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ORIGINAL ARTICLE

Public and private health service in Norway: a comparison of patient characteristics and surgery criteria for patients with nerve root affections due to discus herniation

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Abstract
Purpose To compare sociodemographic, life style and clinical characteristics in patients operated for lumbar disc herniation in public and private clinics in Norway, and evaluate whether selection for surgery and surgical treatment were different across the two settings.
Methods A cross-sectional multicenter study of patients who underwent elective surgeries for lumbar disc herniation at 41 (31 public and 10 private) hospitals. Data were included in the Norwegian Registry for Spine Surgery.
Results Of the 5,308 elective surgical procedures, 3,628 were performed at public hospitals and 1,680 at private clinics. Patients in the private clinics were slightly younger, more likely to be man, have higher level of education, and more likely to be employed. Disability and retirement pensions were more than double in the public as compared to the private clinics. Mean duration of sick leave was 24 weeks (SD 36.4) in the public and 15 weeks (20.7) in the private clinics. There were minor differences in pain, disability and quality-of life, number of verified disc herniations and radiological findings. Number of days at hospital, total operation time and proportion of complications were significantly higher in the public than in the private clinics.
Conclusion Patients having elective surgery due to lumbar disc herniation in public and private clinics were different with respect to many sociodemographic and life style variables. There were minor differences with respect to clinical variables and selection of patients for surgery, but substantial differences related to aspects of the surgical treatment.

Keywords Lumbar disc herniation · Sociodemographic characteristics · Life style characteristics · Surgical indications · Private health service

Introduction

Like in many countries worldwide, specialized health services in Norway are provided by both public and private hospitals. During the last decade there has been a remarkable growth in private supplementary health insurance in Norway, especially employment-based private health insurance [1–3]. Most of the health care provided by private hospitals has public funding through contracts with the public regional health authorities. This means that for most of the patients co-payment is the same irrespective of provider. Since 2000, an increasing number of patients with sciatica due to lumbar disc herniation are referred to medical specialists in a growing private health service, offering shorter waiting time for evaluation and surgical treatment.

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In the last decades the use of spine surgery has increased considerably in many countries [4, 5]. A study comparing back surgery rates across 11 developed countries showed that the rate increased almost linearly with the supply of orthopedic surgeons and neurosurgeons [5]. There is little clinical justification for the large variation in rates of lumbar spine surgery across countries and regions [4], and the increasing rates of spine surgery cannot be explained by higher frequency of spine disorders [4]. One explanation might therefore be that the threshold for offering surgical treatment is lowered due to increased supply of private health services, in particular for those who can afford a private insurance or have an employment-based private health insurance. Several studies have showed that private health insurance is an important contributor to inequities in health care utilization in specialist care [1, 3, 6]. This implies that sociodemographic and lifestyle characteristics, and the severity of health problems indicating need for operative treatment for lumbar disc herniation might be different between patients who are accepted for surgery at public and private hospitals. Overuse will result in excessive and possibly ineffective surgeries. To the best of our knowledge no previous studies have evaluated these aspects of public and private health services. The purpose of this study was therefore to compare sociodemographic, some lifestyle and clinical characteristics in patients operated for lumbar disc herniation in public and private clinics in Norway, and evaluate whether the surgical indication(s) and surgical treatment were similar across the two clinical settings.

Materials and methods

This is a cross-sectional multicenter study of patients who underwent a total of 5,308 elective surgeries for lumbar disc herniation and were included in the Norwegian Registry for Spine Surgery (NORspine) between January 1 2008 and September 1 2012 in Norway. They were operated at 41 (31 public and 10 private) hospitals, representing 80.5 % of all the surgical units performing this type of surgery in Norway. The NORspine is a government funded clinical registry for quality control and research. The registry protocol of NORspine was approved by The Data Inspectorate of Norway, and the protocol for the current study was approved by the Regional Medical Research Ethics Committee. The study was carried out according to the Helsinki Declaration and written informed consents were obtained from all patients.

