (0-100) and mean leg pain on the VAS scale 65 (0-99), Figures 9 and 10.

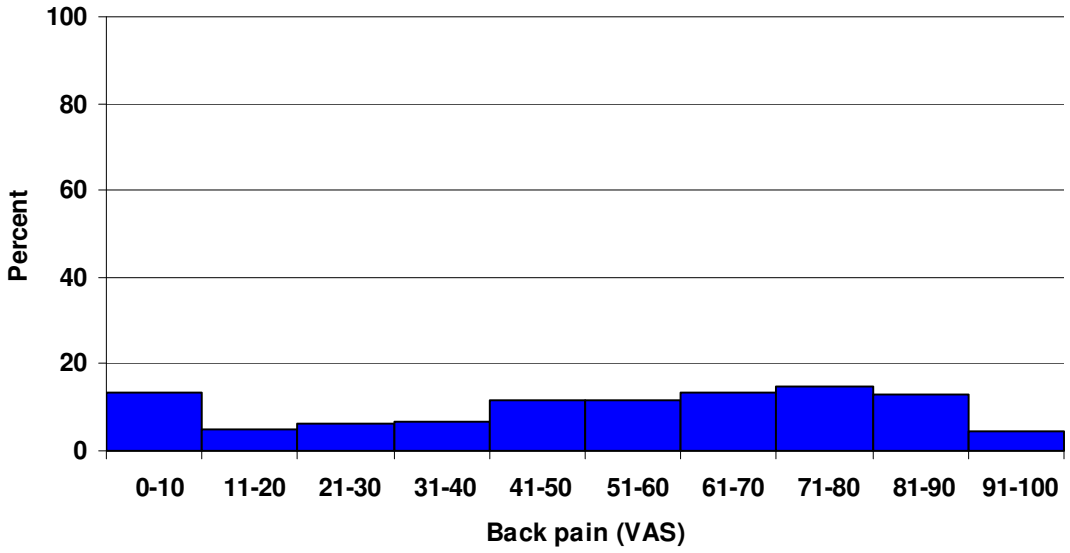

Fig 9. Back pain on the visual analog scale preoperatively in patients operated on for lateral spinal stenosis (%).

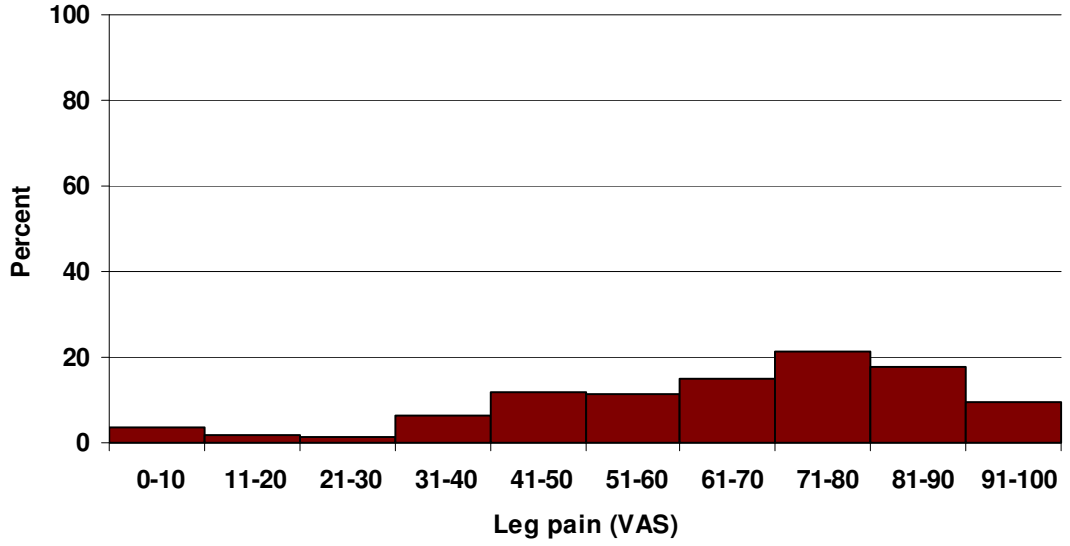

Fig 10. Leg pain on the visual analog scale preoperatively in patients operated on for lateral spinal stenosis (%).

Regular consumption of analgesics was reported by 56% of the patients, intermittent by 28% and no consumption at all by 16% of the patients. The majority of patients had limited walking ability, 32% less than 100 m, 32% 100–500 m, 15% 500 m–1000 m and only 21% had a walking distance exceeding 1000 m.

Surgical data

The vast majority of procedures performed in this patient group was decompressive surgery, 69%, of which 49% conventionally and 20% microscopically. 17% had decompression + posterior instrumented fusion, and 5% decompression + TLIF. Mean hospitalization time was 3.76 (0-30).

Spondylolisthesis

Demographic data

In total 361 patients 45% of which were males and 55% females, were reported for 2010. 10% of these patients were smokers. Mean age was 50 (11–83) years and the age distribution is presented in Figure 11.

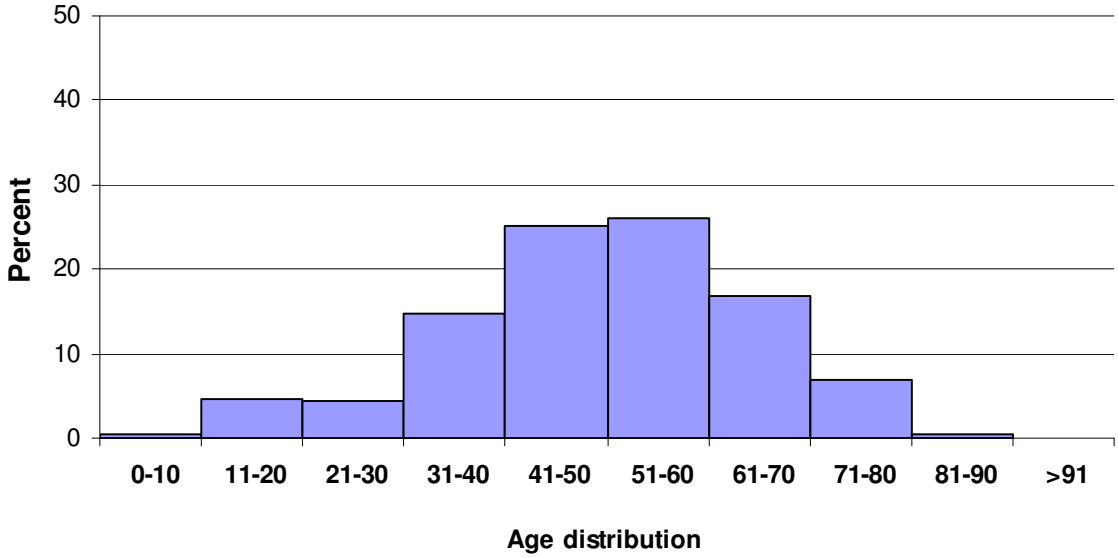

Fig 11. Age distribution for patients operated on for spondylolisthesis, n = 361 patients.

For 88% of the patients the current procedure was their first operation on the lumbar spine while the remainder had one or two previous procedures.

Preoperative duration of back pain was as follows: 1% had no back pain, 1% with spondylolisthesis had back pain for less than 3 months, 10% for 3-12 months, 19% for 1-2 years and 69% for more than 2 years before surgery. Corresponding figures for leg pain/sciatica were as follows: 8% had no leg pain, 2% had less than 3 months duration of leg pain, 15% 3-12 months, 29% 1-2 years and 47% more than 2 years duration of leg pain at the time of surgery.

Preoperative back pain on the VAS scale was 60 (0-100) and leg pain 52 (0-100). The distribution of pain on the VAS scale is presented in Figures 12 and 13.

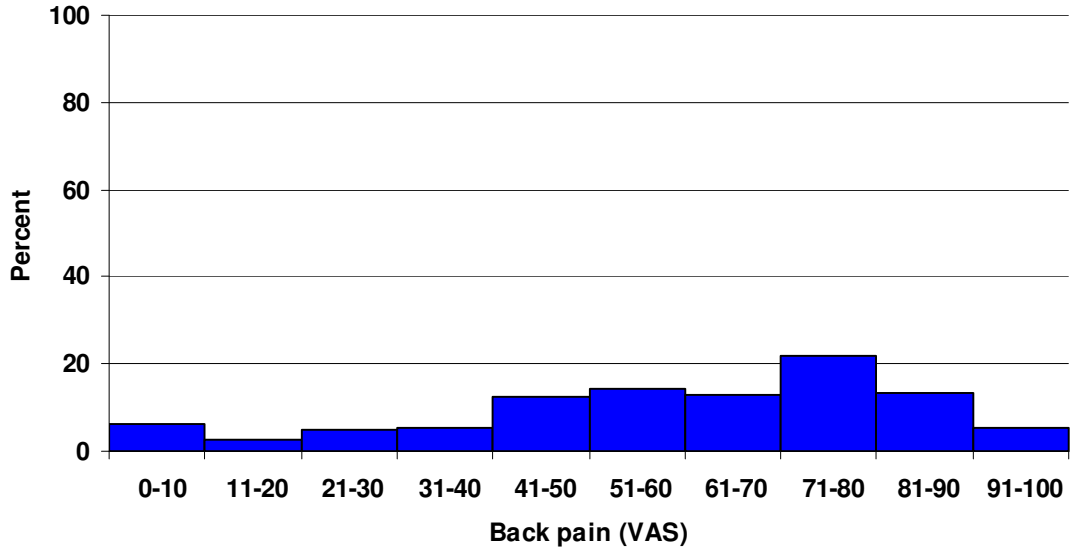

Fig 12. Back pain preoperatively on the visual analog scale scale in patients with spondylolisthesis (%).

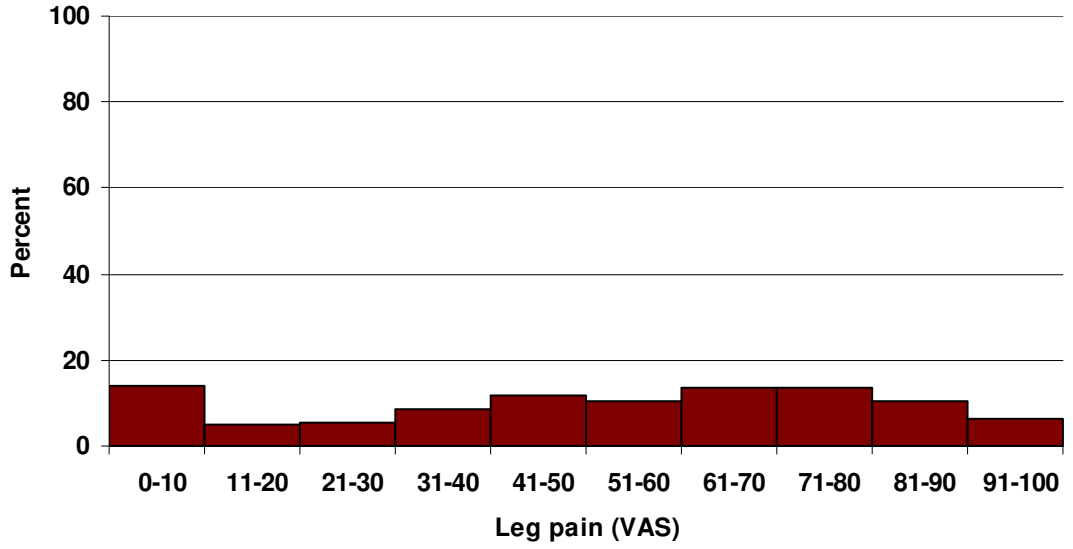

Fig 13. Leg pain preoperatively on the visual analog scale in patients with spondylolisthesis (%).

Regular consumption of analgesics was reported by 50% of the patients, intermittent by 31% and no consumption by 19% of the patients operated on for spondylolisthesis.

Walking distance was estimated to less than 100 m for 19% of the patients, 100-500 m for 27% of the patients, 500-1000 m for 20% of the patients and exceeding 1000 m for 34% of the patients.

Surgical data

In patients with spondylolisthesis, varying surgical procedures were undertaken, the most common as follows: decompression + instrumented fusion 56%, posterior instrumented fusion only 17%, PLIF instrumented or non-instrumented 10%, decompression + TLIF 5%, decompression + PLIF 4%, decompression + non-instrumented fusion 3%, posterior non-instrumented fusion 1% and various decompressive procedures for the remainder.

Mean hospitalization time was 5.8 (1-28) days.

DDD/segmental pain

Demographic data

During 2010, 692 patients were registered for surgical intervention for DDD. 48% of the patients were males and 52% females. The proportion of smokers was 12%. Mean age was 46 (18–80) years and the age distribution is presented in Figure 14.

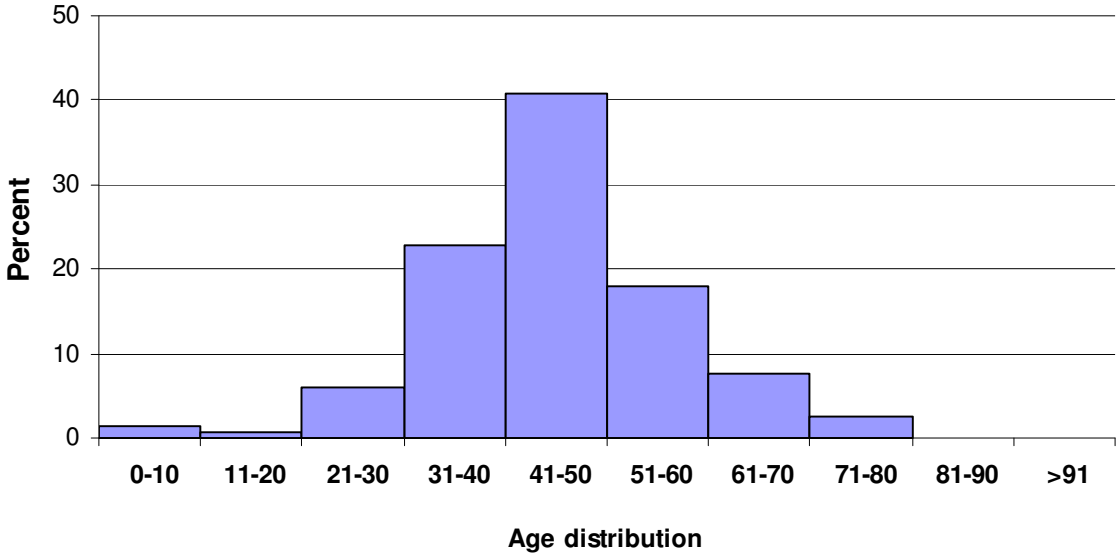

Fig 14. Age distribution for patients operated on for DDD, n = 692 patients.

In this group of patients significantly more patients had had previous operations than in the other diagnostic categories, the current procedure was the first operation for 68% while 32% had been operated on one or more times previously.

Preoperative duration of back pain in the patients with DDD was as follows: 0.3% had no back pain, 1% had had back pain for less than 3 months, 11% for 3-12 months, 14% for 1-2 years and 75% for more than 2 years. Corresponding figures for leg pain were: 17% had no leg pain, 2% had less than 3 months duration of leg pain, 18% 3-12 months, 14% 1-2 years and 50% more than 2 years duration of leg pain at the time of current procedure.

Distribution of back and leg pain on the VAS scale is shown in Figures 15 and 16 and mean back pain was 62 (0-100) and mean leg pain 42 (0-100).

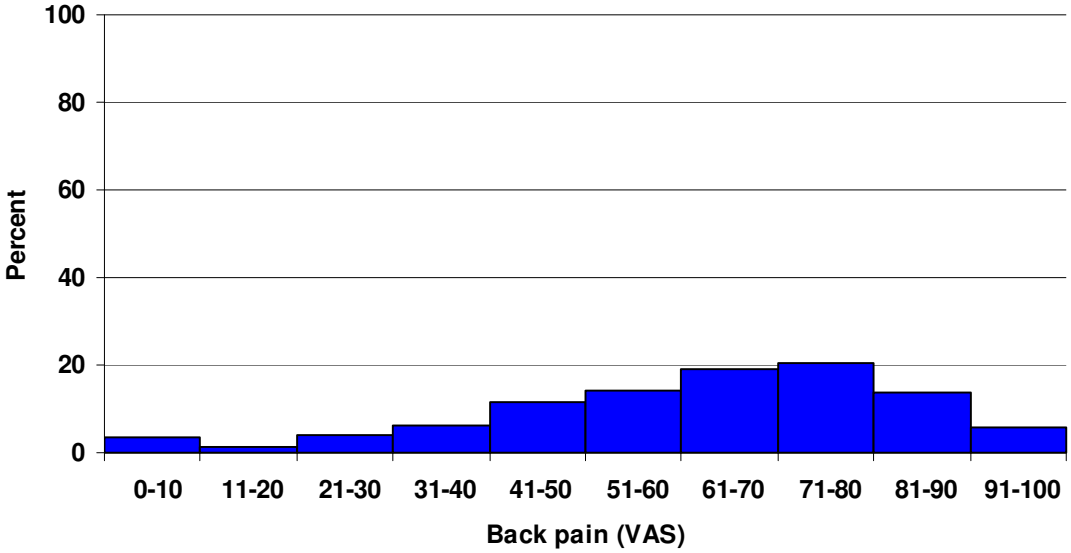

Fig 15. Back pain preoperatively on the visual analog scale in patients with DDD (%).

