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Research paper

Factors affecting lumbar surgery outcome: A nation-wide, population-based retrospective study

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ABSTRACT

Background: Lower back pain is a very common symptom and treatment strategies vary according the severity and duration of illness. Surgical approaches are becoming increasingly popular with the advent of new and less invasive technologies; however, treatment outcomes are not yet well established on a population-based level.

Taiwan's National Health Insurance Research Database (NHIRD) is longitudinal and includes 98% of the population since its inception in 1995. The database includes the ICD 9.0 codes (International Classification of Diseases) of all patients with lower back pain and lumbar surgery; furthermore, all the prescriptions.

Methods: As part of a population-based cohort study of one million participants randomly selected from the NHIRD, we analyzed changes in prescription of analgesics 1 year before and 1 year after lumbar surgery; co-morbidities, such as diabetes, asthma, osteoporosis, arthritis, depression and anxiety were also analyzed as covariates. A total of 3916 cases were enrolled in final analysis.

Results: Post-operatively, the defined daily dosage (DDD) of analgesics decreased from a median DDD of 50.0 to a median of 14.2. In a multivariate model analysis, female, older age, anxiety and asthma were the significant factors for unfavorable outcome (defined by dosage of analgesics decreased less than 50% after surgery).

Conclusions: The analgesics significantly decreased for patients received lumbar surgeries, implying the decreased of pain. In addition, co-morbidity factors were identified by the failure for analgesics reduction, such as female, older age, anxiety and asthma. For patients with lower back pain, these factors should be considered before receiving lumbar surgeries.

1. Introduction

The lifetime prevalence of chronic back pain is very high in the general population and estimates range from 33% to 56%, depending the inclusion criteria. (Jackson et al., 2015; Neuhauser et al., 2005). Furthermore, due to the emerging diagnostic technology (e.g. magnetic resonance imaging and computed tomography) and newer surgical techniques, surgical procedures are becoming increasingly popular to obtain pain relief and the restore the ability to work.

There are still controversies about when and how the lower back

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pain should be managed, conservatively or aggressively. A meta-analysis revealed short-term benefits for radicular pain in the group receiving surgical treatment; however, patients also experienced improvement without surgical procedures. (Chou et al., 2009a, 2009b) Moreover, of the non-surgical procedure, (e.g. topical injections, chemonuecleolysis and radio-frequency denervation), only few of non-surgical procedures were reported to be superior to conservative treatment in randomized controlled studies. (Chou et al., 2009a) Thus, the treatment of choice for lower back pain should be based on the best available evidence.

The assessment of surgical outcome is typically ascertained from questionnaires, pain scales or telephone call visits. (Markwalder et al., 2011; Saban and Penckofer, 2007; Zub et al., 2013) Questionnaires, such as 36-Item Short Form Health Survey (SF-36), are commonly employed to assess the quality of life for patients received back surgeries. (Weinstein et al., 2006a, 2006b; Zanoli, 2005) These studies however are limited by the relative lack of objective indicators to appropriately address the neuromotor outomes of surgery as well as smaller case size (500–700).

Taiwan's National Health Insurance has provided comprehensive health care for more than 98% of the Taiwanese population since 1995. (Chen and Liu, 2005; Fang et al., 2015) The National Health Insurance Research Database (NHIRD) includes data on medical claims and prescriptions. With the NHIRD, we utilized the defined daily dosage (DDD) to quantify the accumulation dosage of all analgesics. The DDD of analgesics was used to proxy a component of the quality of life for patients received lumbar surgeries. (Jones et al., 2002) The present study aimed to investigate the change in analgesics prescription one year after surgery. We additionally aimed to identify medical comorbidities associated with poor treatment outcomes.

2. Materials and methods

This retrospective cohort study was conducted using the Taiwan National Health Insurance Research Database (NHIRD). The NHIRD is longitudinal and includes medical claims data on outpatient visit and inpatient care, as well as prescription, from 1998 to 2011 in 98% of the national Taiwanese population. With assistance from National Health Research Institute, we randomly extracted data from a total of 1000,000 patient profiles from 1998 to 2011 using a systemic sampling method (Oracle's internal random number generator). (Wu et al., 2015).

