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Hospital readmission after ovarian cancer surgery: Are we measuring surgical quality?

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Abstract

Objectives—Readmission after surgery is a quality metric hypothesized to reflect the quality of care in the index hospitalization. We examined the link between readmissions and a surrogate of surgical quality -- major postoperative complication -- among ovarian cancer patients.

Methods—Patients who underwent surgery for ovarian cancer between 2012–2013 were identified from the National Surgical Quality Improvement Project (NSQIP). Major complications were defined as > grade 3 complications on the validated Clavien-Dindo scale and included both NSQIP and non-NSQIP defined complications based on readmission ICD-9 code. Readmissions and complications within 30-days of surgery were analyzed using rate ratios.

Results—We identified 2,806 ovarian cancer patients of whom 9.1% (n=259) experienced an unplanned readmission. Overall major complication rate was 10.9% (n=307). Major complications in the index hospitalization were not associated with subsequent readmission (RR 1.2, 95% CI 0.7–1.9). Overall, 41.4% of readmissions were not attributable to any major postoperative complication. Of the unplanned readmissions, 55.2% (n=143) never experienced a NSQIP-defined major complication. Of these 143 patients, the reason for readmission was known for 107 patients and was: 28.0% non-NSQIP-defined major complications; 16.8% cancer or other medical factors; 22.4% minor complications; and 32.7% symptoms without a diagnosis of complication.

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Conclusions—Forty percent of unplanned readmissions after ovarian cancer surgery occur among patients who have not experienced a major postoperative complication. Quality metric benchmarks and efforts to decrease readmissions should account for this high percentage of readmissions not associated with a major complication.

INTRODUCTION

In the mid-2000s, a government analysis of Medicare data revealed that readmissions are costly, representing an approximate cost of up to 41 billion annually (1). Given this large cost, in 2009, CMS developed a hospital readmission reduction program which began tracking 30-day readmissions for all Medicare patients (2). In 2013, the first financial penalties were rolled out with hospitals facing penalties of 1% of Medicare reimbursements if risk-adjusted readmission rates are higher than expected for three chronic health conditions: congestive heart failure, myocardial infarction and pneumonia. In 2015, the program was expanded to include surgical procedures. Hip and knee arthroplasty were added as the first surgical procedures and penalties were increased to up to 3% of Medicare reimbursements. In 2017, coronary artery bypass grafting will be added and it is likely that additional procedures will be included in the future.

Attention was originally focused on readmissions as a cost-saving measure. However, currently, readmissions have morphed into a quality metric with the hypothesis that poor quality of care in the index hospitalization is associated with the subsequent readmission. Readmissions as a quality metric began within the paradigm of chronic health conditions and it is unknown if this paradigm extends to surgical procedures. However, if readmission is a marker of surgical quality, the mechanism could be thus: poor surgical care leads to a postoperative complication, which, in turn, leads to a readmission. For surgical procedures, if readmission is a surrogate marker of surgical quality, it should be strongly associated with postoperative complication, a marker of surgical quality.

The objectives of this study were to: (1) determine the association between major postoperative complication and unplanned readmission and (2) examine the reasons for readmission in the absence of postoperative complication among patients undergoing ovarian cancer surgery.

METHODS

This study is a secondary analysis cohort study of prospectively collected surgical quality data. The National Surgical Quality Improvement Program (NSQIP) database is a national, hospital-based, surgical quality database. Participation by hospitals is voluntary. Trained clinical reviewers prospectively collect preoperative variables and post-operative outcomes for each individual procedure for 30 days following surgery. Periodic auditing, including for data points occurring after hospital discharge, ensures high quality data specifically for post-discharge complications (3). Details of methods of data collection and reliability have been previously reported (4). The Institutional Review Board at the University of North Carolina at Chapel Hill reviewed this study and declared it exempt from formal review.

We identified patients who underwent surgery for ovarian cancer between 2012 and 2013 from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) using International Classification of Diseases, Ninth Revision codes for ovarian cancer (183.xx). Given that hospital readmission was our primary outcome, patients who died in the index hospitalization or had a length of stay greater than 30 days were excluded from our analysis.