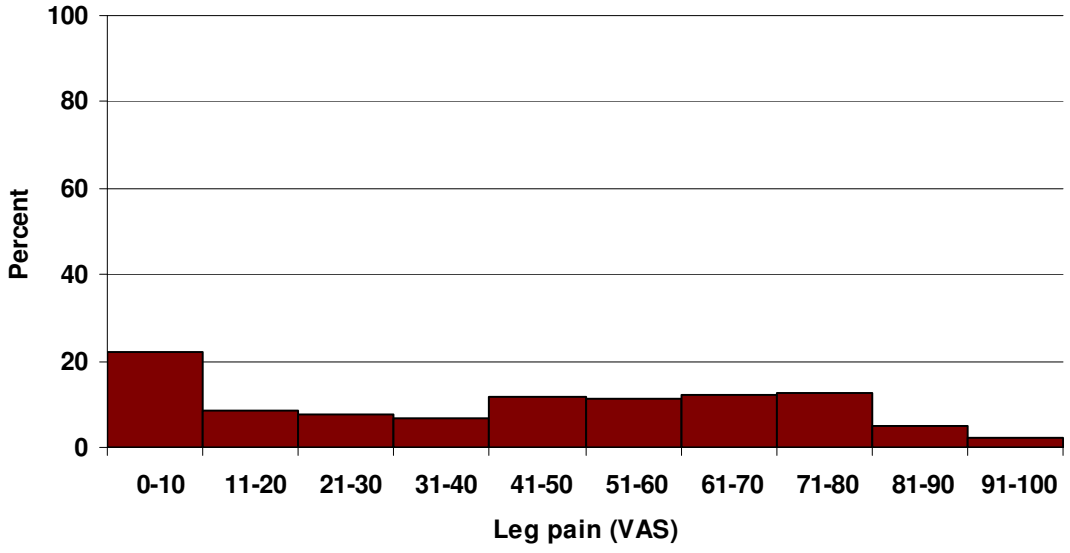

Fig 16. Leg pain preoperatively on the visual analog scale in patients with DDD (%).

53% of the patients operated on for DDD reported regular consumption of analgesics, 35% intermittent and 13% did not use analgesics at all.

The walking distance was estimated to less than 100 m for 15% of the patients, 100-500 m for 19% of the patients, 500-1000 m for 22% of the patients and 43% of the patients reported a walking distance exceeding 1000 m.

Surgical data

A heterogeneous surgical treatment spectrum was seen also for this diagnosis. The following procedures were undertaken: Posterior instrumented fusion 26%, disc prosthesis 22%, PLIF 19%, decompression + posterior instrumented fusion 11%, TLIF 6%, decompression + TLIF 6%, decompression + PLIF 5%, ALIF instrumented 2%, posterior non-instrumented fusion 1%, decompression + posterior non-instrumented fusion 1% and various procedures for the remainder.

Mean hospitalization time was 5.2 (0-24) days.

II. One-year follow-up of lumbar spine surgery

Totally included are 6 540 patients operated on in 2009, 4 977 of which (76%), have completed the one-year follow-up protocol. They are distributed as follows: lumbar disc herniation 1 361, central spinal stenosis 2 351, lateral spinal stenosis 335, spondylolisthesis 247 and DDD 518 while 165 patients had procedures categorized as "other operations" and these are not reported below.

Lumbar disc herniation

Of 1 361 patients who were operated on for lumbar disc herniation and completed one-year follow-up, 56% were males and 44% females, mean age 45 (14-89) years

Mean preoperative back pain on the VAS scale was 47, mean postoperative 24. Corresponding figures for leg pain were 65 and 21 respectively. Figures 17 and 18 demonstrate pre- and postoperative estimation of back and leg pain on the VAS scale.

The surgical procedures were conventional disc surgery 43%, microscopic disc surgery 46%, decompressive surgery 6% and other operations 5%.

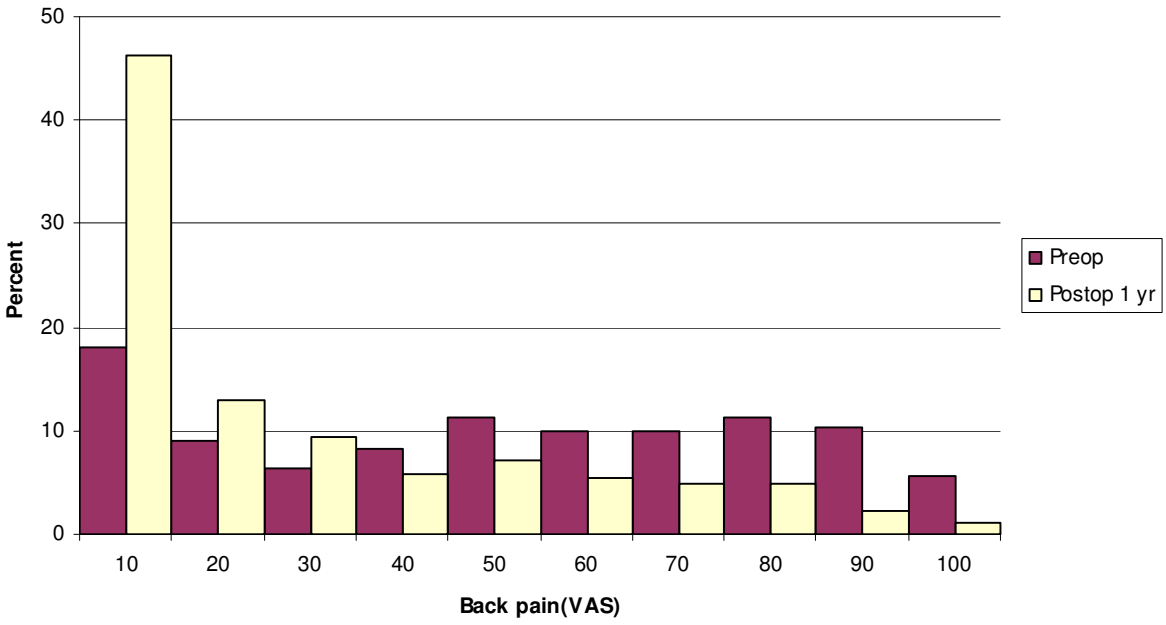

Fig 17. Back pain on the visual analog scale pre- and one year postoperatively in patients operated on for lumbar disc herniation 2009 (%).

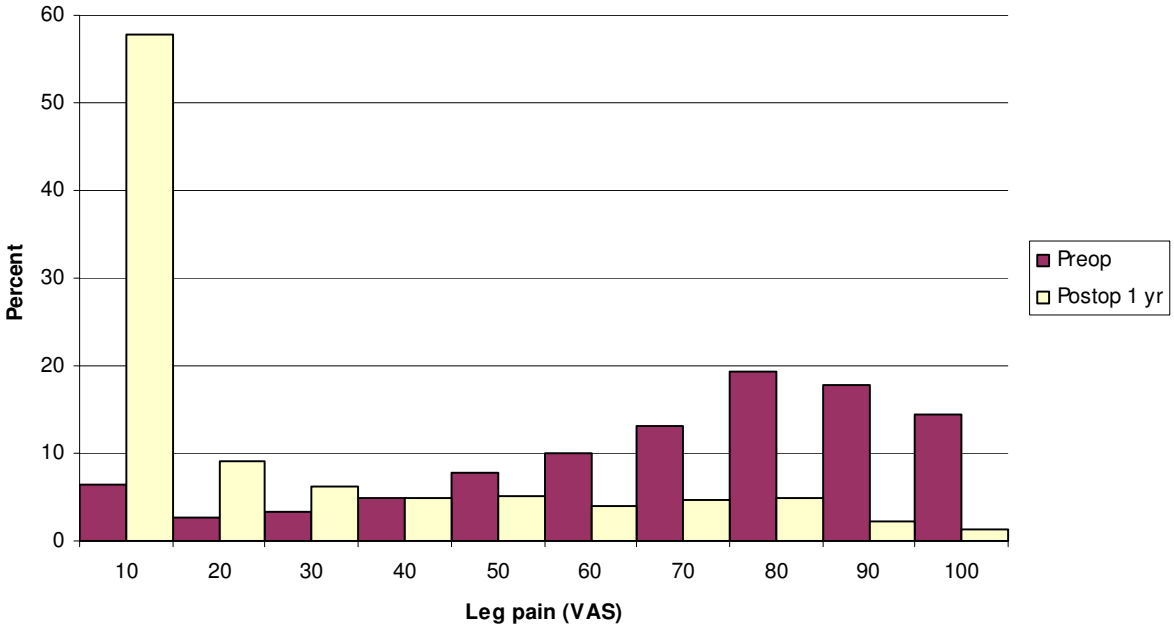

Fig 18. Leg pain on the visual analog scale pre- and one year postoperatively in patients operated on for lumbar disc herniation 2009 (%).

Global assessment of back pain was as follows: Completely painfree 23%, significantly improved 45%, somewhat improved 16%, unchanged 6% and deteriorated 5%, 6% of the patients did not experience back pain preoperatively.

Global assessment concerning leg pain was as follows: Completely painfree 35%, significantly improved 39%, somewhat improved 14%, unchanged 5% and deteriorated 5%. 2% of the patients had no preoperative leg pain.

Overall patient satisfaction with outcome of surgery was: 78% were satisfied, 15% uncertain and 7% dissatisfied.

Consumption of analgesics one year postoperatively was regular for 17%, intermittent for 32% and none for 51%.

Walking distance one year after surgery: <100 m 4%, 100-500 m 9%, 500 m-1000 m 12%, >1000 75%, a substantial improvement compared to preoperatively.

Pre- and one year postoperative health related quality of life as measured with the SF-36 is demonstrated in Figure 19. In all domains except ”General health” the improvement is significant.

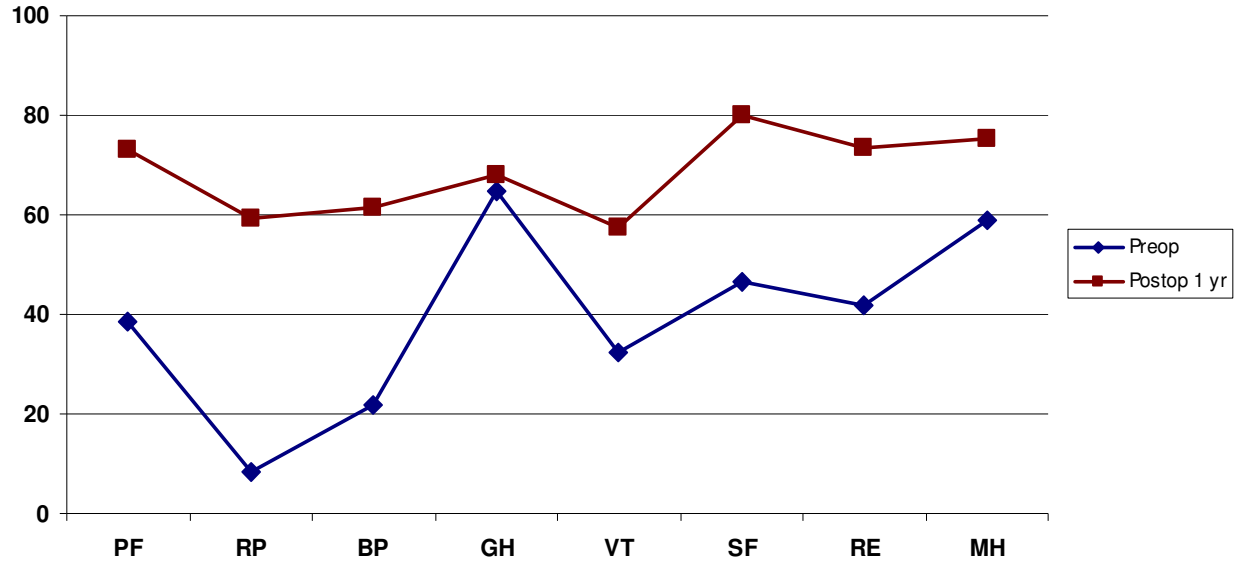

Fig 19. SF-36 pre- and one year postoperatively for patients undergoing surgery for lumbar disc herniation 2009.

The results from the EQ-5D-analysis are presented both as an Index derived from patients' answer to the 5 included dimensions (0 equals death and 1 perfect quality of life), and as a VAS scale, EQ-VAS (0-100 where a higher value is better). The value for patients operated on for lumbar disc herniation were as follows: The mean value for EQ-5D 5 preoperatively: 0.27, and one year postoperatively: 0.70. The corresponding figures for EQ-VAS was 45 preoperatively and 72 at one-year follow-up.

Central spinal stenosis

This group included 2 351 patients with a mean age of 68 (19-92) years, 44% of which 44% were males and 56% females.

The surgical procedures carried out were decompression only for 68%, decompression + posterior instrumented fusion 23%, decompression + posterior non-instrumented fusion 4%, decompression + PLIF 1%, decompression + TLIF 1% and other procedures 3%.

Mean preoperative estimated back pain on the VAS scale was 55 and mean one year postoperative 34, corresponding figures for leg pain was 61 and 33. Figures 20 and 21 demonstrate the distribution of VAS estimations pre- and one year postoperatively for leg and back pain.

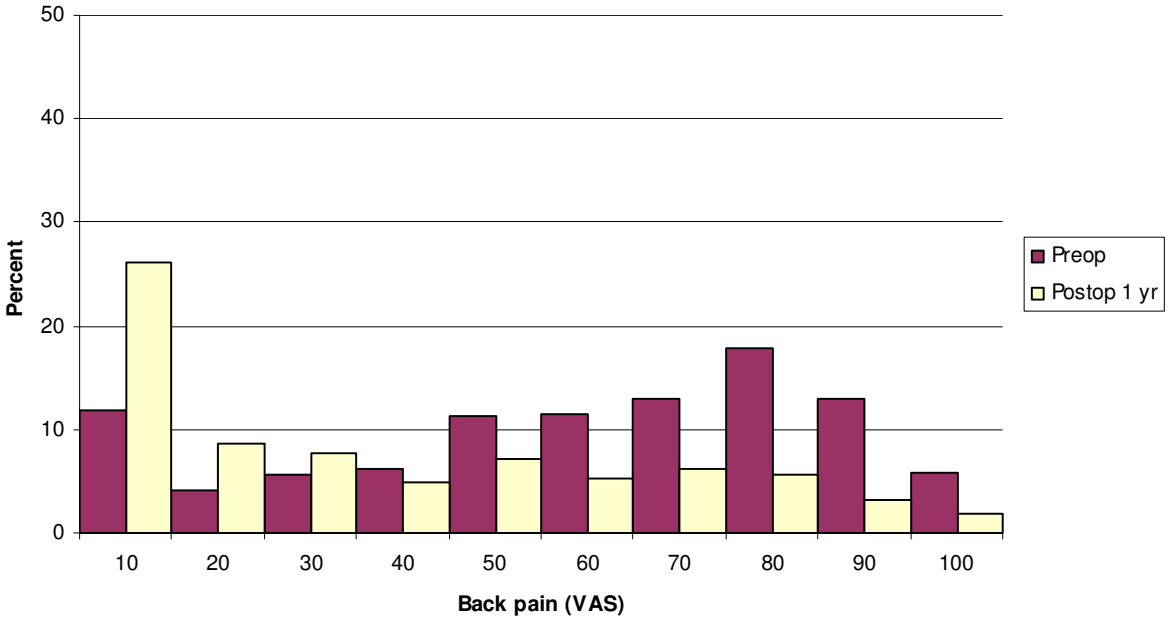

Fig 20.Back pain estimated on the VAS scale pre- and one year postoperatively by patients operated on for central lumbar spinal stenosis 2009 (%).

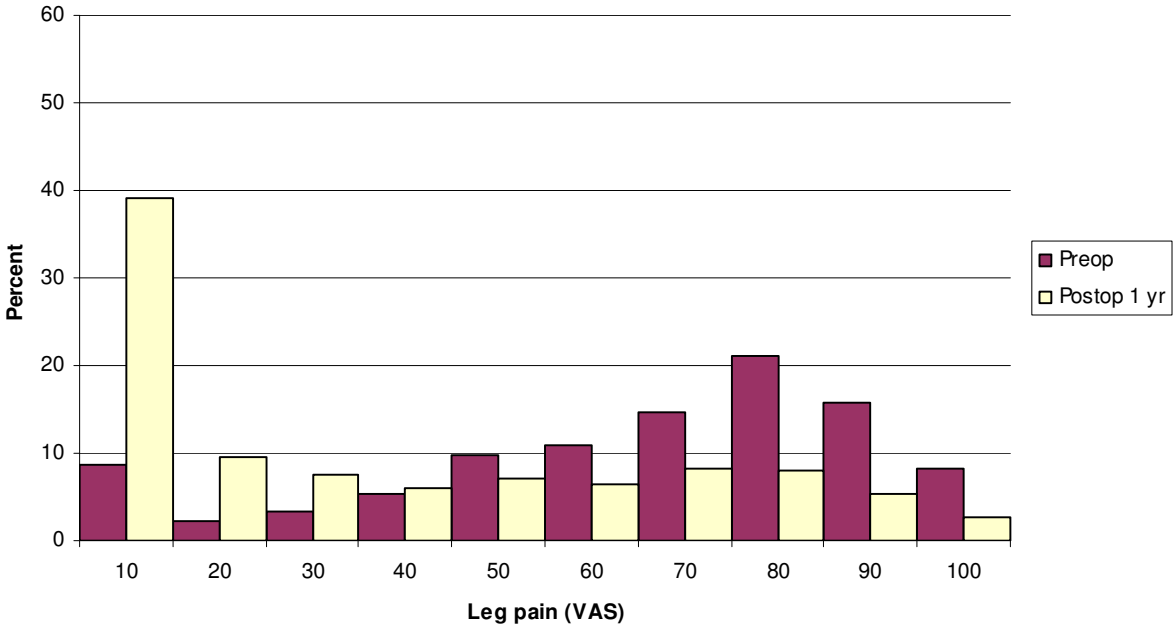

Fig 21. Leg pain estimated on the VAS scale pre- and one year postoperatively by patients operated on for central lumbar spinal stenosis 2009 (%).

Global assessment of back pain: 16% were completely pain free, 35% significantly improved, 19% somewhat improved, 13% unchanged and 9% deteriorated. 7% of the patients denied preoperative back pain.