Lower back pain was operationalized using International Classification of Disease, ninth version (ICD-9) codes for lower back pain, lumbar herniated disc, lumbar spondylolisthesis and miscellaneous low back pain diagnosis (ICD codes: 81.x, 80.x, 722.x, 721.x, 722.x, 723.x, 738.x, 739.x, 756.x, 856.x, 847.x). Lumbar surgery was operationalized using ICD 9.0 codes: 83002c, 83003c, 83024c, 83043b, 83095b, 83044b, 83096b, 83045b, 83046b and 83097; cervical and thoracic surgeries were excluded. All patients meeting the above criteria (between 1998 and 2011) were enrolled, a total of 543,705 patients out of one million randomized selected cases from out database. Additional exclusion criteria were tumors, inflammation, infection, autoimmune disease and patients with co-existing cervical radiculomyelopathy as listed in Fig. 1. In addition, patients with diagnosis of seizure/bipolar disease (ICD code 345.*/ 296.0, 296.4, 296.5, 296.6, 296.7, 296.80 and 296.89) and patient who did not have any pain medications were also excluded in this analysis.

A total of 3916 patients with back pain diagnosis received lumbar surgeries and the endpoint was Dec 31st, 2013. The analgesics included all NSAIDs, anticonvulsants and morphine/codeine prescription pre- and post-operatively. The DDD was based on the medications with Anatomic Therapeutic Chemical code for assumed average dosage per day. The prescription of anticonvulsants for patients with lumbar surgery but without diagnosis of seizure/bipolar disorder was eligible for surgical treatment of neurogenic pain in this study. Demographic factors, such as gender, age and comorbidities (i.e. depression, anxiety, diabetes, asthma, osteoporosis and arthritis) were also analyzed to assess the risk for any contribution to overall outcome. We defined the unfavorable outcome as "dosage of analgesics

decreased less than 50% after surgery compared to that before surgery."

2.1. Statistical analysis

Descriptive analysis was performed for patients' demographic profiles, including gender, age, urbanization, income and comorbidity. We examined DDD differences as outcome by logistic regression model. The analgesics DDDs were compared to pre-operative status separately and were adjusted with comorbidity factors. The statistical significance of associations was defined by p -value < 0.05. All of these analyses were conducted by SAS software (Version 9.4; SAS institute, Cary, NC, USA).

2.2. Ethics statement

The study was approved by Institutional Review Board of Chang Gung Memorial Hospital.

3. Results

A total of 3916 cases were enrolled in final analysis. 75.61% of the patients were older than 40 years of age. 2.86% and 2.81% of these cases were diagnosed with depression and anxiety, respectively (Table 1). The annual number of lumbar surgery doubled from 179 procedures in 1998 to 374 in 2011 (Table 2).

Overall, lumbar surgery was associated with a significant decrease in DDD of analgesics (median 50.0 pre-operatively vs. 14.2 post-operatively), suggesting pain-relief 1-year post-operatively (Fig. 2A). Among all analgesics, post-operatively, 61.01% of subjects had prescription of NSAIDs DDD decreased more than 50%; however, 24.67% of subjects had higher NSAIDs DDD post-operatively (Table 2B). The prescribed DDD of anticonvulsants, codein/morphin was relatively low (Table 2A). Higher analgesics DDD post-operatively is thus defined as unfavorable outcome in this study.

Males accounted for 56% of our cohort; in addition, male gender was associated with greater reduction in analgesics post-operatively (OR= 0.74, 95% CI = 0.65 to 0.84) (Table 3).

Older patients also correlated with higher analgesics after lumbar surgery in this study. The ORs were 1.42, 1.83, 1.66 and 1.81 for age groups 40–49, 50–59, 60–69 and ≥ 70 (compared to patients younger than 40 years of age) respectively, for unfavorable outcome (Table 3).

We included psychiatric conditions and medical conditions that may interact with outcomes from lumbar surgery. The diagnosis of depression pre-operatively was significantly associated with an unfavorable outcome (OR: 1.76, 95% CI: 1.20–2.56) in a univariate logistic regression model; however, the influence was not significant in the multivariate regression model (OR: 1.42, 95% CI: 0.94–2.14) (Table 3).

Anxiety itself is a strong comorbidity factor for unfavorable outcome. The OR is 1.61 (95% CI: 1.07–2.43) even in a multivariate logistic regression model (Table 3).

For medical diseases, osteoporosis was a factor leading to unfavorable outcome in the univariate model, yet not as significant in the multivariate model. Asthma, on the other hand, was a factor leading to unfavorable outcome in either univariate or multivariate logistic regression mode (OR:1.43, 95% CI: 1.11–1.84). The co-existing arthritis and diabetic mellitus did not affect the dosage of analgesics after lumbar surgery.

Income status in this study did not reveal any correlation to the analgesics usage; however, urbanization (Chen and Liu, 2005) disclosed an arbitrary results; class 1, as the most urban region, may result in more analgesics use after lumbar surgery.