THE NATIONAL SWEDISH REGISTER FOR LUMBAR SPINE SURGERY REPORT 2008

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SWEDISH SOCIETY OF SPINAL SURGEONS

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List of contents

Introduction

This is a presentation of data from the Swedish Spine Register regarding the year 2007. Of 43 departments performing spinal surgery in Sweden 39 have registered patients during 2007 and the total number of patients registered is 4 932. Demographic data and surgical data presented, thus, concern patients operated on during 2007. Patients followed-up one year after surgery were operated on during 2006 and the data presented are follow-up data registered 2007 while 2-year follow-ups contain patients followed-up to and including 2007. The main part of this volume contains presentation of basic data and follow-up data but since 2006 a special chapter concerning focused analyses is contained. This year it focuses on risk factors for bad outcome of lumbar disc herniation surgery. The idea with analysis is to increase the ability for the society to benefit from register data in the future.

Since 2006 the register for degenerative lumbar disorders has been supplemented with register capability for the entire spine and other diseases such as deformities, fractures, infections and tumours. In the development of this "complete" register, many dedicated surgeons in the Swedish Society of Spinal Surgeons have participated in elaborating protocols.

On behalf of the Register Group in the Swedish Society of Spinal Surgeons

September 24, 2008

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I. Lumbar disc herniation surgery performed 2007

In total, 39 departments, orthopaedic and neurosurgical, registered degenerative lumbar spine surgery in 2007. These 39 departments reported on in total 4 932 patients,

The distribution of diagnoses for surgery during the year was as follows: disc herniation 31%, central spinal stenosis 42%, lateral spinal stenosis 7%, spondylolisthesis 6%, DDD/segmental pain (disc degenerative pain) 11% and others 3% (Figure 1).

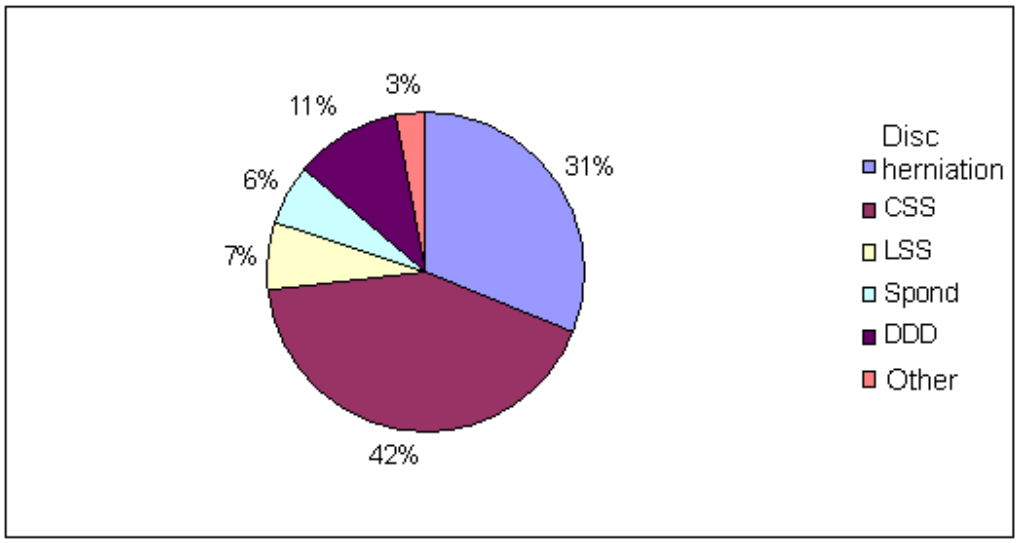

Fig 1. Distribution of diagnoses in the total material 2007, 4 932 patients.

Below demographic as well as surgical data related to diagnosis are presented. Missing data are excluded from the percentage calculations.

Disc herniation

Demographics

1 535 procedures for disc herniation was registred in 2007 of whom 54% males and 46% females. 22% were smokers and the mean age was 45 (15–88) years. The age distribution is presented in Figure 2.

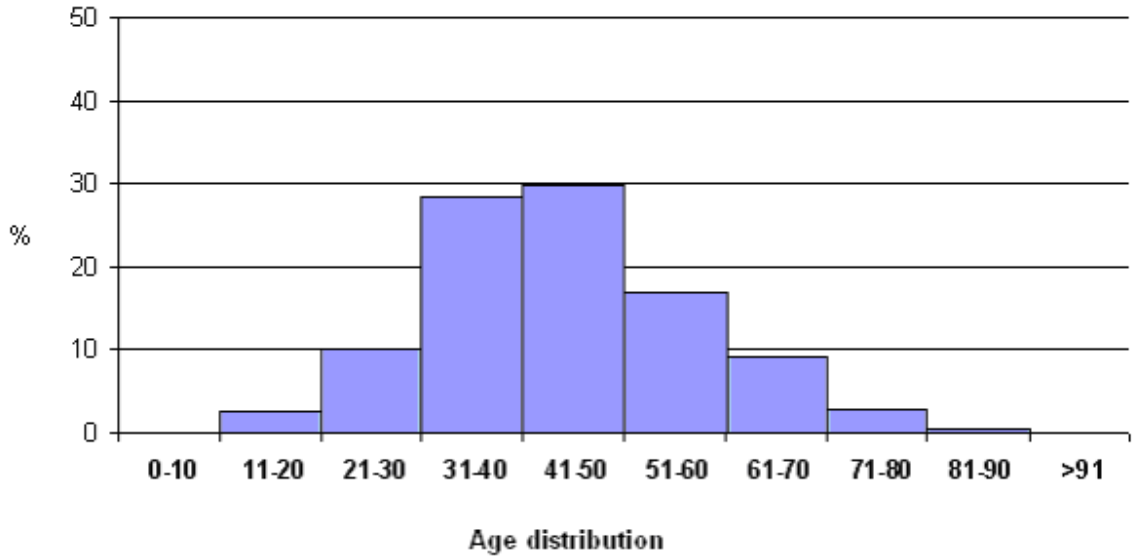

Fig 2. Age distribution, disc herniation, n = 1 532 patients.

Previous operations: 12% of the patients had gone through one surgical procedure of the lumbar spine previously.

Preoperative duration of back pain for the patient group was: 7% had no back pain, 12% less than 3 months, 46% 3 to 12 months, 16% 1-2 year and 20% more than 2 years.
Preoperative duration of leg pain (sciatica) for the patient group was: 2% had no leg pain, 18% less than 3 months, 52% 3 to 12 months, 16% 1-2 year and 13% more than 2 years.

The mean preoperative back pain on the VAS scale was 45 (0–100) and the mean preoperative leg pain 65 (0-100). Figures 3 and 4.

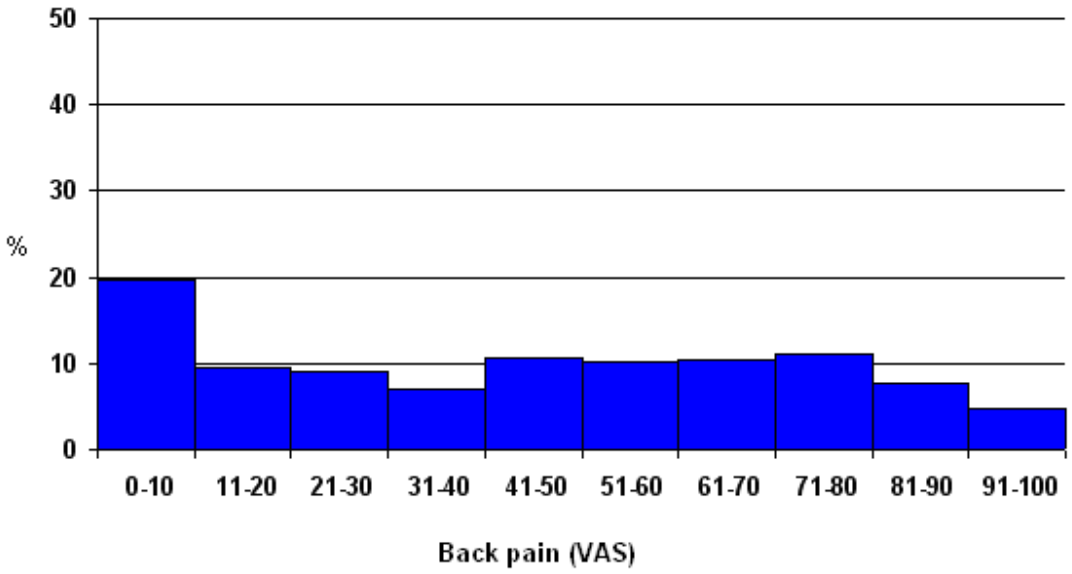

Fig 3. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from disc herniation (%).

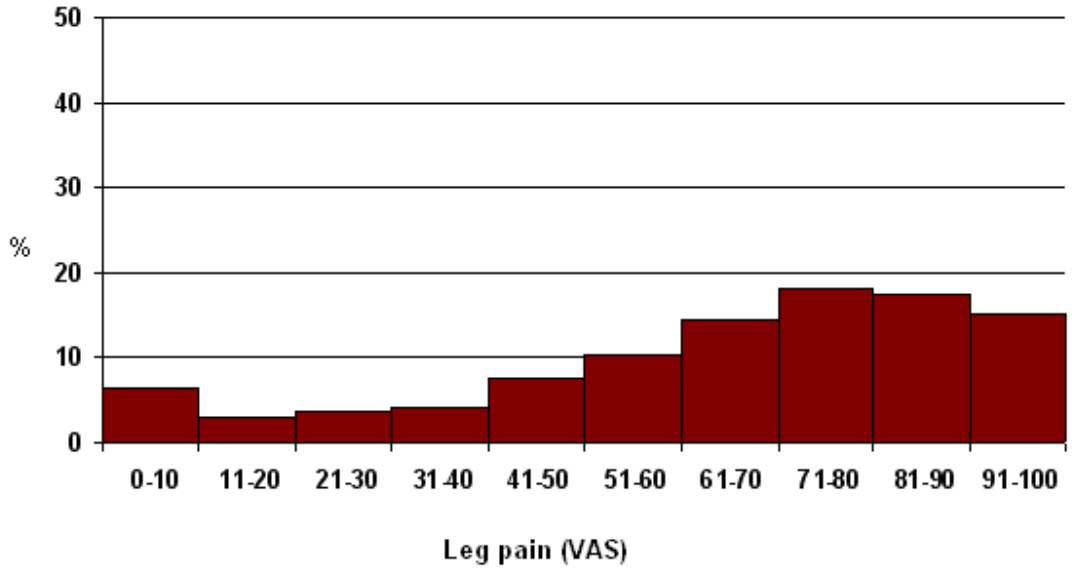

Fig 4. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from disc herniation (%).

Regular consumption of analgesics was reported by 58% of the patients, intermittent consumption by 30% while 12% did not use any analgesics.

Walking distance was estimated to less than 100 m for 31% of the patients, 21 % 100–500 m, 16% 0.5–1 km and 33% more than 1 km.

Surgical technique

In 43% of the operations, conventional open disc surgery was performed while microscopic disc surgery was performed in 48% of the cases. The remaining operations were mainly either decompressive procedures or decompressive procedures combined with posterior instrumented fusion.

The average length of stay, i.e. the time from registration to discharge, was for patients with conventional open disc surgery 3.1 days and for patients with microscopic disc surgery 3.0 days.

Central spinal stenosis

Demographics

Total number of patients: 2 089, 43% of whom were males and 57% females and 17% were smokers. Mean age was 68 (24-96) years. The age distribution is presented in Figure 5.

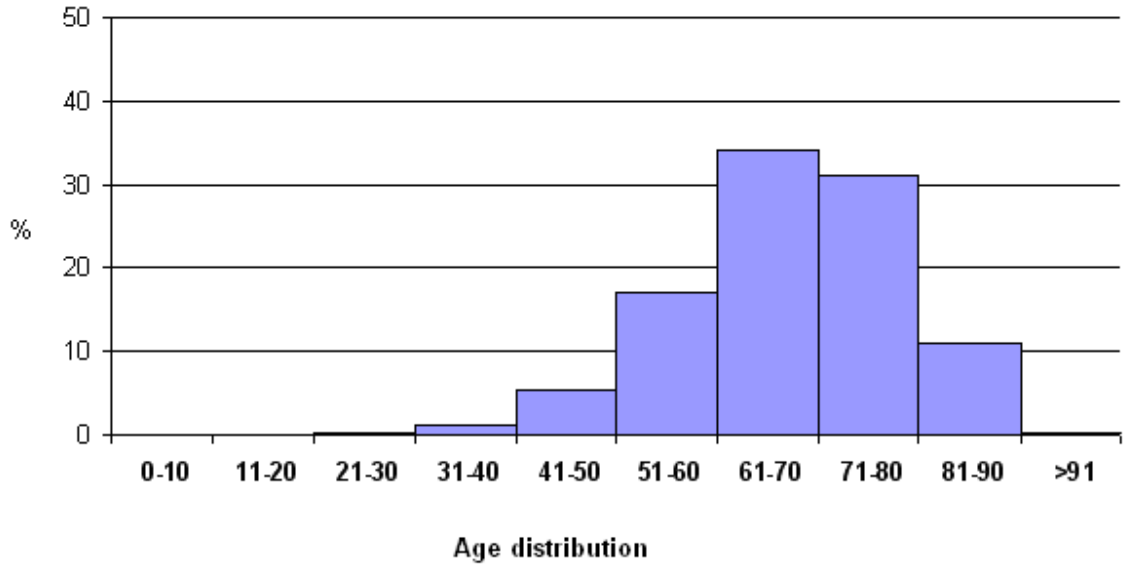

Fig 5. Age distribution, central spinal stenosis, n =2 089 patients.

Previous operations: 17% of the patients had gone through one to three surgical procedures of the lumbar spine previously.

Preoperative duration of back pain was: 4% had no back pain before the operation, 2% less than 3 months history of back pain, 14% 3-12 months, 21% 1-2 years and 59% more than 2 years.
3% of the patients had no leg pain before the operation, 3% less than 3 months, 20% 3-12 months, 29% 1-2 years and 45% more than 2 years.

The mean preoperative back pain on the VAS scale was 55 (0-100) and the mean preoperative leg pain 62 (0-100), Figures 6 and 7.

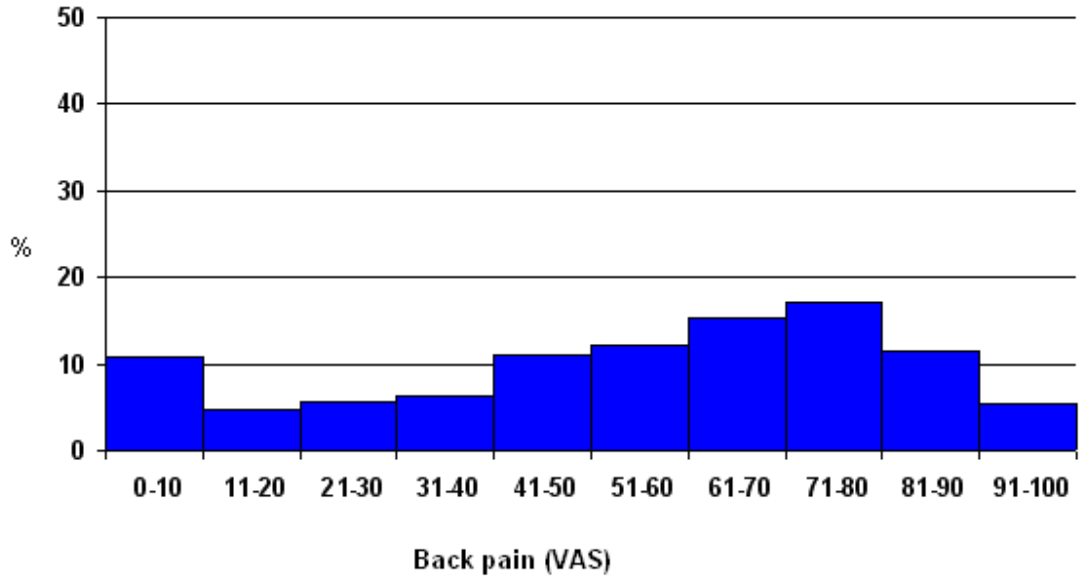

Fig 6. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from central spinal stenosis (%).

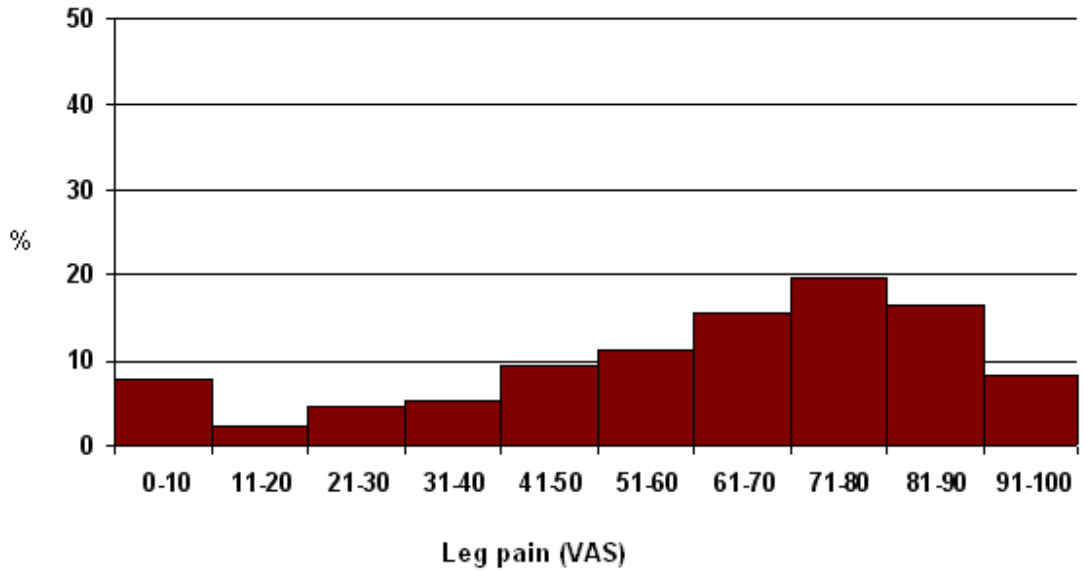

Fig 7. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from central spinal stenosis (%).

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

Walking distance: 42% of the patients had a walking distance less than 100 m, 30% between 100-500 m and 14% 500-1000 m. The remaining 13% had a walking distance exceeding one km.

Surgical technique

Decompressive surgery/laminectomy was the sole procedure performed in 73% of the cases, 45% conventionally and 28% microscopically. Decompression combined with posterior instrumented fusion was performed in 18% and decompression combined with PLIF in 2% of the cases. In 3% of the cases decompression + posterior non-instrumented fusion was performed.

The average length of stay for patients operated on by conventional decompression was 5.3, for patients operated on by microscopic decompression, 4.8 and for patients with decompression + posterior non-instrumented fusion 7.5.

Lateral spinal stenosis

Demographics

Total number of patients: 331, 45%of whom were males and 55% females.
23% were smokers.

Mean age 60 (27-88) years, the age distribution is presented in Figure 8.

