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Determinants of 30-d readmission after colectomy

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ABSTRACT

Background: Readmission after colectomy has become an important metric for measuring quality of care. Our aim was to investigate the impact of patient and hospital characteristics on 30-d readmission rates among patients undergoing colectomies in Pennsylvania.
Methods: Data were obtained from the Pennsylvania Health Care Cost Containment Council, which included all patients undergoing colectomy during 2011 ($n = 10,155$). Characteristics of non-readmitted and readmitted patients were compared with univariate tests. The primary outcome was 30-d readmission, which was modeled using multivariable logistic regression.
Results: Of the 10,155 patients who underwent colectomy, 1492 (14.7%) were readmitted within 30 d of discharge. Readmission was influenced by the underlying diagnosis ($P < 0.001$). Additionally, readmission was more likely with a Charlson comorbidity index ≥ 2 (odds ratio [OR] = 1.57, $P < 0.001$), emergent admission (OR = 1.26, $P = 0.001$), an in-hospital complication (OR = 1.46, $P < 0.001$), lowest quartile for surgeon volume (OR = 1.24, $P = 0.01$), and construction of an ileostomy (OR = 2.31, $P < 0.001$). Factors associated with decreased likelihood of readmission included laparoscopic surgery (OR = 0.73, $P < 0.001$). No association with hospital volume was found.
Conclusions: A 30-d readmission after colectomy is influenced by numerous patient- and surgeon-related factors. Reducing in-hospital complications, and improving patient education after ileostomy construction, provide substantial targets for intervention. Our data also suggest that there may be a critical range of colectomies performed annually by surgeons, greater than which no additional benefit is conferred in reducing readmissions, but below which there is an increased risk of readmission. Further research is needed to determine the influence of laparoscopic surgery in reducing readmission in equally matched patient populations.

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1. Introduction

Growing attention has been directed toward readmissions as a metric for measuring quality health care [1,2]. Costs exceeding 40 billion dollars have been attributed to the financial impact of readmissions annually to the health care system [2]. The Centers for Medicare and Medicaid Services and other payers have targeted readmissions as a potential cost-saving

measure for some procedures and conditions, and many providers are responding by escalating efforts to reduce readmissions [1].

Among surgical patients, colectomies are associated with high complications rates, longer hospitalizations, and significant risks for readmission [1,3,4]. Readmissions are difficult to predict and in colorectal surgery alone have been estimated to cost 300 million dollars annually in health-care expenditure [5]. Recent literature has aimed to understand the factors associated with readmission [6—8]. Previous studies have focused on disease-type, admission-type, or payer-specific or single-institution databases or have emphasized mortality as the primary outcome [2,3,5,9,10].

The present study used a unique statewide, all-payer discharge database containing data for all hospital discharges in Pennsylvania, to evaluate factors associated with 30-d readmission after elective and emergent colectomies. Delineating these factors provides an opportunity to identify areas for targeted intervention, to reduce costs from readmissions, and to improve patient outcomes. The present analysis was performed with the hypothesis that patient comorbidities and in-hospital complications would increase the likelihood of 30-d readmission, whereas higher surgeon and hospital volume would decrease readmissions.

2. Methods

This was an institutional review board exempt, retrospective cohort study performed solely at the authors' institution.

2.1. Data

Data on colectomies performed in the Commonwealth of Pennsylvania during the year 2011 were obtained from the Pennsylvania Health Care Cost Containment Council (PHC4). PHC4 is an independent state agency responsible for monitoring the quality and cost of health care, as well as improving access [11]. The PHC4 data set is unique in that it is an all-payer database and contains longitudinal data relating to patient demographics (age, sex, and race), admission and discharge diagnoses (up to 18 distinct codes including primary admission diagnoses), surgical procedures (up to six distinct codes including primary procedure), unique physician and hospital identifiers, resource utilization (length of stay [LOS], charges), and discharge status for all hospital discharges occurring in all general acute care Pennsylvania hospitals (not including Veterans Affairs Hospitals). The database registers all readmissions within any of these hospitals in the state of Pennsylvania, but does not capture out-of-state readmissions. Complete 30-d follow-up information was available for all patients.

This study included all patients with a principal *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9) procedure code of open (multiple segmental-[45.71]; cecum-[45.72]; right-[45.73]; transverse-[45.74]; left-[45.75]; sigmoid-[45.76]; other and unspecified partial excision of large intestine-[45.79]; total intra-abdominal-[45.81]; other and unspecified total intra-abdominal-[45.83]) colectomy, as well as laparoscopic (multiple segmental resection of large intestine-

[17.31]; cecum-[17.32]; right-[17.33]; transverse-[17.34]; left-[17.35]; sigmoid-[17.36]; other partial excision of large intestine- [17.39]; total intra-abdominal-[45.81]) colectomy.

2.2. Covariates and outcomes

Primary diagnoses for undergoing colectomy were categorized into the following underlying etiologies based on ICD-9 codes: malignant (153, 153.0, 153.1, 153.2, 153.3, 153.4, 153.4, 153.5, 153.6, 153.7, 153.8, 153.9), diverticular (562.10, 562.11, 562.12, 562.13), obstructive (560, 552.8, 552.1, 552.21, 552.9, 560.2, 560.81, 560.89, 560.9), ischemic (557.0, 557.1, 557.9), inflammatory bowel disease (IBD) (555.0, 555.1, 555.2, 555.9, 556, 556.5, 556.6, 556.8, 556.9), functional (560.1, 564, 564.09, 564.4, 564.7, 564.89), and other.

The previously described ICD-9 procedure codes were used to categorize operations into proximal colectomy (cecum or right hemicolectomy), distal colectomy (left hemicolectomy or sigmoid), total abdominal colectomy, or other colectomy (transverse, multiple segmental, or other partial). Construction of an ileostomy during the index hospitalization was derived from the ICD-9 codes as follows: 46.20, 46.21, 46.22, 46.23.

By PHC4 definitions, urgent admissions include those admissions where a patient requires immediate attention for the care and treatment of a physical disorder. Emergent admissions refer to patients requiring immediate medical intervention as a result of a severe, life threatening, or potentially disabling condition; these patients are generally admitted through the emergency room.

Surgeons were categorized into quartiles based on the total number of colectomies (including both open and laparoscopic) performed by surgeons in Pennsylvania during 2011 based on PHC4 data. In similar fashion, hospital volumes were categorized as quartiles based on the total number of colectomies (including both open and laparoscopic) performed during 2011 at Pennsylvania hospitals. LOS was based on duration of hospital stay associated with the index operative admission.

Comorbidities were defined using the Deyo adaptation of the Charlson comorbidity index (CCI), which uses ICD-9 diagnosis codes [12,13]. The impact of comorbidities was assessed using the CCI, which assigns weights to various patient comorbidities and has been validated in numerous studies for a wide variety of diseases for various clinical outcomes [13,14]. In-hospital complications during index hospitalizations were established using previously described methods with the following classification system, which includes: wound (mechanical), infection, urinary, pulmonary, gastrointestinal, cardiovascular, systemic, and procedural [15,16].

The primary outcome of interest was 30-d readmission. Readmission was based on the date of discharge.

2.3. Statistical analysis

The purpose of the statistical analysis was to determine the characteristics that affected 30-d readmission, controlling for other confounding factors. Univariate statistical tests were used to compare baseline characteristics between non-readmitted and readmitted patients, using chi-square tests