Global assessment of leg pain: 23% completely pain free, 29% significantly improved, 16% somewhat improved, 14% unchanged and 11% deteriorated. 7% had no preoperative leg pain.

Overall satisfaction with outcome of surgery was as follows: 64% were satisfied, 24% uncertain and 12% dissatisfied with the outcome of surgery.

Consumption of analgesics 1 year postoperatively was regular in 30%, intermittent in 32%, and none in 38% of the patients.

Walking distance one year postoperatively was as follows: < 100 m 20%, 100-500 m 20%, 500 m-1000 m 17%, >1000 m 43%, a pronounced improvement when compared to preoperative figures.

Regarding health related quality of life on the SF-36 questionnaire, a significant improvement was noted one year postoperatively in all aspects, except general health. The improvement was less marked than for the disc herniation patients but, when adjusted for age, very similar, Figure 22.

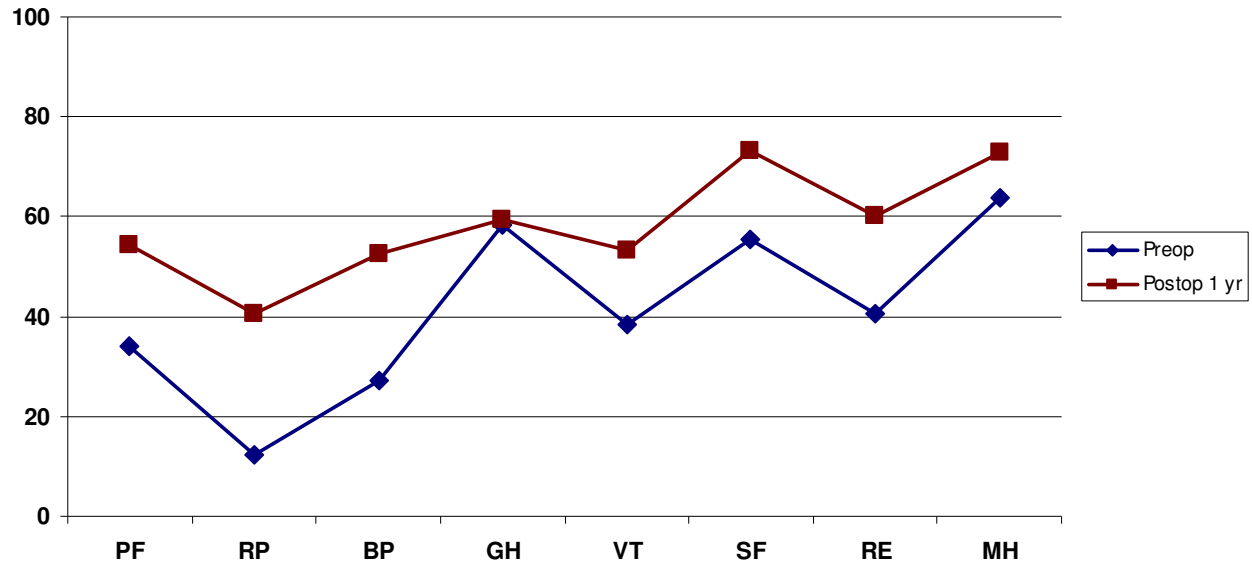

Fig 22. SF-36 pre-and one year postoperatively in patients operated on for central lumbar spinal stenosis 2009.

Mean EQ-5D Index value preoperatively was 0.34, and after 1 year 0.62. Mean EQ-VAS value preoperatively was 48 and one year postoperatively 64.

Lateral spinal stenosis

This patient group consisted of 335 patients, aged 61 (21-88) years, 53% of which were males and 47% females.

Surgical procedures: Decompression only was utilized in 73% of the patients, decompression + posterior fusion in 19% (17% instrumented and 2% non-instrumented), decompression + PLIF 1% and other procedures accounted for 7% of the patients.

Mean preoperative back pain on the VAS scale was 54, mean one year postoperative value 33. Corresponding figures for leg pain were 64 and 35 respectively. Figures 23 and 24 demonstrate the distribution of pre- and postoperative estimation of leg and back pain on the VAS scale.

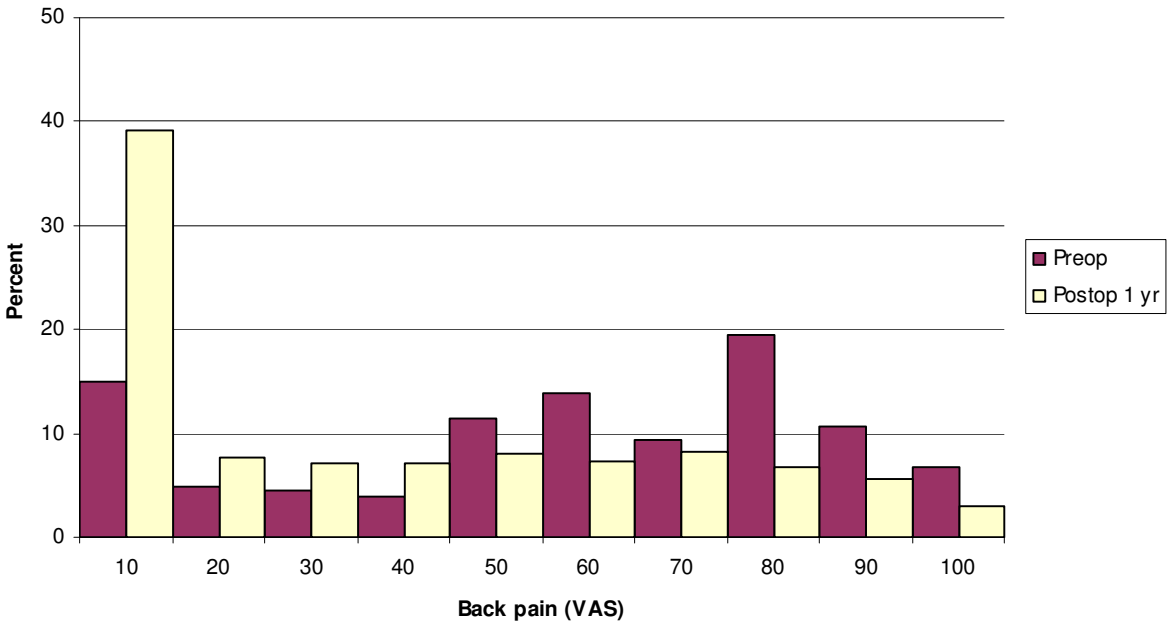

Fig 23. Back pain estimated on the VAS scale pre- and one year postoperatively by patients operated on for lateral lumbar spinal stenosis 2009 (%).

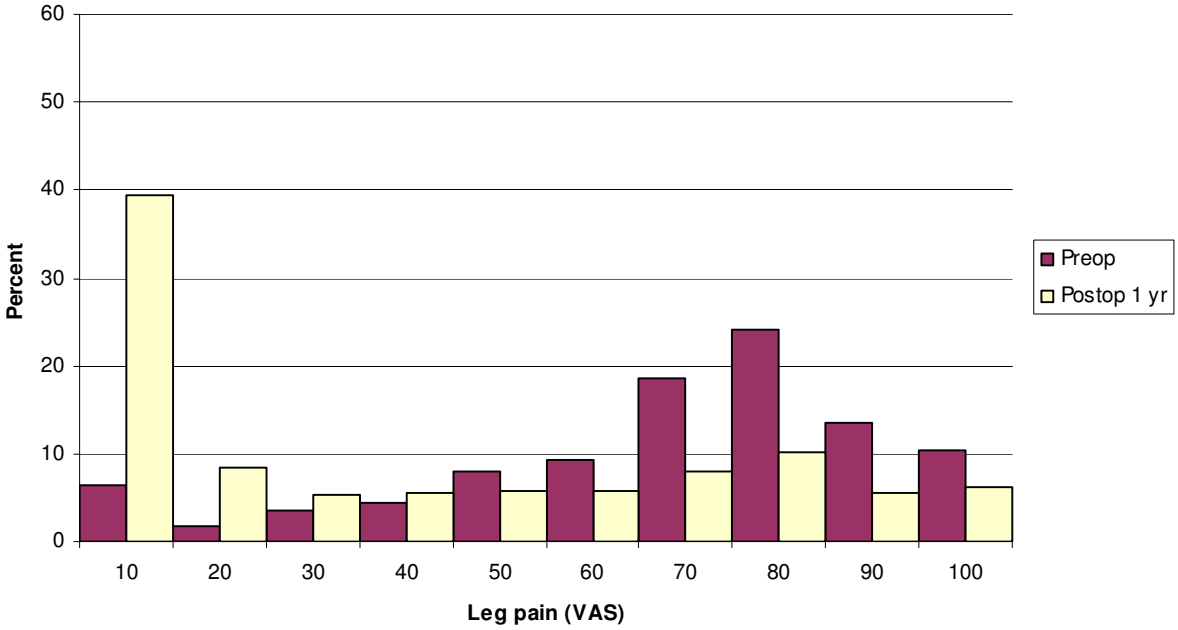

Fig 24. Leg pain estimated on the VAS scale pre- and one year postoperatively by patients operated on for lateral lumbar spinal stenosis 2009 (%).

One year postoperatively the global assessment concerning back pain was as follows: 17% were completely pain free, 32% significantly improved, 21% somewhat improved, 15% unchanged and 7% deteriorated, 7% had no preoperative back pain.

For leg pain the figures were: 26% completely pain free, 29% significantly improved, 20% somewhat improved, 12% unchanged and 10% deteriorated. 2% had no preoperative leg pain.

Patient satisfaction with outcome of surgery was as follows: 59% were satisfied, 27% uncertain and 14% dissatisfied.

Regular consumption of analgesics one year after surgery was reported by 32%, intermittent by 31%, and none by 37% of the patients.

Walking distance one year postoperatively was: < 100 m 16%, 100–500 m 18%, 500 m–1000 m 18% and > 1000 m 49%.

The patients operated on for lateral spinal stenosis showed somewhat less improvement in SF-36 score compared to patients operated on for central spinal stenosis (Figure 25).

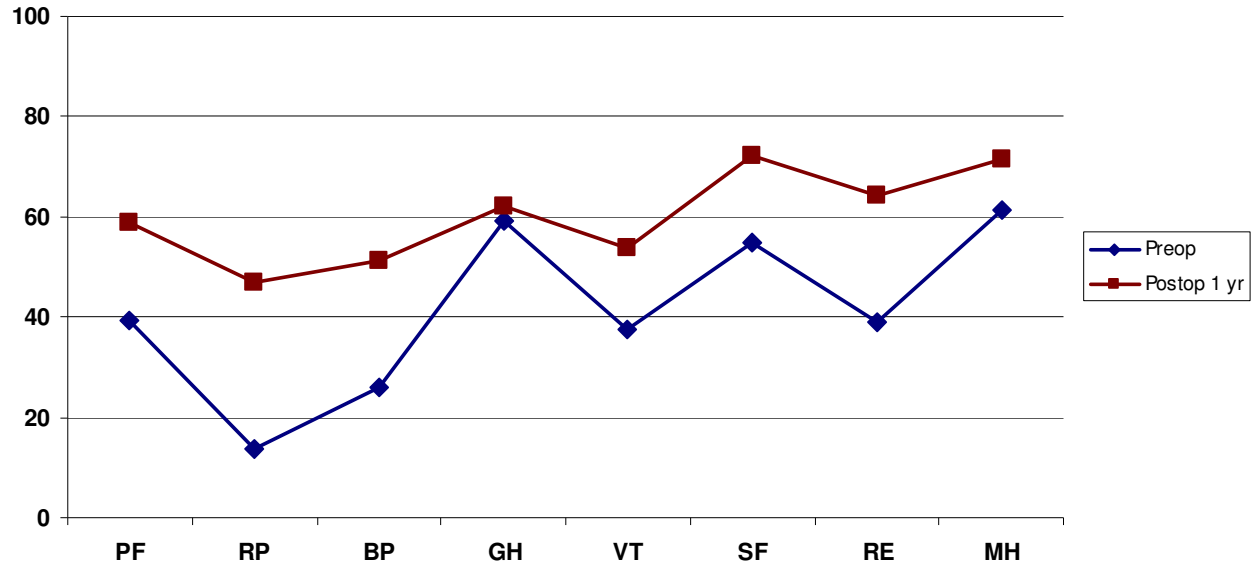

Fig 25. SF-36 pre- and one year postoperatively for patients operated on for lateral lumbar spinal stenosis 2009.

Mean preoperative EQ-5D Index value was 0.33, and after 1 year 0.60. Corresponding figures for EQ-VAS were 49 and 63 (0-100).

Spondylolisthesis

247 patients operated on for spondylolisthesis completed one-year follow-up. Their mean age was 50 (12-84) years, 46% were males and 54% females.

The surgical technique was as follows: Decompression and posterior instrumented fusion 62%, posterior instrumented fusion only 15%, PLIF 9%, decompression + TLIF 4%, decompression + PLIF

3%, decompression + posterior non-instrumented fusion 2%, posterior non-instrumented fusion 2%, decompression only 1%, 360º instrumented/global fusion 1% and 1% had other types of operations.

Mean back pain on the VAS scale preoperatively was 59 and one year postoperatively was 28. Corresponding figures for leg pain was 53 and 27. Figures 26 and 27 illustrate pre- and one year postoperative pain on the VAS scale concerning back and leg pain.

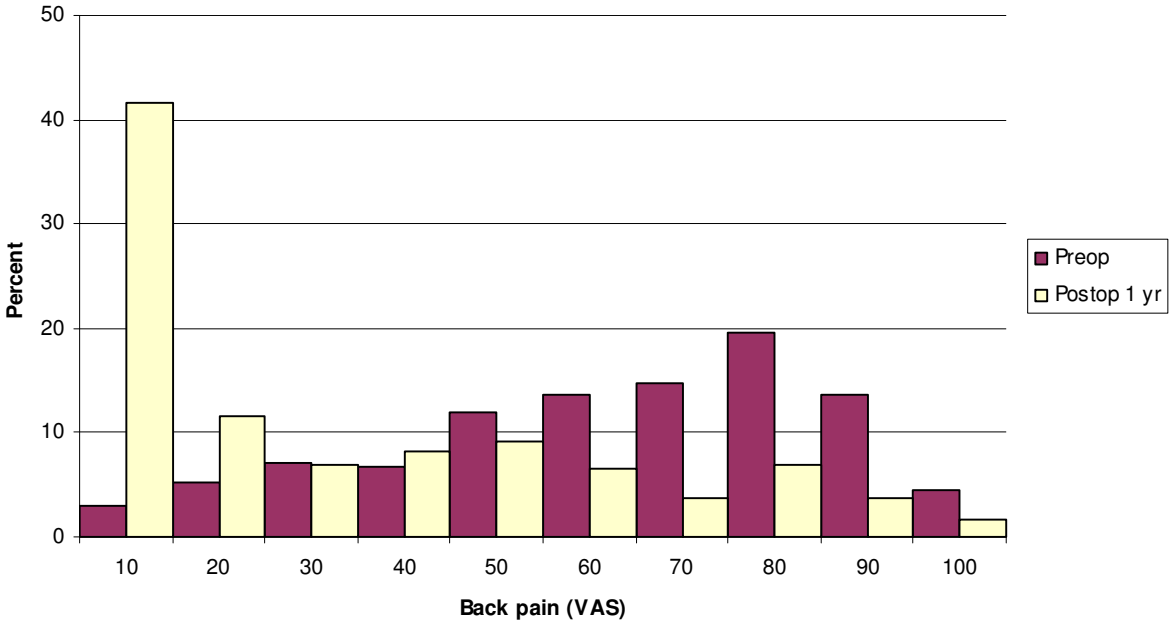

Fig 26.Back pain estimated on the VAS scale pre- and one year postoperatively by patients operated on for spondylolisthesis in 2009 (%).

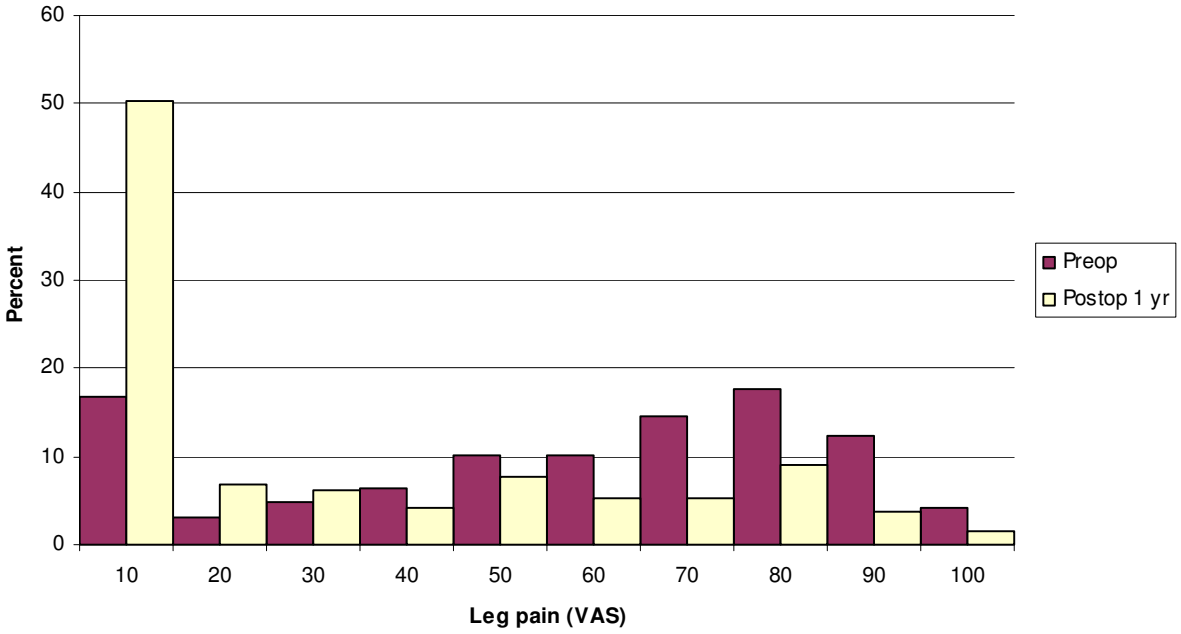

Fig 27. Leg pain estimated on the VAS scale pre- and one year postoperatively by patients operated on for spondylolisthesis in 2009 (%).