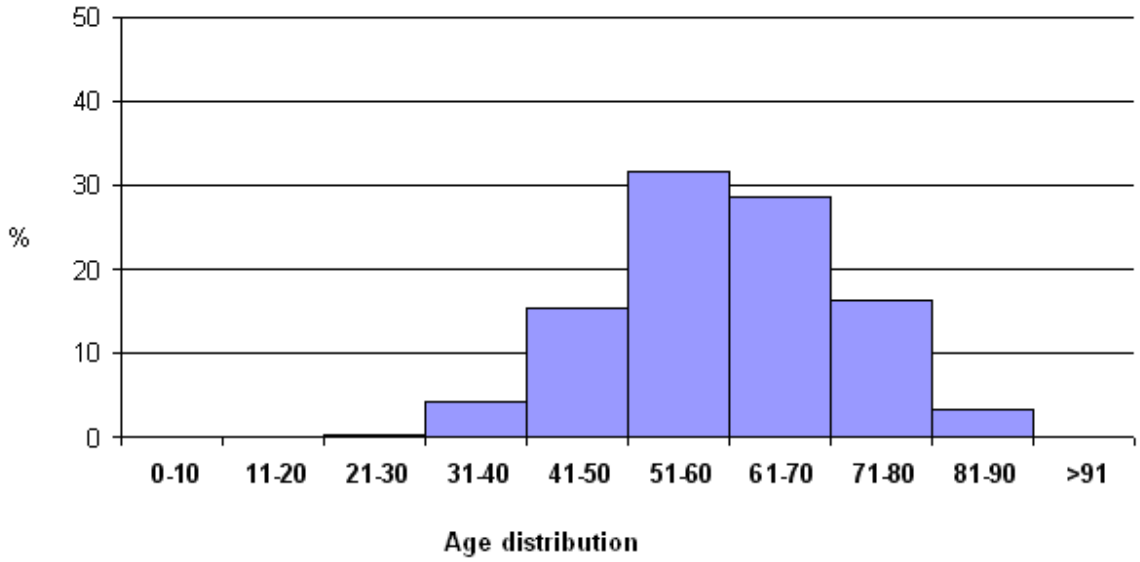

Fig 8. Age distribution, lateral spinal stenosis, n = 331 patients.

Previous operations: 25% of the patients had gone through one or more surgical procedures.

Preoperative duration of back pain: 5% had no back pain before the operation, 2% less than 3 months history of back pain, 20% 3-12 months, 20% 1-2 years and 52% more than 2 years.

Preoperative duration of leg pain: 2% of the patients had no leg pain before the operation, 2% less than 3 months, 27% 3-12 months, 28%1-2 years and 41% more than 2 years.

The mean preoperative back pain on the VAS scale was 55 (0-100) and the mean preoperative leg pain 64 (0-100), Figures 9 and 10.

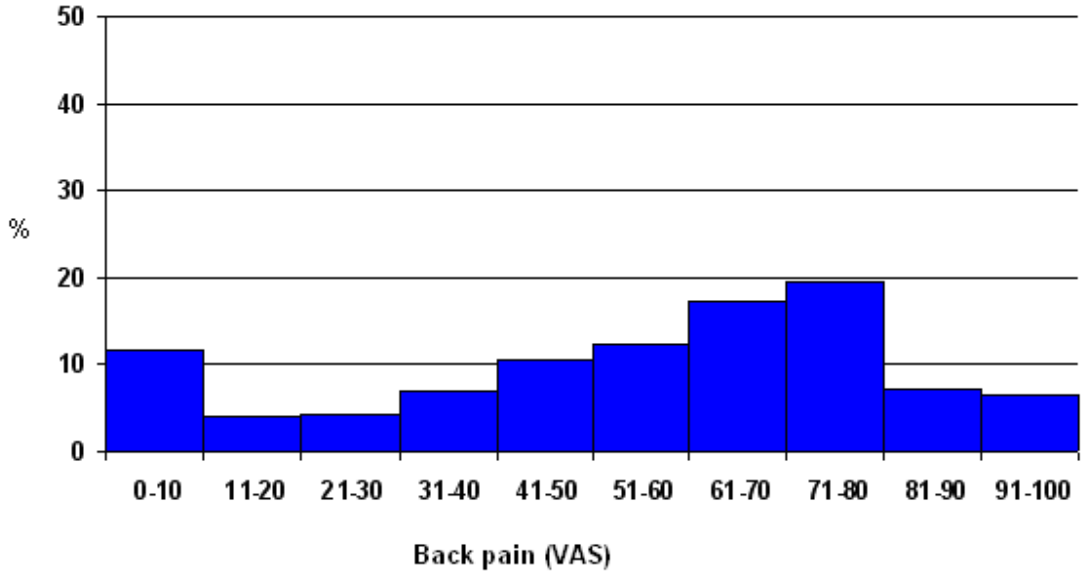

Fig 9. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from lateral spinal stenosis (%).

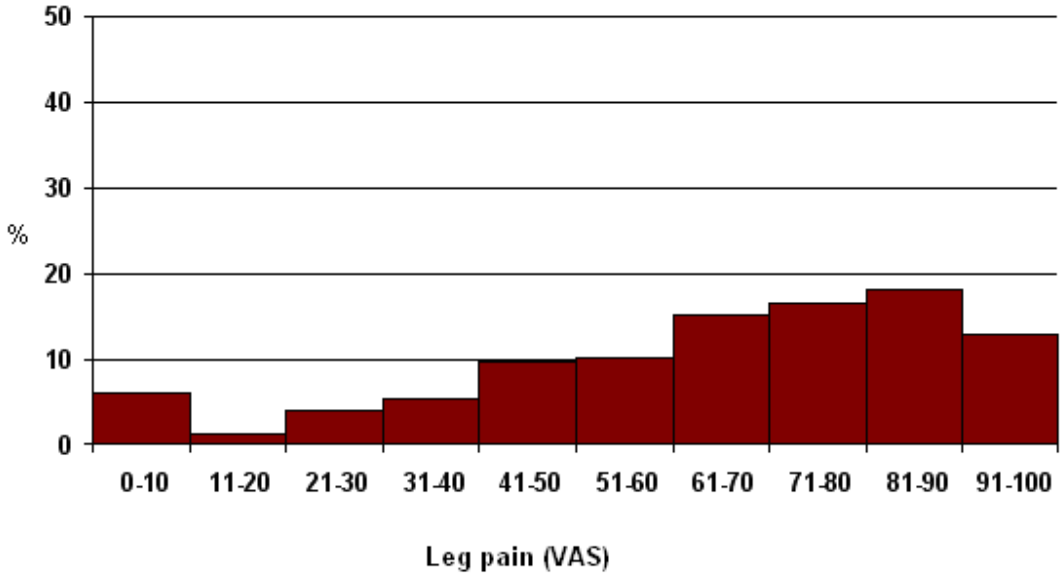

Fig 10. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from lateral spinal stenosis (%).

Regular consumption of analgesics was reported by 54%, intermittent consumption by 33% while 13% did not use analgesics.
Walking distance: 33% of the patients had a walking distance less than 100 m, 33% between 100-500 m and 15% 500-1000 m. The remaining 20% had a walking distance exceeding one km.

Surgical technique

Decompression surgery was used in the majority of cases, i.e. 91% of which 53% conventionally with an average length of stay of 4.0, 25% microscopically with an average length of stay of 3.3 and 13% had decompression + posterior non-instrumented fusion with an average length of stay of 6.4 days.

Spondylolisthesis (isthmic)

Demographics

Total number of patients: 283, 48% of whom were males and 52% females. 20% were smokers.

Mean age 49 (14-79) years and the age distribution is presented in Figure 11.

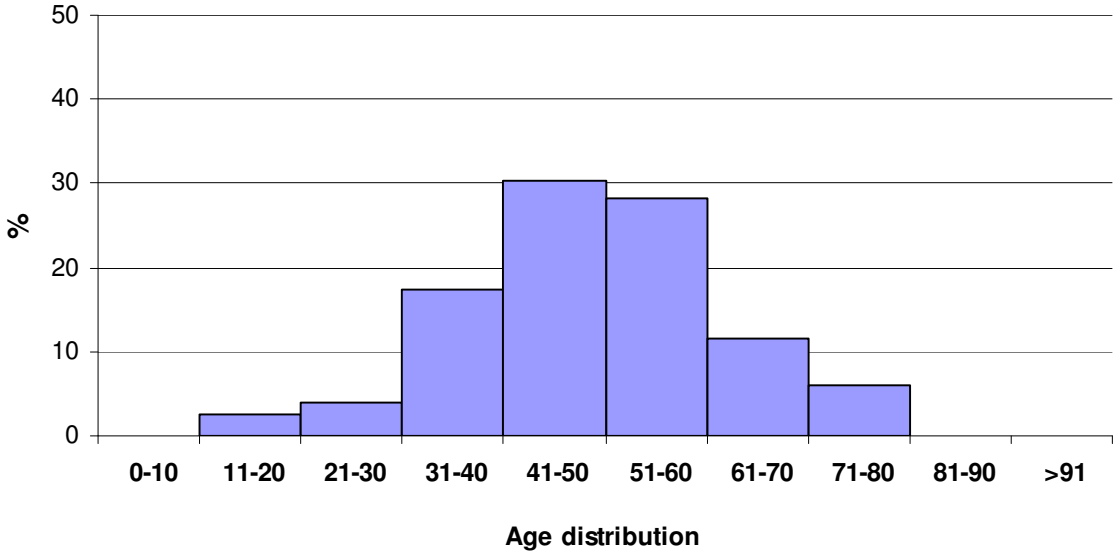

Fig 11. Age distribution, spondylolisthesis, n = 283 patients.

Previous operations: 10% of the patients had gone through one or more lumbar spine operations before.

Preoperative duration of back pain: 1% had no back pain before the operation, 1% less than 3 months history of back pain, 8% 3-12 months, 17% 1-2 years and 73% more than 2 years.
Preoperative duration of leg pain: 10% of the patient had no leg pain before the operation, 2% less than 3 months, 12% 3-12 months, 27%1-2 years and 49% more than 2 years.

The mean preoperative back pain on the VAS scale was 60 (0-100) and the mean preoperative leg pain 53 (0-100), Figures 12 and 13.

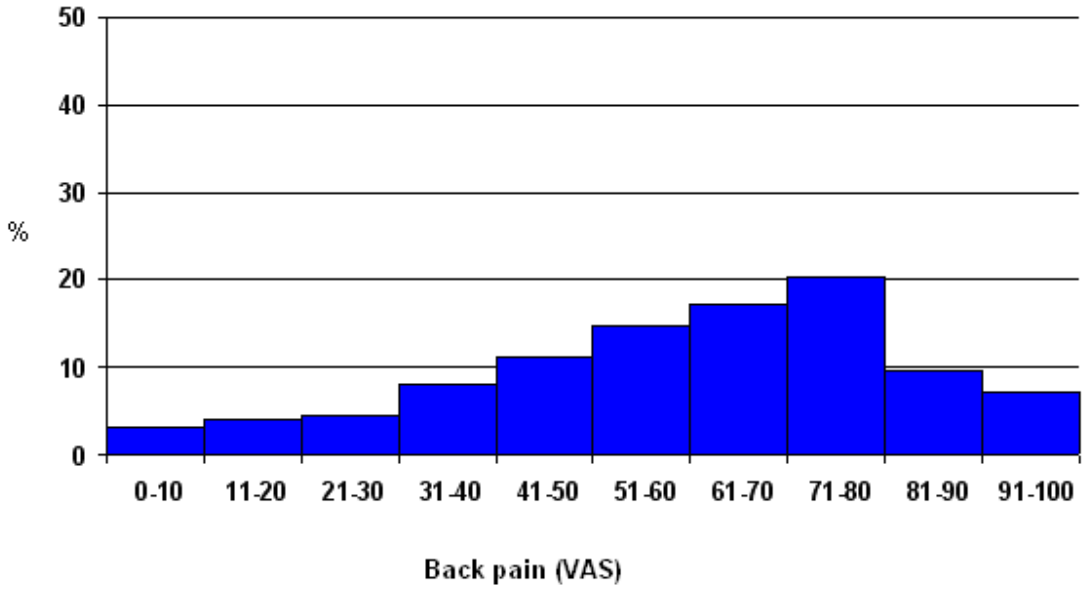

Fig 12. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from spondylolisthesis (%).

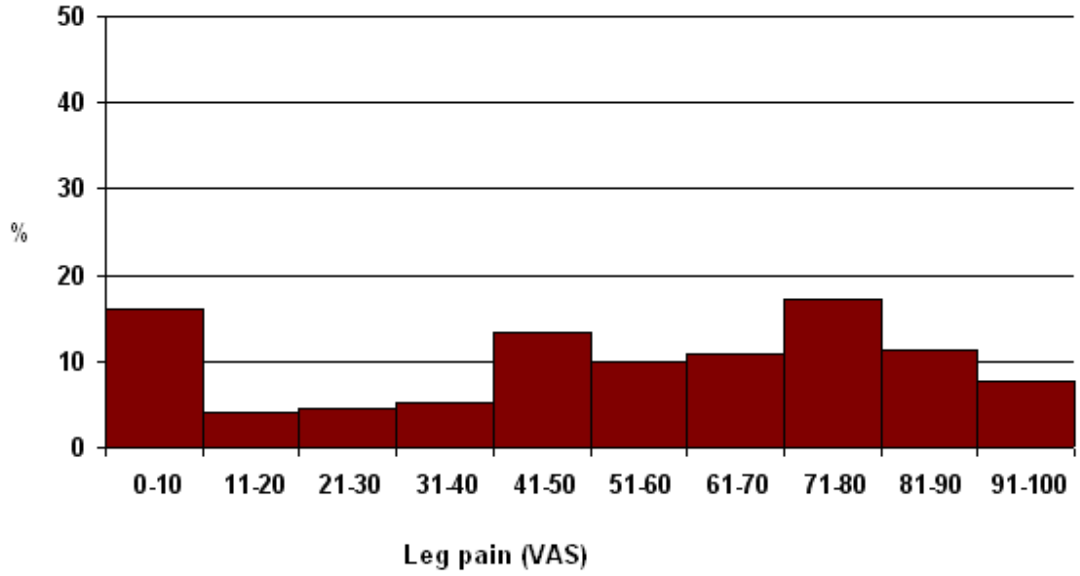

Fig 13. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from spondylolisthesis (%).

Regular consumption of analgesics was reported by 42%, intermittent consumption by 35% while 22% did not use analgesics.

Walking distance: 18% of the patients had a walking distance less than 100 m, 25% between 100-500 m and 21% 500-1000 m. The remaining 35% had a walking distance exceeding one km.

Surgical technique

A number of different operations was performed on patients suffering from spondylolisthesis: Decompression + instrumented fusion 42%, posterior instrumented fusion 21%, PLIF with or without implants 10%, decompression + non-instrumented fusion 8%, decompression + PLIF 7%, posterior non-instrumented fusion 1%, ALIF with or without implants 0.4%. Decompressive surgery was used in the remaining cases.

Average length of stay varied from 6.9 when using decompressive surgery + posterior instrumented fusion, 6.8 when using instrumented fusion to 7.1 when using PLIF.

DDD/Segmental pain

Demographics

Total number of patients: 524, of whom 45% were males and 55% females. 20% were smokers.

Mean age 46 (21-78) years and the age distribution is presented in Figure 14.

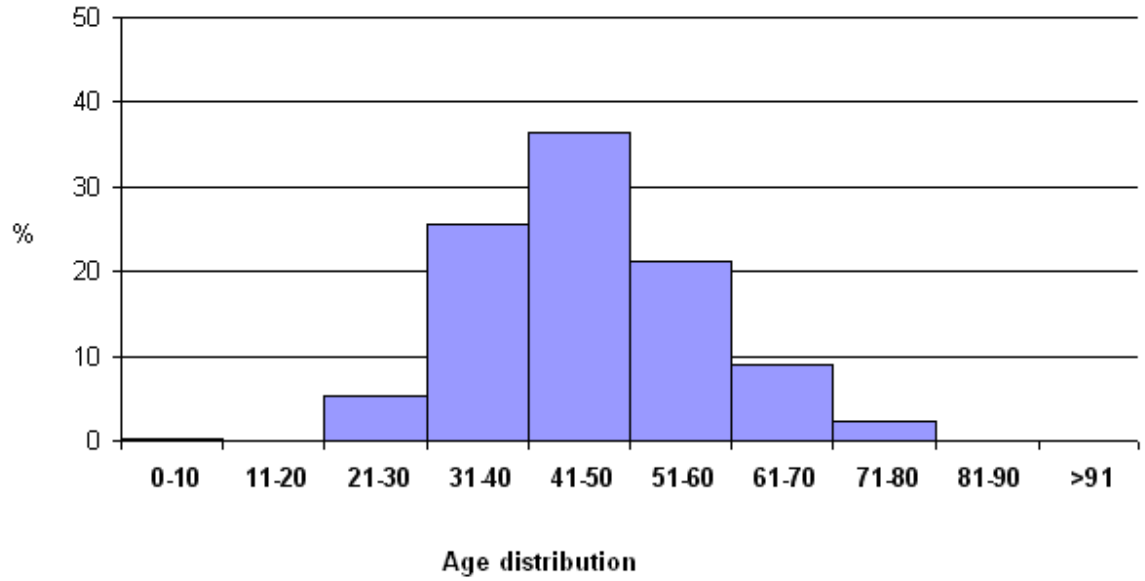

Fig 14. Age distribution, segmental pain, n = 524 patients.

Previous operations: 32% of the patients had one or more previous lumbar operations.

Preoperative duration of back pain: 1% had no back pain before the operation, 1% less than 3 months history of back pain, 8% 3-12 months, 16% 1-2 years and 74% more than 2 years.
Preoperative duration of leg pain: 16% of the patient had no leg pain before the operation, 3% less than 3 months, 12% 3-12 months, 20%1-2 years and 50% more than 2 years.

The mean preoperative back pain on the VAS scale was 64 (0-100) and the mean preoperative leg pain 44 (0-100), Figures 15 and 16.

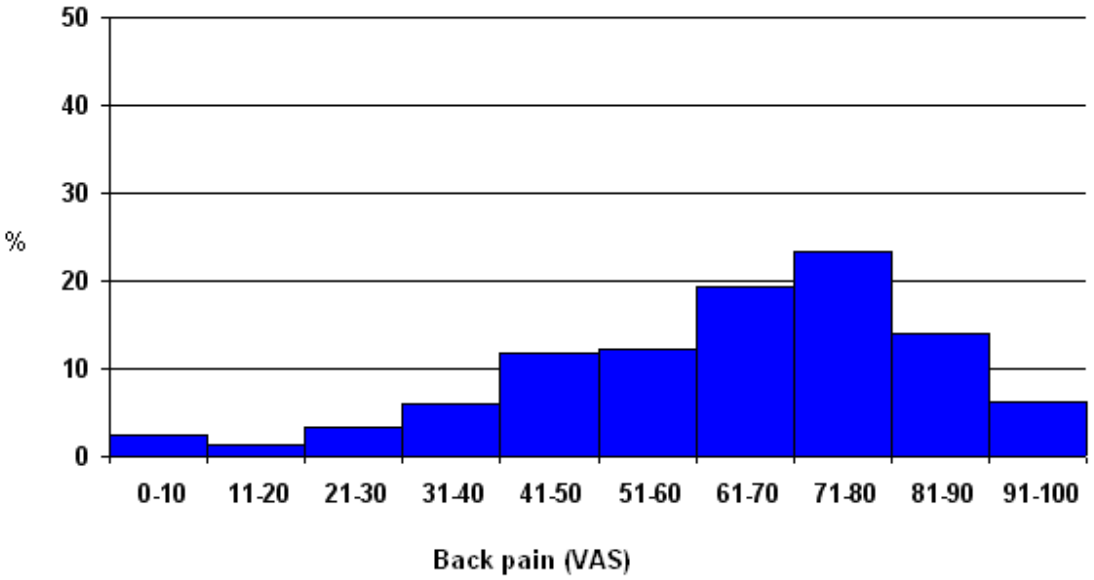

Fig 15. Back pain, according to the visual analog scale (VAS) preoperatively in patients suffering from DDD (%).

