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Risks of adverse events in colorectal patients: population-based study

Tina M. Hernandez-Boussard, PhD,[a,b,*] *Kathryn M. McDonald, MM,*[b] *Doug E. Morrison, MS,*[a] *and Kim F. Rhoads, MD*[a]

[a] *Department of Surgery, Stanford School of Medicine, Stanford University, Stanford, California*
[b] *Department of Medicine, Stanford School of Medicine, Stanford University, Stanford, California*

ARTICLE INFO

Article history:
Received 11 September 2015
Received in revised form
8 January 2016
Accepted 12 January 2016
Available online 20 January 2016

Keywords:
Colorectal surgery
Adverse events
Risk adjustment

ABSTRACT

Background: Postoperative (PO) outcomes are rapidly being integrated into value-based purchasing programs and associated penalties are slated for inclusion in the near future. Colorectal surgery procedures are extremely common and account for a high proportion of morbidity among general surgery. We sought to assess adverse events in colorectal surgical patients.

Methods: We performed a retrospective study using the Nationwide Inpatient Sample database, 2008–2012. Patients were identified using International Classification of Diseases, Ninth Revision, Clinical Modification codes and classified based on procedure indication: colon cancer, benign polyps, diverticulitis, inflammatory bowel disease, and ischemic colitis. The outcome of interest was inpatient adverse event identified by Agency for Healthcare Research and Quality's patient safety indicators (PSIs).

Results: We identified 1,100,184 colorectal patients who underwent major surgery; 2.7% developed a PSI during their hospital stay. Compared to all colorectal patients, those with ischemic colitis had significantly higher risk-adjusted rates per 1000 case for pressure ulcer (50.20), failure to rescue (211.30), central line bloodstream infection (2.33) and PO DE/deep vein thrombosis (16.02), and sepsis (46.99), whereas benign polyps were associated with significantly lower risk-adjusted rates per 1000 cases for pressure ulcer (11.48), failure to rescue (84.79), central line bloodstream infection (0.97) and PO pulmonary embolism/deep vein thrombosis (4.81), and sepsis (11.23). Compared to both patient demographic and clinical characteristics, the procedure indication was the strongest predictor of any PSI relevant to colorectal surgery; patients with ischemic colitis had higher odds of experiencing a PSI (odds ratio, 1.84; 95% confidence interval, 1.71–1.99) compared with cancer patients.

Conclusions: Among colorectal surgery patients, inpatient events were not uncommon. We found important differential rates of adverse events by diagnostic category, with the highest odds ratio occurring in patients undergoing surgery for ischemic colitis. Our work elaborates the need for rigorous risk adjustment, quality improvement strategies for high-risk populations, and attention to detail in calculating financial incentives in emerging value-based purchasing programs.

A portion of this work was presented at Academy Health Annual Research Meeting in June 8–10, 2014.

* *Corresponding author*. Department of Surgery, Population Health Sciences Building, 1070 Arastradero #307, Palo Alto, CA 94306. Tel.: +1 650 725 5507; fax: +1 650 723 6450.
E-mail address: Boussard@stanford.edu (T.M. Hernandez-Boussard).

0022-4804/$ – see front matter
http://dx.doi.org/10.1016/j.jss.2016.01.013

Introduction

Over the past two decades, the growing interest in the quality of surgical care provided in the United States has led to a plethora of reports documenting and measuring different adverse events. At a national level, many of these reports focus on hospital-level data for medical conditions, such as rate of readmissions for pneumonia and cardiac arrest [1]. There are significant gaps in evidence related to adverse events after high prevalence surgical conditions, such as colorectal surgery. However, postoperative (PO) outcomes are rapidly being integrated into value-based purchasing programs sponsored by the Centers for Medicare and Medicaid Services with penalties associated with surgical outcomes slated for inclusion in 2015 [2].