The global assessment one year postoperatively regarding back pain revealed 19% to be completely pain free, 44% significantly improved, 18% somewhat improved, 9% unchanged and 5% deteriorated. 4% of the patients reported no preoperative back pain. For leg pain the corresponding figures were: completely pain free 29%, significantly improved 27%, somewhat improved 14%, unchanged 11% and deteriorated 9%. 10% of the patients denied preoperative back pain.

Overall patient satisfaction with the outcome of surgery was as follows: 72% were satisfied, 18% uncertain and 10% dissatisfied.

25% of the patients reported regular consumption of analgesics one year postoperatively, 29% reported intermittent and 47% no consumption of analgesics.

Walking distance one year postoperatively: < 100 m 5%, 100-500 m 13%, 500 m-1000 m 14% and >1000 m 68%, thus, pronounced improvement compared to preoperatively.

In all aspects, except general health, the patients operated on for spondylolisthesis improved significantly on the SF-36 score, Figure 28.

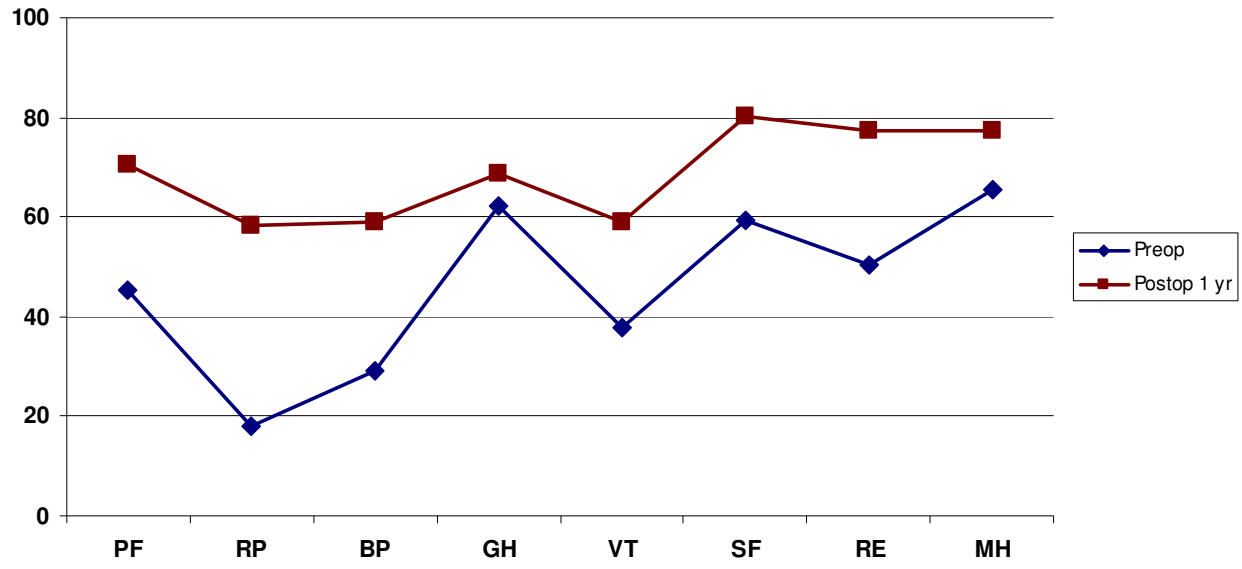

Fig 28. SF-36 score pre- and one year postoperatively for patients operated on for spondylolisthesis 2009.

Mean preoperative EQ-5D Index value was 0.38, and after one year 0.69. Mean preoperative EQ-VAS value was 50 and one year postoperatively 71 (0-100).

DDD (disc degenerative disorder)/segmental pain

In total 518 patients operated on during 2009 had completed one-year follow-up. Mean patient age was 45 (15–79) years, 47% were males and 53% females.

The operations performed for DDD were as follows: posterior instrumented fusion 32%, PLIF 22%, disc prosthesis 14%, decompression + posterior instrumented fusion 12%, decompression + PLIF 5%, TLIF 5%, decompression + TLIF 5%, posterior non-instrumented fusion 2% and other procedures 3%.

Preoperative mean back pain on the VAS scale was 62, one year postoperative value was 30. Corresponding figures for leg pain were 41 and 23. Figures 29-30 illustrate distribution of pre- and postoperative VAS estimation for back and leg pain.

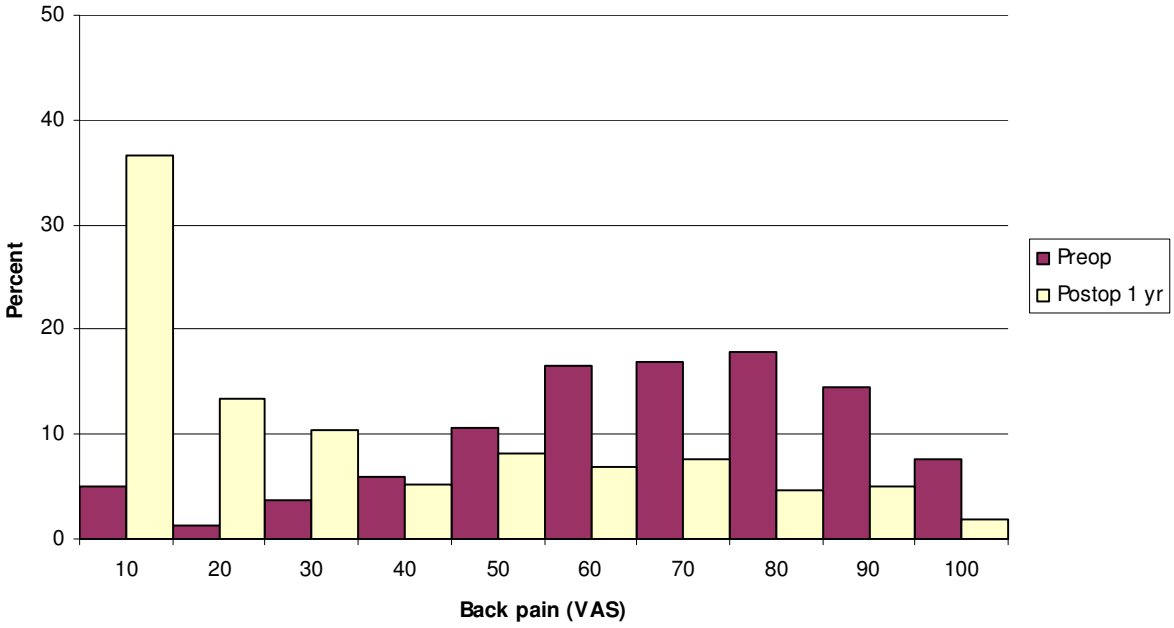

Fig 29. Back pain on the visual analog scale pre- and one year postoperatively in patients operated on for DDD 2009 (%).

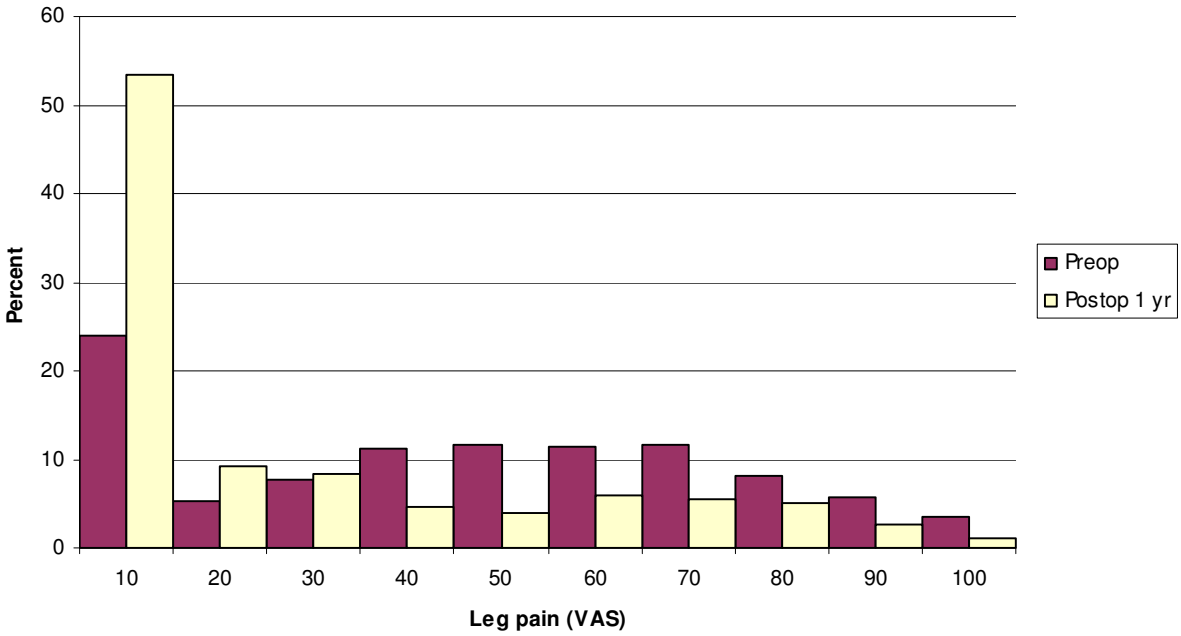

Fig 30. Leg pain on the visual analog scale pre- and one year postoperatively in patients operated on for DDD 2009 (%).

Global assessment of back pain one year postoperatively in the DDD group was as follows: Completely pain free 14%, significantly improved 47%, somewhat improved 23%, unchanged 9% and deteriorated 6%. 1% had no preoperative leg pain.

Corresponding figures for leg pain were: Completely pain free 23%, significantly improved 32%, somewhat improved 15%, unchanged 10% and deteriorated 9%. 11% of the patients denied leg pain preoperatively.

Regarding overall patient satisfaction with outcome of surgery, 72% reported as satisfied, 18% as uncertain and 10% as dissatisfied.

Regular consumption of analgesics one year postoperatively was reported by 27%, intermittent by 37% and none by 36% of the patients.

Walking distance one year after surgery: < 100 m 4%, 100-500 m 11%, 500 m-1000 m 16%, >1000 m 69%, a pronounced improvement compared to before surgery.

The SF-36 profiles, presented in Figure 31, show similar profiles as for the other diagnoses with improvement in physical as well as mental components, and with no difference in General Health.

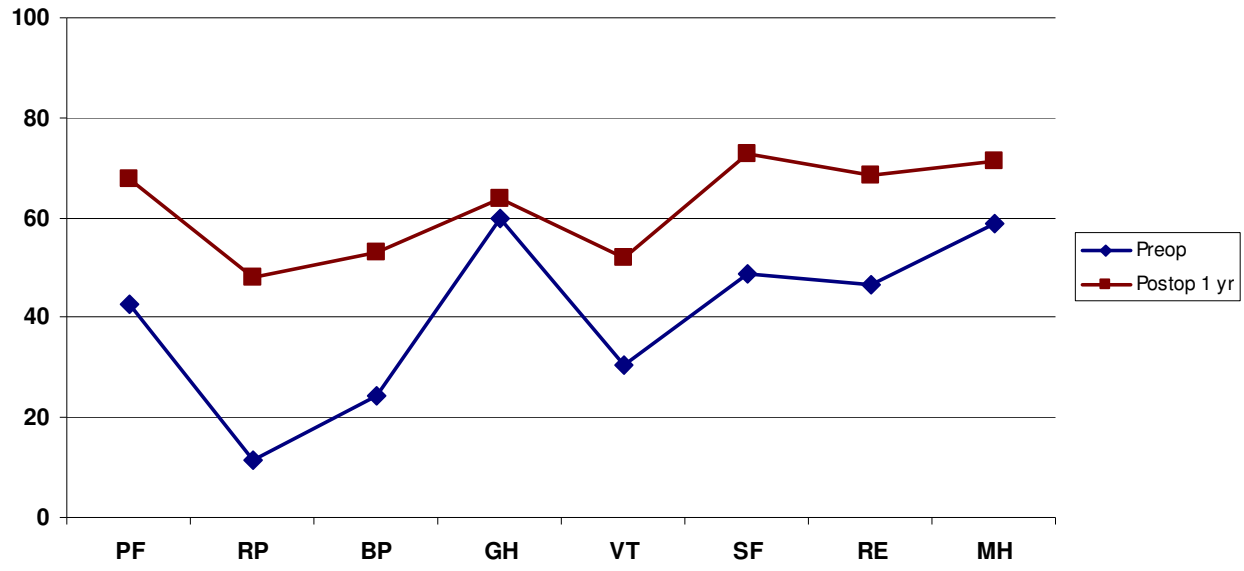

Fig 31. SF-36 pre- and one year postoperatively for patients operated on for DDD 2009.

Mean EQ-5D Index value preoperatively was 0.33, and after one year 0.63. Mean EQ-VAS value preoperatively was 43, and 1 year postoperatively 66 (0-100).

Oswestry Disability Index, ODI, before and one year after surgery for all diagnoses

Figure 32 demonstrates a comparison between pre- and postoperative functional disability as measured by the Oswestry Disability Index (ranging from 0-100 where less is better, and where 0-20 is regarded as “no or insignificant disability”). The reduction of disability at the one year follow up is significant for all diagnoses, and to the highest extent for patients operated on for disc herniation.

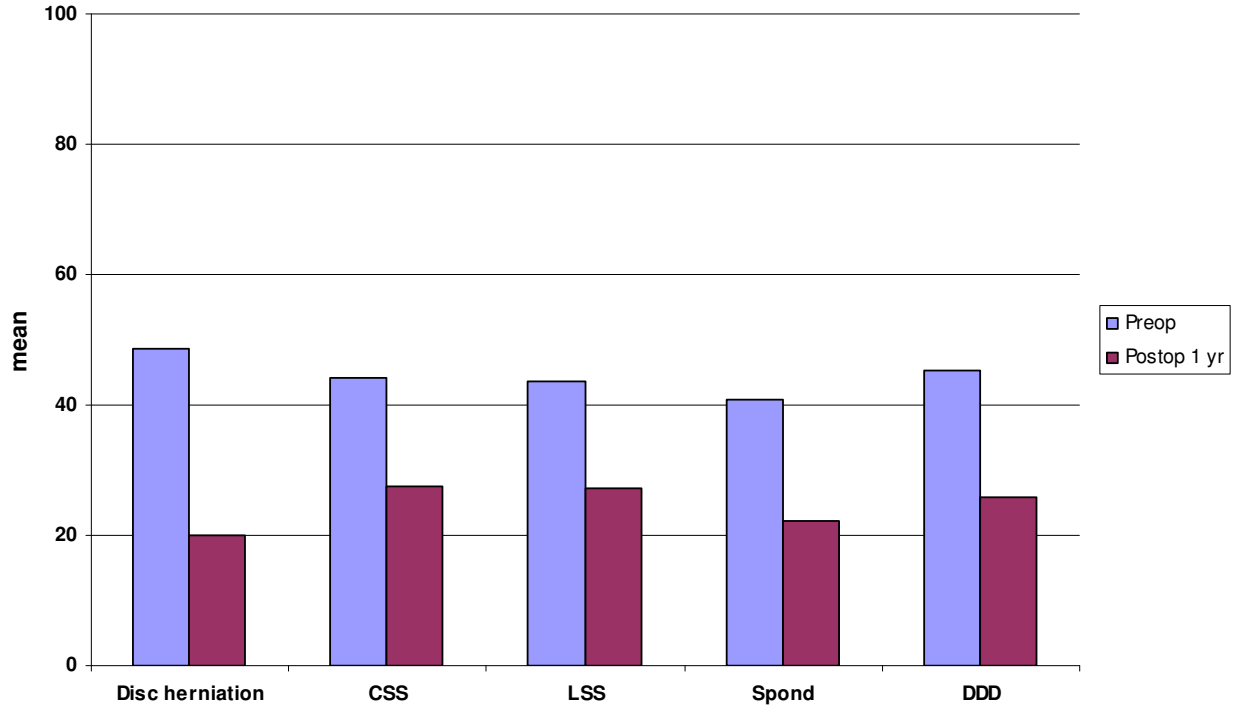

Fig 32. ODI score before and one year after lumbar spine surgery, related to diagnosis, for patients operated on in 2009.

III. 2-year follow-up of lumbar spine surgery

In total 3 660 patients operated on in 2008 have completed pre- as well as one- and two-year follow-up postoperative protocols. The most common diagnoses are disc herniation: 1 001, and central spinal stenosis: 1 692 patients. In all 255 patients were operated on for lateral spinal stenosis, 186 patients were operated on for spondylolisthesis and in all 424 patients for DDD. There were 102 patients categorized as having "other operations". Below is presented a comparison between one- and two-year follow-up regarding the parameters registered. Only patients completing the protocol preoperatively and both one- and two-year postoperatively are included.

Leg and back pain, diagnosis related, on the VAS scale at one- and two-year follow-up (Table 1).

Table 1. Pain in the back and leg (mean value) diagnosis related, before surgery and at 1- and 2-year follow-up.

	Back			**Leg**		
	Preop	**1 yr postop**	**2 yrs postop**	**Preop**	**1 yr postop**	**2 yrs postop**
Disc herniation	47	22	24	67	20	23
Central stenosis	55	30	34	61	31	34
Lateral stenosis	51	32	34	60	31	34
Spondylolisthesis	58	25	28	49	19	24
DDD	63	29	31	43	22	23

Tables 2-6 present walking ability, diagnosis related, at one and two years postoperatively and the outcome is more or less identical at the two time points.

