Spine Deformity
www.spine-deformity.org

Spine Deformity 6 (2018) 226–230

Predictors of Increased Hospital Stay in Adolescent Idiopathic Scoliosis Patients Undergoing Posterior Spinal Fusion: Analysis of National Database

Hiroyuki Yoshihara, MD, PhD[a,b,*], Carl Paulino, MD[a], Daisuke Yoneoka, PhD[c]

[a]*Department of Orthopaedic Surgery & Rehabilitation Medicine, SUNY Downstate Medical Center, 450 Clarkson Ave, Brooklyn, NY 11203, USA*
[b]*Department of Orthopaedic Surgery, Nagoya City University Graduate School of Medicine, 1, Kawasumi, Mizuho-cho, Mizuho-ku, Nagoya 467-8601, Japan*
[c]*Department of Medicine, University of Tokyo Graduate School of Medicine, 7-3-1, Hongo, Bunkyo-ku, Tokyo 113-8654, Japan*

Received 14 August 2017; accepted 17 September 2017

Abstract

Study Design: Analysis of population-based national hospital discharge data collected for the Nationwide Inpatient Sample (NIS).
Objective: To examine the predictors of increased hospital stay in adolescent idiopathic scoliosis (AIS) patients undergoing posterior spinal fusion.
Summary of Background Data: As policy makers and hospitals are increasingly looking to cut costs, length of stay (LOS) after surgery has come into focus as an area for improvement. Despite this, there is limited research about the factors contributing to increased LOS for AIS patients undergoing posterior spinal fusion.
Methods: The Nationwide Inpatient Sample was used to identify pediatric patients with idiopathic scoliosis who underwent posterior spinal fusion from 2004 to 2009, using the International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) codes. Patient demographics, surgical variables, hospital characteristics, and in-hospital outcomes were retrieved. LOS was divided into two groups (longer- and shorter-stay groups) by its average. Longer stay was defined as ⩾6 days. Multivariable logistic regression analysis was performed to identify the predictors of increased LOS in AIS patients undergoing posterior spinal fusion.
Results: Significant predictors of increased LOS in posterior spinal fusion for AIS patients included increased Elixhauser Comorbidity Score, number of fused levels ⩾9 vertebrae, teaching hospital status, in-hospital complications, and nonroutine disposition. Wound-related complications were the strongest predictor and patients with wound-related complications were 3.14-fold more likely to have an increased LOS compared to those without wound-related complications.
Conclusions: This study identified significant predictors of increased hospital stay in posterior spinal fusion for pediatric patients with idiopathic scoliosis and patients at higher risk of longer hospitalization can be recognized. Eventually these data are expected to help optimize LOS and cost containment.

Keywords: Predictor; Increased hospital stay; Adolescent idiopathic scoliosis; Posterior spinal fusion; Nationwide inpatient sample

Introduction

Health care cost is continuously increasing, and policy makers and hospitals are looking to cut costs [1]. The average cost of a single stay in the hospital is more than $4,000 in the United States and hospital length of stay (LOS) after surgery has come into focus as an area for improvement [2]. Actually, advances in surgical technique, pain management, anesthesia, and antibiotic prophylaxis have all benefited the health care system in decreasing LOS [3,4]. Earlier and faster rehabilitation protocols have become the standard of care, which also helped decreasing LOS [3,4].

In several elective orthopedic procedures, an average of LOS has decreased dramatically with the above-mentioned efforts. For example, LOS for a single total joint arthroplasty has decreased to current averages of 3.7 days [5,6]. Similar to total joint arthroplasty, posterior spinal fusion

Author disclosures: HY (none); CP (personal fees from DePuy, outside the submitted work); DY (none).

*Corresponding author. SUNY Downstate Medical Center, 450 Clarkson Ave, Brooklyn, NY 11203, USA. Tel.: (646) 703-4138; fax: (646) 703-4138.
E-mail address: hiroyoshihara55@yahoo.co.jp (H. Yoshihara).

2212-134X/$ - see front matter
https://doi.org/10.1016/j.jspd.2017.09.053

surgery for adolescent idiopathic scoliosis (AIS) has been an established elective procedure for one decade. Deformity correction and fixation using pedicle screw placement are currently performed universally and, therefore, LOS should be standardized.