At admission for surgery, the patients completed a questionnaire about sociodemographic and lifestyle issues in addition to clinical information. The sociodemographic variables were age, gender, mother language, marital status, number of children, level of education, work status, application for disability pension and/or reimbursement. Two lifestyle characteristics were recorded; smoking status, and body height and weight, of which were used to calculate the Body mass index (BMI: weight/height^2). The clinical information concerned pain, functional status, and health-related quality of life. Pain intensity was assessed by two separate 0–10 numerical rating scales (NRS) for back (NRS back) and leg (NRS leg) pain. Functional status was assessed by the Oswestry Disability Questionnaire version 2.0 (ODI) [7], which contains 10 questions on limitations of activities of daily living. Each variable is rated on a 0–5 point scale, added up, and transferred into a percentage score. The range of possible values is from 0 to 100 (0 = no disability). EQ-5D was used as a generic and preference-weighted measure of health-related quality of life (HRQoL) [8]. It evaluates five dimensions: mobility, self-care, activities of daily life, pain and anxiety and/or depression. For each dimension, the patient describes three possible levels of problems (no, mild to moderate and severe). We used the value set based on the main survey from the EuroQol group [9], which has been validated for patient populations similar to that of the present study [10], Total score range is from −0.594 to 1, where 1 corresponds to perfect health, and 0 to death. Negative values are considered worse than death (e.g. intolerable pain). These instruments are frequently used in back pain research. The Norwegian versions of these instruments have shown good psychometric properties [10, 11].

A doctor or a nurse collected data on employment status, duration of symptoms, and pain medication and summarized the radiological findings described by the radiologist according to a standard registration form. During the hospital stay the surgeon recorded data concerning diagnosis, comorbidity, radiological findings, pain distribution, the surgical procedure and intraoperative complications according to a standard registration form. The American Society of Anaesthetists grading system (ASA) grade I–V was registered for each patient by a doctor or a specialized nurse before surgery. ASA grade classifies patients according to their vulnerability, i.e. physical condition (from no to life-threatening systemic disease). The proportion of back and sciatica related health problems presented by the patients at admission for surgery, which was recorded by the surgeon, was used as proxy for the strength of the surgical indication in this material.

Statistical analyses

All statistical analyses were performed in SPSS for Windows, Version 18.0. Comparisons between public and private health services in categorical variables were carried out by frequency analyses and Chi-square tests. Continuous

Table 1 Sociodemographic and life style characteristics of patients operated for disc herniation in public or private health service in Norway

	Public hospitals (n = 3,628)	Private clinics (n = 1,680)	p value
Age group, *N* (%)			<0.001
<20 years	70 (1.9)	22 (1.3)	
20–30	347 (9.6)	149 (8.9)	
30–40	820 (22.7)	437 (26.1)	
40–50	681 (18.8)	349 (20.8)	
50–60	453 (12.5)	164 (9.8)	
60–70	198 (5.5)	49 (2.9)	
80 or more	35 (1.0)	8 (0.8)	
Missing	11	3	
Age, mean (SD)	46.14 (14.16)	44.81 (12.71)	0.001
Males, *N* (%)	2,064 (56.9)	1,098 (65.3)	<0.001
Mother language, *N* (%)			0.947
Norwegian	3,417 (94.2)	1,588 (94.5)	
Other	198 (5.5)	87 (5.2)	
Missing	13	5	
Marital status, *N* (%)			0.174
Married	1,875 (51.7)	922 (54.8)	
Co-habiting	832 (22.9)	364 (21.7)	
Living alone	890 (24.5)	383 (22.8)	
Missing	31	11	
Children, *N* (%)			0.014
0	505 (13.9)	250 (14.9)	
1	527 (14.5)	258 (15.3)	
2	1,254 (34.6)	619 (36.9)	
3 or more	1,040 (28.7)	404 (24.0)	
Missing	302	149	
Level of education, *N* (%)			<0.001
7–10 Years basic school	707 (19.5)	201 (12.0)	
Vocational school	1,336 (36.8)	505 (30.1)	
High school	470 (13.0)	222 (13.2)	
University or college education <4 years	597 (16.5)	388 (23.1)	
University or college education ≥4 years	476 (13.1)	346 (20.6)	
Missing	42	18	
Work status, *N* (%)			<0.001
In work	596 (16.4)	464 (27.6)	
Home workers	40 (1.1)	14 (0.8)	
Student	115 (3.2)	38 (2.3)	
Sick leave	1,734 (47.8)	883 (52.6)	
Rehabilitation	237 (6.5)	41 (2.4)	
Disability pension	371 (10.2)	60 (3.6)	
Age pension	318 (8.8)	77 (4.6)	
Non-employed	53 (1.5)	10 (0.6)	
Missing	164	93	
Duration sick leave (weeks), mean (SD)	23.7 (36.4) (n = 1,088)	15.0 (20.7) (n = 574)	<0.001
Applied for disability pension, *N* (%)			<0.001
Yes	84 (2.3)	21 (1.2)	
No	2,945 (81.2)	1,545 (91.9)	
Plan to apply	79 (2.2)	17 (1.0)	