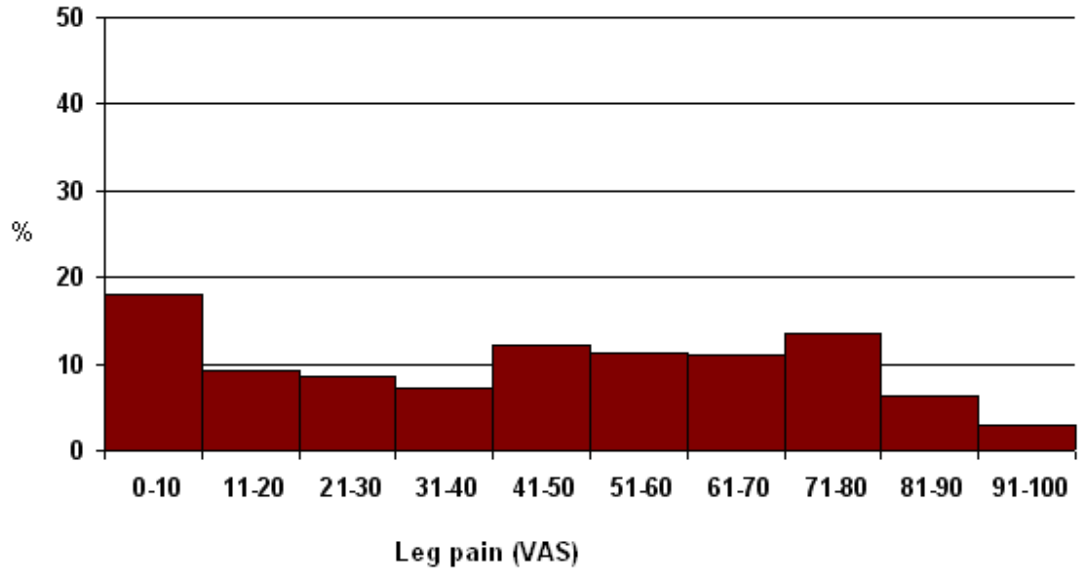

Fig 16. Leg pain, according to the visual analog scale (VAS) preoperatively in patients suffering from DDD (%).

Regular consumption of analgesics was reported by 55%, intermittent consumption by 35% while 10% did not use analgesics.

Walking distance: 15% of the patients had a walking distance less than 100 m, 23% between 100-500 m and 25% 500-1000 m. The remaining 37% had a walking distance exceeding one km.

Surgical technique

A heterogenous surgical spectrum was seen also for this diagnosis: Posterior instrumented fusion 20%, PLIF 18%, disc prosthesis 18%, decompression + posterior instrumented fusion 11%, decompression + PLIF 9%, TLIF 8%, decompression + TLIF 8%, posterior non-instrumented fusion 4%, decompression + posterior non-instrumented fusion 2%, ALIF with or without implants 1% and decompression 1%. Average length of stay was 6.2 days and varied between 3.0 and 9.7 days for the different types of operations.

II. ONE-YEAR FOLLOW-UP OF A COHORT OF PATIENTS OPERATED ON IN THE YEAR OF 2006

Total number of patients operated on in 2006 was 4 696, of these 3 415 (72.7%) completed the one-year follow-up during 2007. Distribution of diagnoses: disc herniation 1 596, central spinal stenosis 1 797, lateral spinal stenosis 320, spondylolisthesis 272, DDD 552 and 159 patients had other diagnoses.

Disc herniation

Total number of patients at one-year follow-up was 1 596, 57% of whom were males and 43% females and the mean age was 44 (15-92) years.

Surgical techniques used: 46% conventional disc excision, 42% microscopic disc excision, 7% decompressive procedures and the remaining 5% other procedures.

Results: Mean back pain before surgery (VAS) 44, at 12 months postoperatively 24.
Mean leg pain before surgery (VAS) 64, at 12 months postoperatively 21. Figures 17 and 18 display VAS distribution regarding back and leg pain pre- and postoperatively.

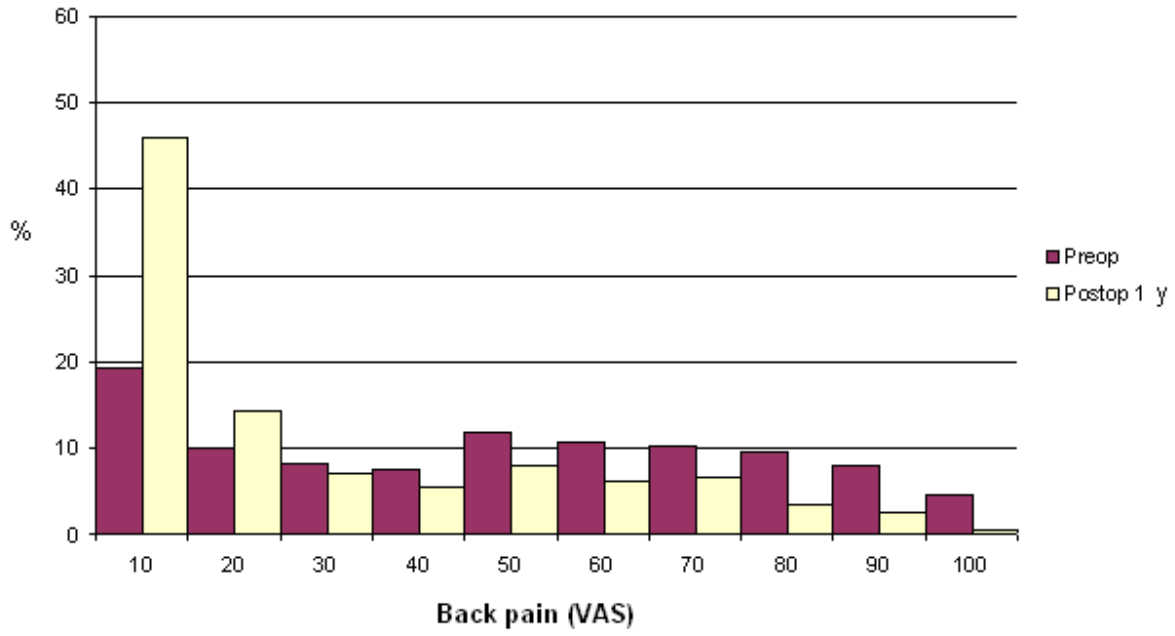

Fig 17. Back pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for lumbar disc herniation (%).

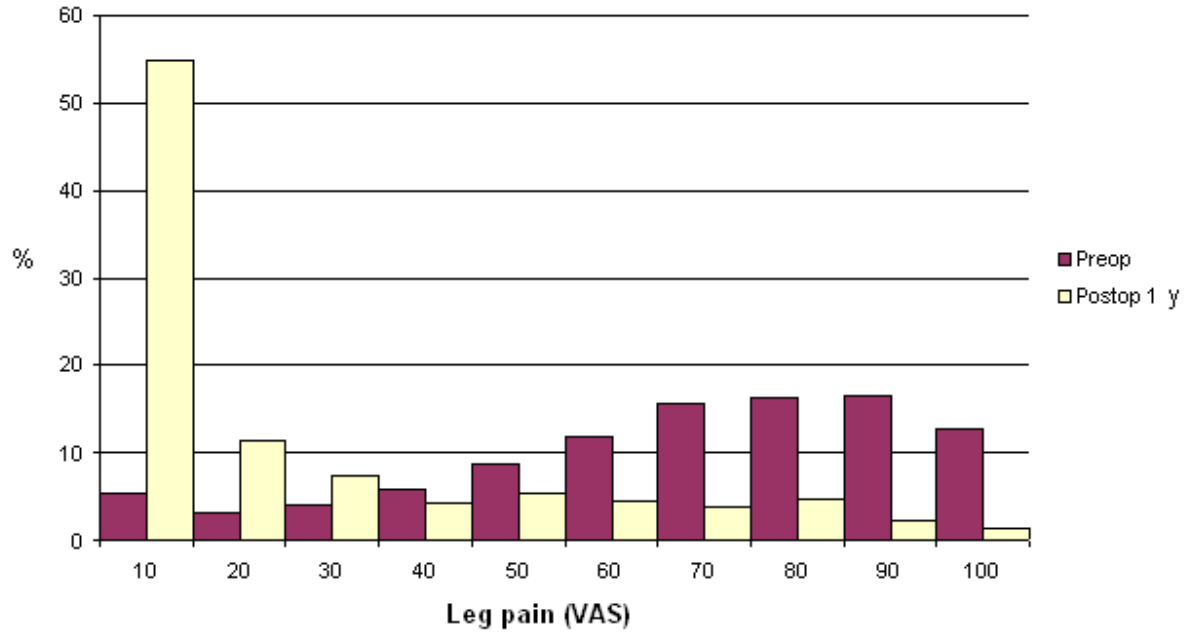

Fig 18. Leg pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for lumbar disc herniation (%).

Subjective improvement of back pain: Total pain relief 22%, significant improvement 43%, slight improvement 18%, unchanged pain 7%, deteriorated 3% and 6% did not have back pain before the operation.

Subjective improvement of leg pain: Total pain relief 36%, significant improvement 38%, slight improvement 14%, unchanged pain 6% and deteriorated 4%. 2 % did not have leg pain before the operation.

Patient satisfaction with surgery: Satisfied 76%, uncertain 17%, dissatisfied 7%.

Consumption of analgesics at 12 months: Regularly 18%, intermittently 31% and no consumption 52%.

Walking distance, one year postoperatively: 4% of the patients had a walking distance less than 100 m, 8% between 100-500 m and 12% 500-1000 m. The remaining 77% had a walking distance exceeding one km. This is a significant improvement compared to preoperative values.

SF-36: The pre- and postoperative SF-36 profiles are given in Figure 19, showing improvement postoperatively in all domains except General Health.

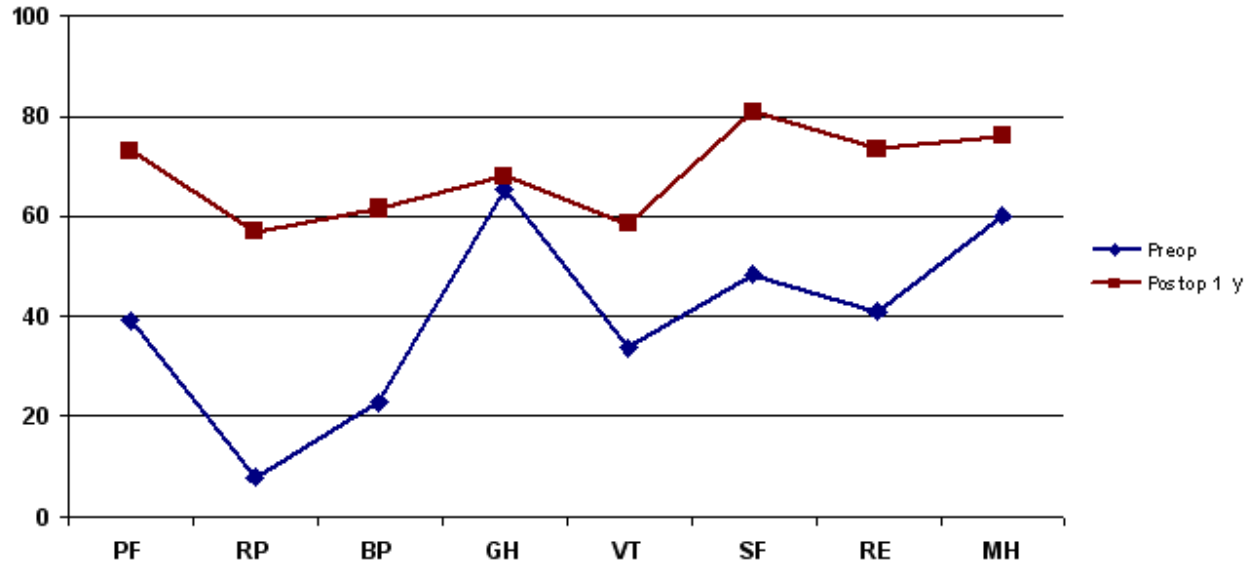

Fig 19. SF-36 scores (mean) pre- and postoperatively for patients operated on for lumbar disc herniation 2006.

The results from the EQ-5D-analysis are presented, both as EQ-5D-5 (meaning the outcome index based of the 5 questions included in the EQ-5D protocol) and as the EQ-5D-VAS.

EQ-5D results: EQ-5D 5 (index) preoperative: 27 and 71% 1 year postoperative. The mean value at VAS preoperatively (max value 100): 45 and 1 year postoperatively 71.

Central spinal stenosis

Total number of patients for one year follow-up was 1 797, 43% of whom were males and 57% females and the mean age was 67 (22-92) years.

Surgical techniques used: Decompression 70%, decompression and posterior instrumented fusion 17%, decompression + posterior non-instrumented fusion 4% andposterior fusion without instrumentation only 2%.

Results: Mean back pain before surgery (VAS) 55, at 12 months postoperatively 32. Mean leg pain before surgery (VAS) 62, at 12 months postoperatively 33. Figures 20 and 21 display VAS distribution regarding back and leg pain pre- and postoperatively.

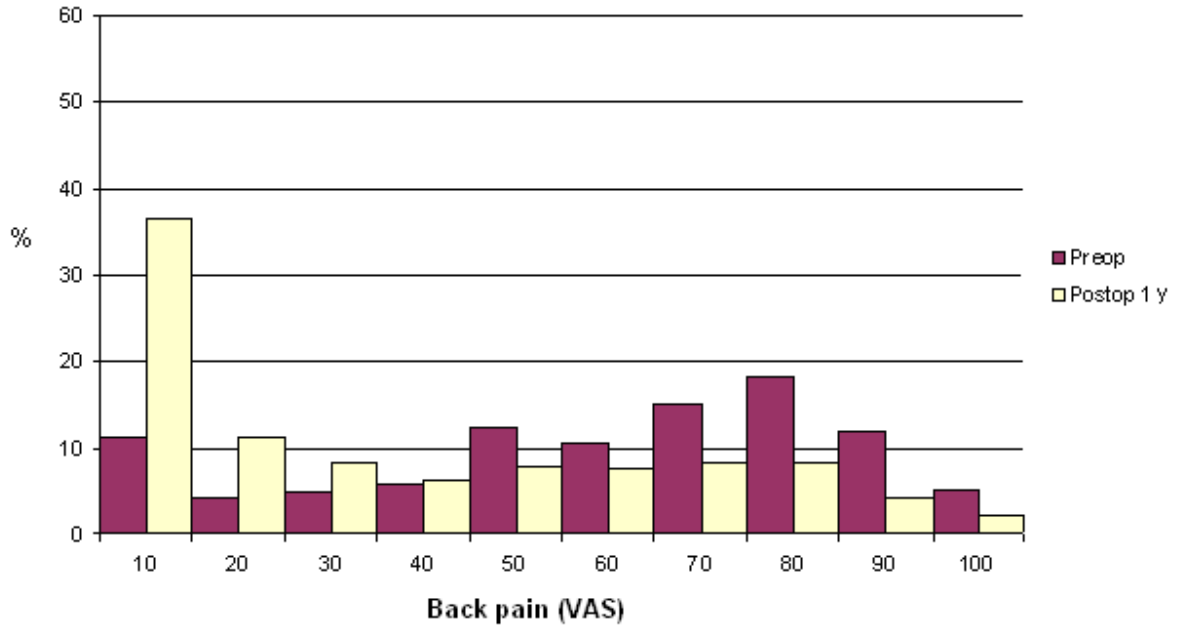

Fig 20. Back pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for lateral spinal stenosis 2006 (%).

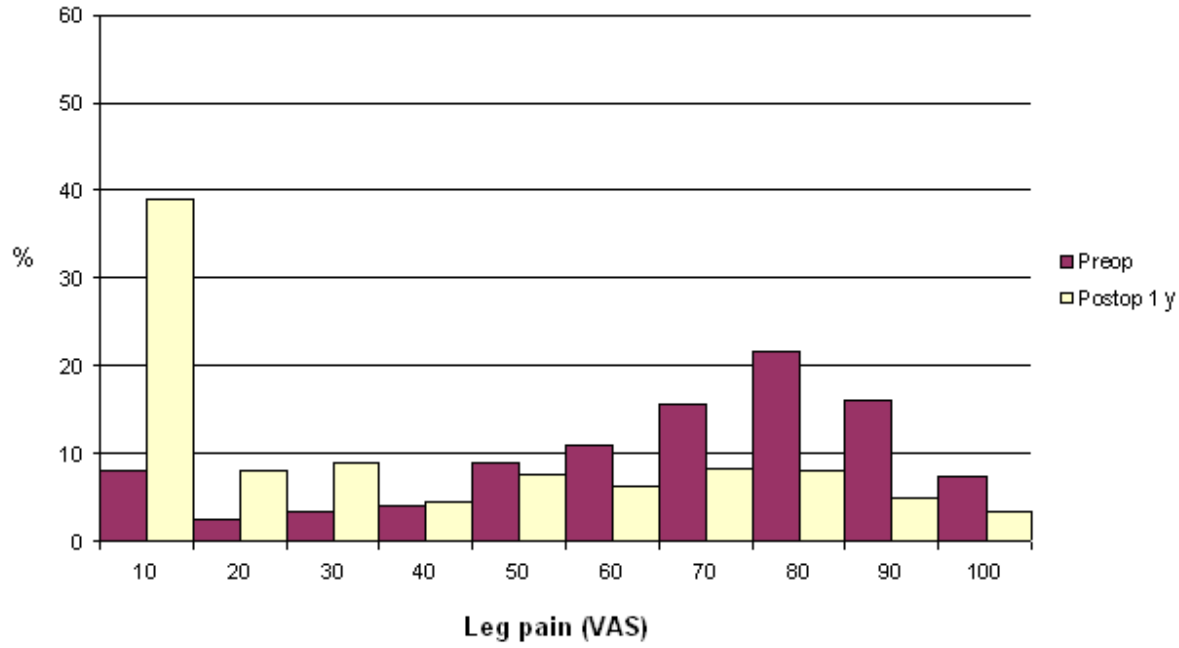

Fig 21. Leg pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for lateral spinal stenosis 2006(%).

Subjective improvement of back pain: Total pain relief 16%, significant improvement 37%, slight improvement 18%, pain unchanged 13%, deteriorated 10% and 7% did not have back pain before the operation.

Subjective improvement of leg pain: Total pain relief 21%, significant improvement 31%, slight improvement 17%, pain unchanged 13%, deteriorated 13% and 6% did not have leg pain before the operation.

Patient satisfaction with surgery: Satisfied 64%, uncertain 23%, dissatisfied 13%.

Consumption of analgesics at 12 months: Regularly 30%, intermittently 32% and no consumption 38%.

Walking distance: 20% of the patients had a walking distance less than 100 m, 20% between 100-500 m and 17% 500-1000 m. The remaining 43% had a walking distance exceeding one km. This is a significant improvement compared to preoperatively.

SF-36: The pre- and postoperative SF-36 profiles are given in Figure 22, showing improvement postoperatively in all domains except General Health. The improvement was less significant than for disc herniation but related to age probably similar.

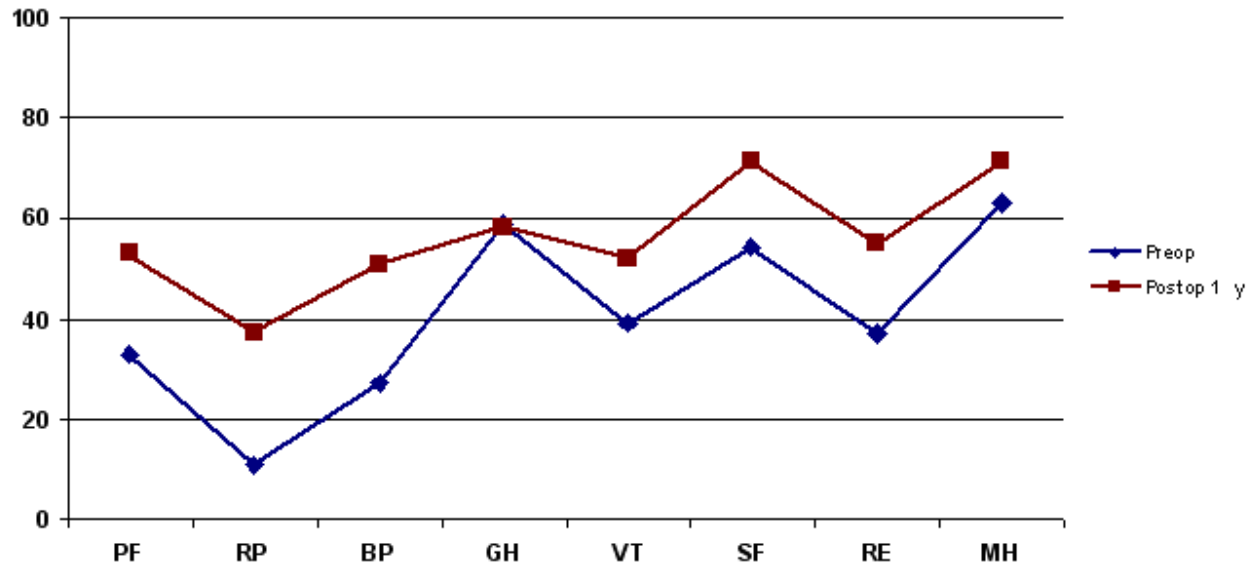

Fig 22. SF-36 scores (mean) pre- and postoperatively for patients operated on for central spinal stenosis 2006.

