Spine Deformity

www.spine-deformity.org

Spine Deformity 5 (2017) 145−150

Timing of Complications Occurring Within 30 Days After Adult Spinal Deformity Surgery

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Received 3 July 2016; revised 19 October 2016; accepted 30 October 2016

Abstract

Study Design: Cross-sectional study of a national surgical database.
Objective: To investigate the timing of complications after adult spinal deformity (ASD) surgery.
Summary of Background Data: There is limited data on the range of days when complications after ASD surgery occur.
Methods: The American College of Surgeons National Surgical Quality Improvement database was reviewed for the years 2007−2013. Inclusion criteria were adult patients (over 21 years of age) who underwent spinal fusion for ASD. Ten unique complications occurring within 30 postoperative days were examined and the median day to diagnosis was recorded.
Results: A total of 1,250 patients met inclusion criteria with an overall complication rate of 13.5%. The median day of diagnosis (and interquartile range) for each complication was as follows: myocardial infarction (3.5, 1−5), pulmonary embolism (4, 2−16), reintubation (4.5, 1−11), pneumonia (6, 3−9), urinary tract infection (11, 5−15), sepsis (12, 6−18.5), deep vein thrombosis (12, 6−19), deep surgical site infection (SSI; 18.5, 13−23), superficial SSI (19, 13−24), and organ space SSI (21, 17−25). The three complications that were most commonly diagnosed before hospital discharge included pneumonia, reintubation, and myocardial infarction (diagnosed before discharge on more than 70% of cases). On the other hand, superficial, deep, and organ space infection were diagnosed in less than 40% of cases before patients left the hospital. On univariate analysis, predictors of complication occurrence included older age ($p = .014$), instrumentation of 7−12 levels ($p = .034$), and instrumentation of 13 or more levels ($p = .035$).
Conclusion: Understanding the timing of specific complications after adult spinal deformity surgery is important for both patients and clinicians. Efforts in prevention of such conditions should continue, as well as heightened awareness during the periods of highest risk.

Keywords: Adult spinal deformity; Spinal fusion; Complications; Timing; National Surgical Quality Improvement database

Author disclosures: RDGR (none); CRG (is a UNCF Merck Postdoctoral Fellow and has received an award from the Burroughs Wellcome Fund and the Johns Hopkins Neurosurgery Pain Research Institute); PGP (none); BJN (none); KMK (none); VL (none); FS (none); DMS (consulting relationships with Medtronic, Globus, DePuy-Synthes, and Orthofix).

The American College of Surgeons National Surgical Quality Improvement Program and the hospitals participating in the ACS NSQIP are the source of the data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

The manuscript submitted does not contain information about medical device(s)/drug(s). No funds were received in support of this work. The authors have no conflicts of interest. Timing of Complications Occurring within 30 Days after Adult Spinal Deformity Surgery.

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2212-134X/$ - see front matter
http://dx.doi.org/10.1016/j.jspd.2016.10.009

Introduction

Surgery for adult spinal deformity (ASD) is associated with favorable outcomes in terms of back and leg pain relief [1-3], but the procedure carries the risk of both minor and major postoperative complications [4-7]. Such complications include respiratory complications (including adult respiratory distress syndrome, pneumonia, and reintubation), urinary tract infection (UTI), surgical site infection (SSI), deep vein thrombosis (DVT), pulmonary embolism (PE), implant-related complications, and others [4-6,8]. Nevertheless, despite multiple studies examining the incidence and risk factors for complication occurrence [7,9,10], there is limited data on the *timing* of these complications, specifically as to *when* these complications present in the postoperative period.

Bohl et al. reported in 2015 the timing of eight complications after posterior lumbar fusion [11]. Some of the identified complications that occurred ''early'' included anemia requiring transfusion, myocardial infarction (MI), pneumonia, and PE; ''later'' occurring complications (after 7 postoperative days) included UTI, DVT, sepsis, and SSI [11]. However, the timing of complications after ASD surgery is relatively unknown. Thus, the purpose of this investigation is to characterize the timing of 10 postoperative complications occurring within a 30-day period in ASD surgery.

Materials and Methods

Study design and data source

This is a cross-sectional study of the American College of Surgeons National Quality Improvement Program (ACS-NSQIP) databases from 2007 to 2013; this study was deemed exempt from review by our local institutional review board. ACS-NSQIP is a prospectively collected surgical database containing information on patient demographics, comorbidities, intraoperative variables, and 30-day outcomes. Data are captured by a trained ''Surgical Clinical Reviewer'' and patients are followed up for 30 days after discharge via chart reviews, letters, and/or phone calls. Data capture and inter-rater reliability has been estimated to be approximately 95% [12], and multiple studies have used this database to report short-term outcomes after spine surgery [13-18].

Inclusion criteria were patients over 21 years of age who underwent spinal fusion for ASD. ASD included the following *International Classification of Disease 9th Edition* diagnostic codes: idiopathic kyphoscoliosis (737.30, 737.10, 737.19, 737.34), degenerative kyphoscoliosis (737.39), and postlaminectomy kyphosis (737.12). Patients who did not undergo spinal fusion (n = 307) and patients younger than 21 years (n = 87) were first excluded. Afterwards, patients with a concomitant diagnosis of cancer (n = 3), quadriplegia (n = 6), ventilator dependency (n = 6), preoperative wound infection (n = 13), and sepsis (n = 2) were also excluded. Hence, the final analytic sample consisted of 1,250 patients.

Collected variables and outcome measures

Patient data such as age, sex, body mass index, comorbidities (hypertension, diabetes, smoking status, chronic obstructive pulmonary disease, steroid use, renal failure, and congestive heart failure), revision status (revision/exploration of previous spinal fusion), use of osteotomy (including three-column osteotomy), and number of instrumented levels were gathered from the database.

Ten unique complications occurring within the first 30 postoperative days were examined. These included (1) UTI; (2) sepsis; (3) pneumonia; (4) reintubation; (5) DVT; (6) PE; (7) MI; (8) superficial SSI; (9) deep SSI; and (10) organ space SSI.

The ACS-NSQIP database contains the day at which any specific complication is first diagnosed, and this variable was used to define the mean (±standard deviation) and median (with interquartile range) day of complication occurrence. Ranges were also captured, as well as the percentage of complications that were diagnosed before patient discharge.

Statistical analysis

All analyses were performed in Stata SE 12 (StataCorp LP, College Station, TX). General descriptive statistics were conducted to describe the study population. ''Early'' complications were defined as complications diagnosed (based on median day of diagnosis) before the median day of discharge for all patients; ''later'' occurring complications were defined as complications occurring after the median day of discharge. Day of complication diagnosis is reported as means ±standard deviations and median with interquartile range. A univariate logistic regression was used to examine the association between patient/operative parameters and complication development; results are presented as odds ratios (ORs) with 95% confidence intervals (CIs). A correlation coefficient matrix was constructed to assess the correlation between individual complications. Statistical significance was defined as a p value less than .05.

Results

Population characteristics

There were 1,250 patients who met our inclusion criteria and were included in this study. General and operative characteristics are summarized in Table 1. Average age at surgery was 61 years, and a majority of patients (72.1%) were female. Average body mass index was 28.3, and the most common preoperative comorbidity was hypertension, found in 53.3% of patients.

Approximately one-tenth (8.5%) of patients underwent revision of previous spinal fusion, and osteotomy was performed in 27.7% of cases; three-column osteotomy was performed in 6.3% of cases. Almost half of patients (47.0%) underwent fusion of 7−12 spinal levels and 15.5%