Table 1 continued

	Public hospitals (n = 3,628)	Private clinics (n = 1,680)	p value
Application supported	376 (10.4)	69 (4.2)	
Missing	144	28	
Applied for reimbursement, N (%)			0.004
Yes	66 (1.8)	45 (2.7)	
No	3,302 (91.0)	1,528 (91.0)	
Plan to apply	95 (2.6)	47 (2.8)	
Application supported	43 (1.2)	29 (1.7)	
Missing	121	31	
Smokers, N (%)	1,284 (35.4)	488 (29.0)	<0.001
Missing	48	15	
Body mass index[a], N (%)			<0.001
<20	104 (2.9)	35 (2.1)	
20.01–25.00	1,052 (29.0)	567 (33.7)	
25.01–30.00	1,329 (36.6)	654 (39.0)	
>30.00	656 (18.1)	192 (11.4)	
Missing	487	232	
Body mass index, mean (SD)	26.8 (4.6)	26.1 (3.7)	<0.001

[a] Body mass index calculated by weight/height^2

variables were explored with respect to normal distribution and differences between the two health care settings were analyzed by independent t test. Potential differences with respect to health status variables (ODI scores, back and leg pain, and EQ5D scores) were also analyzed in a general linear model, adjusting for age, gender, smoking, level of education, work status, and BMI.

Results

Of the 5,308 elective surgical procedures, 3,628 were performed at public hospitals and 1,680 at private clinics. The sociodemographic and life style characteristics of the patients in the two clinical settings are presented in Table 1. The patients who had surgery in the private clinics were slightly younger (1.3 years), more likely to be men, had higher education, and were less likely to be unemployed. The proportion of patients being on sick leave was slightly higher in the private clinics than in public hospitals, whereas the proportions of disability, and retired pensioners were more than double in the public as compared to the private clinics. The duration of sick leave prior to surgery was significantly higher in public hospitals with a mean of 24 weeks (SD 36.4) as compared to 15 weeks (SD 20.7) in the private clinics.

There were no statistical significant differences between the patients in the two clinical settings in mother language and marital status, but there were higher proportions of patients who were smoking and obese (BMI > 30) in the public health service. They also used more pain medication, had longer pain duration in the back and leg, and had more comorbidity (Table 2), especially heart disease, hip osteoarthritis, depression and chronic lung diseases (data not shown). This is also reflected in a higher ASA grade among patients operated in public hospitals (Table 3).

