PRM+
JOURNAL OF QUANTITATIVE RESEARCH IN REHABILITATION MEDICINE

PRM+ (2018) Vol 1 Issue 2 45-48
ISSN 2489-8457

Rates and age trends in lumbar fusions in 2002 – 2017 – a descriptive analysis of 3,000 patients

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Abstract

Objectives

The objective of this study was to describe the change in rates and age averages among patients undergoing lumbar fusion during the last 20 years in a university hospital district located in Finland.

Methods

The data on 3,066 fusion surgeries were obtained from an electronic register between 2002 – 2017. The t-test, chi square, and regression analyses were used.

Results

In 2002 – 2017, 3,066 patients underwent lumbar fusion. The annual fusion rates grew in 16 years by 500%. The regression coefficient for annual rates of lumbar fusion procedures was 17.4 (95% CI 14.8 to 20.0, p-value <0.0001) procedure/year. In general, the patients were becoming older over time with regression coefficient 0.67 (95% CI 0.55 to 0.78, p-value <0.0001, R^2 0.04) year/year.

Conclusions

In the studied cohort, the annual rates of lumbar fusions grew explosively during the last 16 years by 500% and the patients were 10 years older in 2017 than back in 2002. It seems, that if the trend observed here will continue then fusion patients may on average be even 20 years older in 2030 than they were in 2002. Surgeons and policy makers should take this probability under consideration when planning future techniques, rehabilitation, and allocation of funding.

Keywords:

lumbar fusion, incidence, prevalence, trend, trajectory analysis

INTRODUCTION

The rates of spinal fusion surgery are growing (1). It has been suggested that fusion rates are mounting even faster than the rates of other surgical procedures on bony structures (1). This trend has been evident in the last decades especially amongst elderly people with spinal stenosis (2). As the general population is ageing, the prevalence of degenerative spinal disorders grows resulting in an increasing need for surgery (3). On the other hand, people are continuing to work longer expecting better health and higher readiness for a more active life style both when working and when retired.

There has been an enormous growth of lumbar fusion rates in the United States – over 100% per decade (1, 4). With its cost up to $ 70 000, spinal fusion is a very expensive procedure (3). Increasing incidence of spinal fusion combined with growing age of patients inevitably leads to even more expenses. A possibility to predict upcoming challenges could be crucial in providing patients the best available treatment and policy makers solid foundation for planning the use of limited health care resources.

Except for the United States, there have not been large-scale analyses on the incidence of lumbar fusion. Even though the statistics from the United States is usually obtained from large datasets, the observed trends are needed to be confirmed in diverse settings. Even within a single country, the rates of lumbar fusion may vary up to 20-fold (5). The age development in those trends have been studied even less.

The objective of this study was to describe the change in rates and age averages among patients undergoing lumbar fusion during last 16 years in a university hospital district.

METHODS

The data on fusion surgery were obtained from an electronic register of surgical procedures kept by a university hospital district. The data were gathered for a period between 2002 and 2017. The ethical committee of the hospital district has approved the study. The hospital district provides health care for 28 municipalities with 470 000 inhabitants, which is about 1/10 of the population of Finland. This is a public healthcare corporation that

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Conflicts of interest: None to declare

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receives funding from the state and municipal taxes. The patients pay only a small fixed fee for using the services. Annually, over 200 000 patients are treated in the hospital district. Fusion surgery is performed by either orthopedists or neurosurgeons.

Only a limited set of variables was available for the present study. Age was defined in full years at the day of surgery. Only adults >18 years were included. Information on surgery levels was derived from the codes of Nordic Classification of Surgical Procedures recorded in an electronic register. The code for lumbar fusion NAG6. If a person underwent two or more lumbar fusion procedures on the same day, only one code was retained.

Statistical analysis

The data were reported in means, standard deviations (SDs), percentages, and absolute numbers (n). The linear regression model was employed to study the change in age within the studied time interval. The results were reported along with coefficient of correlation (R^2) and 95% confidence intervals (95% CIs). When appropriate, the results were accompanied by 2-tailed p-values considering <0.05 statistically significant. The changes in age averages were also assessed graphically. All the analyses were performed using Stata/IC Statistical Software: Release 15. College Station (StataCorp LP, TX, USA).

RESULTS

During the 16-year period 2002 – 2017, 3,066 patients underwent primary lumbar fusion. The sample was predominated by women – 1,979 (65%) vs. 1,087 (35%). The women were a little older – 61.1 (SD 13.0) vs. 55.8 (SD 13.4) years, p-value 0.226 (Table1). The annual rates of lumbar fusions grew from 57 procedures in 2002 up to 286 in 2017 increasing by 500% (Figure1).

