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Benign hysterectomy performed by gynecologic oncologists: Is selection bias altering our ability to measure surgical quality?☆·☆☆

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HIGHLIGHTS

- Women having benign hysterectomy by a gynecologic oncologist differ from those having surgery by a benign gynecologist.
- Women undergoing benign open hysterectomy with a gynecologic oncologist appear to have higher rates of complication.
- Risk-adjustment eliminates differences in complication rates and improves measured surgical outcomes of gyn oncologists.

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ABSTRACT

Objective. To compare the characteristics of women undergoing hysterectomy for benign disease with either a benign gynecologist or a gynecologic oncologist and to assess for differences in complication rates with and without risk adjustment.

Methods. Patients undergoing benign hysterectomy recorded in the National Surgical Quality Improvement Program (NSQIP) targeted hysterectomy file in 2015 were identified. The primary outcome was any postoperative complication. Stratified analysis was performed by route of surgery. Bivariable tests and modified Poisson regression were used to adjust for confounding by procedure type and patient characteristics.

Results. We identified 17,639 patients who underwent hysterectomy for benign pathology, primary surgeon was a benign gynecologist (82%) or gynecologic oncologist (18%). Patients who underwent surgery with gynecologic oncologists were older (51yo v 46yo), had a higher mean BMI (32 v 30), and a higher prevalence of prior abdominal surgery (29% v 25%, $p < 0.001$), diabetes (10.6% v 7.0%), hypertension (34% v 25%) and higher ASA and Charlson comorbidity scores ($p < 0.001$, for all). For laparoscopy, surgery with a gynecologic oncologist was associated with a decreased risk of complication (RR 0.80, 95% CI 0.66–0.98). For laparotomy, surgery with a gynecologic oncologist was associated with an increased risk of complication (RR 1.18 95% CI 1.01–1.38), however, this was no longer the case with risk adjustment (aRR 0.90, 95% CI 0.76–1.07).

Conclusions. Patients operated on by gynecologic oncologists have a higher prevalence of risk factors for complication compared to those operated on by benign gynecologists even with a benign indication for surgery. Quality measurement should account for this selection bias.

1. Introduction

Gynecologic oncologists are increasingly operating on women with benign disease who are referred due to suspicion of cancer, preinvasive disease or anticipated need for complicated surgery [1–3]. These patients can have complicated surgical histories, endometriosis or a pelvic mass that is suspicious for a gynecologic malignancy prompting the referral. Aside from the operating surgeon, cases referred from a benign gynecologist to a gynecologic oncologist *versus* those performed by a

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benign gynecologist appear similar in data sources as the indication for the procedure (diagnosis code) and the procedure itself (procedure code) will be the same.

Hospital-wide quality metrics are currently comparing physician outcomes for certain "like" procedures. In general, patients with cancer will be separated and evaluated as a different cohort as the diagnosis code for the procedure is different. However, as gynecologic oncologists are increasingly operating on benign gynecology patients, it is unknown, if or how, these patients with benign pathology operated on by benign gynecologists or gynecologic oncologists may differ from one another. This is important because it impacts surgeon-associated surgical quality outcomes with respect to how they are currently measured. There is a known phenomenon in quality metric reporting called referral bias, where physicians or institutions who care for more complicated patients actually appear to have worse outcomes due to the complexity of cases referred to them – whether this occurs in gynecologic oncology is unknown [4]. Risk adjustment, which refers to the use of multivariable statistical methods to equalize patient outcomes by adjusting for differences in patient case mix, is a strategy to help alleviate this bias, to the extent differences in patient characteristics can be measured [5]. Risk adjustment is currently applied when institutions are compared to one another, however, currently, risk adjustment in gynecology is not performed based upon the subspecialty of the operating surgeon.

We examined this question in a large national surgical quality database which provides information about the gynecologic surgical subspecialty. The objective of this study was to compare the characteristics of women undergoing hysterectomy for benign disease with either a benign gynecologist or a gynecologic oncologist and to assess for differences in complication rates with and without risk adjustment.

2. Methods

We performed a cohort study of women undergoing hysterectomy recorded in the National Surgical Quality Improvement Program (NSQIP). The National Surgical Quality Improvement Program is a national database that collects preoperative, intraoperative and postoperative variables related to surgical procedures [6]. Hospitals voluntarily participate in the database, and for participation, are given data regarding their own procedures to drive quality improvement. Data are abstracted by trained clinical reviewers and are audited regularly. For an institution's data to be used in the nationally available file, the interobserver agreement during the audit must be <5% and averages 2% for included sites [7]. Within NSQIP, there is a targeted hysterectomy file which records patient history, intraoperative, and postoperative variables specific to hysterectomy [8]. The targeted hysterectomy file for 2015 was linked to the main NSQIP data for this study. This study was reviewed by the Institutional Review Board at Northwestern University and was deemed exempt from formal review given the deidentified nature of the data.