The unadjusted analyses of the scorings in pain, functional limitations, and HRQoL indicated a poorer health status among the patients in public hospitals when compared to private clinics (Table 2). However, these differences were only minor as there were no statistical differences in scorings when adjusting for differences in sociodemographic and lifestyle variables. The adjusted p values from the multivariate general linear model analyses were 0.816 for leg pain, 0.216 for back pain, 0.084 for ODI, 0.464 for EQ5D, and 0.219 for EQ general health. Of the adjusting variables gender and level of education had a highly statistical significant effect on all the outcome measures (gender p value <0.001, level of education p value <0.013).

There was no statistically significant difference between the two clinical settings with respect to proportion of patients with previous surgery and use of MRI and radiculography (Table 2). In the public health service there was a slightly higher proportion of patients with paresis (9.6 %) as compared to the private clinics (5.6 %), and there was more use of CT (data not shown), however. The proportion of back and sciatica related health problems presented by the patients at admission for surgery was statistically significant different across the two clinical settings. In the private clinics there was a 10 % larger proportion of patients with leg pain, whereas in public

Table 2 Clinical and radiographic characteristics of patients operated for disc herniation in public or private health service in Norway

	Public hospitals (n = 3,628)	Private clinics (n = 1,680)	p value
Previous low back operation, *N* (%)			0.117
No	2,800 (77.2)	1,351 (80.4)	
Yes, same level	526 (14.5)	212 (12.6)	
Yes, another level	230 (6.3)	87 (5.2)	
Yes, the same and another level	36 (1.0)	13 (0.8)	
Missing	36	17	
Use of pain medication, *N* (%)			0.005
No	575 (15.8)	324 (19.3)	
Yes	3,031 (85.5)	1,342 (79.9)	
Missing	22	14	
Frequency use of pain medication, *N* (%)			0.001
Less than each month	88 (2.4)	32 (1.9)	
Each month	193 (5.3)	83 (4.9)	
Each week	516 (14.2)	283 (16.8)	
Daily use	729 (20.1)	334 (19.9)	
Several times per day	1,466 (40.4)	599 (35.7)	
Missing	636	349	
Comorbidity, *N* (%)	892 (24.6)	240 (14.3)	<0.001
Missing	368	411	
Duration back pain, *N* (%)			<0.001
Not relevant (no symptom)	131 (3.6)	105 (6.3)	
<3 Months	278 (7.7)	192 (11.4)	
3–12 Months	1,499 (41.3)	748 (44.5)	
12–24 Months	605 (16.7)	221 (13.2)	
>24 Months	891 (24.6)	127 (7.6)	
Missing	224	127	
Duration leg pain, *N* (%)			<0.001
Not relevant (no symptom)	37 (1.0)	20 (1.2)	
<3 Months	433 (11.9)	294 (17.5)	
3–12 Months	1,831 (50.5)	927 (55.2)	
12–24 Months	576 (15.9)	183 (10.9)	
>24 Months	526 (14.5)	154 (9.2)	
Missing	225	102	
NRS[b] back, Mean (SD)	6.22 (2.34)	5.82 (2.37)	<0.001, 0.2,16[1]
NRS[b] leg, Mean (SD)	6.76 (2.17)	6.58 (2.12)	0.005, 0.816[1]
ODI,[c] Mean (SD)	43.68 (16.99)	41.36 (16.72)	<0.001, 0.084[1]
EQ5D,[d] Mean (SD)	0.30 (0.34)	0.33 (0.33)	0.002, 0.464[1]
EQ general health (VAS), Mean (SD)	45.54 (20.63)	47.72 (20.55)	<0.001, 0.219[1]
Radiographic assessment, *N* (%)			
CT	233 (6.4)	31 (1.8)	<0.001
MRI	3,535 (97.4)	1,648 (98.1)	0.140
Radiculography	12 (0.3)	5 (0.3)	0.842
Pain localization (for surgical indication), *N* (%)			<0.001
Back/hip pain	62 (1.7)	20 (1.2)	
Leg pain	1,759 (48.5)	983 (58.5)	
Both back and leg pain	1,649 (45.5)	596 (35.5)	
Not specified pain	126 (2.7)	41 (2.4)	
Missing or no pain	158 (4.4)	81 (4.8)	