Table 1. Lumbar fusion annual rates and age distribution in 2002 – 2017 (age in full years at the time of surgery)

Year	Both genders			Men			Women		
	Age	SD	N	Age	SD	N	Age	SD	N
2002	47.9	11.4	57	44.8	10.6	24	50.1	11.6	33
2003	48.6	12.6	72	45.7	13.4	29	50.5	11.7	43
2004	52.2	11.6	83	51.9	9.2	33	52.4	13.1	50
2005	55.6	11.0	97	54.5	10.7	28	56.0	11.1	69
2006	55.6	12.7	117	53.1	11.2	46	57.2	13.5	71
2007	58.6	10.4	139	57.0	9.6	53	59.6	10.8	86
2008	57.6	12.2	184	53.7	12.2	69	60.0	11.6	115
2009	58.4	13.3	170	53.7	13.4	67	61.5	12.2	103
2010	58.6	13.1	247	53.6	13.4	95	61.7	11.9	152
2011	60.1	12.4	241	57.1	13.2	77	61.5	11.8	164
2012	60.5	13.9	240	57.5	14.3	98	62.5	13.4	142
2013	63.4	12.6	278	60.4	12.6	104	65.1	12.3	174
2014	59.6	13.9	282	55.3	15.7	93	61.7	12.4	189
2015	60.5	13.3	289	56.2	13.1	95	62.6	12.9	194
2016	60.8	13.6	284	58.3	13.4	95	62.0	13.6	189
2017	61.9	14.6	286	59.1	14.2	81	63.0	14.6	205
Total	59.2	13.4	3066	55.8	13.4	1087	61.1	13.0	1979

The overall age trends were similar for both genders (Figure1) – the trajectories of both genders displayed similar patterns throughout the entire period of follow-up. There was a small gap in age between the male and female patients (women were older). The regression coefficient for annual rates of lumbar fusion procedures was 17.43 (95% CI 14.84 to 20.02, p-value <0.0001, R^2 0.94). In general, the patients were becoming older over time. The overall regression coefficient was 0.67 (95% CI 0.55 to 0.78, p-value <0.0001, R^2 0.04) year/year.

DISCUSSION

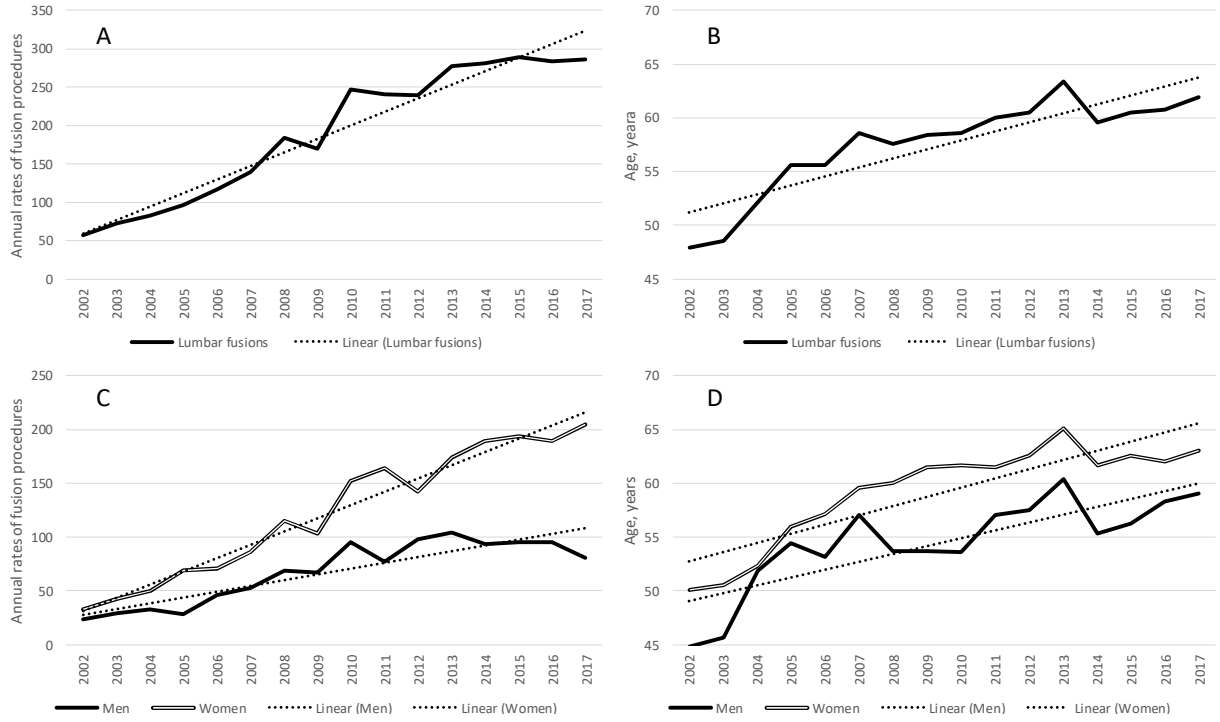
In this population-based register study among 3,000 patients who underwent lumbar fusion between 2002 and 2017, the annual fusion rate of the surgery grew by 500% while the age of patients was slowly increasing. The regression analysis showed that the age of patients who underwent lumbar fusion increased annually by over six months. It seemed that the change in the patients' age was not associated with their gender.

