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The transition to data-driven quality metrics: determining the optimal surveillance period for complications after surgery

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ABSTRACT

Background: Thirty-day complications frequently serve in the surgical literature as a quality indicator. This metric is not meant to capture the full array of complication resulting from surgical intervention. However, this period is largely based on convention, with little evidence to support it. This study sought to determine the optimal surveillance period for postsurgical complications, defined as the shortest period that also encompassed the highest proportion of postsurgical adverse events.

Methods: TRICARE data (2006-2014) were queried for adult (18-64 y) patients who underwent one of 11 surgical procedures. Patients were assessed for complications up to 90 d after surgery. Kaplan–Meier curves, linear spline regression models at each incremental postsurgical day, and adjusted R-squared values were used to identify critical time point cutoffs for the surveillance of complications. Optimal length of surveillance was defined as the postsurgical day on which the model demonstrated the highest R-squared value. A supplemental analysis considered these measures for orthopedic and general surgical procedures.

Results: One lakh ninety-eight patients met the inclusion criteria. A total of 21.8% patients experienced at least one complication during the follow-up period, with 59% occurring within the first 15 d. Kaplan–Meier curves for complications showed a demonstrable inflection before 20 d and 14-15 d possessed the highest R-squared values.

Conclusions: In this analysis, the optimal surveillance period for postsurgical complications was 15 d. While the conventional 30-d period may still be appropriate for a variety of reasons, the shorter interval identified here may represent a superior quality measure specific to surgical practice.

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Introduction

Short-term outcomes after surgery, including complications and readmission rates, have long been used as metrics to evaluate and improve the quality of care. These short-term measures are used as an indicator of health care quality and are not meant to represent an exhaustive array of all events attributable to the index surgical intervention. Historically, postoperative mortality was regularly used as an indicator of quality in the realm of surgery. With improvements in the quality of surgical care, however, the focus has recently shifted to postoperative morbidity.

At present, 30-d outcome measures including complication rates are frequently used in the surgical literature.[1-3] The American College of Surgeons' National Surgical Quality Improvement Program (ACS-NSQIP) has integrated 30-d measures into their quality improvement registry,[4] and similar time frames are used by several state collaboratives. Recently, hospital compensation has also been linked to these 30-d measures.[5,6] Many Federal quality improvement programs focus on inpatient events only, while the global postsurgical period used by insurers links all events that occur up to 90 d after surgery to the index procedure. The rationale behind the use of these variable periods for the purposes of surveilling postsurgical morbidity remains unclear. Many agree that a focus on inpatient events alone is too narrow a window, while a 90-d time frame is likely too broad when using postoperative complications as a quality measure. Although 30-d metrics seem popular, it is quite possible that this time frame also captures medical events that cannot rightly be construed as postoperative morbidity.

In this context, we sought to determine an optimal window for surveillance of postsurgical complications, defined as the shortest postsurgical time frame that also encompassed the highest proportion of attributable postsurgical events, among a large series of patients receiving one of 11 commonly performed surgical interventions. Our hope is that the results of this work will indicate an ideal surveillance period for the purposes of assessing postoperative complications as a specific measure of surgical quality.

Methods

Data source

This study utilized TRICARE insurance claims data (September 2006-December 2014) from the Military Health Systems Data Repository. TRICARE is the Department of Defense insurance plan for military personnel and their families and provides health care coverage to 9.5 million Americans.[7] This program is not responsible for care provided to soldiers in war zones or the care administered through the Veterans Affairs system. The details regarding how care is administered through TRICARE and how data are accessed have been elaborated previously.[8-10] TRICARE data have previously been used in the literature to study health care outcomes for surgical and nonsurgical patients and the demographic characteristics of this population closely approximate the U.S. general population under the age of 65 y.[10-12] These studies also demonstrate that care provided at military and civilian hospitals, despite difference in models of care, have similar outcomes, except for the absence of racial disparities at military centers.[10,11]

This data source was selected for analysis because TRICARE uniquely provides longitudinal follow-up for enrollees both in the inpatient and outpatient setting. Moreover, the reliability of reporting ICD-9 diagnostic and procedure codes in TRICARE has previously been validated in a number of works.[8,11]

The study data were used under a data use agreement with the Uniformed Services University of Health Sciences, and the study was reviewed and deemed exempt from full review by the Partners' Institutional Review Board. All patient data were de-identified.

Study population

Data were surveyed using International Classification of Disease 9th Clinical Modification (ICD-9 CM) code for patients (18 to 64 y) undergoing high-volume surgical procedures including general surgical (appendectomy, esophagectomy, colectomy, inguinal hernia repair, ventral hernia repair), neurosurgical (lumbar spine surgery), urological (nephrectomy, radical cystectomy), and orthopedic (total knee arthroplasty, total hip arthroplasty, hip fracture repair) procedures. These procedures were selected because they are established high-volume interventions within their respective surgical subspecialties, include urgent and elective care, and have been previously used in the study of surgical quality.[10] The rationale behind selecting such a diverse surgical population was to render the findings translatable to the surgical field as well as applicable to national data sets that report measures for surgical procedures across disciplines.

Patients were followed-up for 90 d after the procedure and those who died during the hospitalization were excluded from the analysis. The lost to follow-up rate in TRICARE is less than 10% at 1 y and insignificant at 90 d, so this was not a substantive concern for bias. As a result, complete case analysis was performed on those patients with 90-d follow-up.

Variables

Patients included in the study had their records abstracted, including their age at time of surgery, biologic sex, and self-reported race (white, black, Asian, and others). Clinical characteristics including length of hospitalization and medical comorbidity were also documented. Comorbidities were collated using the Charlson Comorbidity score (Deyo Modification) and calculated using an ICD-9 algorithm.[13]

The time to the report of the first postsurgical complication was the primary outcome. In many respects, the first complication serves as a sentinel event that creates a domino effect leading to additional morbidity. Owing to our reliance on claims data, the temporal relation between reported complications cannot be discerned and several events may be reported on the same day. Hence, we documented the day on which the first complication was reported. We assessed