The results from the EQ-5D-analysis is presented, both as EQ-5D-5 (the outcome index based of the 5 questions included in the EQ-5D protocol) and as the EQ-5D-VAS.

EQ-5D results: EQ-5D 5 (index) preoperatively: 34 and 60 1 year postoperatively. The mean value at VAS preoperatively (max value 100): 49 and 1 year postoperatively 62.

Lateral spinal stenosis

Total number of patients for one year follow-up was 320, 53% of whom were males and 47% females and the mean age was 60 (28-86) years.

Surgical techniques utilized: Decompression 83%, decompression and posterior fusion 8% (instrumented 7% and non-instrumented 1%), 9% other techniques.

Results: Mean back pain before surgery (VAS) 54, at 12 months postoperatively 31. Mean leg pain before surgery (VAS) 62, at 12 months postoperatively 33. Figures 23 and 24 display VAS distribution regarding back and leg pain pre- and postoperatively.

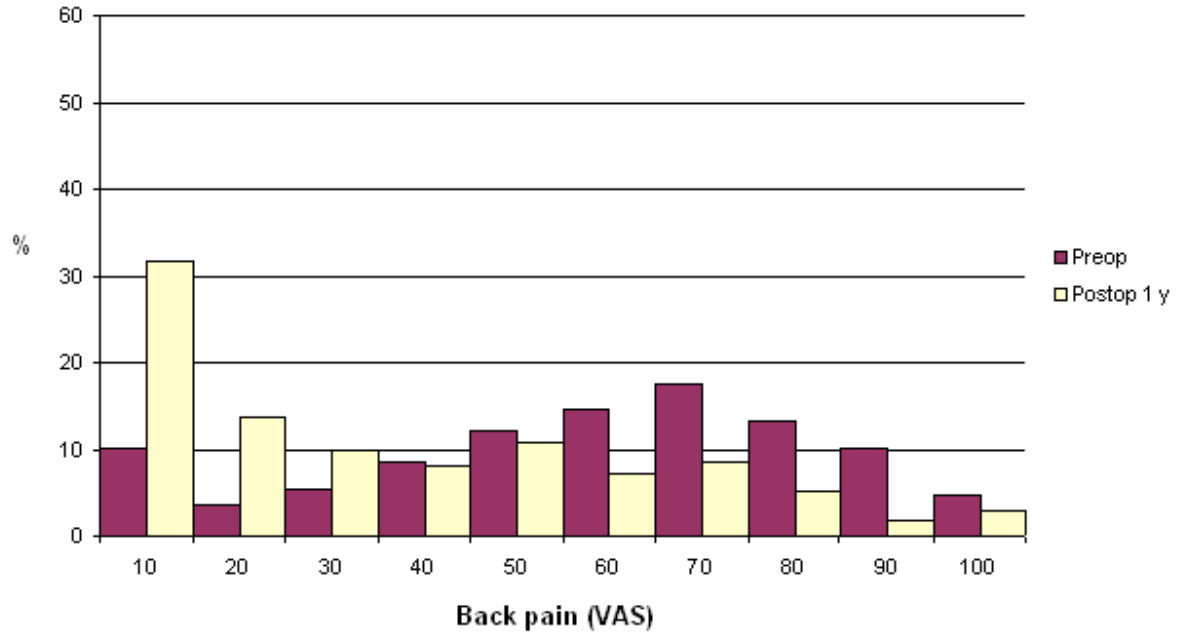

Fig 23. Back pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for lateral spinal stenosis (%).

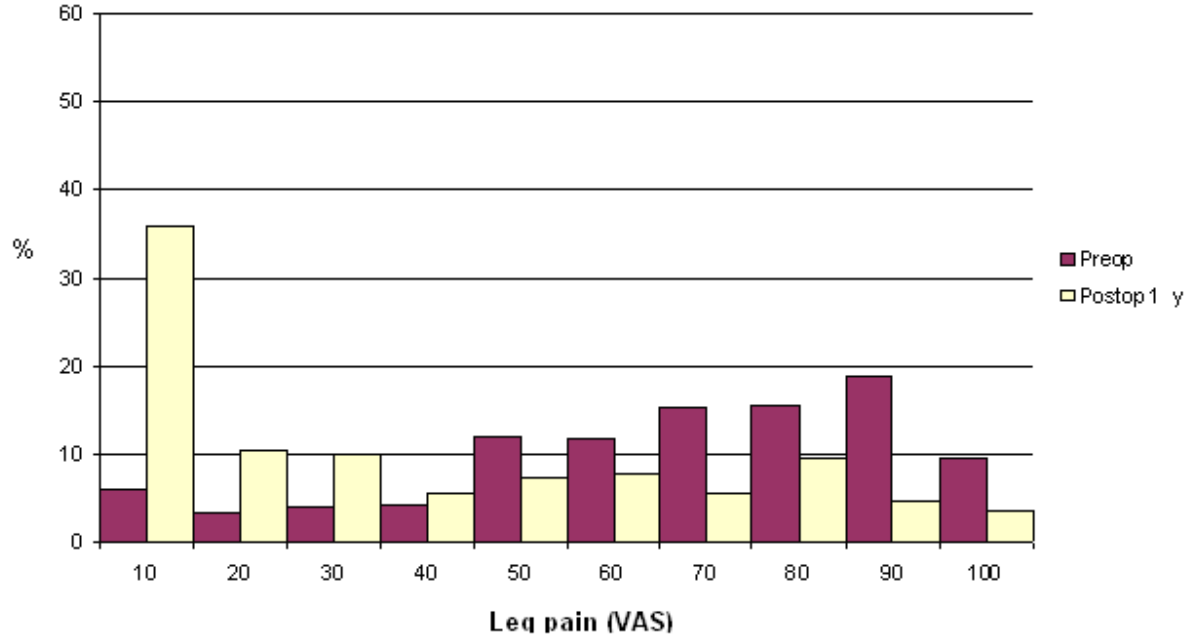

Fig 24. Leg pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for lateral spinal stenosis (%).

Subjective improvement of back pain: Total pain relief 14%, significant improvement 38%, slight improvement 19%, pain unchanged 16%, deteriorated 6% and 6% did not have back pain before the operation.
Subjective improvement ofleg pain: Total pain relief 23%, significant improvement 32%, slight improvement 21%, pain unchanged 17%, deteriorated 6% and 2% did not have leg pain before the operation.

Patient satisfaction with surgery: Satisfied 64%, uncertain 24%, dissatisfied 12%.

Consumption of analgesics 1 year preoperatively: Regularly 27%, intermittently 33% and no consumption 40%.

Walking distance: 11% of the patients had a walking distance less than 100 m, 15% between 100-500 m and 20% 500-1000 m. The remaining 53% had a walking distance exceeding one km.

SF-36: The pre- and postoperative SF-36 profiles are given in Figure 25, showing improvement postoperatively in all domains except GH.

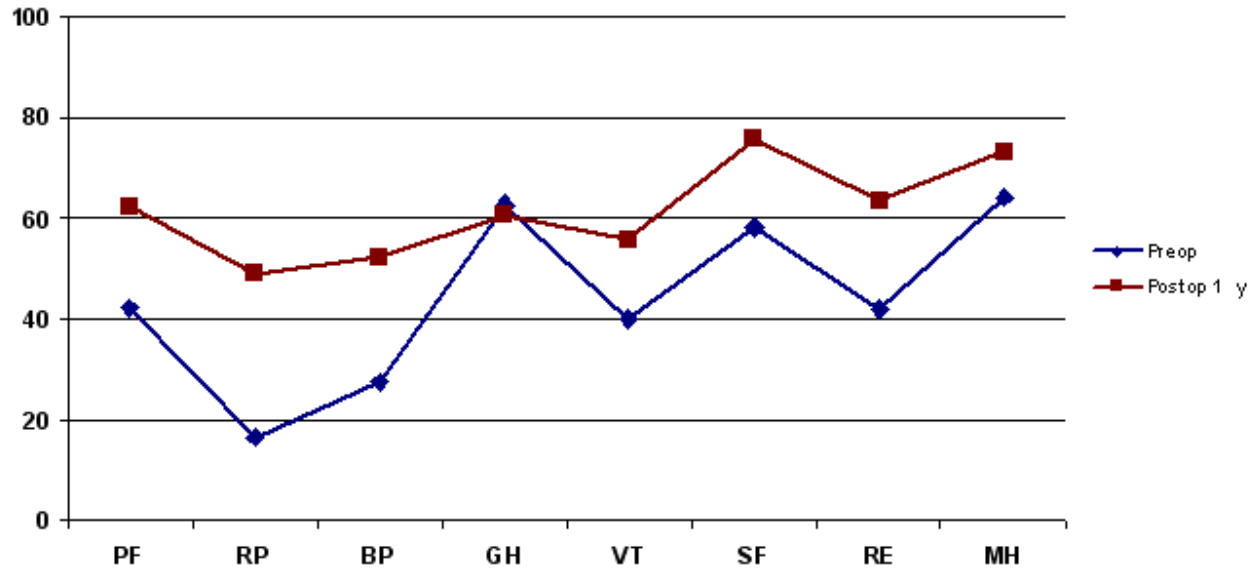

Fig 25. SF-36 scores (mean) pre- and postoperatively for patients operated for lateral spinal stenosis

The results from the EQ-5D-analysis is presented, both as EQ-5D-5 (the outcome index based of the 5 questions included in the EQ-5D protocol) and as the EQ-5D-VAS.

EQ-5D results: EQ-5D 5 (index) preoperative: 35 and 65% 1 year postoperative. The mean value at VAS preoperative (maxvalue 100): 50 and 1 year postoperativt 66.

Spondylolisthesis

Total number of patients at one year follow-up was 272, 50% of whom were males and 50% females and the mean age was 47 (15-78) years.

Surgical techniques utilized: Decompression and posterior instrumented fusion 45%, posterior instrumented fusion 17%, PLIF 14%, decompression + PLIF 6 %, decompression and posterior non-instrumented fusion 6%, posterior non-instrumented fusion 2%, decompression only 3% and other techniques 7%.

Results: Mean back pain before surgery (VAS) 57, at 1 year postoperatively 29. Mean leg pain before surgery (VAS) 51, at 1 year postoperatively 24. Figures 26 and 27 display VAS distribution regarding back and leg pain pre- and postoperatively.

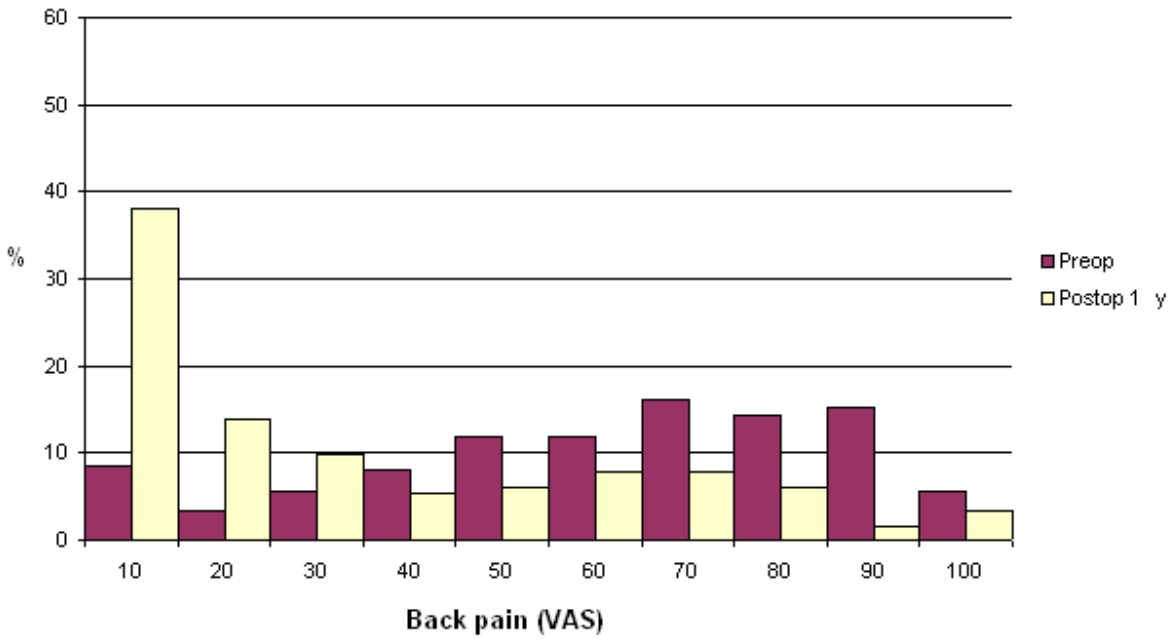

Fig 26. back pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for spondylolisthesis

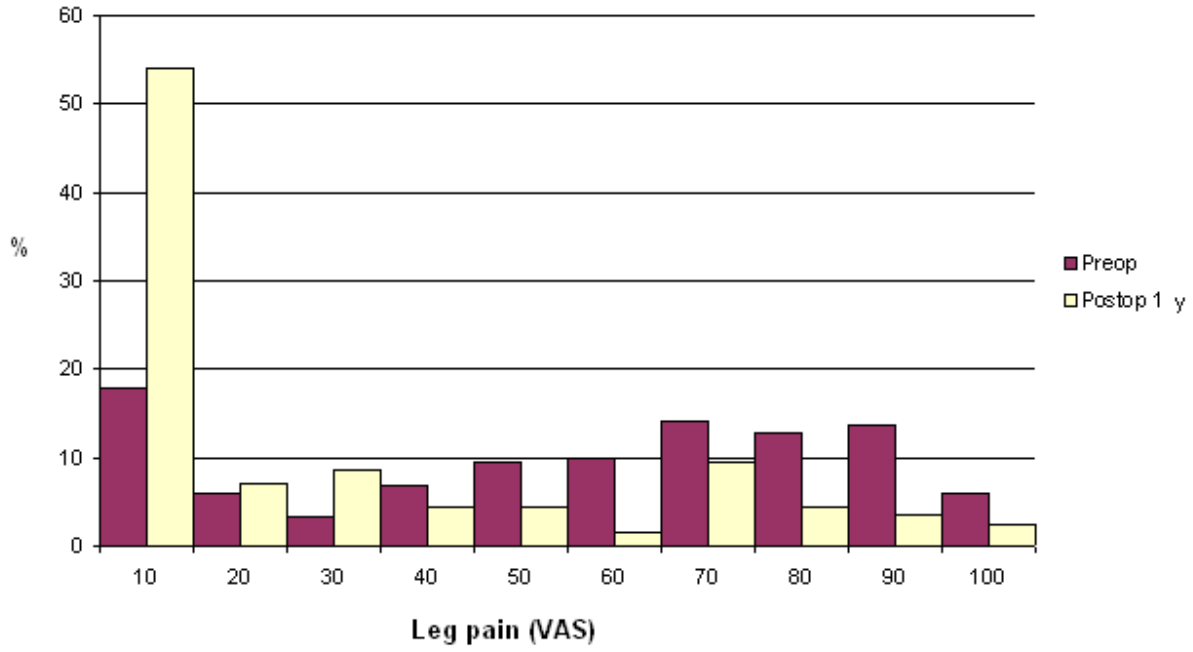

Fig 27. Leg pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for spondylolisthesis

Subjective improvement of back pain: Total pain relief 17%, significant improvement 45%, slight improvement 21%, unchanged pain 8%, deteriorated 6% and 3% did not have back pain before the operation.

Subjective improvement of leg pain: Total pain relief 29%, significant improvement 32%, slight improvement 11%, unchanged pain 12%, deteriorated 8% and 6% did not have leg pain before the operation.

Patient satisfaction with surgery: Satisfied 74%, uncertain 17%, dissatisfied 8%.

Consumption of analgesics at 12 months: Regularly 23%, intermittently 37% and no consumption 40%.

Walking distance: 4% of the patients had a walking distance less than 100 m, 9% 100-500 m and 13% 500-1000 m. The remaining 74% had a walking distance exceeding one km.

SF-36: The pre- and postoperative SF-36 profiles are given in Figure 28, showing improvement postoperatively in all domains except GH.

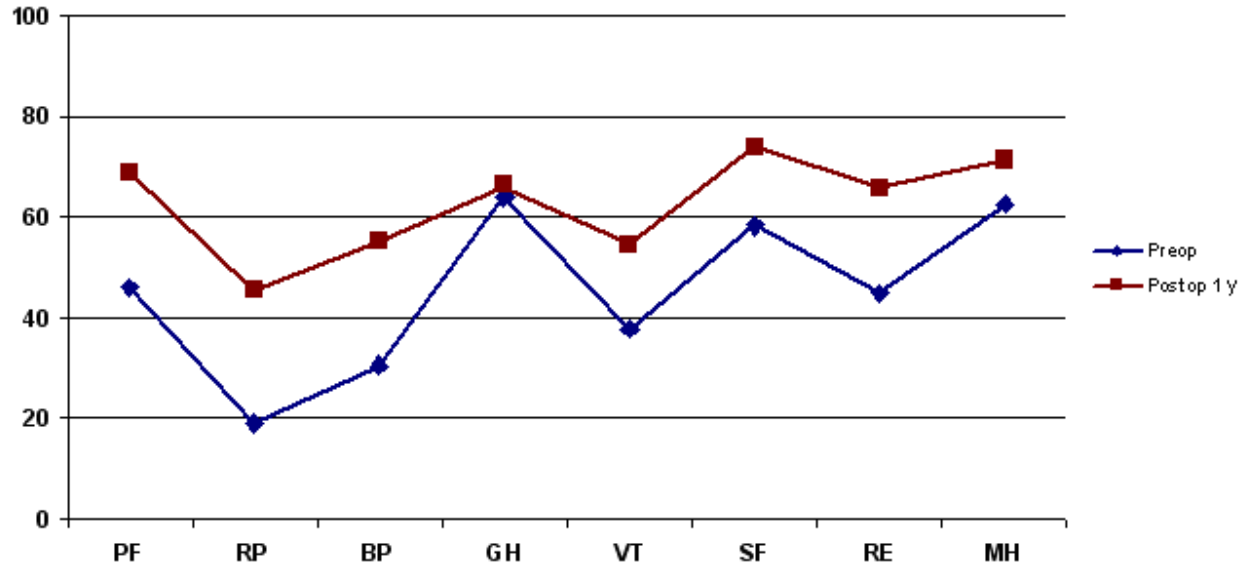

Fig 28. SF-36 scores (mean) pre- and postoperatively for patients operated for spondylolisthesis

The results from the EQ-5D-analysis are presented, both as EQ-5D-5 (the outcome index based on the 5 questions included in the EQ-5D protocol) and as the EQ-5D-VAS.

EQ-5D results: EQ-5D 5 (index) preoperatively 39 and 64 1 year postoperatively. The mean value at VAS preoperatively (max value 100): 49 and 1 year postoperatively 67.

DDD (disc degenerative disorder)/segmental pain

The total number of patients with one-year follow-up was 552, 49% of whom were males and 51% females and the mean age was 46 (20-80) years.

