K.-Å. Jansson
P. Blomqvist
F. Granath
G. Németh

Spinal stenosis surgery in Sweden 1987–1999

Received: 24 October 2002
Revised: 16 January 2003
Accepted: 31 January 2003
Published online: 24 May 2003
© Springer-Verlag 2003

K.-Å. Jansson was partly funded
by the Karolinska Institute and the
Karolinska Hospital

K.-Å. Jansson (✉) · G. Németh
Department of Orthopedics,
Karolinska Hospital,
171 76 Stockholm, Sweden
Tel.: +46-8-51776257,
Fax: +46-8-51776446,
e-mail: karl-ake.jansson@ks.se

P. Blomqvist · F. Granath
Unit of Clinical Epidemiology,
Department of Medicine
at Karolinska Hospital,
Karolinska Institute, Stockholm, Sweden

Abstract Despite being recognised for many years as a clinical diagnosis, no exact definition of spinal stenosis has yet been agreed, leading to difficulties in interpreting and comparing studies of the incidence, prevalence and treatment. This study presents the first analysis of national data to be reported. It is a retrospective population-based national register study, aimed at analyzing surgical interventions in patients with lumbar spinal stenosis, patient characteristics, subsequent development, and case fatality rate, based on Swedish national data for 1987–1999. Complete follow-up data were obtained of incidence and type of spinal stenosis surgery, rate of multiple operations, mortality, underlying causes of death, length of hospital stay, and case fatality rate by linkage of the National Inpatient Register and Swedish Death Register. The study cohort consisted of 10,494 patients. Laminectomy was performed in 89%,

and additional fusion in 11%. The mean annual rate of operations was 9.7 per 100,000 inhabitants, the annual number of operations performed increased from 4.7 to 13.2 per 100,000 inhabitants per year. The case fatality rate within 30 days after surgery was 3.5 per 1000 operations. Cardiovascular disease was the most common cause of death (46%). Relative risk of dying within 30 days of admission was doubled in men, and for fusion surgery, and increased four fold in patients older than 80 years. The relative risk of dying decreased during the study period. The results show that spinal stenosis surgery in Sweden has increased, and is associated with a low risk. Within an ageing group of patients, mortality has declined.

Keywords Spinal stenosis · Population based · Epidemiology · Mortality

Introduction

Spinal stenosis has been recognized as a clinical diagnosis for many years, but no exact definition has yet been agreed upon. This has made studies of the incidence, prevalence and treatment difficult to interpret and compare. With a lack of diagnostic criteria, concomitant degenerative vertebral changes appear to be a prerequisite for symptomatic spinal stenosis [15].

The diagnosis of spinal stenosis is mainly based on the patient's clinical symptoms and signs, and is confirmed by radiological examinations [1, 5, 6, 14, 21].

The aim of therapy is to alleviate the symptoms, especially to reduce the pain. Nonoperative treatment of spinal stenosis in patients with mild or moderate symptoms is an option [15]. In an earlier study it was found that 15% of nonoperatively treated patients with lumbar spinal stenosis improved. However, 15% of the patients experienced significant deterioration, while in the remaining patients

the symptoms were unchanged [12]. Immediate operation is indicated only if neurological symptoms develop, or if pain is intolerable [9, 12]. Controlled clinical studies comparing conservative and surgical treatment are rare, and there are few reports on long-term results. The outcome of those studies favor surgical over conservative treatment [2, 3, 12].

Since the introduction of high-resolution noninvasive radiographic image technologies such as magnetic resonance imaging (MRI) and computed tomography (CT), spinal stenosis has been diagnosed more frequently [14].

The incidence of surgical management has been reported from individual regions or hospitals [4, 7, 11, 16]. The characteristics and mortality of these patients have only been reported occasionally [8, 17]. To our knowledge there have been no previous reports on analyses of national data.

The aim of this study was to report the incidence of surgical intervention in patients with lumbar spinal stenosis, the characteristics of the patients, the subsequent development, and the case fatality rate, based on national data in Sweden for the period 1987–1999.