Table 2. Walking distance, disc herniation (%)

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
<100 m	36	5	5
100 m– 500 m	18	9	9
500 m– 1000 m	15	11	10
>1000 m	30	76	77

Table 3. Walking distance, central spinal stenosis (%)

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
<100 m	40	16	20
100 m– 500 m	31	22	22
500 m– 1 km	13	17	17
>1 km	15	45	41

Table 4. Walking distance, lateral spinal stenosis (%)

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
<100 m	29	12	16
100 m– 500 m	34	18	18
500 m– 1 km	15	16	16
>1 km	23	54	51

Table 5. Walking distance, spondylolisthesis (%)

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
<100 m	19	7	10
100 m– 500 m	28	10	11
500 m– 1 km	15	12	14
>1 km	38	72	65

Table 6. Walking distance, DDD (%)

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
<100 m	12	4	5
100 m– 500 m	19	9	8
500 m– 1 km	23	16	15
>1 km	46	72	72

Also consumption of analgesics shows a stable pattern at follow-up as demonstrated in Tables 7-11.

Table 7. Consumption of analgesics, disc herniation preoperatively, one and two years postoperatively (%).

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Regularly	60	17	17
Intermittently	28	29	33
No consumption	13	53	50

Table 8. Consumption of analgesics, central spinal stenosis preoperatively, one and two years postoperatively (%).

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Regularly	55	27	31
Intermittently	30	33	31
No consumption	16	41	38

Table 9. Consumption of analgesics, lateral spinal stenosis preoperatively, one and two years postoperatively (%).

	Preoperatively	1 yr postoperatively	2 yrs postoperatively
Regularly	52	31	32
Intermittently	31	32	35
No consumption	17	37	34

Table 10. Consumption of analgesics, spondylolisthesis preoperatively, one and two years postoperatively (%).

	Preoperatively	1 yr postoperatively	2 yrs postoperatively
Regularly	51	19	22
Intermittently	31	35	32
No consumption	18	46	46

Table 11. Consumption of analgesics, DDD preoperatively, 1 and 2 years postoperatively (%).

	Preoperatively	1 yr postoperatively	2 yrs postoperatively
Regularly	53	24	25
Intermittently	36	38	35
No consumption	11	39	40

Patient graded satisfaction with outcome of surgery similar at one and two years after surgery (Table 12).

Table 12. Satisfaction with outcome of surgery one and two years postoperatively related to diagnosis.

	1 year postoperatively			2 years postoperatively		
	Satisfied	Uncertain	Dissatisfied	Satisfied	Uncertain	Dissatisfied
Disc herniation	77	16	8	77	14	9
Central stenosis	67	21	12	65	23	12
Lateral stenosis	64	23	13	61	24	15
Spondylolisthesis	80	12	8	72	17	11
DDD	76	16	9	73	18	9

Quality of life as measured by EQ-5D is illustrated in Tables 13 and 14 and Figure 33. A very pronounced improvement in EQ-5D Index as well as EQ-VAS is reported and retained over time after surgery.

Table 13. EQ-5D means preoperatively, one and two years postoperatively, related to diagnosis.

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Disc herniation	0.26	0.72	0.72
Central stenosis	0.36	0.64	0.62
Lateral stenosis	0.39	0.66	0.61
Spondylolisthesis	0.36	0.69	0.67
DDD	0.34	0.66	0.64

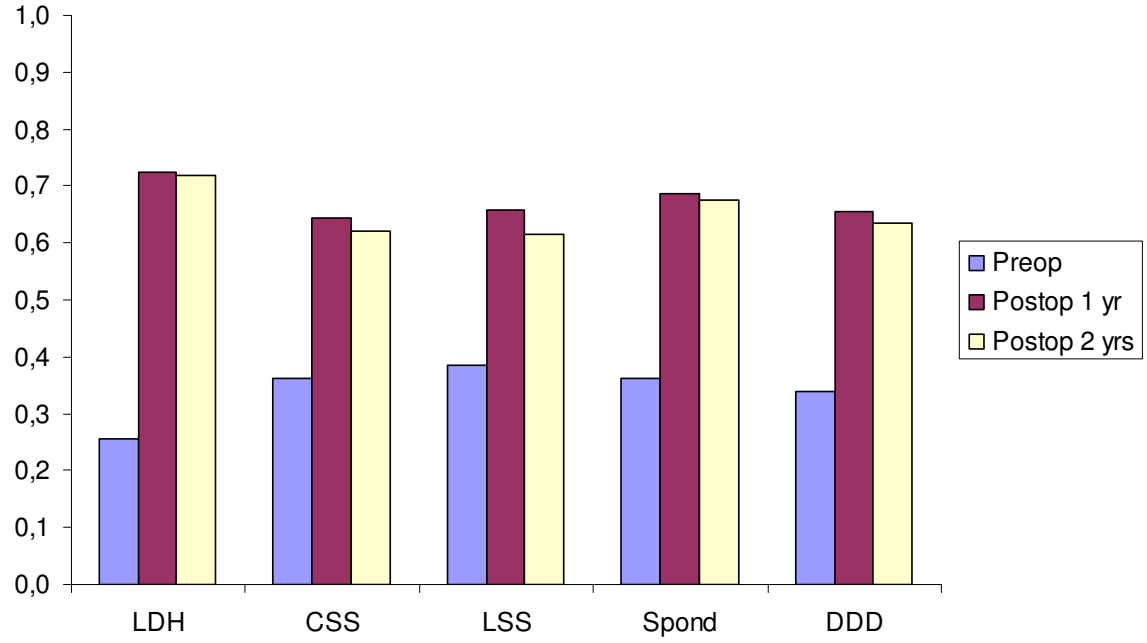

Fig 33. Quality of life preoperatively, one and two years postoperatively measured by EQ-5D.

Table 14. EQ-5D health estimation according to the VAS scale, means.

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Disc herniation	45	72	71
Central stenosis	49	65	63
Lateral stenosis	51	66	64
Spondylolisthesis	45	68	66
DDD	42	66	62

Oswestry Disability Index, ODI, preoperatively, one and two years after surgery for all diagnoses.

Table 15. Mean ODI results preoperatively, one and two years after disc herniation surgery, related to diagnosis. (ODI: 0-100 where less is better)

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Disc herniation	49	19	19
Central stenosis	43	26	28
Lateral stenosis	42	25	26
Spondylolisthesis	42	22	21
DDD	44	25	26

IV. Five-year follow-up of lumbar spine surgery

In total 1 810 patients completed one-, two- and 5-year follow-up after having undergone lumbar spine surgery in 2005. Dominating diagnoses are disc herniation 564 and central spinal stenosis 701 patients. In all 154 patients were operated on for lateral spinal stenosis, spondylolisthesis 125 patients, and DDD/segmental pain 220 patients. The remaining 46 patients had different types of "other diagnoses." Below is presented a comparison between one-, two- and 5-year follow-up regarding some parameters registered. Only patients completing the protocol preoperatively, one-, two- and 5-year postoperatively are included.

Pain on the VAS scale (Back and Leg) did not change much over the years, Table 16.

Table 16. Pain on the VAS scale (means), related to diagnosis.

	Back				Leg			
	Preop	**1 yr**	**2 yrs**	**5 yrs**	**Preop**	**1 yr**	**2 yrs**	**5 yrs**
Disc herniation	45	23	22	20	66	20	18	24
Central stenosis	56	30	31	35	62	30	31	32
Lateral stenosis	50	28	31	33	61	34	35	34
Spondylolisthesis	59	31	30	28	53	22	25	27
DDD	65	36	35	34	45	26	27	24

Walking distance, diagnosis related, is presented in the following 5 tables (17-21), and minimal changes are observed over time.

Table 17. Walking distance, disc herniation (%).

	Preoperatively	**1 yr postop**	**2 yrs postop**	**5 yrs postop**
< 100 m	33	2	2	3
100 m – 500 m	22	9	8	6
500 m – 1 km	18	10	8	9
> 1 km	28	79	82	83

Table 18. Walking distance, central spinal stenosis (%).

	Preoperatively	**1 yr postop**	**2 yrs postop**	**5 yrs postop**
< 100 m	38	12	16	23
100 m – 500 m	32	21	19	21
500 m – 1 km	16	18	17	16
> 1 km	14	49	48	40

Table 19. Walking distance, lateral spinal stenosis (%).

	Preoperatively	1 yr postop	2 yrs postop	5 yrs postop
< 100 m	28	6	12	16
100 m – 500 m	31	21	22	15
500 m – 1 km	13	15	13	14
> 1 km	28	58	53	55

Table 20. Walking distance, spondylolisthesis (%).

	Preoperatively	1 yr postop	2 yrs postop	5 yrs postop
< 100 m	20	3	3	9
100 m – 500 m	29	15	12	10
500 m – 1 km	21	14	17	15
> 1 km	30	68	68	66

Tabell 21. Walking distance, DDD (%)

	Preoperatively	1 yr postop	2 yrs postop	5 yrs postop
< 100 m	19	7	5	8
100 m – 500 m	18	8	14	10
500 m – 1 km	27	18	15	16
> 1 km	36	67	67	66

Consumption of analgesics, preoperatively, one-, two-, and 5-years postoperatively is presented in Tables 22-26.

Table 22. Consumption of analgesics, disc herniation, preoperatively, one, two and 5 years postoperatively (%).

	Preoperatively	1 yr postop	2 yrs postop	5 yrs postop
Regularly	55	15	13	16
Intermittently	32	33	33	32
No consumption	13	53	54	52

Table 23. Consumption of analgesics, central spinal stenosis, preoperatively, one, two and 5 years postoperatively (%).

	Preoperatively	1 yr postop	2 yrs postop	5 yrs postop
Regularly	53	26	26	32
Intermittently	28	31	30	31
No consumption	19	43	44	37

Table 24.Consumption of analgesics, lateral spinal stenosis, preoperatively, one, two and 5 years postoperatively (%).

	Preoperatively	1 yr postop	2 yrs postop	5 yrs postop
Regularly	44	25	26	28
Intermittently	37	34	34	33
No consumption	19	41	40	39

Table 25. Consumption of analgesics, spondylolisthesis, preoperatively, one, two and 5 years postoperatively (%).

	Preoperatively	1 yr postop	2 yrs postop	5 yrs postop
Regularly	40	23	19	25
Intermittently	40	35	33	34
No consumption	20	42	48	41

Table 26. Consumption of analgesics, DDD, preoperatively, one, two and 5 years postoperatively (%).

	Preoperatively	1 yr postop	2 yrs postop	5 yrs postop
Regularly	53	26	32	33
Intermittently	36	41	35	30
No consumption	10	34	33	37

Patient graded satisfaction with outcome of surgery was measured, and only minor changes are seen over the years, Table 27.

Table 27. Satisfaction with outcome of surgery one, two and 5 years postoperatively related to diagnosis.

	1 yr postoperatively			2 yrs postoperatively			5 yrs postoperatively		
	Satis-fied	Un-certain	Dis-satisfied	Satis-fied	Un-certain	Dis-satisfied	Satis-fied	Un-certain	Dis-satisfied
Disc herniation	79	15	6	80	14	6	84	12	4
Central stenosis	68	23	9	68	21	11	68	20	12
Lateral stenosis	70	19	12	66	22	12	65	14	21
Spondy-lolisthesis	76	15	9	77	14	10	76	13	11
DDD	67	21	12	64	23	13	67	19	14

Quality of life on the EQ-5D and perceived health on EQ-VAS scales are presented in Tables 28 and 29 and in Figure 34. All diagnostic groups reported an improved quality of life postoperatively.

Table 28. EQ-5D means preoperatively, one, two and 5 years postoperatively, related to diagnosis.

	Preoperatively	1 yr postoperatively	2 yrs postoperatively	5 yrs postoperatively
Disc herniation	0.26	0.75	0.76	0.77
Central stenosis	0.37	0.66	0.66	0.61
Lateral stenosis	0.39	0.65	0.61	0.62
Spondylolisthesis	0.32	0.65	0.65	0.63
DDD	0.35	0.58	0.59	0.61

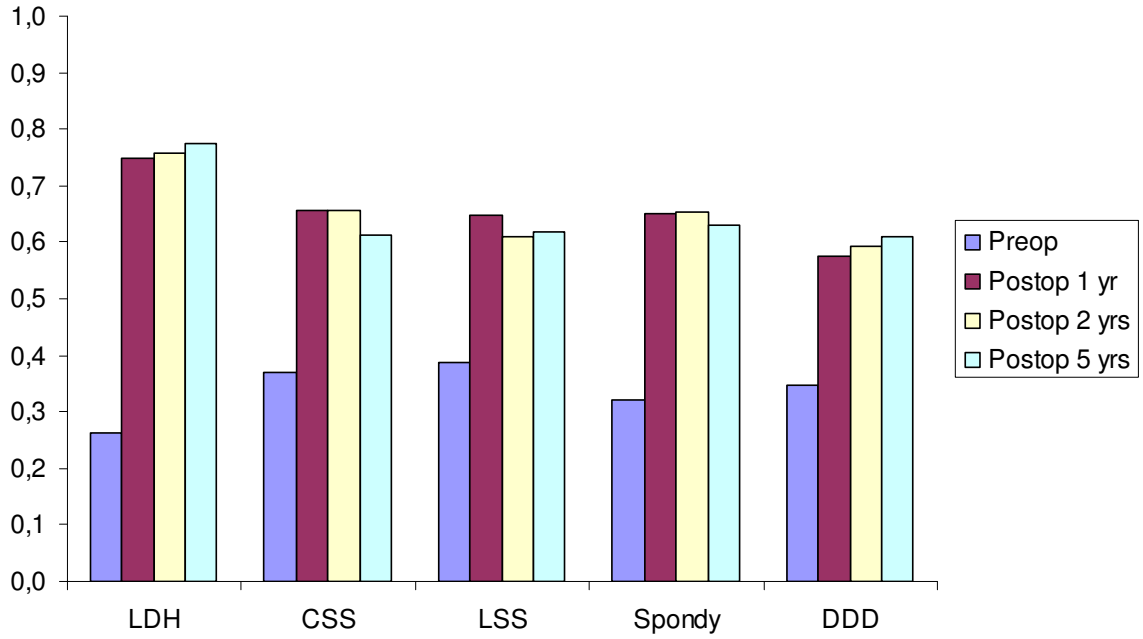

Fig 34. Quality of life, preoperatively, one, two and 5 years postoperatively measured with EQ-5D.

Table 29. EQ-5D health estimation according to the VAS scale (EQ-VAS: 0-100 where higher is better), means.

	Preoperatively	1 yr postoperatively	2 yrs postoperatively	5 yrs postoperatively
Disc herniation	46	73	75	77
Central stenosis	49	66	65	61
Lateral stenosis	51	64	62	63
Spondylolisthesis	46	64	68	66
DDD	45	64	62	65

To conclude, the outcome regarding various parameters was fairly stable over 5 years after surgery but the long-term follow-up is less complete than the short-term.

V. Surgery for degenerative cervical spine disorders

During 2010, in all 627 patients were registered for having surgery of degenerative cervical spine disorders, and 53% of them were males and 47% females. 26% of the patients were smokers and 9% had previously undergone cervical spine surgery.

Duration of pain preoperatively was as follows: <3 months 3%, 3-12 months 25%, 1-2 years 21% and >2 years 40% while 11% denied cervical pain. Pain radiating to the arm/arms had been prevalent for <3 months for 4% of the patients, 3-12 months for 31%, 1-2 years for 23% and >2 years for 29% while 13% denied radiating pain.

Regular consumption of analgesics was reported by 49% of the patients, intermittent by 29% and no consumption of analgesics by the remaining 22%.

Concerning walking distance, 10% of the patients reported <100 meters, 12% 100-500 meters, 14% 500-1000 meters and 64% >1000 meters. 70% of the patients experienced affliction of fine motor movements of the hand/hands.

In all 28% of the patients reported co-morbidity as follows: Heart disease 3%, neurologic disease 5%, tumour disease 0%, other disease affecting walking ability 9% and other pain provoking disorders 11%. 72% denied co-morbidity.

Neck pain on the VAS scale was mean 53 (range 0-100) while radiating pain was 48 (range 0-100).

Preoperatively, the mean EQ-5D Index was 0.38 (ranging from 0-1 where 1 is best), and NDI (Neck Disability Index ranging from 0-100 where higher is worse), was mean 61.8%, while the mean value on the European Myelopathy scale was 14.6 (range between 5-18 and where 5-8 represents severe handicap and 17-18 is normal neurological status).

Surgical data
48% of the operations were performed for cervical disc herniation, 24% for cervical spinal stenosis, 20% for cervical foraminal stenosis, 1% for segmental neck pain, 3% for rheumatoid arthritis and 0.2% for ankylosing spondolitis. Neurological status was as follows: 22% normal, 46% nerve root affliction, 30% medullary compression and 1.5% combined root and medullary compression. Preoperative Ranawat score was as follows: I: 22%, II: 46%, IIIa: 30% and IIIb: 2%. Neurological status according to the Frankel classification was as follows: A: 0%, B 1%, C 14%, D 57% and E 28%.

Horizontal instability between C1-C2 was evident in 3% of the cases, vertical between C0-C2 in 1% of the cases and subaxial instability between C2 and Th1 in 2% of the total number of patients. For 2% of the cases a combined instability was seen.

The following surgical procedures were performed: Disc resection + fusion without plate 2.6%, disc resection + fusion with plate 13.8%. disc resection + fusion cage without plate 27%, disc resection with fusion cage + plate 21.8%, corpektomy 5.2%, Disc prosthesis 5.5%, laminectomy without fixation 3.2%, laminectomy with fixation 6.8%, SKIP laminectomy 0.3%, laminoplasty 0.6%, foraminotomy 5.2%, combined laminectomy and laminoplasty/foraminotomy 0.8%, posterior fixation without decompression 5.3% and other operations 1.8%. Anterior implants were used in 77% of the cases and posterior in 15% of the cases.