Table 2 continued

	Public hospitals (n = 3,628)	Private clinics (n = 1,680)	p value
ASA grade, 1 N (%)[a]			<0.001
1	1,823 (50.2)	1,173 (69.8)	
2	1,530 (42.2)	442 (26.3)	
3	204 (5.6)	33 (2.0)	
4	1 (0.0)	0	
Missing	70	32	

[a] The American Society of Anaesthetists grading system

[b] NRS = Numerical Rating Scale, higher scores indicate more pain

[c] ODI = Oswestry Disability Index, higher scores indicate more disability

[d] EQ-5D = EuroQoL 5D, higher scores indicate better health

[1] Adjusted for gender, age, smoking, education, work status, and body mass index

Table 3 Characteristics of the surgical treatment for patients operated for disc herniation in public or private health service in Norway

	Public hospitals (n = 3,628)	Private clinics (n = 1,680)	p value
Day surgery, N (%)	305 (8.4)	972 (57.9)	<0.001
Missing	149	81	
Days of hospital stay, Mean (SD)	2.64 (2.42)	0.68 (0.92)	
Type of surgery, N (%)			<0.001
With microscope/lupes	2,913 (80.3)	1,521 (90.5)	
Without microscope/lupes	664 (18.4)	152 (9.0)	
Surgery level, N (%)			
L2–L3	72 (2.0)	16 (1.0)	0.006
L3–L4	297 (8.2)	122 (7.3)	0.243
L4–L5	3,307 (91.2)	1,563 (93.0)	0.024
L5–S1	1,696 (46.7)	794 (47.2)	0.741
No of levels operated, N (%)[1]			0.157
1	3,384 (93.3)	1,562 (93.0)	
2	192 (5.3)	103 (6.1)	
>2	12 (0.3)	3 (0.2)	
Missing	40 (1.1)	12 (0.7)	
Total operation time, Mean (SD)	72.32 (36.16)	48.76 (22.06)	<0.001
Received prophylactic antibiotic treatment, N (%)	2,894 (79.8)	1,620 (96.4)	<0.001
Missing	59	28	
Complications, N (%)	91 (2.5)	20 (1.2)	<0.001
Dural tear	65 (1.8)	6 (0.4)	
Nerve root injury	8 (0.2)	4 (0.2)	
Operated at wrong side/level	7 (0.2)	1 (0.1)	
Bleeding	9 (0.2)	6 (0.4)	
Respiratory complications	2 (0.1)	0	
Cardiovascular complications	2 (0.1)	0	
Anaphylaxis	2 (0.1)	2 (0.1)	

hospitals there was a 10 % larger proportion with a combination of back and leg pain. Lower ASA grading was reported for the patients in the private as compared to the public health service.

Many aspects concerning the surgical treatment were different across the two clinical settings (Table 3). More patients operated in the private clinics were sent home the same day of surgery and a larger proportion received

prophylactic antibiotic treatment. Use of visual enhancement (microscope or loupes) during surgery was more frequent in private clinics; 91 versus 80 % in public, and the duration of surgery was shorter; 49 versus 72 min the in public hospitals. There were also more complications in the public as compared to the private health service. The most frequent intraoperative complication was dural tear, which occurred at a higher rate in public (1.8 %) than in private clinics (0.4 %). There were only minor differences with respect to surgery level and number of levels operated.

Discussion

To our knowledge this is the first study to compare sociodemographic, lifestyle characteristics and surgical indication criteria among patients operated for lumbar disc herniation in public and private clinics. Patients operated in public hospitals were older, had lower educational level, were more likely to receive disability or age pension and to smoke, had more obesity, co-morbidity, longer duration of symptoms, and longer sick leave before surgery. Furthermore, patients operated in public hospitals reported more disability and pain, poorer HRQoL and general health status than those operated in private clinics. The differences were consistent but small and should not be attributed to less strict indications for surgical treatment in private clinics, as confirmed by the adjusted analyses.