Materials and methods

Setting

Sweden (population 8.9 million) has a national health care system based on administratively independent county councils. The country is divided geographically into six medical regions. The private hospital sector is small and provides only elective care. Health care is mainly funded by local taxes. Since 1964, the Swedish National Board of Health and Welfare has compiled data on individual hospital discharges in the National Inpatient Register, and since 1987 the register has covered all Swedish hospitals. Besides a national registration number, uniquely identifying every resident of Sweden, each record contains medical data including surgical procedures performed and diagnoses at discharge. Surgical procedures were coded according to the Swedish Classification of Operations and Major Procedures, sixth edition, and Classification of Surgical Procedures 1997, and diagnoses at discharge were coded according to the Swedish version of the International Classification of Diseases, Ninth Revision (ICD9) during 1987–1996 and Tenth Revision (ICD10) during 1997–2000.

Patients

All discharges during the years 1987 through December 1999 with the following procedure codes were selected from the Inpatient Registry: laminectomy (0300), posterior fusion (8440) other fusion (8449) decompression of nerve roots in lumbar spine (ABC36), decompression of spinal cord and nerve roots in lumbar spine (ABC56), decompression of spinal cord in lumbar spine (ABC66), other decompression in lumbar spine (ABC99), posterior fusion without instrumentation (NAG69), posterior fusion with instrumentation (NAG79), and unilateral posterior fusion (NAG89). In addition, only patients with a primary diagnosis of spinal stenosis not including the cervical spine (ICD9: 724A) or spinal stenosis (ICD10: M48.0) were selected. Operations on the cervical spine were not included. We further classified these discharges according to the complexity of the procedure. Fusion surgery with or without

instrumentation (procedure codes 8440, 8449, NAG69, NAG79, and NAG89) were characterized as complex.

Due to invalid data in the National Inpatient Register, we had to exclude 0.4% of the total number of patients in our study.

To analyze the risk of dying among those operated on, we linked information on date of death and underlying cause of death from the Swedish Death Register to the National Inpatient Register, using the personal identification number. Underlying causes of death were coded by the ICD9 and ICD10 classifications. Date of surgery was not recorded in the National Inpatient Register during the study period. Therefore, the time at risk of dying was calculated as the difference between the dates of admission and death or end of follow-up (December 31, 1999), on the assumption that the patient had undergone surgery within 1 day after admission. Patients dying while in the hospital were also included.

Data analysis and statistics

Descriptive analyses of the characteristics of all patients and case fatality within 30 and 90 days after admission were performed, considering age, gender, discharge diagnoses, time period, underlying causes of death, and time elapsed between admission and death. Annual number of operations performed for lumbar spinal

Table 1 Spinal stenosis surgery in Sweden 1987–1999: the study cohort ($n=11,283$)

	Operations for spinal stenosis	
	N	%
Age (years)		
–49	1,489	13.2
50–54	1,011	9.0
55–59	1,222	10.8
60–64	1,378	12.2
65–69	1,738	15.4
70–74	2,067	18.3
75–79	1,620	14.4
80–	758	6.7
Total	11,283	100.0
Gender		
Female	5,699	50.5
Male	5,584	49.5
Total	11,283	100.0
Surgical interventions		
Single	10,494	93.0
Multiple	789	7.0
Total	11,283	100.0
Type of operation		
Laminectomy only	10,027	88.9
Fusion ^a	1,256	11.1
Total	11,283	100.0
Year of operation		
1987–1991	2,633	23.3
1992–1995	4,204	37.3
1996–2000	4,446	39.4
Total	11,283	100.0

^a With or without instrumentation and with or without laminectomy

Fig. 1 Age at surgery. The curve indicates the mean age of patients undergoing surgery for spinal stenosis in Sweden 1987–1999. The box plots show the range of ages that account for the central 50% (by age) of all patients undergoing this operation each year and the vertical lines indicate the top and bottom quartiles. The line in each box indicates the median age

stenosis in Sweden, and the regional distribution of operations per 100,000 inhabitants was correlated to the total population of Sweden during 1987–1999 [24, 25].

Case fatality rate (CFR) per 1000 spinal stenosis operations was computed by categories of age, gender, number of surgical interventions, type of surgery and time period. Multivariate analysis of 90 days mortality was performed by Cox' regression. The covariates included were the number of spine surgical interventions, as a time-dependent variable, and the variables shown in Table 4 [19, 20].

Results

The study cohort consisted of 10,494 patients. The mean follow-up time was 4.5 years, and standard deviation (SD) was 3.2 years.