For our first objective, we sought to determine the association between major postoperative complication and unplanned readmission. For this analysis, the primary exposure was major postoperative complication. We identified all major postoperative complications and categorized the complications into major or minor using the Clavien-Dindo scale (5). Minor complications were grade 2 or less and major complications were grade 3 or higher. Major postoperative complications included myocardial infarction, deep surgical site infection, deep organ space infection wound dehiscence, renal failure, stroke, sepsis, septic shock, pneumonia, cardiopulmonary arrest, venous thromboembolism, unplanned intubation and reoperation. Minor postoperative complications included urinary tract infections, blood transfusions, and superficial wound infections. Exact clinical definitions of these postoperative complications were as per NSQIP (6).

For non-NSQIP defined major complications, such as ileus, bowel obstruction, or febrile neutropenia, these complications were defined by the ICD-9 code linked to the unplanned readmission as the reason for the readmission. This ICD-9 code is not a billing ICD-9 code, but rather an ICD-9 code assigned by the NSQIP trained clinical reviewer after review of the entire readmission hospitalization. Non-NSQIP recorded complications were categorized into the following groups: major surgical complications, medical or cancer related complications, minor complications, and symptoms without a diagnosis of complication. Major postoperative complications included: ileus, bowel obstruction, fistula, clostridium difficile infection and renal failure. Medical or cancer related complications included: febrile neutropenia, pleural effusion, symptomatic ascites, GI ulcer, and other medical problems. Minor complications included superficial wound infections and urinary tract infections. Symptoms without a diagnosis of complication included: nausea, pain, constipation, and fatigue. It is important to note that the diagnosis of a symptom without diagnosis of a complication was only made if the patient had an ICD-9 code recorded for a symptom, but no diagnosis made of any of the NSQIP recorded major complications. Complications were further classified as occurring in the index hospitalization or after hospital discharge by comparing the day of the postoperative complication to the length of the index hospitalization.

Our primary outcome was unplanned hospital readmission within 30-days of surgery. We identified readmissions as ‘unplanned’ by the NSQIP categorization, which is defined as a readmission that was unplanned at the time of the primary procedure (6). In order to study whether unplanned readmissions were associated with a postoperative complication, we made a conservative assumption and assumed that if a patient experienced a postoperative complication at any point in the 30 day postoperative period that their readmission could be plausibly linked to that postoperative complication, the symptoms that preceded it, or its sequelae.

For our second objective we examined the reasons for readmission in the absence of postoperative complication among patients undergoing ovarian cancer surgery. Among patients who experienced a readmission in the absence of postoperative complication we examined risk factors potentially associated with that readmission. This analysis was exploratory and not designed to test a specific hypothesis (ie that one risk factor is associated with postoperative complication) and thus, we did not perform a multivariable analysis to adjust for confounding. Examined risk factors included age, race, diabetes, hypertension, smoking, disease burden, greater than 10% weight loss in the preceding 6 months, Charlson comorbidity index, length of index hospital stay, surgical complexity, operating room time and non-home discharge. All of these variables were defined as per NSQIP with the exception of disease burden, surgical complexity and Charlson comorbidity index. In order to appropriately account for the known increase in complications among ovarian cancer patients with high disease burden (7, 8), we defined this variable as those who had either preoperative ascites or had disseminated cancer as per NSQIP definitions. Surgical complexity was defined using the total work relative value units by summing the values assigned to all CPT codes for each surgery. The Charlson comorbidity index was calculated using the comorbid diagnoses reported for each patient as previously defined (9).

We used rate ratios with 95% confidence intervals to measure the association between postoperative complication and unplanned readmission for binary variables. For continuous variables, the association between variables and readmission was measured using a modified Poisson regression. All analyses were performed using SPSS version 20.0 (IBM Corp, Armonk, NY).

Given that there was no ICD-9 code linked to some of the unplanned readmissions, we performed a sensitivity analysis in which we assumed that all of these patients had actually experienced a non-NSQIP recorded major postoperative complication. We know that none of these patients have experienced a NSQIP-recorded major postoperative complication as those are recorded separately.