Surgical techniques utilizeded: Posterior fusion instrumented 20%, PLIF 21%, TLIF 6%, decompression + TLIF 7%, decompression and posterior instrumented fusion 12%, decompression + PLIF 8%, disc prosthesis 13%, posterior non-instrumented fusion 5% and 8% other techniques.

Results: Mean back pain before surgery (VAS) 63, at 1 year postoperatively 35. Mean leg pain before surgery (VAS) 45, at 1 year postoperatively 26. Figures 29 and 30 display VAS distribution regarding back and leg pain pre- and postoperatively.

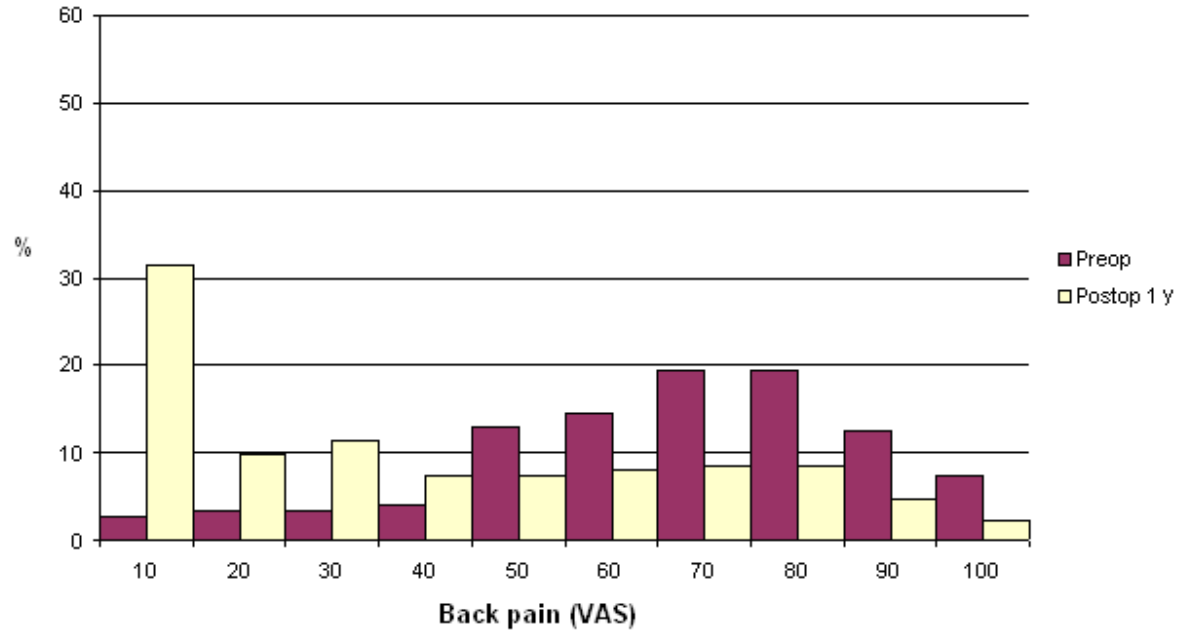

Fig 29. back pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for DDD

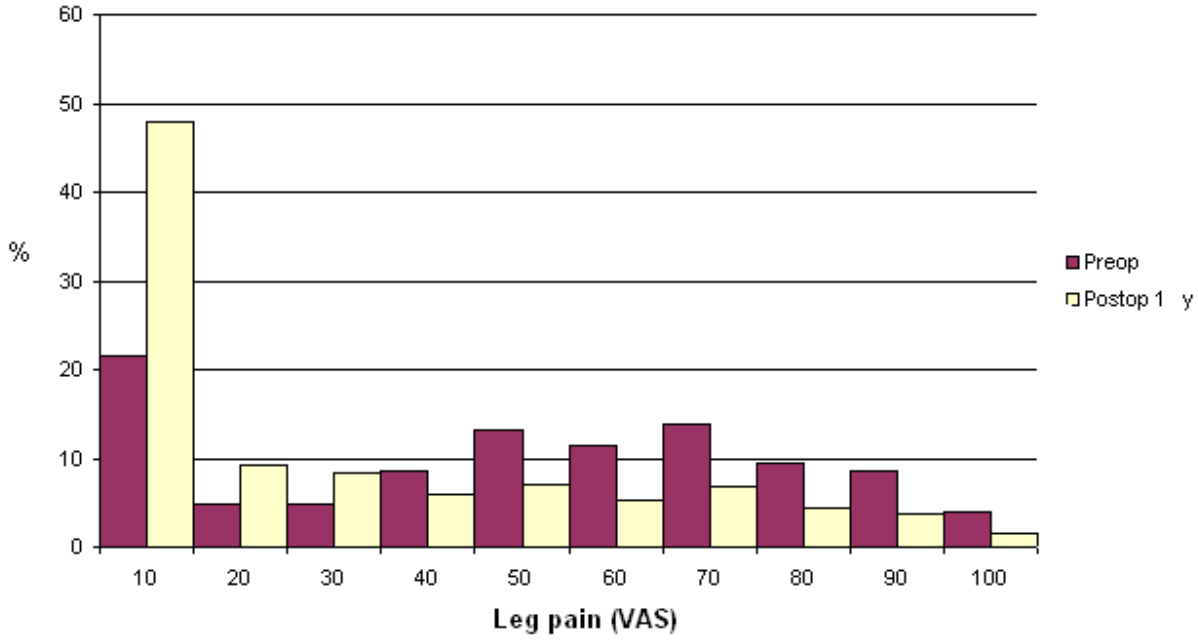

Fig 30. Leg pain, according to visual analog scale (VAS) pre- and postoperatively in patients operated on for DDD

Subjective improvement of back pain: Total pain relief 12%, significant improvement 46%, slight improvement 22%, unchanged pain 12%, deteriorated 8% and 1% did not have back pain before the operation.

Subjective improvement of leg pain: Total pain relief 21%, significant improvement 34%, slight improvement 20%, unchanged pain 10%, deteriorated 7% and 8% did not have leg pain before the operation.

Patient satisfaction with surgery: Satisfied 68%, uncertain 22%, dissatisfied 10%.

Consumption of analgesics at 1 year postoperatively: Regularly 31%, intermittently 37% and no consumption 32%.

Walking distance at one year follow-up: 7% of the patients had a walking distance less than 100 m, 11% 100-500 m and 16% 500-1000 m. The remaining 67% had a walking distance exceeding one km. his is a significant improvement compared to preoperatively.

SF-36: The pre- and postoperative SF-36 profiles are given in Figure 31, showing improvement postoperatively in all domains except GH.

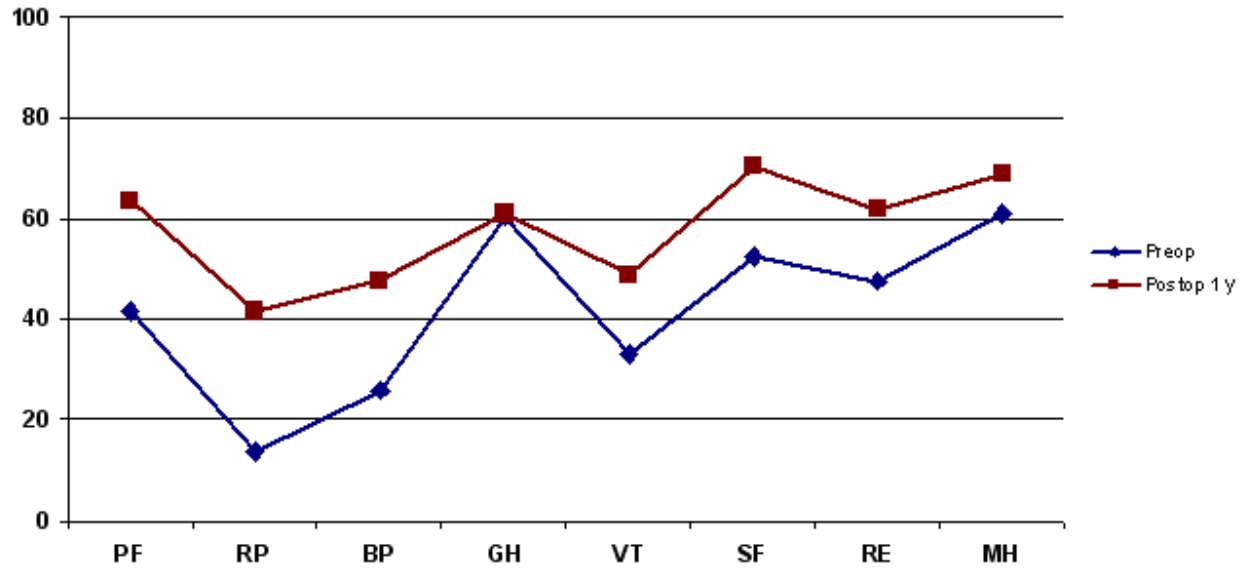

Fig 31. SF-36 scores (mean) pre- and postoperatively for patients operated on for DDD

The results from the EQ-5D-analysis is presented, both as EQ-5D-5 (the outcome index based on the 5 questions included in the EQ-5D protocol) and as the EQ-5D-VAS.

EQ-5D results: EQ-5D 5 (index) preoperatively 31 and 59 1 year postoperatively. The mean value at VAS preoperatively (max value 100): 47 and 1 year postoperatively 62.

Oswestry Disability Index, ODI, pre- and 1 year postoperatively for all diagnoses

For the second time we have been able to compare disability pre- and postoperatively according to the Oswestry index. A significant decrease in disability is seen for all diagnoses especially for disc herniation, Figure 32. Values 0-20 are usually considered as no or insignificant disability.

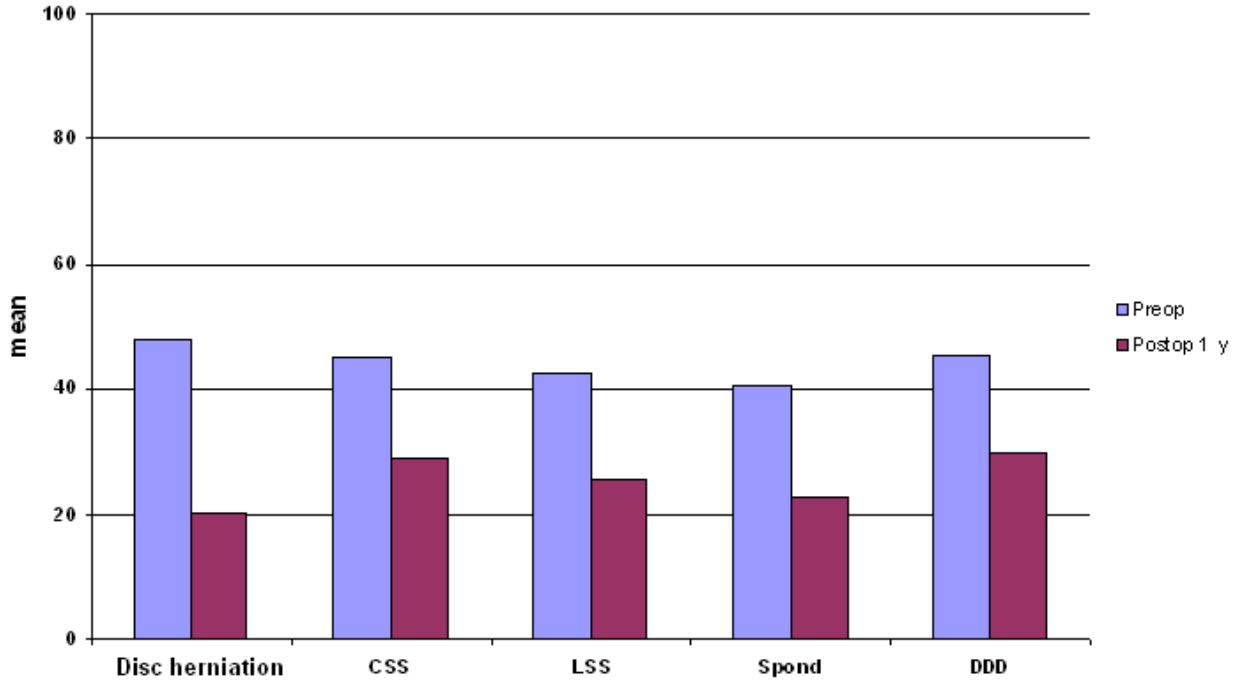

Fig 32. ODI index scores (mean) pre- and postoperatively for patients operated on for DDD, all diagnoses.

III. TWO-YEAR FOLLOW-UP OF A COHORT OF PATIENTS OPERATED ON IN THE YEAR OF 2005

Total number of patients completing both 1- and 2-year follow-up was 2 437. Dominating diagnoses are disc hernitation 771 and central spinal stenosis 988 patients. Lateral spinal stenosis 190, spondylolisthesis 153, DDD 272 and 78 other diagnoses.

Below comparisons between 1- and 2-year follow-up concerning a number of parameters are presented. Only patients responding on all 3 occasions are included.

In Table 1 pain on the VAS scale is shown related to diagnosis, over time.

Table 1. Pain on the VAS scale (mean), related to diagnosis.

	Back			**Leg**		
	Preop	**1 yr**	**2 yrs**	**Preop**	**1 yr**	**2 yrs**
Disc herniation	46	24	23	66	21	21
Central stenosis	56	32	34	62	33	34
Lateral stenosis	51	31	33	63	37	37
Spondylolisthesis	58	32	30	53	21	26
DDD	65	36	36	45	25	27

In tables 2-6 diagnosis-related walking distance is presented preoperatively, 1 and 2 years postoperatively.

Table 2. Walking distance, disc herniation (%)

	Preoperatively	**1 year**	**2 years**
<100 m	32	2	3
100 m– 500 m	22	9	8
500 m– 1 km	18	11	10
>1 km	29	78	79

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

	Preoperatively	**1 year**	**2 years**
<100 m	43	18	22
100 m– 500 m	30	22	20
500 m– 1 km	14	18	16
>1 km	12	43	43

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

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
<100 m	29	8	13
100 m– 500 m	31	23	23
500 m– 1 km	15	17	15
>1 km	26	52	49

Table 5. Walking distance, spondylolisthesis (%)

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
<100 m	19	3	5
100 m– 500 m	29	15	13
500 m– 1 km	17	15	16
>1 km	35	68	66

Table 6. Walking distance, DDD (%)

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
<100 m	19	7	6
100 m– 500 m	19	8	13
500 m– 1 km	28	20	16
>1 km	34	65	65

In tables 7-11 consumption of analgesics is presented preoperatively, 1 and 2 years postoperatively related to diagnosis for surgery.

Table 7. Consumption of analgesics, disc herniation preoperatively, 1 and 2 years postoperatively (%).

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Regularly	57	16	16
Intermittently	30	32	33
No consumption	13	52	52

Table 8. Consumption of analgesics central spinal stenosis preoperatively, 1 and 2 years postoperatively (%).

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Regularly	55	29	30
Intermittently	27	32	32
No consumption	18	40	38

Table 9. Consumption of analgesics, lateral spinal stenos preoperatively, 1 and 2 yrs postoperatively (%).

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Regularly	47	31	29
Intermittently	36	31	34
No consumption	17	39	37

Table 10. Consumption of analgesics, spondylolisthesis preoperatively, 1 and 2 yrs postoperatively (%).

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Regularly	42	26	21
Intermittently	40	34	32
No consumption	18	40	47

Table 11. Consumption of analgesics, DDD/segmental pain preoperatively, 1 and 2 yrs postoperatively (%).

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Regularly	54	26	31
Intermittently	36	39	37
No consumption	10	35	32

The patient's self graded satisfaction with the surgery results after 1 and 2 years is presented in table 12.

Table 12. Satisfaction with outcome of surgery 1 and 2 years postoperatively related to diagnosis.

	1 yr postop			**2 yrs postop**		
	Satisfied	**Uncertain**	**Dissatisfied**	**Satisfied**	**Uncertain**	**Dissatisfied**
Disc herniation	77	16	7	78	15	7
Central stenosis	65	24	11	63	24	13
Lateral stenosis	65	20	15	63	23	13
Spondylolisthesis	74	18	8	75	15	11
DDD	70	20	11	66	22	13

Quality of life measured with the EQ-5D-instrument is presented in Tables 13-14 and Figure 33 as an EQ-5D score, and also on the VAS thermometer scale .All patient groups do postoperatively experience a great improvement of quality of life.

Table 13. EQ-5D means preoperatively, 1 and 2 years postoperatively, related to diagnosis.

	Preoperatively	1 yr postoperatively	2 yrs postoperatively
Disc herniation	26	73	74
Central spinal stenosis	36	62	62
Lateral spinal stenosis	37	62	59
Spondylolisthesis	34	64	65
DDD	33	58	59

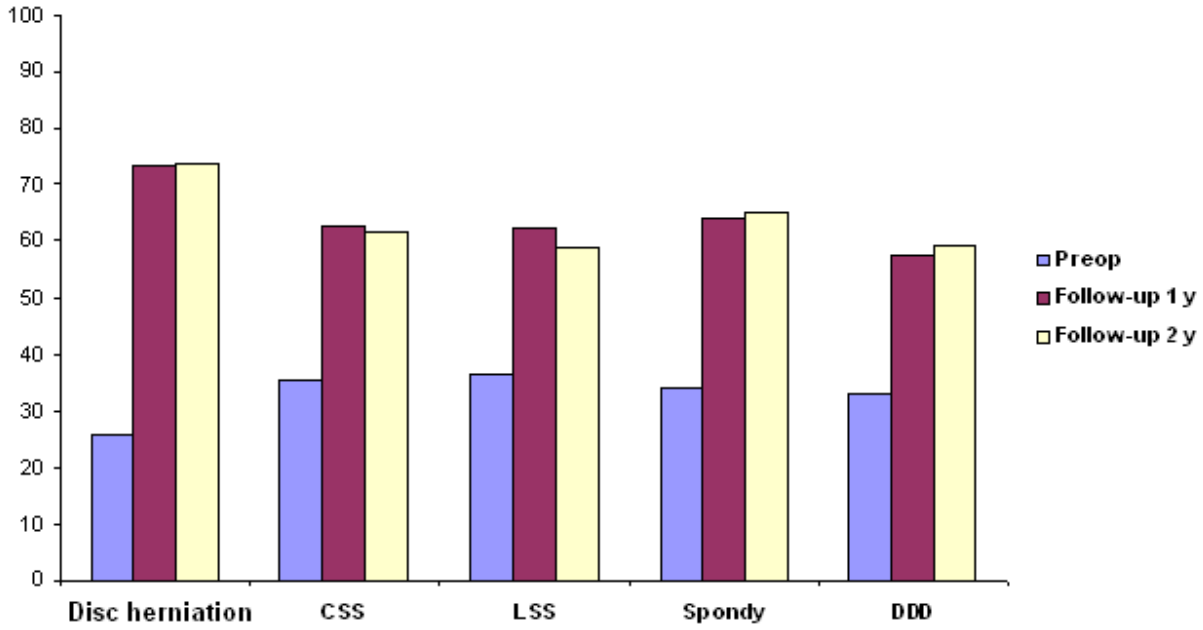

Fig 33. Quality of life preoperatively, 1 and 2 years postoperatively measured by EQ-5D.

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

	Preoperatively	1 yr postoperatively	2 yrs postoperatively
Disc herniation	45	71	72
Central spinal stenosis	49	64	62
Lateral spinal stenosis	50	62	61
Spondylolisthesis	46	63	68
DDD	45	65	62

Oswestry Disability Index, ODI, preoperatively, 1 and 2 years after surgery for all diagnoses.

Table 15. ODI results preoperatively, 1 and 2 years after disc herniation surgery, related to diagnosis.

	Preoperatively	**1 yr postoperatively**	**2 yrs postoperatively**
Disc herniation	48	18	19
Central spinal stenosis	45	27	29
Lateral spinal stenosis	43	26	29
Spondylolisthesis	45	25	24
DDD	46	29	28

IV. Five-years follow-up of lumbar spine surgery in Sweden 2007

793 patients operated on 2002 have been followed-up 1, 2 and 5 years after surgery. Most common diagnoses are disc herniation 333 and central spinal stenosis 271 patients. 58 patients were operated on for lateral spinal stenosis, 44 for spondylolisthesis, 81 for DDD and 6 for other diagnoses. Below a comparison between 1-, 2- and 5-years follow-up is presented regarding a number of parameters. Only patients responding on all 4 occasions are presented.