Our cohort was all women recorded in both the hysterectomy specific data file and the general data file in 2015. Patients undergoing benign hysterectomy were identified by excluding those patients who a hysterectomy for cancer by using the cancer case variable within the hysterectomy file. International classification of disease-9 and -10 (ICD-9 and ICD-10) codes were also examined and patients with cancer related codes were excluded. Patients undergoing surgery with maternal fetal medicine or providers classified as "other" were also excluded.

Our primary outcome was the occurrence of any postoperative complication. Postoperative complications were defined as both major and minor complications and included all complications recorded in the National Surgical Quality Improvement Program [6]. The definition of any postoperative complication included myocardial infarction, pneumonia, venous thromboembolism, deep surgical site or organ space infection, stroke with neurologic deficit, unplanned return to the operating room, renal failure, cardiopulmonary arrest, sepsis, intubation > 48 h, urinary tract infection, blood transfusion, superficial wound infection and death. As in previously published work, all of the above complications were defined as major with the exception of urinary tract infection, blood transfusion and superficial wound infection [9,10]. More specific definitions of what constituted a myocardial infarction or pneumonia and can found in the National Surgical Quality Improvement Project data participant use file [6]. Our exposure was the gynecologic subspecialty of the primary surgeon. The gynecologic subspecialty is recorded in the targeted hysterectomy file of the National Surgical Improvement Program [8]. This was defined as benign gynecologist or gynecologic oncologist. Benign gynecologist encompassed procedures performed by urogynecologists, reproductive endocrinologists and general obstetrician gynecologists. Information regarding number of years of training or fellowship training is not available in this data source.

Demographic variables evaluated included age, race, and BMI. Patient related pre-operative variables abstracted included hypertension requiring medication, diabetes mellitus requiring insulin or oral therapy, smoking in the last year, and American Society of Anesthesiologists (ASA) score. Charlson comorbidity index score was also calculated using methods reported previously [11]. Gynecology-specific preoperative variables evaluated included prior abdominal surgery, prior pelvic surgery and uterine weight. The ACS-NSQIP probability of morbidity was also examined as a confounder. This number is calculated based on risk factors for postoperative complication and has been studied and validated in diverse surgical procedures [12]. Route of surgery was defined by the primary procedure current procedure terminology (CPT) code as minimally invasive (laparoscopic or vaginal) or open.

Patients undergoing surgery with a benign gynecologist were compared to those undergoing surgery with a gynecologic oncologist with respect to outcomes. Stratified analysis was performed by route of surgery, which was defined as minimally invasive or laparotomy, given the differential impact of gynecologic subspecialty on the risk of postoperative complication (effect measure modification) found during analysis. Associations between surgeon subspecialty and postoperative complication were calculated using Poisson regression and adjustment was made for *a priori* identified potential confounders of the association. All p-values were two sided with $p < 0.05$ considered significant. STATA version 14.0 (College Station, TX) was used for all analyses.

3. Results

We identified 17,639 patients who underwent hysterectomy for benign indications. The primary surgeon was a benign gynecologist for 82% (n = 14,550) and a gynecologic oncologist for 18% (n = 3089). Patients who had surgery with a benign gynecologist differed from those who had surgery with a gynecologic oncologist with respect to risk factors for postoperative complication (Table 1). Patients who underwent surgery with a gynecologic oncologist were older, had higher BMIs, more prior abdominal surgery, larger uteri and were more likely to be of white race. They were also more likely to be diabetics, to have hypertension, and had both higher Charlson and ASA scores.

Overall, the rate of postoperative complication was 10.0%, 16.0% for those undergoing open hysterectomy and 7.3% for those undergoing minimally invasive hysterectomy. Major complications were 4.3% for open hysterectomy and 2.1% for minimally invasive hysterectomy while minor complications were 13.3% for open hysterectomy and 5.5% for minimally invasive hysterectomy. Patients who underwent open hysterectomy with a gynecologic oncologist had an increased risk of complication (RR 1.18, 95% CI 1.01–1.38) (Table 2). Whereas patients who underwent minimally invasive hysterectomy with a gynecologic oncologist had a lower risk of complication (RR 0.80, 95% CI 0.66–0.98).

Given the differences in patient population between women operated on by a gynecologic oncologist and a general obstetrician gynecologist, an adjusted analysis was performed. After adjustment for age,

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