There are several studies that analyzed the factors of increased LOS in orthopedic surgery such as total shoulder and knee joint arthroplasty [1,7]. However, studies are limited that have examined the predictors of increased LOS in AIS patients undergoing surgery [8]. The purpose of this study was to examine the predictors of increased LOS in posterior spinal fusion for pediatric patients with idiopathic scoliosis in the United States from 2004 to 2009 by analyzing population-based national hospital discharge data collected for the Nationwide Inpatient Sample (NIS).

Materials and Methods

Data source

The NIS is the largest all-payer inpatient care database in the United States and contains data from approximately 8 million hospital stays from 1,000 hospitals each year. These data comprise a 20% randomly stratified sample of all US community hospitals [9]. Every entry in the database represents a single hospitalization record. Records in the NIS database include discharge and hospital information, which were used to generate national estimates in this analysis.

Patient selection

A retrospective analysis using hospital discharge data from the NIS was performed from 2004 to 2009. The International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM), codes were used to identify discharges. Patients aged 10–18 years who had a primary diagnosis of idiopathic scoliosis (ICD9 code: 737.30) and who underwent posterior spinal fusion surgery of ⩾4 vertebrae (8105, 8107, 8108, excluding 8104, 8106, 8162) were included in this analysis. LOS was divided into two groups (longer- and shorter-stay groups) by its average. Average LOS was 5.49 days, and thus the longer stay was defined as ⩾6 days. Institutional review board approval for the study was obtained locally from each contributing institution's review board, and consent was obtained from each patient prior to data collection.

Patient demographics, surgical variables, and hospital characteristics

Patient age, gender, race, household income, payer information, comorbidities, number of fused vertebrae, hospital caseload, hospital size, hospital teaching status, hospital region, in-hospital complications, disposition status were extracted from the NIS. Age was categorized into the following three groups: 10–12 years, 13–15 years, and 16–18 years. Race was categorized into white, black, Hispanic, others, and not stated. Household income was categorized: ⩽$38,999, $39,000–$47,999, $48,000–$62,999, and ⩾$63,000. The payer information was categorized into Medicaid, private, and others. Comorbidity was assessed using the Elixhauser method, a well-established technique for identifying comorbidities from administrative databases. Elixhauser comorbidity index was reported to be one of the best comorbidity indices for predicting outcome of patients in administrative databases [10]. Elixhauser comorbidity index includes a set of 30 medical comorbidities. A total comorbidity score was determined for each case by adding 1 point per comorbidity. Number of fused vertebrae was categorized into 4–8 vertebrae (81.63), and ⩾9 vertebrae (81.64). Annual hospital caseload was defined according to the number of procedures performed at each participating institution during each study calendar year and divided into tertiles. Hospital size (bed number) was categorized into small, medium, and large, whereas hospital teaching status was categorized into nonteaching and teaching. Hospital census region was categorized into Northeast, Midwest, South, and West. In-hospital complications were obtained using the following ICD-9-CM codes: neurologic complications (997.00–997.09); respiratory complications (518.4, 518.5, 518.81–518.84, 997.3); cardiac complications (410, 997.1); gastrointestinal complications (535.0, 570, 575.0, 577.0, 997.4); urinary and renal complications (584, 997.5); pulmonary embolism (415.1); and wound-related complications including infection, dehiscence, seroma, and hematoma (998.1, 998.3, 998.5, 998.83, 999.3). Both four- and five-digit codes were included under the respective three- and four-digit codes. Disposition of patients was categorized into routine and other disposition status. Other disposition status included home health care, short-term hospital, skilled nursing facility, intermediate care, and other types of facility.

Data analysis

To calculate national estimates using the NIS, discharge weights supplied by the Federal Agency for Healthcare Research and Quality were applied as a weighting scheme. Categorical patient data were retrieved. Chi-square test and Fisher exact test were used to assess differences of proportions between the shorter- and longer-stay groups. Logistic regression models were used to elucidate whether longer hospital stay was independently associated with increased odds while controlling for age, gender, race, household income, payer information, Elixhauser Comorbidity Score, number of fused vertebrae, hospital size, hospital teaching status, hospital caseload, hospital region,