The generalization of the results is compromised by the fact that this was a descriptive study conducted in a single hospital district located in a particular country. Undoubtedly, surgery techniques, guidelines, funding, even education and believes of surgeons and patients may, among other factors, affect the trends observed in other settings. The data available was limited to only a few characteristics like age, gender, and the time of surgery. However, the data were accessible for an over 16-year-long follow-up and covered one tenth of the Finnish population. In many senses, the conditions in Finland may be considered representing the common situations existing in Western countries. Thus, even if purely descriptive, the trends observed in this study may be of interest for clinicians and policy makers outside the particular region.

Our findings are in line with the results (or, better say, fears) of previous reports on the subject. Indeed, the Western population is becoming older while older people are turning out to be healthier and more active than before. Retirement age is going up and more people with chronic back problems seek help from surgeons to stay active in working life and to manage the growing demands of activities when retired. If the trends observed in this study are correct, then it may be expected that the average age of people with a need for a lumbar fusion is going up to around 65 years in 2025 and even 68 years in 2030 – that is 20 years older than in 2002. At the same time, the overall annual number of fusions will also increase. Older patients mean more comorbidities, more complex techniques, and certainly more expenses (6-10). This may establish new demands to surgeons' area of expertise as the age of the patient is unavoidably moving toward geriatric problems.

The main question remained unclear – why is the fusion rate growing? Indeed, "spinal health" is not worsening that

Figure1. Annual rates of lumbar fusion along with their linear trendlines



much in the general population. The prevalence of back pain has increased by a few percent per decade (11-13). One of the reasons of the observed exponential change in fusion rates may be a potential shift in spinal surgery away from discectomy. It may be speculated that some patients who ended up in the 1990's with discectomy, are these days recommended for a fusion. Certainly, the increasing rates of fusion surgery in elderly patients may be a sign of progress in instrumentation and operative techniques rather than the extending indications to surgery. For example, less invasive techniques lead to lower risks of complications and overall postsurgical morbidity as well as to shorter sick leaves that may enhance surgeons' and patients' interest in a surgical solution. If so then it is possible that the increase in fusion rates is going to slow down if the critical stage in instrumentation progress has already passed. Certainly, the prediction is imprecise and it shows only tendency. It remains unclear why there were years with substantially higher increase in the number of fusions like e.g., 2009–2010. In turn, between 2014 and 2017 that number has changed only little. These aberrations might occur due to the factors related rather to local circumstances in a hospital than more general reasons.

To improve generalizability, these findings need to be reproduced and confirmed in other settings. Further research may also reveal the heterogeneity of the observed trends in different subgroups, e.g., based on diagnoses, fusion level, comorbidity, and surgery techniques among other factors. The cost-effectiveness of fusion procedures should be amplified further as well the efficiency of surgery in comparison with conservative treatment.

Research on the effectiveness of such surgical procedures as fusions should be of top priority. Better diagnostic routines, sophisticated data gathering techniques, and comprehensive reports may improve the chances that fusion procedures target those who will benefit of the surgery the most.

CONCLUSIONS

In the studied cohort, the annual rates of lumbar fusions grew explosively during the last 16 years by 500% and the patients were 10 years older now than back in 2002. It seems, that if the trend observed here will continue then fusion patients may on average be even 20 years older in 2030 than they were in 2002. Surgeons and policy makers should take this probability under consideration when planning future techniques, rehabilitation, and allocation of funding.

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ACKNOWLEDGMENTS

We thank the Centre for Clinical Informatics of the Hospital District of South-West Finland for helping to acquire the data for the study