In table 16 pain on the VAS scale is shown, related to diagnosis, over time.

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	47	26	28	24	67	22	24	22
Central stenosis	57	33	35	37	63	33	35	41
Lateral stenosis	59	38	40	40	65	41	43	37
Spondylolisthesis	64	36	38	37	71	32	32	38
DDD	64	32	32	33	39	24	21	23

In tables17-21 diagnosis-related walking distance is presented preoperatively, 1, 2 and 5 yrs postoperatively.

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

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100 m	30	4	4	6
100 m – 500 m	25	9	8	8
500 m – 1 km	18	16	15	11
> 1 km	27	72	73	76

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

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100 m	48	21	24	28
100 m – 500 m	33	25	25	21
500 m – 1 km	12	20	16	16
> 1 km	8	35	35	34

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

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100 m	36	20	11	16
100 m – 500 m	27	18	21	18
500 m – 1 km	20	18	28	19
> 1 km	18	45	40	47

Table 20. Walking distance, spondylolisthesis (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100 m	25	2	7	2
100 m – 500 m	30	11	9	11
500 m – 1 km	20	18	18	16
> 1 km	25	68	66	71

Tabell 21. Walking distance, DDD (%)

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100 m	20	9	4	6
100 m – 500 m	18	7	15	13
500 m – 1 km	25	14	19	17
> 1 km	37	70	63	65

In tables 22-26 consumption of analgesics preoperatively, 1, 2 and 5 years postoperatively related to diagnosis for surgery is shown.

Table 22. Consumption of analgesics disc herniation preoperatively, 1, 2 and 5 years postoperatively (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regularly	54	17	14	16
Intermittently	32	34	33	31
No consumption	14	50	53	53

Table 23. Consumption of analgesics central spinal stenosis preoperatively, 1, 2 and 5 years postoperatively (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regularly	55	29	31	32
Intermittently	32	35	31	33
No consumption	13	36	38	36

Table 24.Consumption of analgesics lateral spinal stenosis preoperatively, 1, 2 and 5 years postoperatively (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regularly	52	40	31	32
Intermittently	30	35	33	37
No consumption	18	26	36	32

Table 25. Consumption of analgesics spondylolisthesis preoperatively, 1, 2 and 5 years postoperatively (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regularly	50	30	27	30
Intermittently	26	27	32	27
No consumption	24	43	41	43

Table 26. Consumption of analgesics DDD preoperatively, 1, 2 and 5 years postoperatively (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regularly	49	28	26	35
Intermittently	35	41	40	24
No consumption	15	31	34	41

The patient's self graded satisfaction with the results of surgery is presented in table 27 after 1, 2 and 5 years.

Table 27. Satisfaction with outcome of surgery 1, 2 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	76	17	7	78	16	6	79	13	8
Central stenosis	66	27	7	64	26	10	68	20	12
Lateral stenos	56	33	11	63	19	18	49	33	18
Spondy-lolisthesis	69	17	14	63	14	23	70	12	19
DDD	69	24	7	69	24	8	76	16	8

Quality of life measured by the EQ-5Dinstrument is presented in Tables 28-29 and in Figure 34 as an EQ-5D score, and also on the VAS scale (EQ-VAS). All patient groups postoperatively experience significant improvement of quality of life.

Tabell 28. EQ-5D means preoperatively, 1, 2 and 5 years postoperatively, related to diagnosis.

	Preoperatively	**1 year postoperatively**	**2 years postoperatively**	**5 years postoperatively**
Disc herniation	26	70	71	73
Central stenosis	33	59	59	58
Lateral stenosis	27	53	54	56
Spondylolisthesis	31	56	59	65
DDD	33	62	67	65

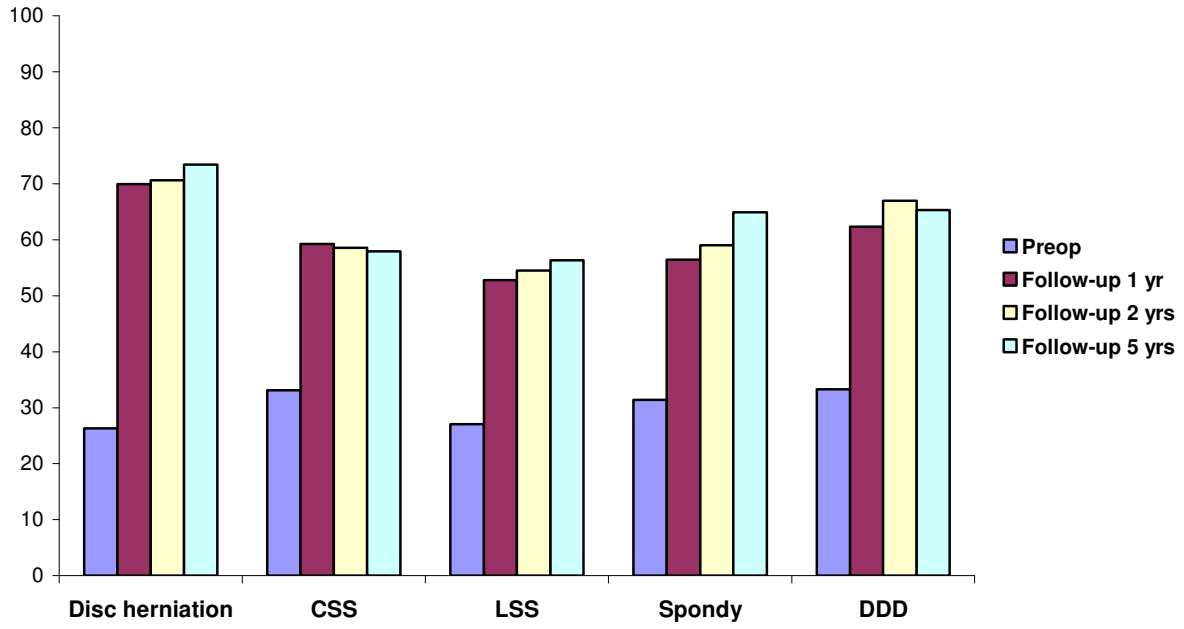

Fig 34. Quality of life, preoperatively, 1, 2 and 5 years postoperatively measured with EQ-5D.

Tabell 29. EQ-5D health estimation according to the VAS scale (EQ-VAS), means.

	Preoperatively	**1 year postoperatively**	**2 years postoperatively**	**5 years postoperatively**
Disc herniation	47	72	72	73
Central stenosis	48	62	61	59
Lateral stenosis	50	59	62	59
Spondylolisthesis	51	63	63	63
DDD	42	63	67	69

V. Outcome of surgical treatment of lumbar disc herniation in Sweden can be improved

Introduction

The current as well as previous reports show the results of surgical treatment for lumbar disc herniation to be good and consistent over time. The main aim of treatment is pain relief which in turn improves function, quality of life and working ability. All patients who undergo surgery for lumbar disc herniation, however, do not achieve a painfree and recovered state. The purpose of this analysis is to identify factors and circumstances that affect the outcome of surgical treatment in order to establish recommendations to obtain improved results.

Material

The register contains 9 245 paramedian lumbar disc herniations, operated on either with conventional or microscopic technique. The follow-up rate of these patients using completed protocols is 73% at one year and 63% at two years after surgery.

Generally, pain relief and improved quality of life is obtained but a significant number of patients report persistent working inability, dissatisfaction with outcome of treatment and unchanged leg pain and quality of life (Table 30).

Table 30. Negative result parameters one and two years after lumbar disc herniation surgery.

	1 yr (%)	**2 yrs (%)**
Sick-listed partly or wholly	18	13
Disability pension	12	16
Uncertain/dissatisfied with outcome of surgery	25	24
Unchanged/increased leg pain	11	12
Unchanged quality of life	8	8

It is unsatisfactory that so many patients are unsatisfied with outcome of surgery and to this end we have posed some questions that might be related to the outcome on an individual basis as well as on a departmental basis.

1. Is a long waiting time for surgery correlated to inferior outcome?
2. Does surgical technique influence the outcome?
3. Should lumbar disc surgery be performed at departments with a large surgical volume?
4. Are there individual related factors that affect the result of the operation, and can these be changed by the patient?

The following outcome measures have been used:

1. Change in leg pain
2. Change in quality of life, measured by EQ-5D
3. Satisfaction with outcome of surgery
4. Sick-listing

1. Waiting time

Duration of leg pain before surgery is documented in the register protocol. This time is a combination of several factors such as the time the patient waits before seeking health care, the waiting time to the

health care unit, to the MRI scanning and to the spine surgery out-patient ward and, finally, also the waiting time to surgery of the individual department. In single cases the patients may have caused delay but our feeling is that the type of neurogenic pain caused by disc herniation generally forces the patient to seek health care and to receive pain killers. It is also documented that the waiting time to MR investigation and to the out-patient ward of the specialist and the surgery frequently are very long in Sweden (www.vantetider.se). Preoperative duration of pain before surgery is markedly different between the three different types of hospitals in Sweden, private hospitals, county hospitals and university hospitals (Table 31).

Table 31. Preoperative duration of pain according to type of hospital.

	Type of hospital		
	Private	**County hospital**	**Univ hospital**
< 3 months	21	19	19
3-12 months	55	52	48
> 1 year	24	29	33

A long preoperative duration of leg pain is significantly correlated to unchanged leg pain both one and two years after surgery, dissatisfaction with outcome of surgery after one and two years and also to sick-listing. Also improvement in quality of life is significantly correlated to duration of preoperative leg pain (Table 32). In all outcome measures studied, a long duration of pain preoperatively correlates to unsatisfactory outcome.

Table 32. Outcome (percent) related to preoperative duration of pain.

		Preoperative duration of pain			
		< 3 months	**3-12 months**	**> 1 yr**	**Chi^2**
		%	**%**	**%**	**P**
Unchanged/increased leg pain	**1 yr**	7	9	17	<0.0001
	2 yrs	7	11	17	<0.0001
Uncertain/dissatisfied with outcome	**1 yr**	18	22	31	<0.0001
	2 yrs	18	21	29	<0.0001
Sick-listed wholly/partly	**1 yr**	13	16	24	<0.0001
	2 yrs	10	12	16	0.002
		Score	**Score**	**Score**	
Improvement of quality of life	**1 yr**	0.63	0.46	0.33	<0.0001
	2 yrs	0.65	0.47	0.34	<0.0001

2. Microscopic or open surgery?

Microscopic surgery was utilized in 4 713 cases and conventional surgery in 4 532 cases. Microscopic surgery was more frequently utilized in private hospitals (58%) and county hospitals (54%) than in university hospitals (36%). Remaining leg pain at follow-up significantly correlates to type of surgery after one but not two years. No difference was seen concerning sick-listing after one or two years but patient satisfaction was better for those with open surgery (Table 33).

Table 33. Outcome parameters correlated to type of surgery.

		Surgery technique		
		Micro	**Conv**	**Chi^2**
		%	**%**	
Unchanged/increased leg pain	**1 yr**	10	11	Ns
	2 yrs	11	12	Ns
Uncertain/dissatisfied with outcome	**1 yr**	22	26	<0.0001
	2 yrs	20	25	0.001
Sick-listed wholly/partly	**1 yr**	17	17	Ns
	2 yrs	12	14	Ns
		Score	**Score**	
Improvement of quality of life	**1 yr**	0.47	0.45	Ns
	2 yrs	0.5	0.45	0.02

We can conclude that the correlation between type of surgery and outcome is not homogenous. Type of surgery does not significantly correlate to reported complication rate except regarding dural lesion (Table 34).

Table 34. Complications related to surgery technique.

	Surgery technique		
	Micro	**Conv**	**Chi^2**
	%	**%**	**P**
Hematoma	0.2	0.2	Ns
Wound infection	0.2	0.1	Ns
Nerve root injury	0.4	0.2	Ns
Dural lesion	3.0	2.0	0.01

There is a tendency in some aspects for microscopic surgery to give better results than open surgery.

3. Outcome related to volume of surgery

The number of disc surgeries performed shows very wide variation between different departments from single operations registered to over 1 000. Figure 35 shows improvement of leg pain correlated to number of operations performed at the individual department.

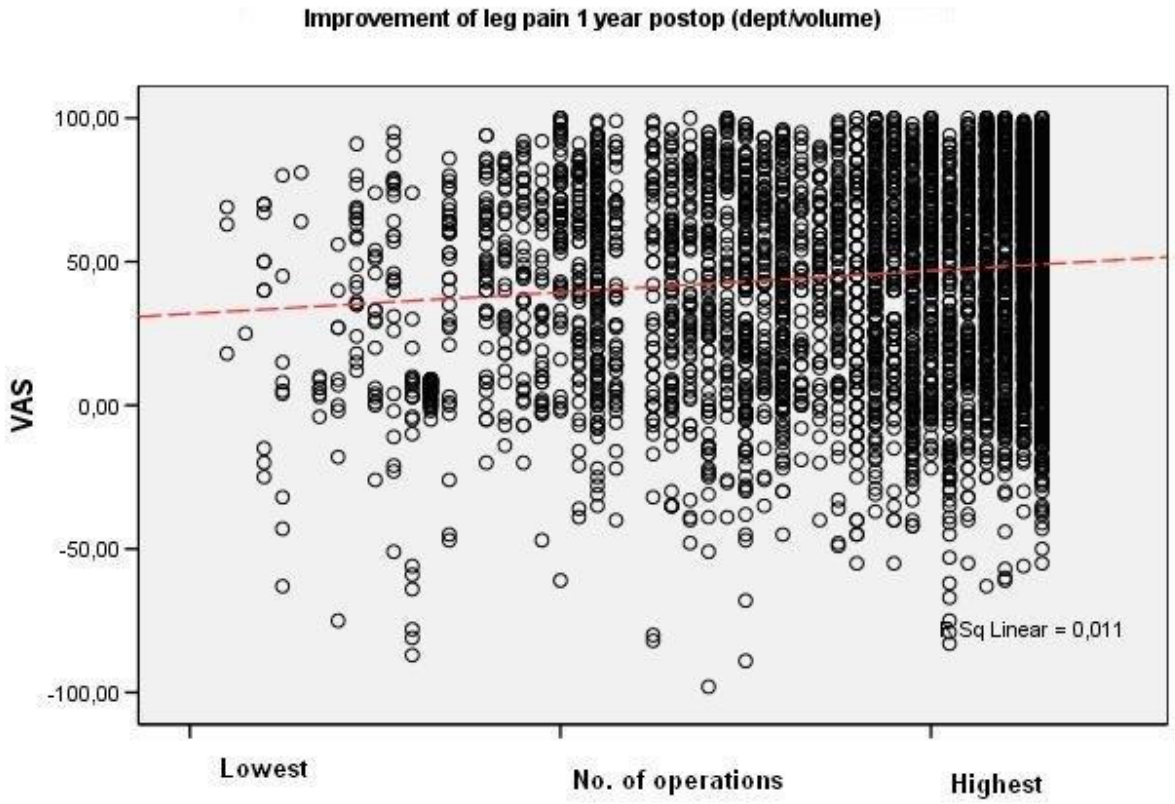

Fig 35. Department related improvement of leg pain 1 year after lumbar disc herniation surgery according to volume of surgery..

Figures 36 and 37 show an absence of correlation between volume of surgery at the individual department and patient outcome and sick-listing one year after surgery.

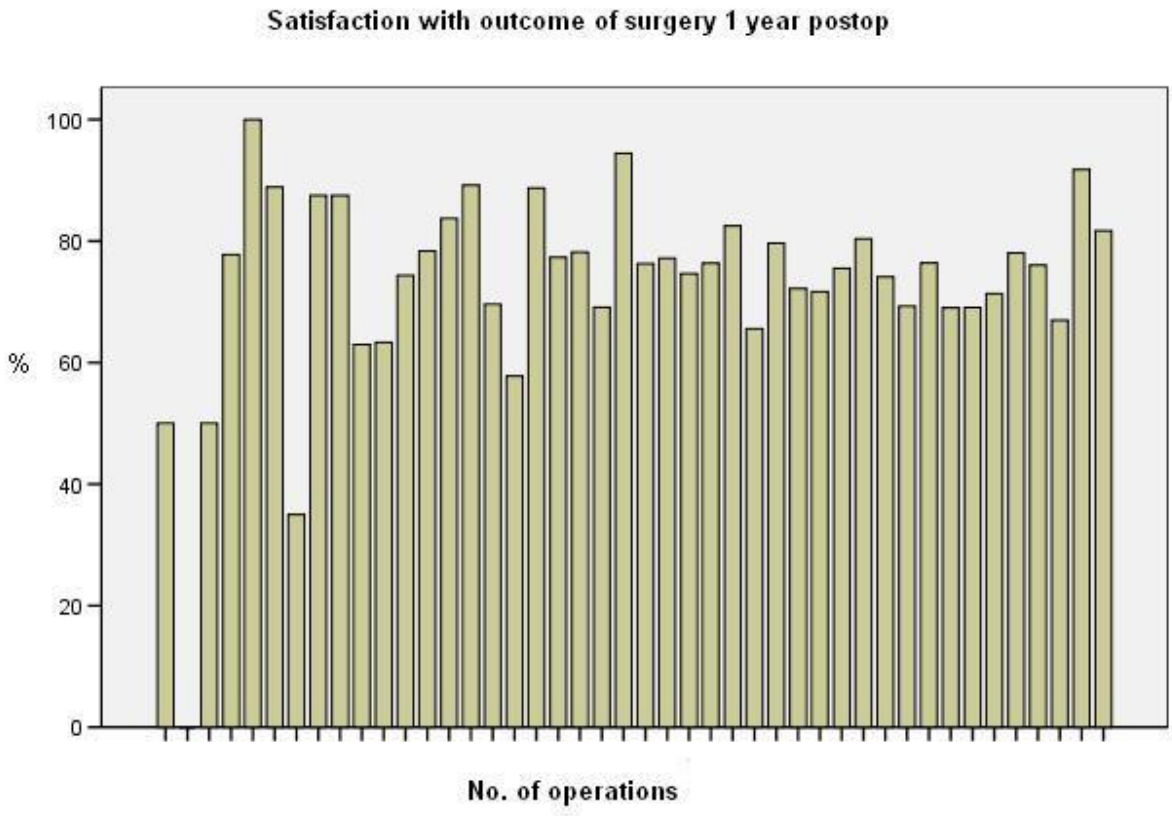

Fig 36. Patient outcome 1 year postoperatively after lumbar disc herniation surgery related to the department's volume of surgery.