Results

Casemix has been studied concerning four factors, age, preoperative duration of pain, degree of neck pain and foraminal stenosis. Mean national values are illustrated by Figures 35-36.

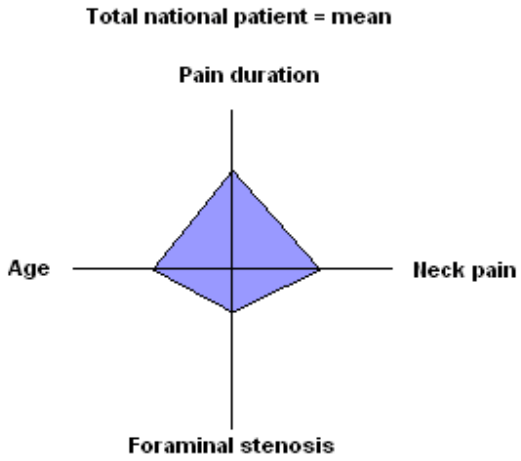

Fig 35 Casemix for the total national patient material.

The results of Figure 35 can be compared for example with one large department reporting significantly less operations for foraminal stenosis.

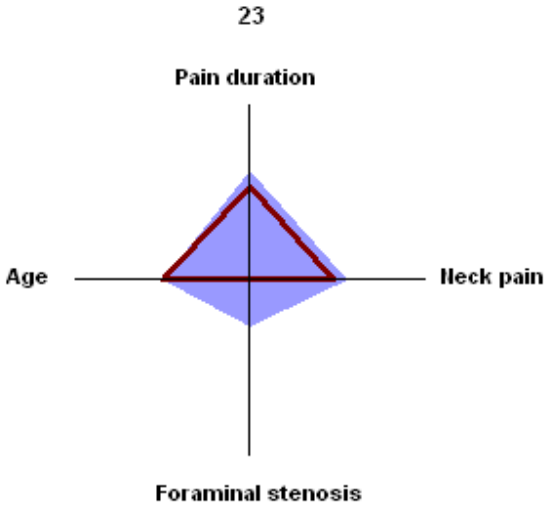

Fig 36. Casemix for one large department..

Analysis of casemix can be of value when outcome parameters between different units are performed, and casemix may explain some of the differences in Figures 37-40.

Follow-up

For patients operated on between 2007 and 2009, one-year follow-up is achieved for over 75% of the cases (Figures 37-38). Below are presented the overall results for Sweden and the results of 10 departments performing cervical spine surgery separately.

NDI preoperatively was mean 63 and postoperatively 46 (lower value better). Radiating pain to the arm/arms improved from mean 54 preoperatively to mean 26 postoperatively, Figure 37.

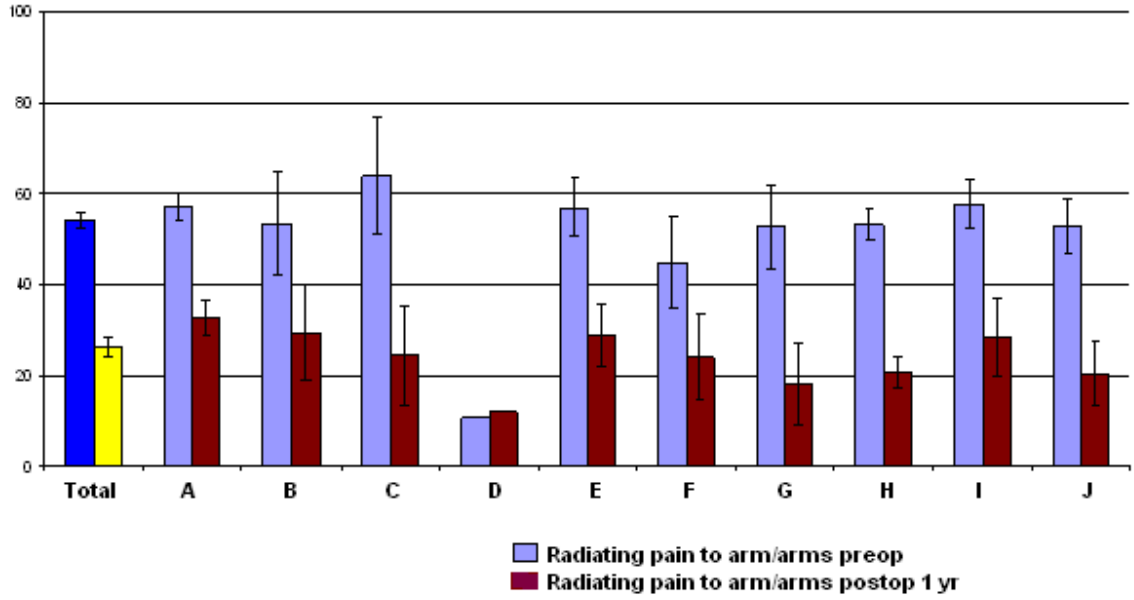

Fig 37. Pain radiating to the arm/arms. (VAS).

Corresponding subjective grading of arm pain one year postoperatively is presented in Figure 38.

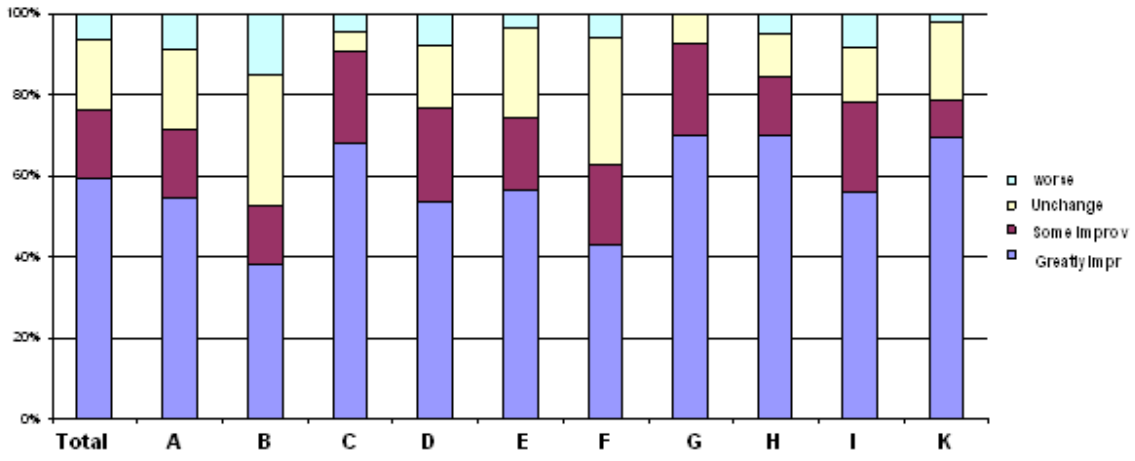

Fig 38. Pain radiating to the arm/arms one year postoperatively.

Reported walking ability one year postoperatively is presented in Figure 39.

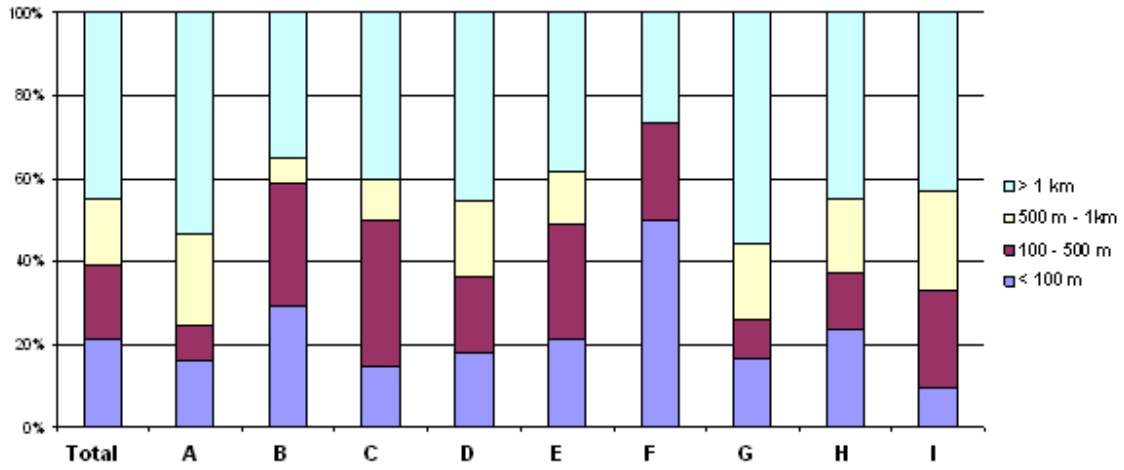

Fig 39. Walking distance one year postoperatively.

Quality of life (EQ-5D) was improved significantly but with some variation between different departments, where A-I represent these departments (Figure 40).

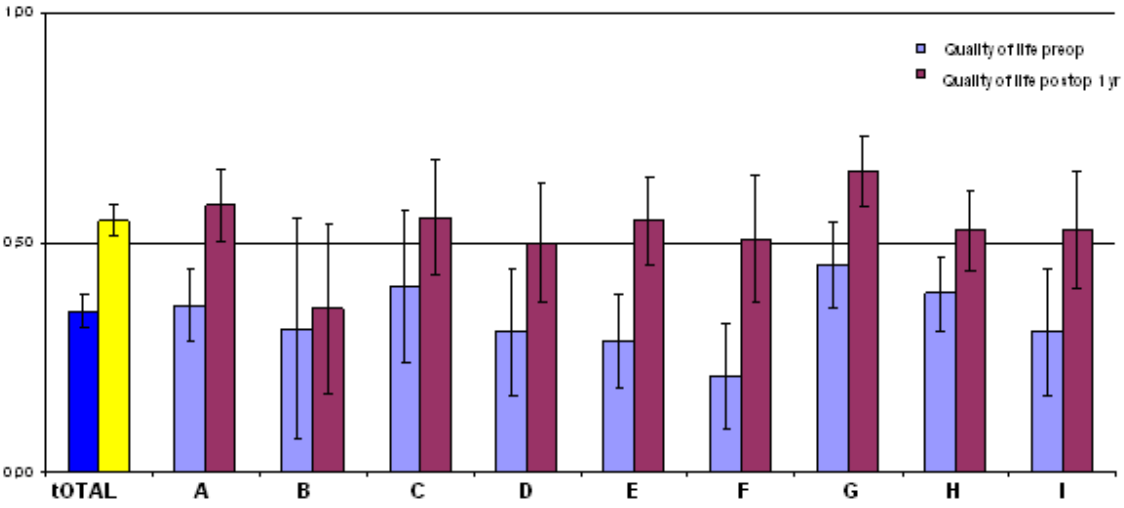

Fig 40. Quality of life one year after surgery.

VI. Surgery for spinal fractures

The register contains 341 patients operated on for a spinal fracture. In 25% of the cases multiple levels were afflicted.

The trauma was in 10% of the cases a traffic accident, in 26% fall from height, in 33% low energetic fall and for the remaining 31% the trauma was not specified.

Totally 100 of the fractures registered occurred in the upper cervical level. 76 of these were Dens fractures, 10 Hangman's fractures and 14 were classified as others.

The remaining 241 fractures occurred in the lower cervical, thoracic and lumbar spine and were classified according to the AO classification as follows: Class A: 33%, Class B: 48% and Class C 19% (Table 30).

Table 30. Fracture types according to the AO classification.

Class A	Class B	Class C
33	48	19

Preoperatively 17% of the cases demonstrated rhizopathy and 19% myelopathy, classified according to Frankel (A complete neurological deficit, and E completely normal neurological status) as follows: A 21%, B 11%, C 18%, D 30% and E 20% (Table 31). Sphincter affection was seen in 13%.

Table 31. Neurological function according to Frankel classification (percent)

Classification	Percent
A	21
B	11
C	18
D	30
E	20

Operative treatment performed for spine fractures was as follows: Halo vest 3%, anterior surgery (all types) 15%, 360º stabilization 6%, posterior stabilization (without decompression) 48%, posterior fixation with decompression 21%, vertebroplasty 3% and other type of surgery without implant 4%.

High dose steroids were given in 3% of the cases. Anterior implants were used in 22% of the cases and posterior implants in 82%.

VII. Surgery for spinal metastases

In total 146 patients were registered for operation of a spinal metastasis in 2010. 17% of these were smokers.

Indication for surgery was as follows: Neurological affection 61%, back/leg pain 17%, progressive deformity 2%, neurological deficit + back/leg pain 18%, and neurological deficit + back/leg pain and progressive deformity 2%.

The primary tumour was known in 73% of the cases and, thus, the spine tumour operated on was the first symptom of malignancy in the remaining 27%. Most common primary tumours were prostatic cancer 41%, Lung cancer 15%, breast cancer 11%, renal carcinoma 11%, gastrointestinal cancer 8%, myeloma/lymphoma 5%, thyroid cancer 1%, and others 8% (Table 32).

Tabell 32. Primary tumour in spinal metastases (percent).

Primary tumour	Percent
Prostate	41
Lung	15
Breast	11
Renal carcinoma	11
Gastrointestinal cancer	8
Myeloma/lymphoma	5
Thyroid cancer	1
Other known primary tumour	8
Unknown primary tumour	27

In 46% of the operated patients a pathological fracture was part of the problem. On the Frankel scale the patients' neurological status was as follows: A 4%, B 8%, C 35%, D 35% and E 18%.

Consumption of analgesics was as follows: Morphic analgesics 90%, non-morphic analgesics 9% and no analgesics 0%.

The operative treatment included tumour resection in 71 % of the cases, 11% as a wide excision, 16% as marginal excision and 73% as an intralesional excision.

The operative procedures performed were posterior decompression 4%, anterior decompression 11%, fusion 43%, and posterior fixation in the remaining cases. Anterior implants were used in 9% of the cases and posterior in 71% of the patients.

VIII. Isthmic spondylolisthesis. The 2011 analysis

The analytic part of this year's report is devoted to isthmic spondylolisthesis (ISL). Its anatomic features are well described, a defect in the pars interarticularis predisposing for forward slipping of the affected vertebra. There is a congenital aspect of the disorder, not fully explained, but also probably with a traumiterative fracture and it is especially common in elite gymnasts and weight lifters. Thus, it might represent a stress fracture in a person with predisposition for the disorder. It is seen in about 5% of the population of the western world and is in most cases asymptomatic.

Problems from ISL mainly appear either in adolescence, when progressing slip may constitute an indication for surgery either because of the risk of a pronounced deformity, even spondyoptosis, or giving back and/or leg symptoms. This usually occurs in puberty. After ceased growth there is no significant further slippage, except when the disc below the affected vertebra degenerates, at such instances, the slip normally progresses slightly. The vast majority of patients operated on for ISL are in the early middle age, when problems usually are elicited by disc degeneration in the segment below the slipped vertebra. The figure below (Figure 41) shows the age of the patients operated on for isthmic spondylolisthesis with a mean age just over 40 years and with a small hump in the left part of the curve representing adolescents with symptoms or progressive slipping.

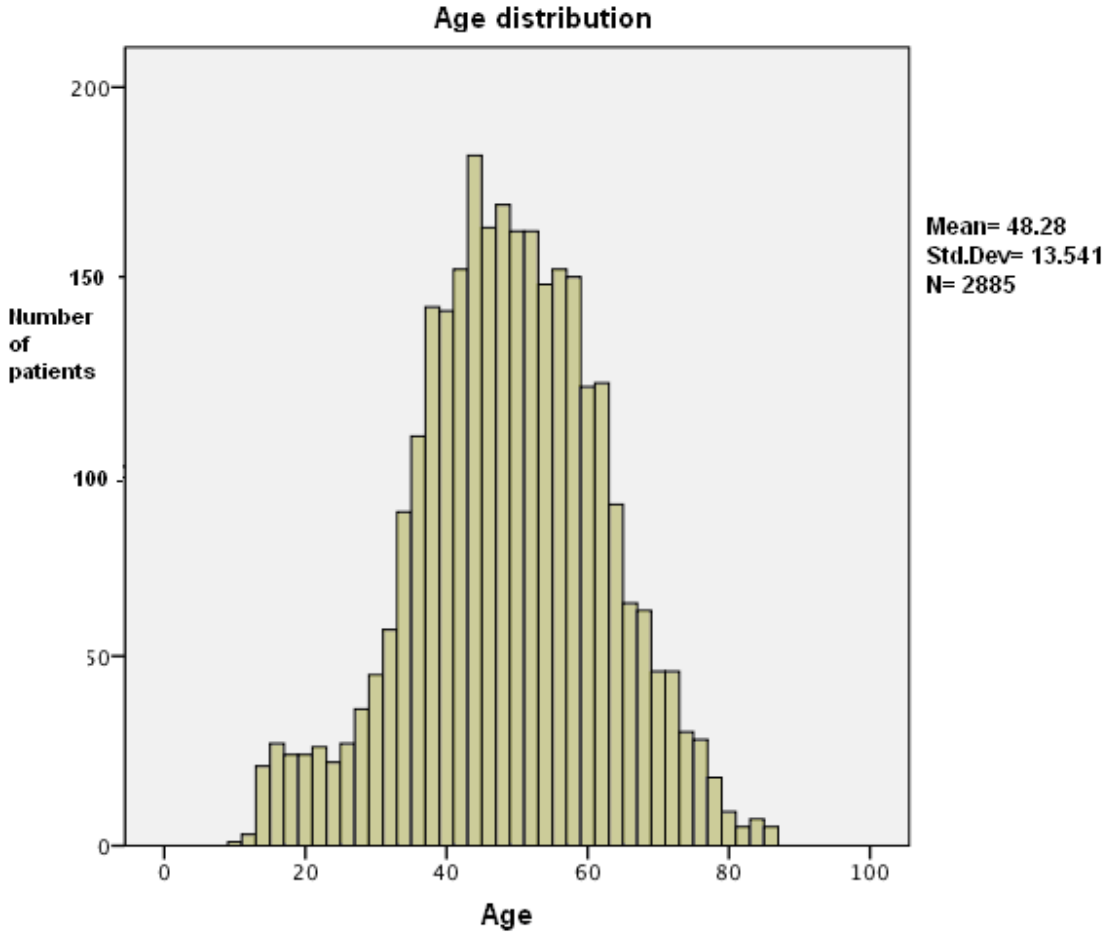

Fig 41. Age distribution of patients operated on for ISL.