Decompression surgery (laminectomy) was performed in 89% of the patients, and decompression with additional fusion in the remaining 11% (Table 1). The overall mean age at surgery was 64 years (range 14–92 years). Over the study period, the mean age increased from 60.1 (SD12.5) to 66.8 (SD11.0) years (Fig. 1). The gender distribution was almost even.

Only 7% of the patients underwent multiple operations for spinal stenosis during the study period. The mean hospital stay decreased from 14.6 (SD10.7) to 7.9 (SD5.0) days during the study period. The annual number of operations performed increased from 4.7 to 13.2 per 100,000 inhabitants per year (Fig. 2).

The geographic distribution of operations for lumbar spinal stenosis per 100,000 inhabitants per year in Sweden in the period 1987–1999 is shown in Fig. 3. The mean rate for the whole of Sweden was 9.7 per 100,000 per year, ranging from 6 in the northern part of Sweden to 13 in the south-east part of the country.

Number of operations/100 000 inhabitants 1987-1999

Fig. 2 Number of operations for spinal stenosis performed in Sweden per 100,000 inhabitants in 1987–1999

Number of operations per 100 000 inhabitants and year in the period 1987-1999 in different regions in Sweden

Fig. 3 Geographic distribution of operations for spinal stenosis operations per 100,000 inhabitants per year in Sweden 1987–1999

The case fatality rate within 30 days after surgery was 3.5 per 1000 operations (Table 2). The case fatality rate increased markedly with patient age, particularly after the age of 75 years. Between days 31 and 90, another 3.9 patients

Table 2 Spinal stenosis surgery in Sweden 1987–1999: death rates

	Total deaths		No. of deaths		Case fatality rate per 1000 operations within:	
	<i>N</i>	%	Within ≤30 days	Between 31 and 90 days	30 days	90 days
Age (years)						
–49	33	2.4	0	0	0	0
50–54	30	2.1	0	1	0	1.0
55–59	65	4.6	1	1	0.8	1.6
60–64	120	8.6	4	1	2.9	3.6
65–69	226	16.2	7	7	4.0	8.1
70–74	356	25.5	6	8	2.9	6.8
75–79	364	26.0	9	20	5.6	17.9
80–	204	14.6	12	6	15.8	23.8
<i>Total</i>	<i>1398</i>	<i>100</i>	<i>39</i>	<i>44</i>	<i>3.5</i>	<i>7.4</i>
Gender						
Female	572	40.9	16	16	2.8	5.6
Male	826	59.1	23	28	4.1	9.1
<i>Total</i>	<i>1398</i>	<i>100</i>	<i>39</i>	<i>44</i>	<i>3.5</i>	<i>7.4</i>
Surgical interventions						
Single	1312	93.8	37	42	3.5	7.5
Multiple	86	6.2	2	2	2.5	5.1
<i>Total</i>	<i>1398</i>	<i>100</i>	<i>39</i>	<i>46</i>	<i>3.5</i>	<i>7.4</i>
Type of surgery						
Laminectomy	1256	89.8	35	37	3.5	7.2
Fusion ^a	142	10.2	4	7	3.2	8.8
<i>Total</i>	<i>1398</i>	<i>100</i>	<i>39</i>	<i>44</i>	<i>3.5</i>	<i>7.4</i>
Year of operation						
1987–1991	616	44.1	5	15	1.9	7.6
1992–1995	575	41.1	20	12	4.8	7.6
1996–2000	207	14.8	14	17	3.2	7.0
<i>Total</i>	<i>1398</i>	<i>100</i>	<i>39</i>	<i>44</i>	<i>3.5</i>	<i>7.4</i>

^a With or without instrumentation

Table 3 Spinal stenosis surgery in Sweden 1987–1999: underlying causes of death

Causes of death	Total number of deaths		No. of deaths (<i>N</i>)	
	<i>N</i>	%	Within ≤30 days	Between 31 and 90 days
Cardiovascular diseases	638	45.6	13	13
Tumors	413	29.5	10	19
Infections	16	1.1	1	3
Spinal disorders	20	1.4	12	6
Other	311	22.2	4	3
<i>Total</i>	<i>1398</i>	<i>100</i>	<i>39</i>	<i>44</i>

per 1000 operated on died. Women were at lower risk than men. Case fatality rate decreased over time.