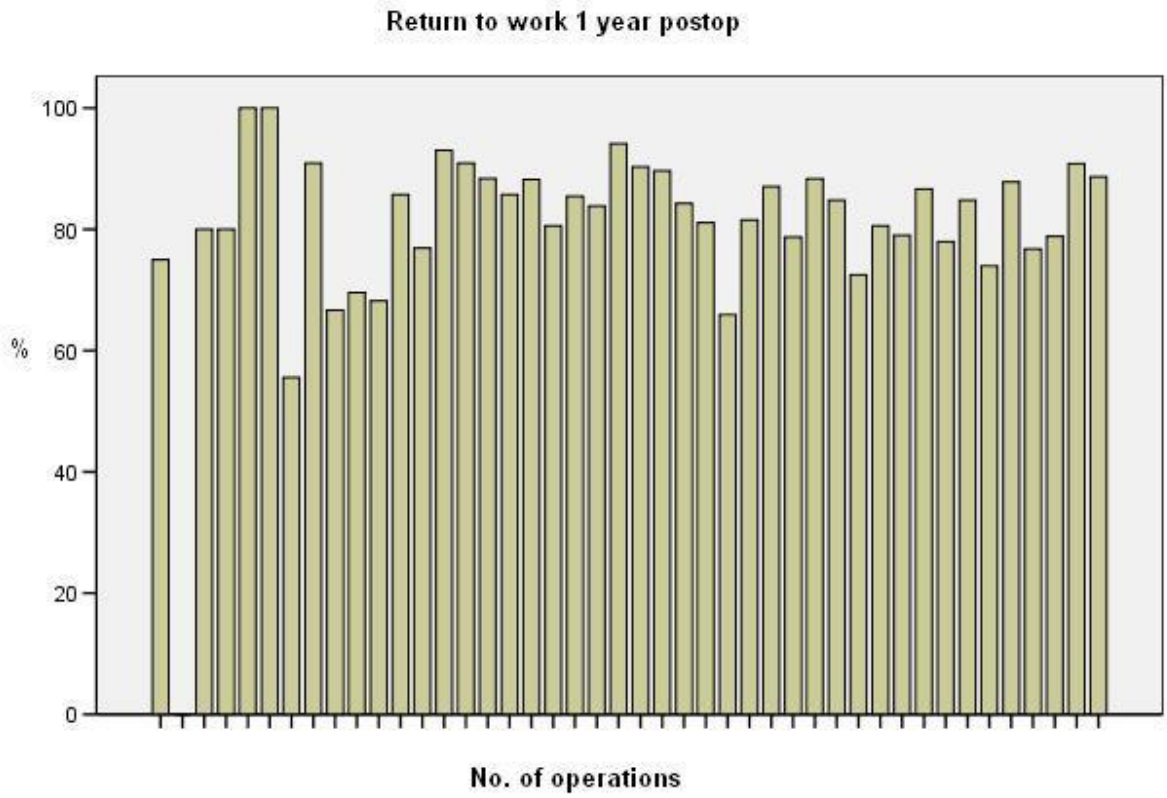

Fig 37. Return to work (percent) 1 year after lumbar disc herniation surgery related to the department's volume of surgery.

Single departments with very small volumes of operations show a vary wide variation regarding leg pain one year after surgery and in some cases low mean values (Figure 38).

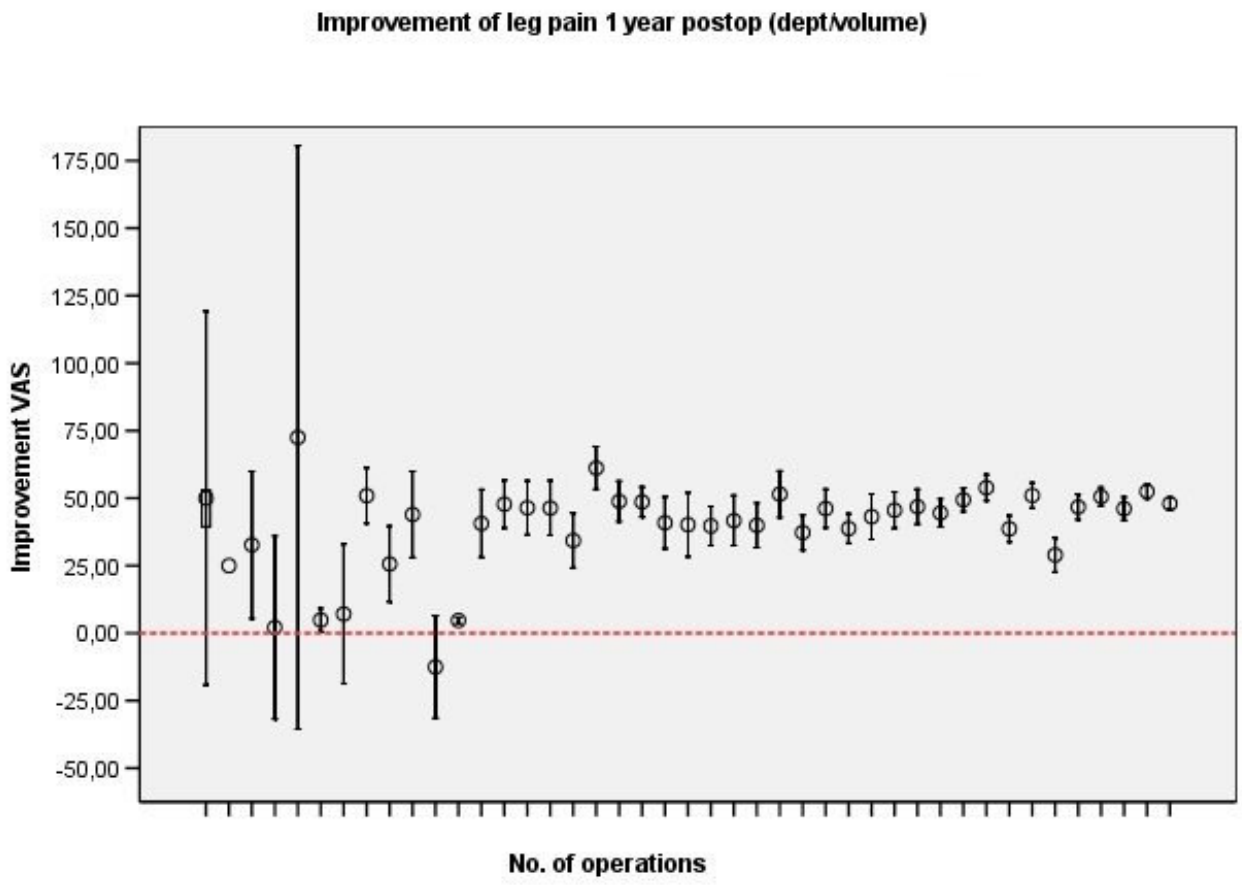

Fig 38. Improvement of leg pain 1 year postoperatively related to volume of operations 2006 (mean value and 95% confidence interval).

In order to increase the power of calculation and to investigate whether changes over time occur, the same analysis regarding the departments have been performed for the years 2004 – 2006 and the same tendency regarding improvement of leg pain is obvious (Figure 39).

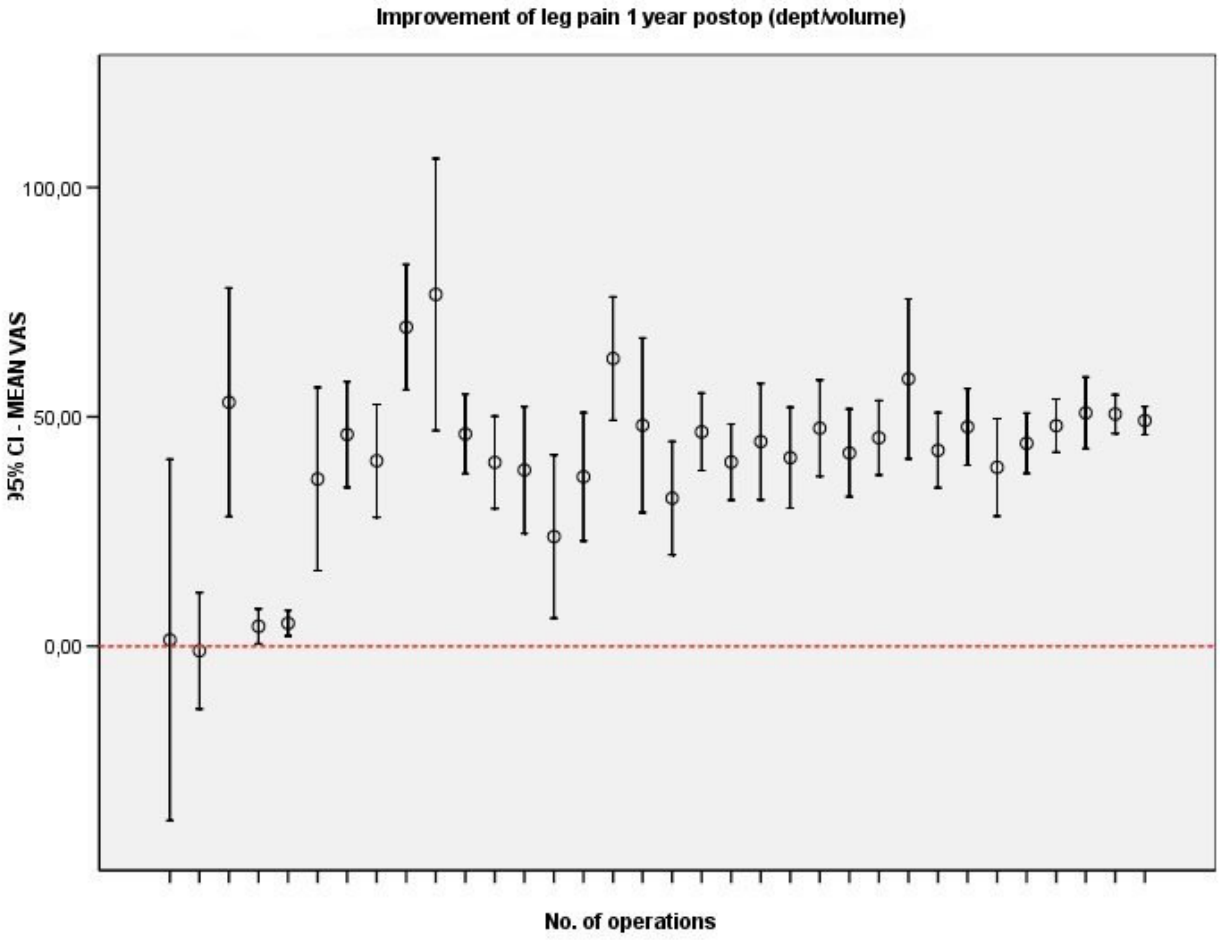

Fig 39. Improvement of leg pain 1 year postoperatively related to volume of operations 2004 – 2006 (mean and 95% confidence interval).

When private hospitals, university hospitals and county hospitals are compared in relation to quality of life at follow-up, measured by EQ-5D (0 = dead, 1 = optimal quality of life) the quality of life achieved is the same magnitude for the three different types of hospitals. The preoperative figures on quality of life are higher in private hospitals and remain so at 2 years (Figures 40-42) but the relative improvement, thus, is like-worthy.

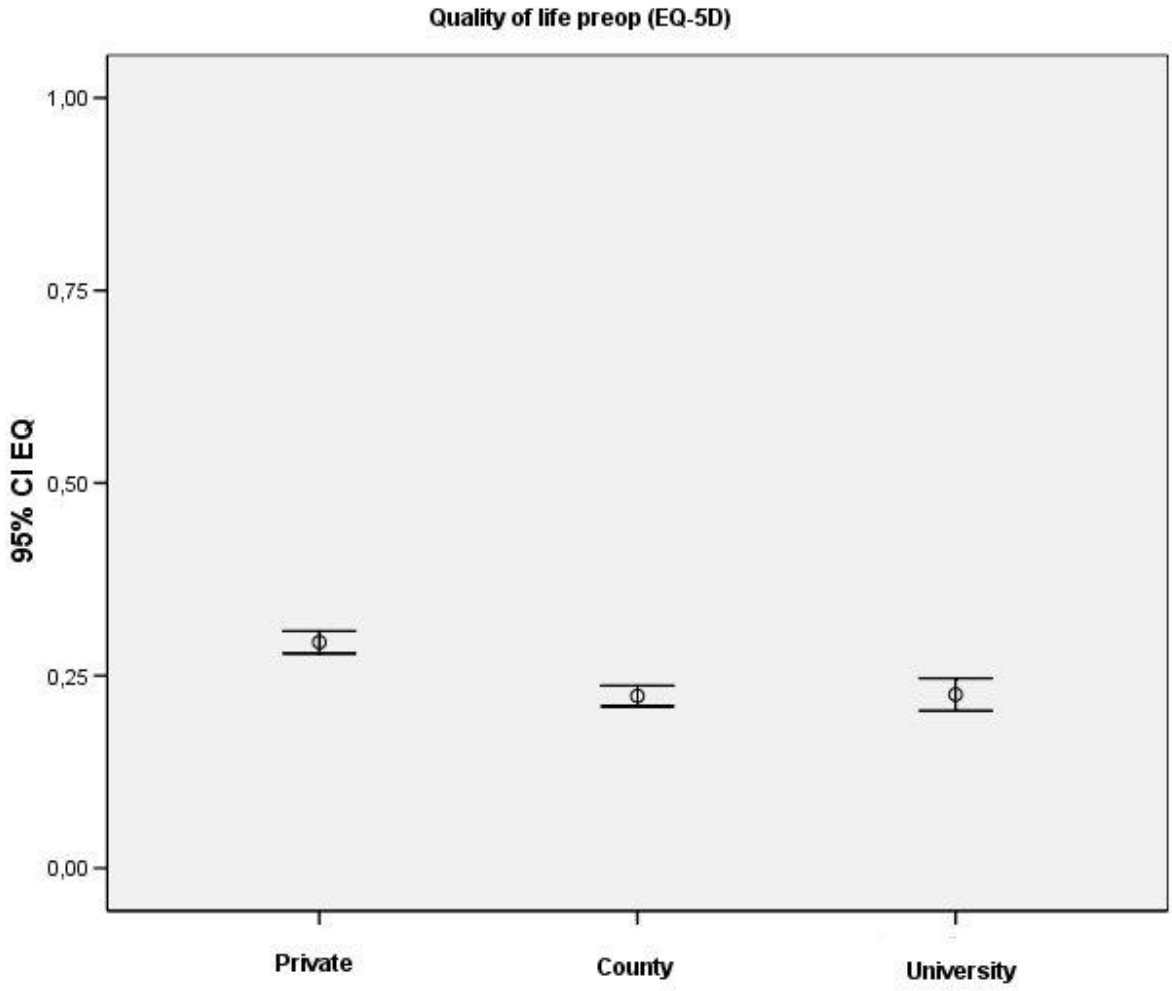

Fig 40. Quality of life preoperatively related to type of clinic (EQ-5D).

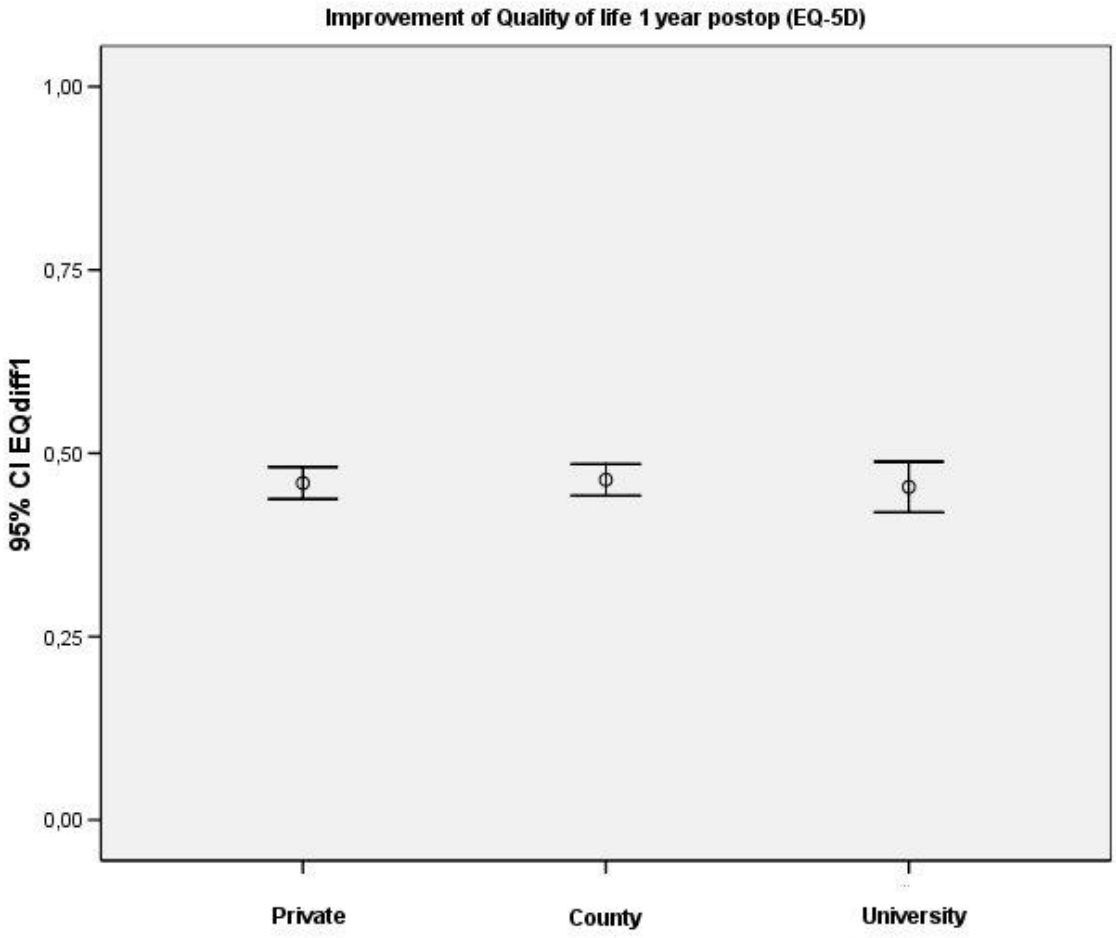

Fig 41. Improvement of quality of life (EQ-5D) (postoperative minus preoperative value) after 1 year compared to preoperatively and related to type of clinic.

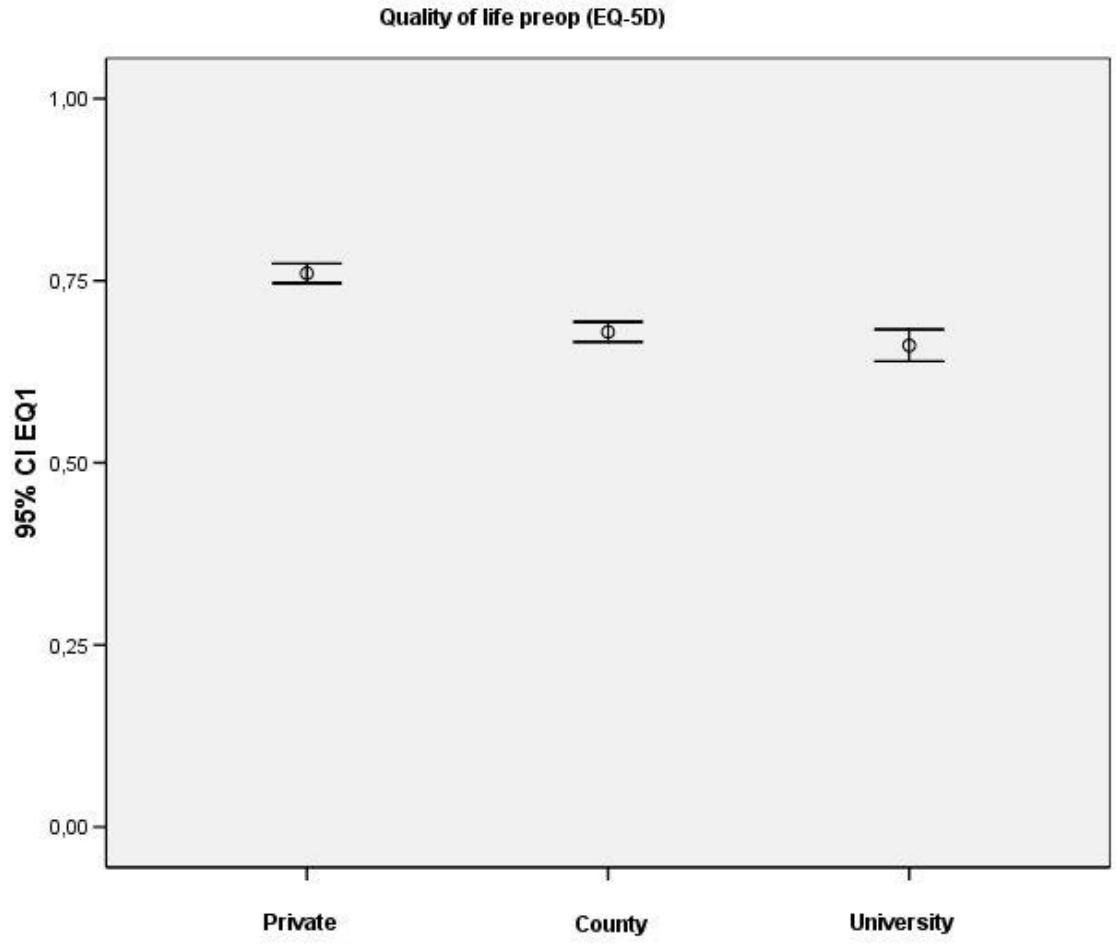

Fig 42. Quality of life (EQ-5D) 1 year postoperatively related to type of clinic.