RESULTS

We identified 2,806 patients who underwent surgery for ovarian cancer. The demographic and operative characteristics of our population are listed in Table 1. Two hundred and eighty-four patients (10.0%) experienced a readmission within 30 days for surgery. Twenty-five of these patients (0.9%) had a planned readmission and 259 had an unplanned readmission (9.1%). Three hundred and seven patients (10.9%) experienced a major postoperative complication. One hundred sixty-eight patients (54.7%) experienced a major complication in the index hospitalization and 127 (41.4%) experienced one after hospital discharge. Twelve (3.9%) experienced both an in hospital and out of hospital complication.

Overall, experiencing any major postoperative complication was associated with readmission. Patients who experienced a major postoperative complication had 5.4 times the risk of being readmitted as those who did not (RR 5.4, 95% CI 4.3–6.6). However, this association differed depending on the timing of the complication. Patients who experienced a major complication during the index hospitalization were not more likely to be readmitted

(RR 1.2, 95% CI 0.76–1.8) whereas patients who experienced a major complication after hospital discharge were highly likely to be readmitted (RR 12.2, 95% CI 10.3–14.5).

Of the 259 patients who experienced an unplanned readmission, 143 (55.2%) had never experienced a NSQIP-defined major postoperative complication at any time in the 30-day postoperative period (Figure 1). The reason for readmission for these patients fit into the following categories: 21% were readmitted for a major complication that is not recorded in NSQIP, mostly commonly an ileus or a bowel obstruction; 13% were readmitted for a cancer or medical factor such as febrile neutropenia or a pleural effusion; 17% were admitted for minor complications such as urinary tract infections; and 24% were readmitted for symptoms such as a pain or nausea without the diagnosis of a major complication. An additional 25% had no ICD-9 code linked to their readmission. Overall, if the NSQIP-defined and non-NSQIP defined major postoperative complications are taken into account, 41.4% of unplanned readmissions occur among ovarian cancer patients who have never experienced a major postoperative complication at any point in the 30-day postoperative period.

Risk factors for readmission among these patients who had never experienced a major postoperative complication were then explored. These patients were 1.5 times more likely to be readmitted if they were of non-white race than white race (RR 1.5, 95% CI 1.1–2.1); 1.6 times more likely to be readmitted if they had high disease burden (RR 1.6, 95% CI 1.2–2.3); 2.1 times more likely to be readmitted if they experienced weight loss greater than 10% in the month prior to surgery (RR 2.1 95% CI 1.2–3.9); and 1.7 times more likely to be readmitted for each one point increase in their Charlson comorbidity index score (RR 1.7, 95% CI 1.2–2.3). Length of the index hospitalization was associated with an increased risk of readmission (RR 1.04 95% CI 1.01–1.17 for each 1 day increase in the length of the index hospital stay). Age, BMI, smoking, diabetes, hypertension, surgical complexity, operating room time, and discharge to a non-home location were all not associated with subsequent readmission among patients who had not experienced a major complication ($p=NS$).

For our sensitivity analysis, we assumed that all patients with an unknown ICD-9 code were readmitted secondary to a non-NSQIP recorded major postoperative complication. We found that even with this conservative assumption, 30% (77/259) of the unplanned readmissions were unrelated to postoperative complication.

DISCUSSION

Among patients who are readmitted following surgery for ovarian cancer, 60% have experienced a major postoperative complication during the 30-day postoperative period. And thus, for many ovarian cancer patients, the commonly thought of pathway of a complication leading to a readmission does occur. However, 40% of patients with ovarian cancer who are readmitted after surgery have not experienced a major postoperative complication at any point in the entire 30-day postoperative period. This suggests an alternative pathway where factors apart from a major postoperative complication lead to patients being readmitted. Plausibly, these could include socioeconomic factors, care coordination issues, or other factors. Efforts to reduce hospital readmissions for the ovarian cancer patient population

should focus on improving surgical quality and decreasing complication rates, but should also acknowledge the significant percentage of readmissions our study suggests will not be altered by such efforts. Furthermore, these results are important in the context of bundled payments or alternative payment models (APMs) where additional reimbursement will not be provided for readmissions following surgical procedures.

We explored some of the risk factors for readmission among those patients who never experienced a major postoperative complication. We found that patients who had higher disease burden and more medical comorbidities were more likely to be readmitted even if they did not experience a postoperative complication. This suggests that these risk factors can lead to readmission through an independent pathway that may not be modulated by improving the quality of the surgical operation or decreasing postoperative complication rates.