Cardiovascular diseases were the most common causes of death (46%), followed by tumors (30%) (Table 3). The most common diagnoses in these categories were myocardial infarction and prostate cancer, respectively. The other causes of death (22%) were very heterogeneous. The underlying causes of death within 30 days after surgery were also cardiovascular diseases (33%), followed by tumors (26%). A high proportion of spinal disorder as causes of

death (31%) was noted, while deaths due to infections were uncommon (3%).

We also calculated the relative risk of dying within 90 days of admission, taking into consideration the combined effect of sex, age, surgical complexity, and time period (Table 4). The risk was significantly lower in women than in men. High age brought an increased risk, but this increase was only significant for those aged 80 or older. High complexity of surgery almost doubled the risk compared to low complexity. The risk decreased over time.

Table 4 Spinal stenosis surgery in Sweden 1987–1999: relative risk of dying within 90 days (*CI* confidence interval, *Ref* reference value)

	Risk	95% CI
Gender		
Male	1	Ref
Female	0.55	0.35–0.86
Age (years)		
0–59	0.10	0.03–0.36
60–64	0.49	0.18–1.36
65–69	1.15	0.55–2.41
70–74	1.0	Ref
75–79	2.76	1.46–5.23
80–	3.97	1.96–8.02
Complexity of surgery		
Low (non-fusion)	1	Ref
High (fusion)	1.93	1.00–3.72
Time period		
1987–1991	1	Ref
1992–1995	0.81	0.46–1.42
1996–1999	0.68	0.38–1.21

Discussion

This national study showed that the 30-day mortality was low and decreased between the years 1987 and 1999. An age above 80 years, and high complexity of surgery increased the risk of dying within 90 days, while female gender reduced the risk.

Our data indicate that the annual rate of spinal stenosis surgery increased threefold from the year 1987 to 1993, and subsequently remained stable. The mean operation rate during the study period was 9.7 per 100,000 inhabitants per year. The incidence of spinal stenosis in Sweden has been studied previously in selected areas, and was reported to be 5 per 100,000 inhabitants per year (1987–1991) [11]. The same study reported a rate of spinal stenosis surgery of more than 3 per 100,000 inhabitants per year. Our findings indicate a surgical rate more than two times higher. The earlier findings were, however, based on local data, and a different time period, whereas our study relied on comprehensive national registers. In a Swiss study, the incidence of operations for spinal stenosis was found to be 11.5 per 100,000 per year, a rate similar to our data [4]. In contrast to our findings of an even gender ratio, they reported a male predominance. The Swedish National Register for Lumbar Spine Surgery also reported a higher proportion of men undergoing spinal stenosis surgery [26]. This study reported data from about 80% of all lumbar spinal stenosis surgery performed in Sweden during the year 1999, compared to our 13-year national study.

We noted a high geographic variation among the six Swedish medical regions, with the highest rate of surgery

being more than twice that of the lowest. At an assessment of spinal stenosis surgery in Medicare beneficiaries in the US, the rate of surgery was observed to have increased eightfold from 1979 to 1992 [7], and the same study reported rates of surgery varying between US states by almost a factor of five.

Reoperation rates for decompressive laminectomy vary from 9% to 23% [9, 10, 13]. In our study, we found that 7% of the patients underwent multiple operations for spinal stenosis within 4.5 years.

The 30-day case fatality rate per 1000 operations in our study was 3.5, which may be compared to 2.9 per 1000 operations in a study of total hip joint replacement [18]. The authors of the latter study concluded that age carried a significantly increased risk above 70 years. In our study, the risk increased significantly with age, but only in patients aged above 80 years. This group constituted less than 7% of all patients.

Oldridge et al. [17] reported a significantly higher 1-year cumulative mortality in men than in women operated on for lumbar spine surgery. Another study also showed increased postoperative mortality with age, and high comorbidity [7]. The gender differences in our study could be due to confounding factors. Men might have more comorbidity, and or several negative lifestyle factors such as smoking. Unfortunately, we could not extract any of these data from our data set. The inpatient registers do not include outcome data, and therefore we could not determine the success of the procedure. Quality of Life measurements are, however, now prospectively collected in the Swedish National Register for Lumbar Spine Surgery, using instruments like SF-36 or Euroqol, and it may be possible to study them in the future [26].

The case fatality rate following spinal stenosis surgery in our study is among the lowest that have been reported. During the study period, the mean age of patients surgically treated for spinal stenosis increased by almost 8 years, and there was still a decline in the mortality rate. This may have been due to more careful patient selection, a healthier population or improved perioperative care.