There is evidence in the literature for treating ISL surgically including fusion which today is regarded as evidence based for this disorder. It is utilized when treating mechanical low back pain and also segmental radiating pain. There is some contrast to segmental pain/disc degenerative disorder (DDD) where patients mainly suffer from low back pain and where fusion surgery still today is strongly questioned due to limited effects on patient symptoms. Some reports show beneficial effects of fusion for DDD but only when compared to the natural course, cognitive behavioural therapy seems to be equivalently efficient.

ISL is subdivided in 6 degrees where 0 means an isthmic defect without slipping, i.e. only fracture/defect to the pars interarticularis. The four following degrees are <25, 26-50, 51-75 and 76-100% slippage in relation to the lower vertebra. Stage 5 is spondyloptosis where the whole vertebra has slipped forwards and is located in front of the next vertebra, normally the sacrum.

The most common level for isthmic spondylolisthesis is L5/S1 followed by L4/L5.

Patients

The register contains 2 889 operations for ISL, the overwhelming majority including fusion. The majority of slips are grades 1 and 2. The segments operated on (Table 33) confirm the lowermost level is most commonly afflicted, the levels above in a decreasing order. The fact that there is a relatively large group with fusion of two segments (L4-S1) is that disc degeneration of the segment above the defect (L4-L5) is fairly common and therefore might provide indication for including it in the fusion especially in elderly patients.

Table 33. Operated segments.

Levels	Number	Frequency (%)
L3-L4	55	2
L4-L5	450	16
L4-S1	585	20
L5-S1	1615	56
Other or uncertain levels	180	6

In total 2 565 patients had passed one-year follow-up and 2 227 two-year follow-up at the time of this evaluation. The follow-up rate at one year was 77% and at two years 68% (Table 34), most complete data exist for back and leg pain on the VAS scale.

Table 34. Number of patients followed up at one and two years regarding the most important evaluation parameters.

Variable	Follow-up 1 year: n	Follow-up 2 years: n
VAS Back	1960	1506
VAS Leg	1957	1508
EQ-5D	1727	1322
ODI	1539	1239
GA Back	1974	1512
GA Leg	1953	1504
Sick leave	1849	1399
Return to work	1927	1480
Satisfaction	1942	1494

The yearly increasing number of operations for ISL demonstrated by Figure 42 are more or less proportional to the generally increasing number of registrations for spine surgery over the last 12 years (Figure 42, compare Figure 50).

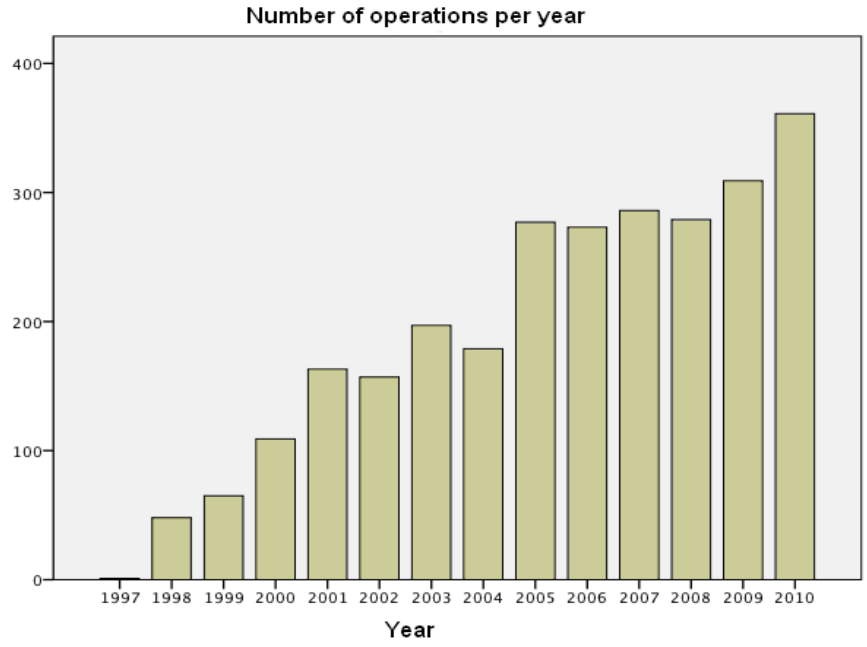

Fig 42. Number of registered fusions for ISL.

The most common operation for ISL is combined decompression and instrumented posterior fusion (45% of all ISL operations). Non-instrumented fusion, with or without concomitant decompression has been performed in 11% of the patients and combined posterior and intercorporal fusion in 18% (Table 35). Decompression was a part of the procedure in 52% of the operations.

Table 35. Surgical methods.

Surgical methods	Number	Frequency(%)
Non-instr PLF	123	4
Instr PLF	506	18
Non-instr PLF + decompr	188	7
Instr PLF + decompr	1299	45
ALIF	54	2
PLIF	441	15
TLIF	96	3
Other methods	181	6

Non-instr = Non-instrumented
Instr = Instrumented (pedicle screws and stages are used for fixation)
PLF= Posterolateral fusion (posterior fusion)
ALIF= Anterior lumbar interbody fusion (anterior fusion)
PLIF= Posterior lumbar interbody fusion(anterior fusion from behind)
TLIF= Transformainal lumbar interbody fusion (anterior fusion from one side)

Preoperative demographic data are presented in Table 36. There are slightly more smokers among the patients operated on and only 26% of the patients were working full-time preoperatively.

Tabell 36. Preoperative demographic data.

Variable	Frequency(%)
Females	35
Smokers	20
Previous back surgery	10
Full-time sick leave	41
Partial sick leave	10
Disability pension	23
Analgesics regularly	45
Analgesics intermittenltly	35
Co-morbidity	23

It is evident that the patients operated on for ISL have had their problems for a long time before surgery. A majority of patients (67%) have had back pain for >2 years before surgery and almost half of them (46%) have been on sick leave >1 year (Figure 43-44). Many studies suggest that a long preoperative duration of symptoms may be a predictor for more unsatisfactory outcome.

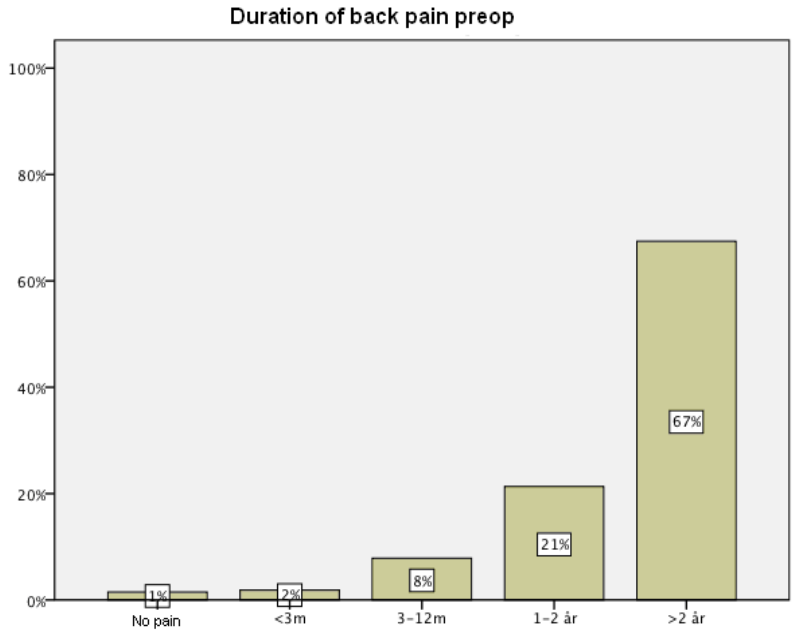

Fig.43. Preoperative duration of back pain.

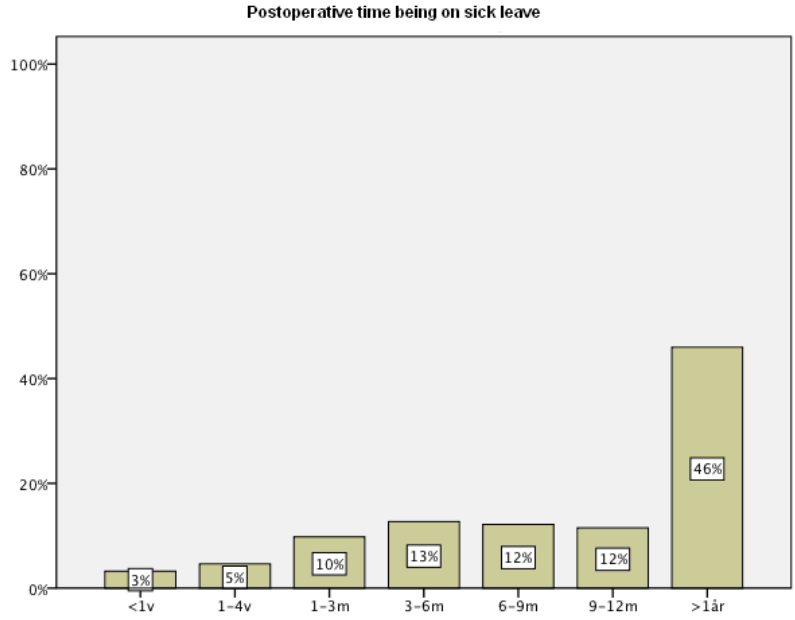

Fig 44. Preoperative time of being on sick leave.

Results

1. Function, quality of life and pain at follow-up
   Estimated back pain at follow-up as compared to preoperatively is presented after 1 and 2 years in Figures 45 and 46. Grading at follow-up is stated as pain free, much improved, slightly improved, unchanged and deteriorated (Global Assessment).

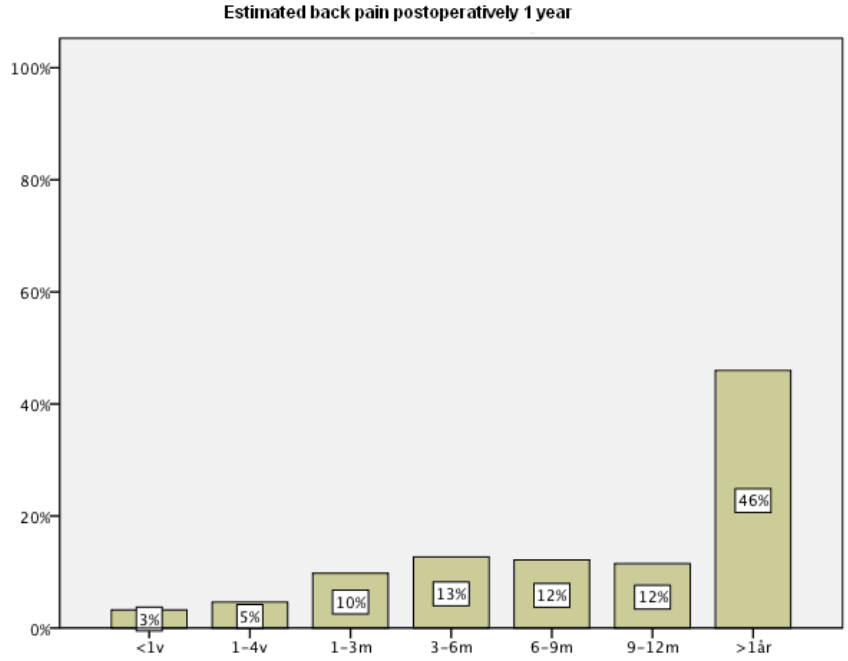

Fig.45. Back pain. Patient reported change after 1 year (Global assessment).

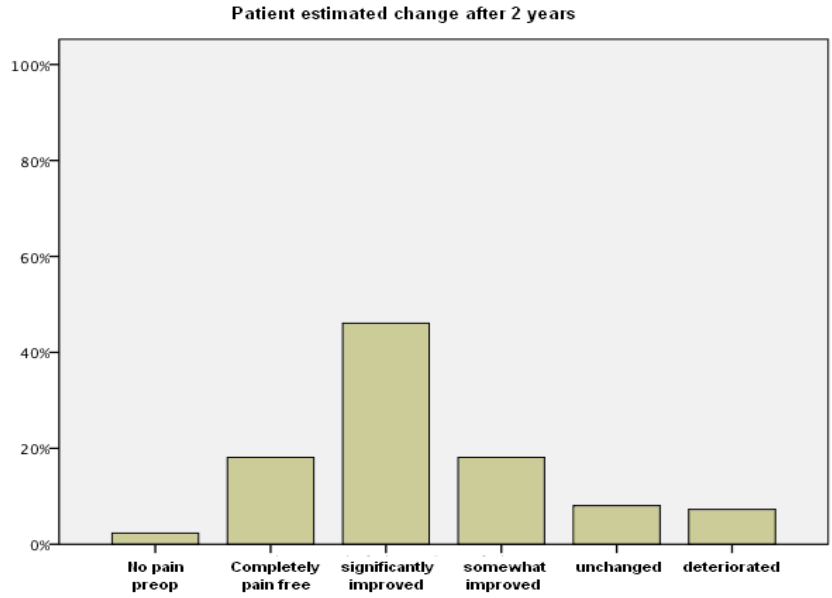

Fig 46. Back pain. Patient reported change after 2 years (Global assessment).

Figures 47 and 48 show the outcome at 1 and 2 year follow-up regarding back pain. Patients without preoperative back pain have been excluded in these figures and the left bar shows patients who are pain free or significantly improved while the right bar shows the three other categories, slightly improved, unchanged and deteriorated. This way of dichotomizing the answers has been used in the further analysis of predictors and other comparisons.

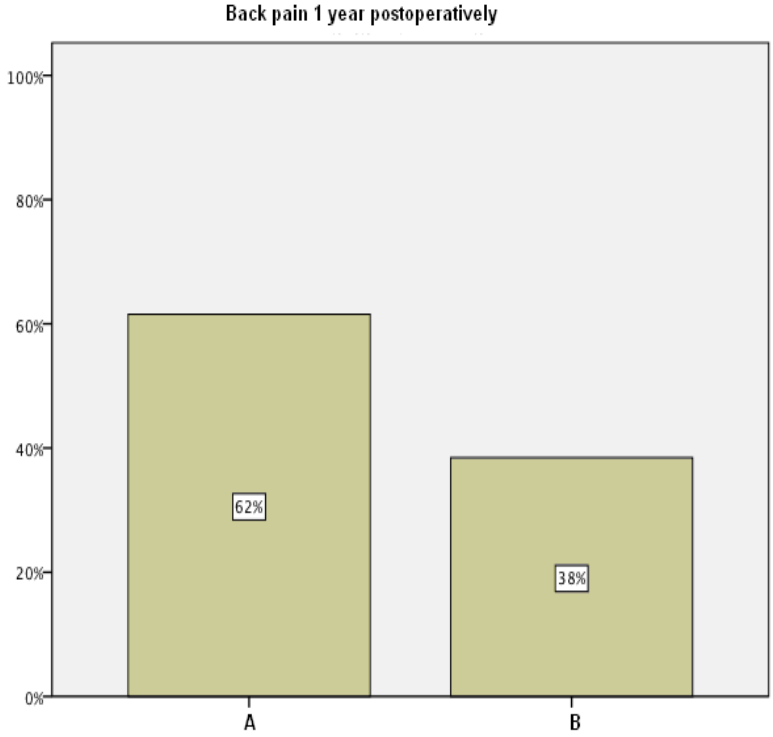

Fig.47. Back pain 1 year postoperatively. Left bar (A) includes patients pain free or significantly improved, right bar (B) includes slightly improved, unchanged and deteriorated.

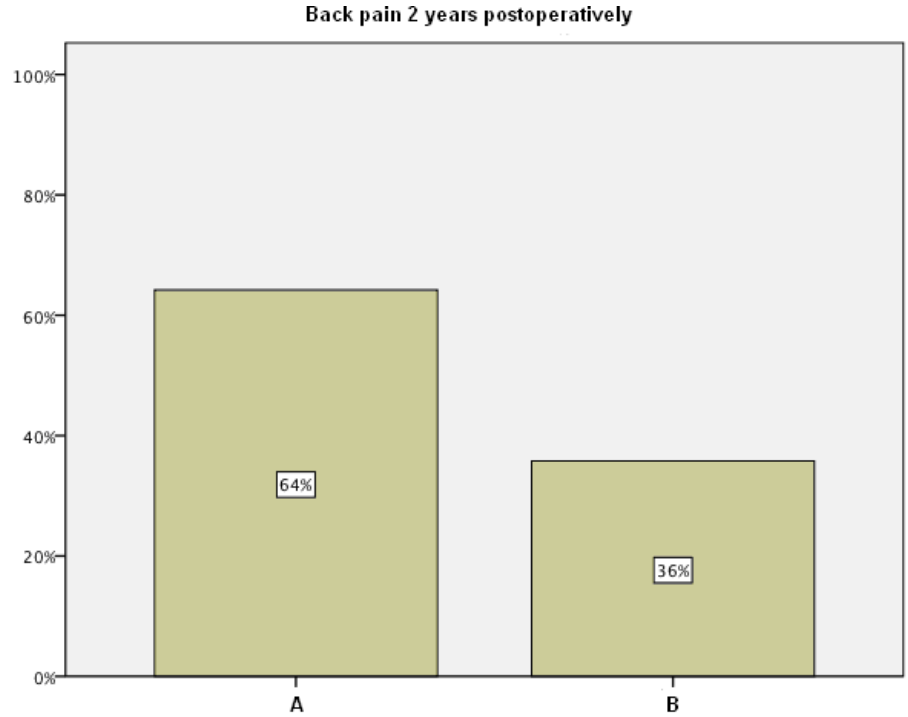

Fig 48. Back pain 2 years postoperatively. Left bar (A) includes patients pain free or significantly improved, right bar (B) includes slightly improved, unchanged and deteriorated.