Patients in private hospitals report lower preoperative leg pain at the time of surgery and also at 1 year after surgery when compared to patients operated on at university or county hospitals (Figures 43-45).

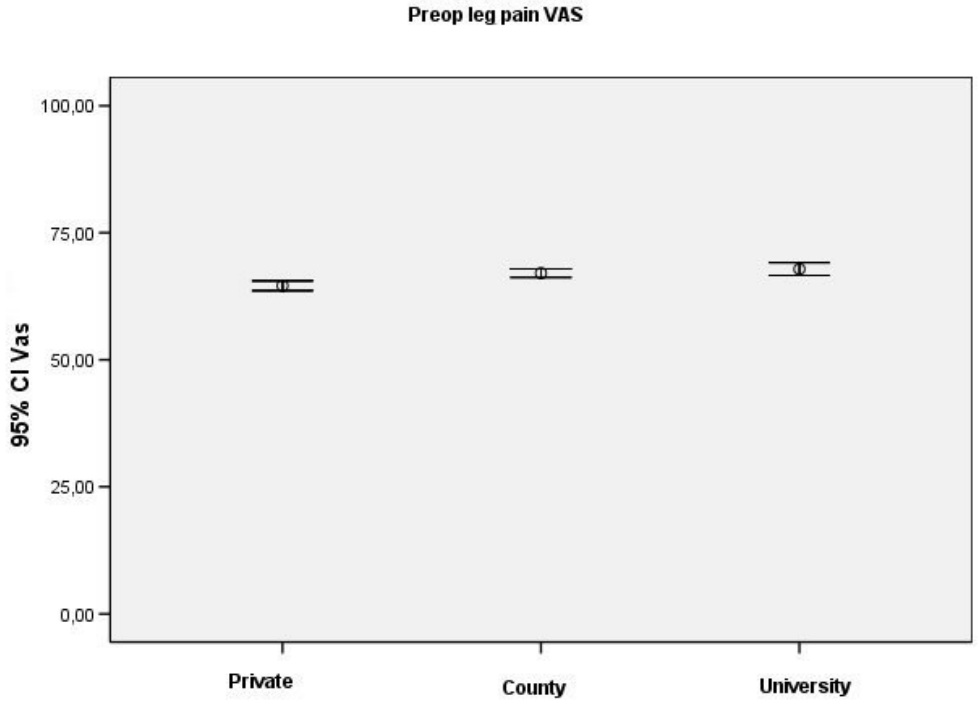

Fig 43. Preoperative leg pain related to type of clinic.

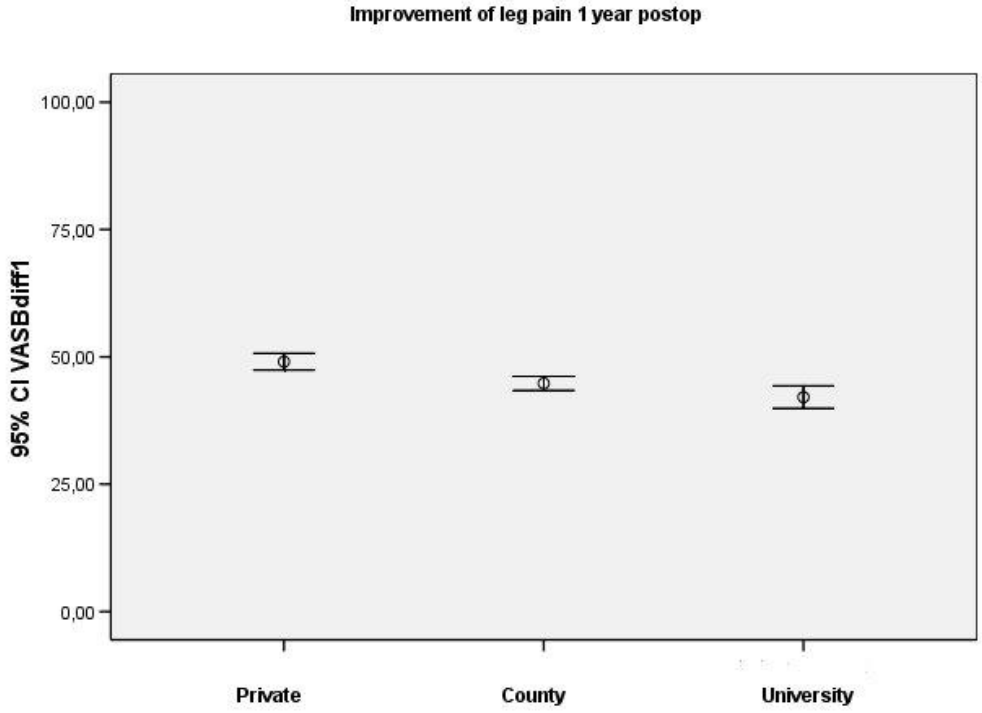

Fig 44. Improvement of leg pain (VAS) (preoperative minus postoperative) 1 year after lumbar disc herniation surgery compared to preoperatively.

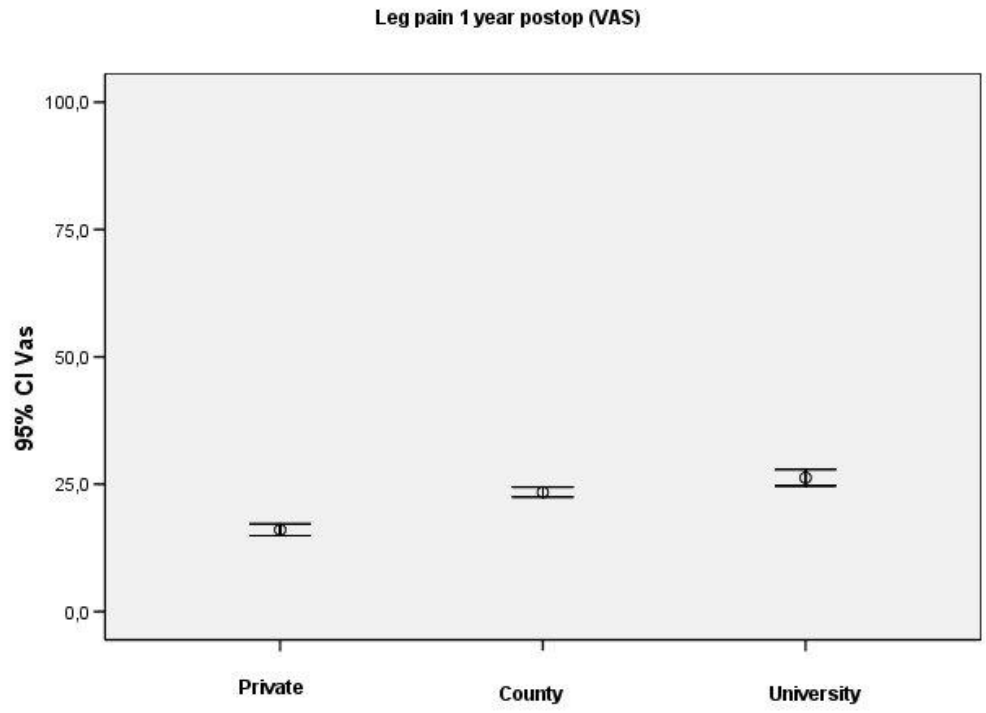

Fig 45. Leg pain (VAS) 1 year after lumbar disc herniation surgery related to type of department.

The proportion sick-listed and/or dissatisfied/uncertain patients one year after surgery was significantly smaller in private hospitals than in university and county hospitals (Table 35).

Table 35. Negative outcome parameters related to type of hospital.

	Type of hospital			
	Private	**County**	**Univ**	**Chi^2**
	%	**%**	**%**	**P**
Unchanged/increased leg pain 1 yr postoperatively	6	11	14	<0.0001
Sick-listed 1 yr postoperatively	11	20	19	<0.0001
Uncertain/dissatisfied with outcome 1 yr postoperatively	15	25	30	<0.0001

The interpretation is that departments with very small volumes of surgery (<20 operations registered during 3 years) demonstrate less satisfactory outcome. A tendency to correlation between good outcome and large volumes of surgery can partly be explained by the fact that the private hospitals show better results in this compilation as private hospitals account for the two largest volumes of surgery on department basis. However the case-mix or patient profile seems more favourable among patients operated on in private hospitals which can be as plausible an explanation.

4. **Patient-related factors**

In total 25% of the patients operated on for lumbar disc herniation were smokers preoperatively. Smoking is an obvious lifestyle marker and has a documented negative effect on many health aspects. It is also obvious from the figures that smoking correlates to outcome of lumbar disc herniation surgery negatively regarding remaining pain after surgery, satisfaction with surgery, sick-listing and improvement of quality of life (Table 36).

Table 36. Outcome parameters correlated to smoking (one year postoperatively).

	Smoker		
	Yes	**No**	**Chi^2**
	%	**%**	**P**
Unchanged/increased leg pain	16	9	<0.0001
Dissatisfied or uncertain with treatment outcome	31	21	<0.0001
Sick-listing full- or part-time	25	14	<0.0001
	Score	**Score**	
Improvement in quality of life	0.39	0.48	<0.0001

5. Logistic regression analysis of individual factors

To estimate the relative significance of the above analyzed individual presumably predictive factors, we have also performed a multiple logistic regression analysis in three versions using improvement of leg pain, improvement of quality of life and sick-listing one year after surgery as outcome parameters. Table 37 demonstrates smoking and duration of pain preoperatively to individually significant correlated to improvement in leg pain, sick-listing and improvement of quality of life. Regarding sick-listing, also female sex has a predictive value and regarding leg pain type of hospital is predictive (more pronounced improvement in private units).

Table 37. Compilation of factors significantly correlating to threee negative outcome measures according to multiple logistic regression.

	Results after 1 year		
	No improvement of leg pain	**Sick-listing full/part-time**	**No improvement of quality of life**
Smoking habits	<0.0001	<0.0001	<0.0001
Duration of pain before the operation	<0.0001	0.02	<0.0001
Type of hospital	0.001	Ns	Ns
Clinic	Ns	Ns	Ns
Sex	Ns	0.001	Ns
Surgery method	Ns	Ns	Ns

Discussion

Patients with lumbar disc herniation in Sweden generally have a long duration of pain before they undergo surgical treatment, far longer than established treatment algorithms (Table 32). Internationally, there is an agreement that after 6-8 weeks of sciatica, MRI should be contemplated and surgical treatment should be performed within 3 months in patients without spontaneous improvement. The Swedish patient with lumbar disc herniation generally is far from this situation as less than 20% are operated on with less than 3 months of preoperative pain.

The analysis above shows an obvious correlation between long duration of pain before surgery and inferior outcome of surgery irrespective of result parameters used (Table 22). Smoking significantly correlates to inferior outcome while other evaluated factors (method of surgery, type of hospital, sex) show a less consistent significance for outcome.

The single most important effort Swedish hospital care should undertake to improve outcome of surgery seems to be to shorten the waiting time to MRI investigation, to see a spine specialist and to come to surgery. In many parts of Sweden MRI investigations are only being requested by spine specialists and this may further prolong the waiting time as this would be the first step when the patient comes to the specialist. This is a logistic problem which can easily be solved through information, however, an increased accessibility to MRI scanners and to spine surgeons is also to be desired but less easily achieved.

The significance of type of surgery for the outcome is difficult to evaluate. In the univariate analysis there are small but significant differences speaking in favour for microsurgery. However, it has to be taken into consideration that there are differences in patient profile; the microsurgically treated patient group contains more males and has a shorter duration of leg pain before surgery. Furthermore, microsurgical technique is most frequently used in private hospitals where other positive predictive factors play a role (patients paying privately, patients with individual health care insurance (still rare in

Sweden thorugh). These correlations were analyzed in the register report of the year 2006, accessible on the homepage of the Swedish Society of Spinal Surgeons (www.4s.nu).

The relationship between the volume of surgery in the individual departments and the outcome regarding improvement of leg pain is mostly absent, however, a small group of departments reporting less than 20 operations per year during the last 3 years show an outcome which deviates negatively from the mean improvement of leg pain of 45 VAS-units and instead shows results hinting at more or less unchanged leg pain after surgery. These departments should analyse the cause for these results and consider sending patients needing surgery on to larger orthopaedic or neurosurgical departments. A weak trend towards better improvement of leg pain in departments with a higher surgical volume is seen (Figure 36). The main reason to this weak trend is the less satisfactory results at the departments for reporting few operations, departments operating more than 20 patients per year do not demonstrate differences in results (Figures 40-42) such as patient satisfaction and sick-listing.

When different types of hospitals are compared, the results at the private hospitals seem better than in the university and county hospitals, measured with most of the outcome parameters. However this conclusion cannot be drawn based upon the analysis of the individual factors above. Patient profiles differ quite a lot between different hospitals, private hospitals treat more males and their patients have a higher quality of life preoperatively and a shorter duration of pain. Further, fewer patients are smokers and fewer are sick-listed in this patient group. All these factors may be expected to have a positive prognostic significance on the outcome.

In conclusion, with some minor exceptions, the significance of the individual department and type of hospital seems to be less important than the preoperative duration of pain and smoking habits regarding the results of lumbar disc herniation surgery.

Conclusion

Outcome of surgical treatment of lumbar disc herniation in Sweden can probably be improved with the following measures:

1. Decreasing waiting times to MRI investigation, specialist investigations and surgery
2. Recommendations to the patients to stop smoking
3. Departments with a lower volume of disc surgery (<20 per year) should consider sending their patients to hospitals with larger volumes

VI. Number of registered operations and follow-up frequency

The number of patients registered for lumbar disc herniation surgery has continously been increasing during the last years and this is shown in Figure 46.

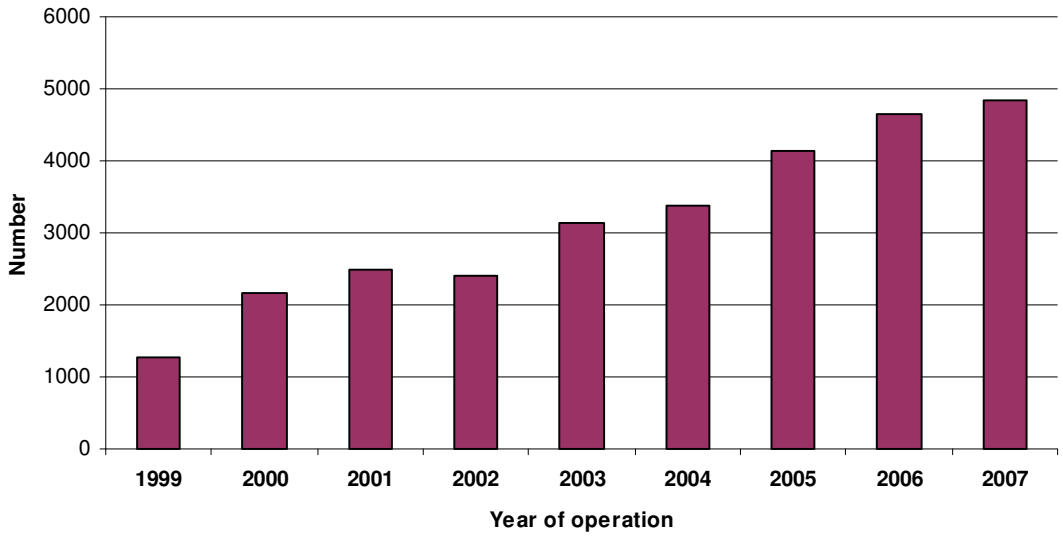

Fig 46. Registered number of patients for lumbar disc herniation surgery 1999-2007.

In Figure 47 the follow-up frequency at 1 and 2 years is shown for patients operated on 2005.

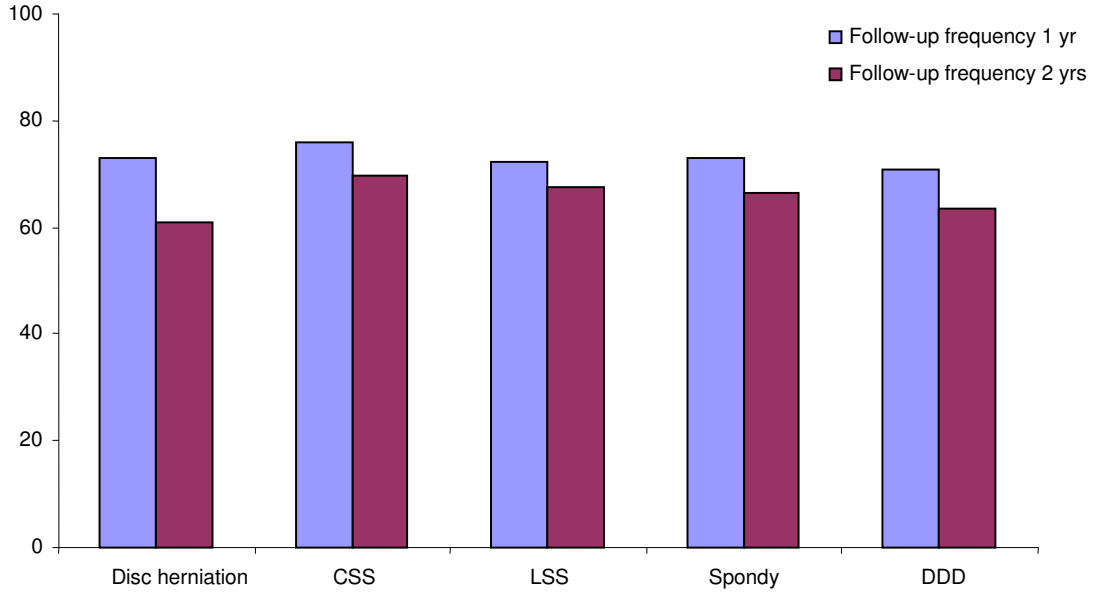

Fig 47. Current follow-up frequency.

VII. Conclusion

As is evident from Figure 46, the number of patients registered has increased gradually since 1999 and this trend is still valid. General demographic results are stable over time while the trend in Sweden with a higher number of spinal stenosis surgeries and a decreasing number of disc surgeries seems to remain. Something that is absolutely mandatory for us working with the spine register is to improve the follow-up frequency (Figure 47) and we hope that everybody participating in the register work contribute to improve it.

Some interesting factors concerning lumbar disc surgery are presented and discussed in the analysis part. Our aim is to add a focused analysis in each annual report in addition to the production control included. Suggestions for future analyses are welcome.

Five-year follow-up results are now starting to be assembled and also a small number of 10-year outcome protocols. The future will show what degree of completeness we can achieve regarding the long-term follow-up. One fact is that quite a few patients decease during a 10-year follow-up and it is also obvious that for everybody 5 and 10 years of life yields a lot of changes that may affect the health recorded in the protocol in addition to the spine problem that has been treated. Such factors may for example affect disability and quality of life.

We look very much forward to the time when we can start to evaluate protocol from the other diagnostic groups of spine surgery but probably one or two years will have to pass before it is possible.

The immense amount of data coming out of the Swedish Spine Register requires the devoted work of many people, secretaries and surgeons at individual departments and, not least, patients. We appreciate all those who have contributed and hopefully will continue to contribute to the increased knowledge on spine problems that can be obtained from the register. The increased economical funding from Sveriges kommuner och landsting/Socialstyrelsen is also highly valuable to continue the work and to improve the application and data handling.