The death rate after spinal stenosis surgery is related to age, gender, and type of procedure. A fusion procedure was associated with an almost twofold increase in the rate of death compared to decompression surgery alone. Previous studies have found that fusion operations had more complications [8, 26]. However, no differences in mortality rates compared to operations without fusions have previously been reported.

In a study of mortality rates after elective hip arthroplasty, high age, male sex, and a history of cardiorespiratory disease were found to contribute to death within 30 days after the operation. This study also reported a positive time trend as well as a significant decline in the 30-day mortality rate after hip arthroplasty [18].

Our study is the largest population-based analysis reported on spinal stenosis surgery. Unlike other studies, we

also included all deaths after these procedures. The study design, with linkage of the National Inpatient Register to the Swedish Death Register, had the advantage of including all discharges after spinal stenosis surgery in Sweden over a period of 13 years. It also allowed a complete follow-up both of dates of death and of underlying causes of death, even after the patients were discharged from hospital. Misclassification of the date of death is unlikely, as the reporting to the Swedish Death Register is virtually complete and is of high quality [23].

We based our analysis on two national databases. Register studies have several advantages, notably virtually complete coverage and unbiased prospective collection of data.

The ICD9 classification did not distinguish between stenosis in the thoracic spine and the lumbar spine, while the ICD10 classification has a specific code for each anatomical region. Procedures on the thoracic spine are rare in Sweden. Therefore, it is unlikely that an inclusion of these could have had a major impact on our results.

We confined our study to patients with a primary diagnosis of lumbar spinal stenosis. Only 20% of the patient records have secondary diagnoses, making an analysis of comorbidity unfeasible. Had this information been available, additional risk factors might have been revealed, for example malignancies, diabetes mellitus or severe cardiovascular diseases.

In a few patients, the underlying cause of death indicated a fatal disease that was not recorded among the discharge diagnoses, and therefore may have been undetected at the time of surgery. In some patients, however, the underlying cause of death was a disease that normally is not considered fatal, e.g. spinal stenosis. We obtained data on causes of death, but we only considered the underlying cause. In Sweden, contributory causes of death are also recorded in the death certificates and in the National Death Register. The order of rank of underlying and contributory causes of death is not always apparent. This may explain our finding that almost one-third of the patients

dying within 30 days had a spinal disorder as an underlying cause. Moreover, the autopsy rates are low, and decreased during the study period. Many died of cardiovascular diseases. Some of these cardiovascular deaths may have been caused by the trauma of anesthesia and surgery in patients with low physiological reserves as a result of high age or comorbidity.

Our results shed additional light on back surgery, since they suggest that the surgical trauma itself may pose a risk among patients who undergo surgery for spinal stenosis. Avoiding or postponing surgery by making a correct preoperative diagnosis, and minimization of surgical trauma by proper timing of surgery, with preoperative optimization of physiological reserves, may therefore be important to reduce the death rate further. Nonsurgical treatment may also be considered in selected patients [22]. Improved diagnostic workup and the availability of CT scan and MRI during the later part of our study may also have contributed to the improved prognosis.

With the changing therapeutic panorama of spinal stenosis in industrialized countries, our results have implications for health care providers. Spinal stenosis surgery is associated with a low number of deaths, the case fatality rate within 30 days after surgery was only 3.5 per 1000 operations.

Conclusion

The mean operation rate was 9.7 per 100,000 inhabitants per year, and increased threefold from 1987 to 1993. The case fatality rate within 30 days after surgery was only 3.5 per 1000 operations. The risk of dying was higher for men, for fusion surgery, and in patients aged above 80 years. The mortality declined despite ageing of patients.

Acknowledgement We thank Anders Ekblom for inspiring discussions on the study design.