Outcome parameters 1 and 2 years postoperatively are presented in Table 37. Back and leg pain is measured on the VAS scale, spine related disability with the Oswestry Disability Index

(ODI) and health related quality of life with EQ-5D. Pronounced and significant improvements are seen in all aspects.

Table 37**.** Pain, function and quality of life before surgery, 1 and 2 years postoperatively.

	Preop	**Change go FU1**	**FU1**	**FU2**	
VAS Back	59	29	30	29	
VAS Leg	52	27	25	26	
ODI	42	18	24	23	
EQ-5D	0.35	0.29	0.64	0.67	

The proportion of patients completely being on sick leave has diminished from preoperatively (41%) to 17% 1 year after operation and 10% after 2 years. 31% and 37% respectively of the patients have returned to full-time work during the first and second postoperative year (Table 38).

Table 38. Working ability after surgery.

	FU1	**FU2**
Disability pension	16	18
Completely on sick leave	17	10
Returned to full-time work	31	37
Returned to part-time work	16	15

Global assessment of outcome shows 72% and 73% (1, 2 years) to be satisfied with the outcome of surgery while 9% (1 year postop) and 10% (2 years postop) of the patients are dissatisfied with the outcome (Table 39).

Table 39. Global assessment of outcome.

	FU1	**FU2**
Satisfied	72	73
Hesitant	19	17
Dissatisfied	9	10

2. Outcome related to segment operated

Minor non-significant differences regarding improvement of back pain and being on sick leave are seen at 1 and 2 year follow-up (Table 40).

Table 40. Results (pain and working ability) related to operated level.

Segment	**Much improved (%)**		**Full sick leave (%)**	
	FU1	**FU2**	**FU1**	**FU2**
L5-S1	61	65	19	12
L4-S1	59	62	18	9
L4-L5	68	65	13	4

3. **Results related to type of surgery**
   The relative improvement is similar in the groups with different types of surgery performed (Table 41).

Table 41**.** Results after 1 year related to type of operation.

Number	Type of operation 1	Much improved (%)	Type of operation 2	Much improved	Chi^2 (P)
444	PLF	53	PLF+instr	63	0.06
1002	PLF± dec	58	PLFinstr±dec	63	ns
1446	PLF±instr	61	PLF±instr±dec	63	ns
1582	PLF instr+dec	63	PLIF/TLIF	62	ns

4. **Predictors**
   In a logistic regression analysis, predictive factors have been analyzed, the main result is that the most important predictors for a bad outcome is previous surgery and being on sick leave for longer periods preoperatively (Table 42). Smoking also seems to be a predictor of bad outcome but with lower significance.

Table 42. Logistic regressions analysis of predictive factors.

Variable	Significance	Odd's Ratio	Confidence interval 95%
Smokers	0.01	1.4	1.1 – 1.8
Previous back surgery	<0.0001	2.0	1.4 – 2.9
Length of sick leave	<0.0001	1.5	13 – 1.7
Pain duration	ns		
Age	ns		
Gender	ns		

5. **Comparison of outcome for ISL to outcome after fusion for segmental pain/DDD**
   In this comparison totally 7 626 patients having undergone fusion for either DDD or ISL were analyzed and the 1-year follow-up studied. The outcome has consistently been more or less identical at one and two years postoperatively in the national register (Swespine) which has led us to stay with the one year outcome in this analysis (Figure 49).

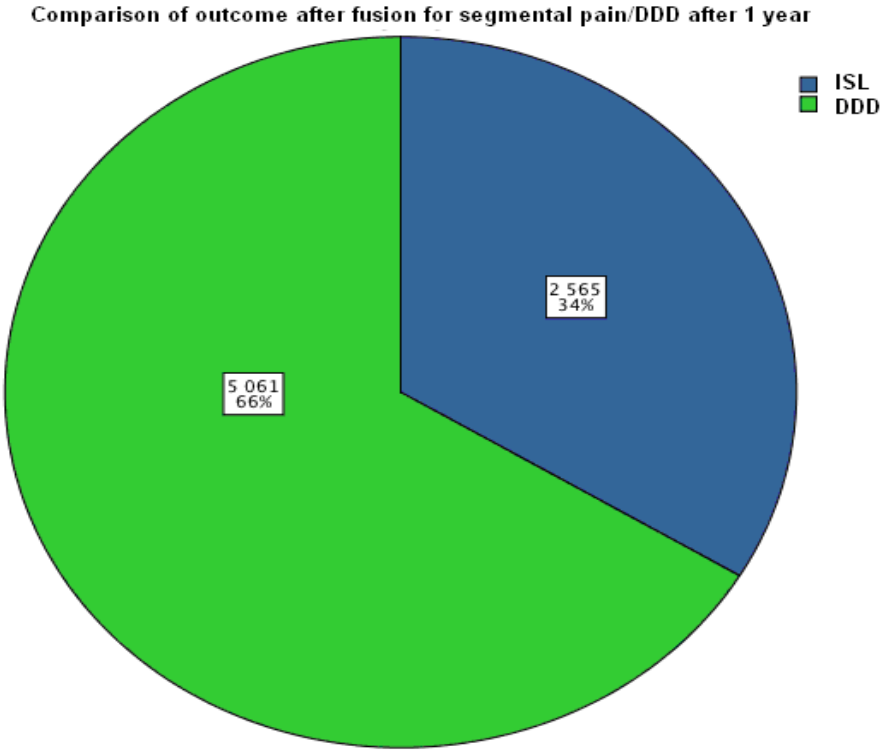

Fig 49. Comparison of outcome after fusion for segmental pain/DDD after one year.

Including all techniques of surgery for DDD compared with all techniques of surgery for ISL, no difference in outcome regarding back pain is seen (Table 43). If comparing only posterior fusion with or without decompression, the outcome is significantly better for ISL. This statistical significance however, hardly corresponds to a clinically relevant difference. For the other techniques used (Table 43) no significant difference is seen.

Table 43. Outcome comparison after fusion for ISL and DDD one year postoperatively. The comparison is restricted to the three most common levels operated ((L5-S1, L4-S1 and L4-L5).

Type of surgery	**n**	**Much better (%)**		**Chi²**
		ISL	DDD	P
All methods	4 069	60.2	59.5	ns
PLF±instr±decompr	2 103	60.7	56.2	0.04
PLF±instr	1 033	59.9	55.5	ns
PLF+instr	846	62.2	55.3	ns(0.06)

6. Complications

The incidence of complication during primary hospitalization is presented in Table 44. Four patients died before discharge which is remarkable. The number of nerve root injuries and dural lesions is relatively low, the risk for under-reporting cannot be excluded.

Table 44. Reported complications during primary hospitalization.

Type	Number
Death	4
Cauda equina syndrom	1
Dural lesion	61
Visual disturbance	1

7. **Re-operations during hospitalization**.
   Forty-eight patients (1.7%) were re-operated during the first hospitalization period. The most common re-operation was replacement of screws (Table 45).
   .

Table 45. Re-operation during the first hospitalization.

Type of re-operation	Number
Replacement of pedicle screw	17
Hemostasis	4
Repair of dural lesion	4
Extraction of implant	4
Drainage of infection	2
Other	17

Re-operation after the primary hospitalization episode is presented in Table 46. These patients, thus, have been readmitted for repeated surgery. 224 of the patients have been re-operated once, 29 patients twice and 24 patients 3 times during follow-up. The most common cause for the first re-operation was extraction of implants and the most common cause for the third re-operation was drainage of postoperative infection.

Table 46. Re-operation after first hospitalization.

Type of re-operation	Re-op 1	Re-op 2	Re-op 3
Number	224	29	24
Frequency (%)	7,8	1,0	0,8
Extraction of implant	111	14	2
Replacement of implant	6	3	2
Re-fusion	57	9	7
Drainage of infection	7		7
Repair of dural lesion			1
Other	43	2	5

Discussion

The patient population with surgically treated isthmic spondylolisthesis presented is uniquely large and allows, in spite of some degree of missing values at different follow-up times, a fairly safe judgement regarding outcome, predictors and comparison with DDD above. The age distribution in ISL underlines that operation mainly is performed in persons of middle age developing disc degeneration in the segment below the pars defect. Therefore ISL in the adult patient mainly can be regarded as a degenerative disorder with obvious resemblances to DDD. Comparing the results of surgery for ISL and DDD does not show any significant differences between different types of surgery except perhaps for posterolateral fusion ± decompression, but this difference however is not clinically relevant. There is a minor trend towards better outcome for ISL than for DDD but, as stated before, the differences are small. The only obvious difference between ISL and DDD is the anatomic aberration with defect of the pars in isthmic spondylolisthesis and if we accept fusion for spondylolsthesis as evidence based medicine, the results presented above speak in favour of regarding fusion for DDD using relevant selection criteria also to be evidence based.

Among predictors for inferior surgical outcome, previous spine surgery is the strongest negative predictor but also long periods of being on sick leave preoperatively and smoking predict a bad surgical outcome.

The overall results show that 72% of the patients report satisfaction with outcome of surgery for ISL while 9-10% are dissatisfied with increased back pain at follow-up. This latter group merits a further analysis in order to improve our ability to select the right patients for surgery and improve results further.

In conclusion, this analysis shows that the clinical picture of isthmic spondylolisthesis is similar to disc degenerative disorders/segmental pain (DDD) and the surgical results in these two groups are also similar.

The clinical picture includes back pain ± either or both of back pain and nerve root pain and the rather diversified surgical methods utilized reflect the variable clinical presentation.

IX. Annual number of operations registered and follow-up frequency

The number of patients registered for degenerative lumbar spine surgery has continually increased over the last 12 years (Figure 50).

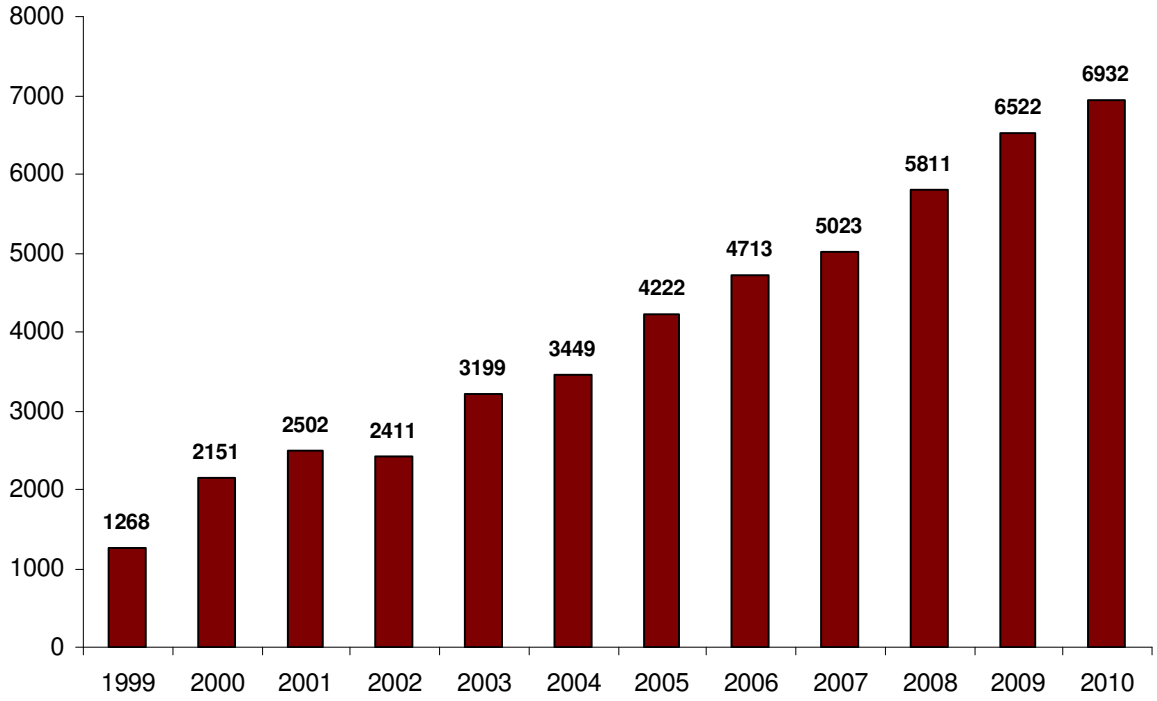

Fig 50. Number of patients registered for degenerative lumbar spine surgery 1999-2010.

The follow-up frequency at one year postoperatively varies between 75 and 80% related to diagnosis and between 60 and 70% regarding 2-year follow-up, Figure 51.

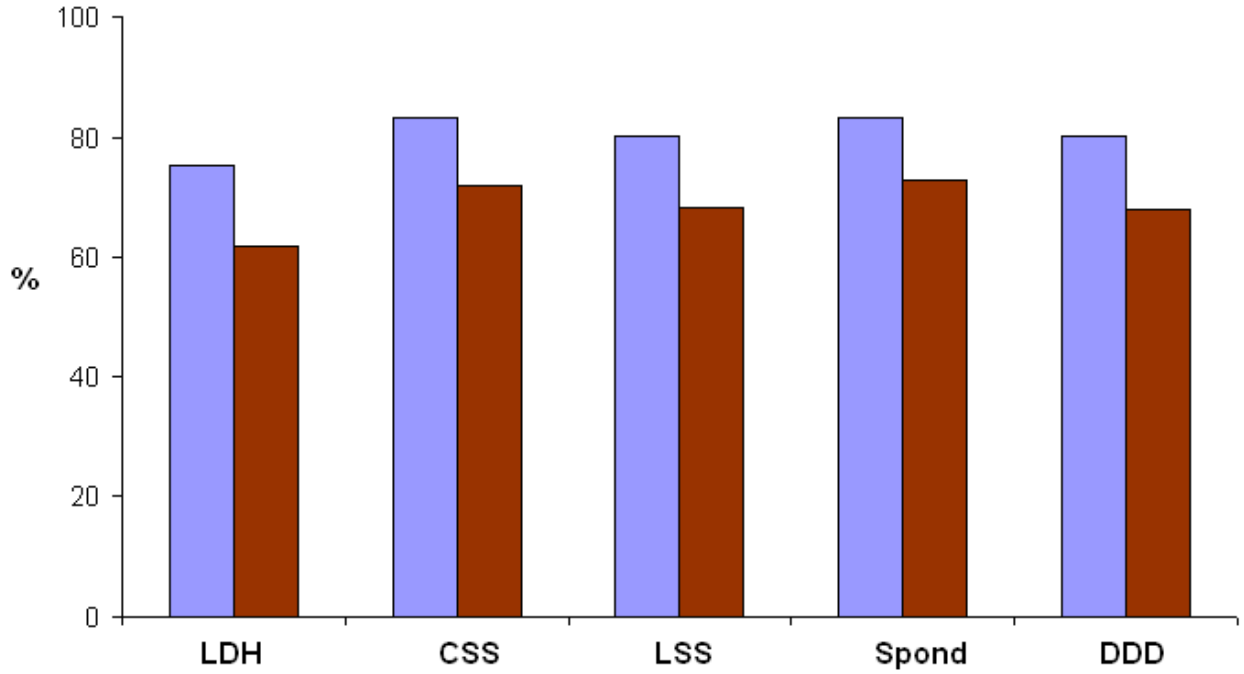

Fig 51. Follow-up frequency, diagnosis related.

X. Conclusion

Swespine, the Swedish national spine surgery register, now contains more than 64 000 spinal operations**.** The vast majority, more than 57 000, concern degenerative lumbar spine surgery. This registration has been ongoing for 20 years, and on a regular nation wide basis since 2000. The last three years also cervical spine problems, deformities, fractures, metastases and infections have been possible to register in separate protocols. This means that these diagnostic groups so far are fairly small and definite results are not possible to present, but some basic data have been included as a demonstration of future possibilities.

The annual presentations contain a specific analytic chapter and this year we have focused on isthmic spondylolisthesis (ISL). This has given us a uniquely large material of patients, 2 889 operations. Demographic data, type of surgery and outcome are presented, and it is striking that clinical presentation as well as outcome data are fairly similar to those of fusion for disc degenerative lumbar pain (DDD or "segmental pain"). Due to the large material, further analysis comparing these two groups will be performed and presented separately in coming reports.

In striving towards evidence based spine surgery we are depending on basic science studies, pilot studies and randomized controlled trials also in the future. However, to evaluate the implementation of surgical techniques in general (in real life) data collection in a national register should also be mandatory as most RCTs are very time consuming and performed within very specialized institutions. The data presented from Swespine thus can be regarded as results of surgery when performed on a national basis in all types of hospitals, and there are ample possibilities in comparing results from both different hospitals but also between types of clinics (as University hospitals, County hospitals and Private clinics). Some differences can for example be seen to be related to the number of operations performed per hospital where hospitals performing very few procedures annually seem to have less satisfactory results. This has been presented in a previous report (Annual report 2010).

Within the framework of the register more than 10 ongoing scientific projects are running. Further, the scientific publications from the register have been published in international peer reviewed journals, and the reference list enclosed contains such examples. It may be noted that a publication from the register was awarded the Eurospine Full Paper Award at the 2011 Eurospine meeting in Milan the past year. Register data provide an enormous potential for analysing surgical data and we hope to be able to present data from the other diagnostic groups within a near future.

Prerequisite for gathering data on a national basis is a dedicated work by secretaries, nurses and physicians working with spine patients and we would like to pronounce our gratitude towards these persons, without whose help data could not have been collected and analyzed. The economical support from the Swedish Association of Local Authorities and Regions is also acknowledged.

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