Our findings regarding differences in sociodemographic and lifestyle characteristics are in line with previous Scandinavian studies [1–3, 6, 10]. For example, data from Norway [2, 3, 10] have showed that people with high level of education and high income are more likely to have a private supplementary health insurance, and that private health insurance is an important contributor to inequities in health care utilization in specialist care. A recently published review of the literature on what characterize individuals with voluntary private health insurance in universal health care systems [2, 3, 6] supports that the probability of being privately insured increases with income and education level. It also shows that people who have a private supplementary health insurance are more likely to be employed and to be in report equal or better health compared to the remaining population. It is important to acknowledge that many of these sociodemographic and lifestyle characteristics represent risk factors for inferior outcomes after surgery [12], if comparisons of treatment effectiveness in public and private are performed.

The evidence regarding the impact of self-assessed health status on use of health care services are ambiguous. A Norwegian study by Iversen and Kopperud [2] found that accessibility and socio-economic variables play a considerable role in determining both the probability of at least one visit and the number of visits to a private specialist, but these associations were not significant for visits to a hospital outpatient department. The use of public outpatient clinics was closely related to a person's self-assessed health status, however, as people who reported poor health were more likely to use this type of health service. There was no significant association between self-reported health and use of private health care [2]. These findings are supported by our current study, which shows that there was no statistical significant difference in the scorings at the standardized health status measures (pain, disability, HRQoL) in the two clinical settings after adjusting for sociodemographic and life style variables.

The indication for surgery is in most cases relative to the subjective complaints of the patients and is a difficult concept to measure. We therefore used the proportion of back and sciatica related health problems presented by the patients at admission for surgery (and recorded by the surgeon) as proxy for the strength of the surgical indication. In addition, we evaluated radiological findings, number of levels operated, and previous surgery. We found only small differences, which we consider to be clinically irrelevant, even though some of them were statistically significant, probably by chance and due to the high numbers of study participants.

Larger differences between the clinical settings were found with respect to aspects of the surgical treatment. In private clinics, the duration of surgery and days of hospital stay were shorter, the intraoperative complication rate was lower and visual enhancement (microscope or loupes) and prophylactic antibiotic was used more frequently. These findings indicate that private hospitals are effective organizations for handling frequent and more simple and straightforward procedures like lumbar discectomies. One possible explanation for the large difference in total surgery time is probably that private clinics use experienced specialists in contrast to public hospitals, in which many patients are operated by supervised trainees. In addition, especially in the public teaching hospitals the planned surgery might be interfered by other activities, which limit an effective management in these complex organizations. On the other hand, this study does not provide data on cost-utility aspects of these two clinical settings, nor on whether there are large geographical variations in the availability or the use of private specialists in spinal surgery, which needs to be addressed in future studies [2]. Increased availability relative to demands of this kind surgery can create a drift toward more liberal indications and overuse and a higher frequency of unnecessary and inefficient operations. Registries like the NORspine can play a role in monitoring effectiveness and indications for surgery in different regions and treatment settings.

This study has some weaknesses. Firstly, the quality of data on radiographic findings has not been assessed with

respect to inter-rater reliability of the numerous neuroradiologists involved. Therefore, interpretation may differ across the surgical units. Secondly, we only have data on duration of symptoms and sick leave, but not on the waiting time before surgery. Such data could provide additional and valuable information about differences in the management of this patient group. An advantage is the large data set, which gives our statistical analyses high power.

Conclusion

Indications for surgical treatment of lumbar disc herniation appear to be similar in the public and private health service. Patients operated in private clinics seem to be handled more effectively. They were younger, healthier and had more socioeconomic and lifestyle attributes, known to be predictors for more favorable outcomes after surgery.

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