References

1. Amundsen T, Weber H, Lilleas F (1995) Lumbar spinal stenosis. Clinical and radiologic features. *Spine* 20:1178–1186
2. Amundsen T, Weber H, Lilleas F, et al (2000) Lumbar spinal stenosis: conservative or surgical management? A prospective 10-year study. *Spine* 25:1424–1435
3. Atlas S, Deyo R, Keller R, et al (1996) The Maine Lumbar Spine Study. III. One-year outcomes of surgical and non-surgical management of lumbar spinal stenosis. *Spine* 21:1787–1794
4. Berney J (1994) Epidemiology of narrow spinal canal. *Neurochirurgie* 40: 174–178
5. Boden S (1996) The use of radiographic imaging studies in the evaluation of patients who have degenerative disorders of the lumbar spine. *J Bone Joint Surg Am* 78:114–124
6. Bolender N, Schönström N, Spengler D (1985) Role of computed tomography and myelography in the diagnosis of central spinal stenosis. *J Bone Joint Surg Am* 67:240–246
7. Ciol M, Deyo R, Howell E, Kreif S (1996) An assesment of surgery for spinal stenosis: time trends, geographic variations, complications, and reoperations. *J Am Geriatr Soc* 44:285–290

8. Deyo R, Cherkin D, Loeser J, Bigos S, Ciol M (1992) Morbidity and mortality in association with operations on the lumbar spine. The influence of age, diagnosis, and procedure. *J Bone Joint Surg Am* 74:536–543
9. Herno A, Airaksinen O, Saari T (1993) Long-term results of surgical treatment of lumbar spinal stenosis. *Spine* 18: 1471–1474
10. Hopp E, Tsou P (1983) Postdecompression lumbar instability. *Clin Orthop* 179:86–96
11. Johnsson K (1995) Lumbar spinal stenosis. A retrospective study of 163 cases in southern Sweden. *Acta Orthop Scand* 66:403–405
12. Johnsson K, Uden A, Rosen I (1991) The effect of decompression on the natural course of spinal stenosis. A comparison of surgically treated and untreated patients. *Spine* 16:615–619
13. Katz J, Lipson S, Larson M, McInnes J, Fossel A, Liang M (1991) The outcome of decompressive laminectomy for degenerative lumbar stenosis. *J Bone Joint Surg Am* 73:809–816
14. Kent D, Haynor D, Larson E, et al (1992) Diagnosis of lumbar spinal stenosis in adults. A meta analysis of the accuracy of CT, MR and myelography. *Am J Roentgenol* 158:1135–1144
15. Martinelli T, Wiesel S (1992) Epidemiology of spinal stenosis. *Instr Course Lect* 179–181
16. Nilasena D, Vaughn R, Mori M, Lyon J (1995) Surgical trends in the treatment of diseases of the lumbar spine in Utah's Medicare population, 1984 to 1990. *Med Care* 33:585–597
17. Oldridge N, Yuan Z, Stoll J, Rimm A (1994) Lumbar spine surgery and mortality among Medicare beneficiaries, 1986. *Am J Public Health* 84:1292–1298
18. Parvizi J, Johnson B, Rowland C, Ereth M, Lewallen D (2001) Thirty-day mortality after elective total hip arthroplasty. *J Bone Joint Surg Am* 83:1524–1528
19. Rothman K (1998) Introduction to categorical statistics. In: Rothman KJ, Greenland S (eds) *Modern epidemiology*, 2nd edn. Lippincott-Raven, Philadelphia
20. SAS Institute (1997) *SAS/STAT (R) software: changes and enhancements through release 6.12*. SAS Institute, Cary, pp 247–348
21. Schönström NS, Bolender NF, Spengler DM (1985) The pathomorphology of spinal stenosis as seen on CT scans of the lumbar spine. *Spine* 10:806–811
22. Simotas A, Dorey F, Hansraj K, Cammisa Jr F, Katz J (2000) Nonoperative treatment for lumbar spinal stenosis. Clinical and outcome results and a 3-year survivorship analysis. *Spine* 25:197–203; <http://ipsapp002.lwwonline.com/content/getfile/160/65/1/fulltext.htm> - R29-10401
23. Statistics (1998) Health, diseases, causes of death 1996. The National Board of Health and Welfare, Centre for Epidemiology, Stockholm
24. Statistics Sweden (1997) *Statistical yearbook of Sweden 1997*. Statistics Sweden, Stockholm
25. Statistics Sweden (2000) *Statistical yearbook of Sweden 2000*. Statistics Sweden, Stockholm
26. Strömquist B, Jönsson B, Fritzell P, Hägg O, Larsson B, Lind B (2001) The Swedish National Register for Lumbar Spine Surgery, Swedish Society for Spinal Surgery. *Acta Orthop Scand* 72: 99–106