Colorectal surgery procedures are extremely common, with approximately 333,000 procedures in 2011 [3] representing (10%) of all general surgical discharges performed in the United States [4]. The operations are associated with high levels of morbidity and hospital resource utilization [4,5]. After colectomy, common PO occurrences include anastomotic leak; and attendant sequela, including superficial, deep and organ space surgical site infection; sepsis; and a requirement for high intensity care delivery. These hospital-acquired conditions are often correlated with increased length of stay (LOS) [6,7] and readmissions within 30 d of discharge [8,9]. If colectomies are included in the next generation of value-based purchasing programs, the high rate of adverse outcomes could have significant and negative financial implications for both health care costs and hospital reimbursement.

To reduce rates of hospital-acquired conditions in colorectal surgery, we must gain a better understanding of the correlates and predictors of these adverse events. Interventions designed to increase quality and decrease costs related to avoidable complications require the use of a framework that includes standardized quality indicators, such as those developed by the Agency for Healthcare Research and Quality (AHRQ) [10]. Population-level data are needed to uncover actionable targets for quality improvement studies and interventions.

The aim of this project was to assess adverse events in colorectal surgical procedures at a national level using standardized quality indicators. In this retrospective, observational study, we report diagnosis-specific risk-adjusted rates of potential adverse events (PAEs) for the most commonly diagnosed inpatient colorectal conditions; characterize patient and hospital factors associated with the development of an adverse event; and identify factors predictive of increased odds of an adverse event development. We hypothesized that rates of inpatient adverse events would significantly differ by patient demographic and clinical characteristics.

Materials and methods

Data source

Our source of data was the Nationwide Inpatient Sample (NIS) database [11]. AHRQ's Healthcare Cost and Utilization Project distributes this database. The NIS represents approximately 20% of all hospitalizations across the United States. The NIS includes up to 25 diagnosis codes, 15 procedure codes, and both patient and hospital demographics for each patient record. In addition, each unique hospitalization is associated with a Medicare-sensitive diagnostic-related group (DRG). Patient insurance status/intended payer for the discharge as well as patient disposition at the time of discharge (including inpatient mortality) is also included in the NIS. These data are weighted to provide a nationally representative sample of all-payer inpatient hospitalizations in the United States.

Study sample

Adult patients undergoing planned colorectal operations in 2008–2012 inclusive were identified using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic codes. We identified patient discharge records with a principal diagnosis code corresponding to the colorectal conditions of interest and an associated code indicating a major operating room procedure, which is identified in the NIS database based on DRGs to determine whether the procedure would be performed in a hospital operating room in most hospitals. Diagnoses codes included colon cancer—153.X, 154.0X, and 154.1X; benign polyps—211.3X; diverticulitis 562.1X; inflammatory bowel disease—555.X and 556.X; and ischemic colitis—557.0X, 557.1X, and 557.9X. Patients with appropriate diagnoses but no coding for a major operating room procedure were excluded.

Patient and hospital predictor variables

Patient demographics included age at discharge, gender, and race. Hospital characteristics included procedure volume, bed size, and nurse-to-patient ratio.

We stratified our results by the most common procedure indicators for colorectal surgery as follows: cancer, benign polyps, diverticular disease, inflammatory bowl disease, and ischemic colitis. We chose to stratify by procedure indicator, as the same surgical procedure can be performed for different indications, for example, partial colectomy for cancer and ischemic colitis [12]. Although it is the same operative procedure, the underlying disease is likely to drive patient outcomes. Hospital volume of procedures by diagnosis type was calculated based on the number of annual colorectal cases from each unique hospital. Hospital volume was divided into terciles based on the total number of procedures performed each year, a method previously used to report the quality–volume relationship [13]. There are approximately 33% of all hospitals in each volume tercile.

Outcome measures of interest

Our primary outcome measure is the occurrence of any of the AHRQ–developed patient safety indicators (PSIs). AHRQ created the PSIs to screen large administrative databases for PAEs following surgeries, medical procedures, and childbirth