We found an overall readmission rate of 10.0% for patients undergoing ovarian cancer surgery. This is similar, although lower, than single institution series examining patients undergoing ovarian cancer surgery, which found rates of readmission ranging from 12%–19% (10–12). However, it is higher than the 7.7% postsurgical readmission rate reported for patients in an ancillary study of GOG 218 (13). Our rate of unplanned readmission of 9.1% is also similar to the rate of 8.8% reported for ovarian cancer patients in a previous study using NSQIP data from 2011–2013 to describe readmission rates (14). However, all of these readmission rates are higher than the 3.8% reported nationally for all patients undergoing hysterectomy (15). This points to the importance of policies and procedures regarding readmission rates to account for both the procedure being performed and the indication for the procedure as benign gynecology patients and gynecologic oncology patients likely have different readmission indications and different readmission risk profiles.

Additionally, our analysis revealed that the timing of the postoperative complication is crucial. Out of hospital postoperative complication is strongly associated with readmission. However, in hospital postoperative complication was not associated with readmission in our cohort. If penalties are imposed for both the complication and the resulting readmission; hospitals may be doubly penalized for out of hospital complications relative to in-hospital complications. This differential in the penalties for out of hospital versus in hospital complications has the potential to create incentives for providers to lengthen postoperative stays to decrease the chances of a readmission. Lengthening hospital stays is not likely to increase the delivery of high value care, may increase expenses in the healthcare system, and place patients at risk for other unanticipated complications.

This study is subject to several limitations. Our data source is a hospital based quality improvement program in which hospitals voluntarily participate and therefore it is not a nationally representative sample. We also had patients who experienced unplanned readmissions with no ICD-9 code linked to their readmission. We know that these patients did not experience a NSQIP recorded major postoperative complication, but it is possible that they did experience a non-NSQIP recorded major complication that accounts for their readmission. We performed a sensitivity analysis to evaluate this possibility and our results remained robust in this analysis. Additionally, we examined possible risk factors for

readmission among patients who did not experience a postoperative complication and the results of this analysis should be considered exploratory. We may have found a false-negative result for certain risk factors and readmission due to small sample size, conversely, we may have found a false-positive result due to multiple hypothesis testing. Finally, we made a decision to use a conservative assumption and so assumed that any readmission of a patient who experienced a postoperative complication was due to symptoms preceding the complication, the complication itself, or sequelae of the complication. This assumption may have led us to overestimate the percentage of patients who were actually readmitted for a major postoperative complication and thus it is possible that a higher percentage of ovarian cancer patients are readmitted for factors independent of major postoperative complication. Despite these limitations, our data provides evidence that although readmissions for patients with ovarian cancer are linked to major postoperative complications, for approximately 40% of patients, a pathway exists to readmission that is independent of major postoperative complication.

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Highlights

40% of ovarian cancer postoperative readmissions are unrelated to major complications.

Risk factors for readmission exist that are independent of complication.

In hospital complications are not associated with subsequent readmission.

Figure 1. Unplanned Readmissions

Indications for unplanned readmissions among patients who have never experienced a major postoperative complication.

Table 1

Demographic and Operative Characteristics

Characteristics	N=2,806
Age (years)	61 (52–69)
BMI (kg/m ²)	27.1 (23.4–32.4)
Race	
White	2162 (77.0)
Black	189 (6.7)
Asian	116 (4.1)
Alaska/American native	24 (0.9)
Unknown	315 (11.2)
Smoking	381 (13.6)
Diabetes	322 (11.5)
Hypertension	1141 (40.7)
Preoperative stage IIIC or higher	1115 (39.7)
>10% weight loss in preceding 6 months	124 (5.5)
Charlson comorbidity index	
0	1427 (50.9)
1	222 (7.9)
2	514 (18.3)
3+	643 (22.9)
Length of stay (days)	4 (3–7)
Operating time (min)	171 (118–238)
Surgical complexity (wRVU)	37.1 (27.3–56.7)
Non-home discharge	176 (6.3)

Data is presented as n(%) for categorical variables and median (interquartile range) for continuous variables. Length of stay is defined as the length of stay for the index hospitalization.