



## Trends over time in the use of laparoscopic hysterectomy for the treatment of endometrial cancer



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### HIGHLIGHTS

- rates of laparoscopy to treat endometrial cancer have increased over time in Ontario, Canada
- median length of hospital stay after abdominal hysterectomy was significantly longer than after laparoscopic hysterectomy
- probability of admission or emergency room visit within 30 days of surgery was significantly higher after abdominal surgery

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### ABSTRACT

**Objective.** To determine the rates of laparoscopy compared to laparotomy over time for the treatment of endometrial cancer in the province of Ontario, Canada, and to determine factors associated with having laparoscopic surgery.

**Methods.** This was a population-based retrospective cohort study using healthcare administrative databases. Incident cases of endometrial cancer from April 2002–March 2011 were identified in the provincial cancer registry. Record linkages were made with other healthcare databases to determine type of hysterectomy (laparoscopic or abdominal ± staging), year of diagnosis, comorbidities, location of residence, surgeon and hospital type.

**Results.** 12,104 patients with endometrial cancer treated with hysterectomy were identified, of which 2116 had laparoscopic surgery (17.5%). Rates of laparoscopy increased over time from 6.5% in 2002 to 30.2% in 2011 ( $p < 0.0001$ ). The median length of hospital stay after abdominal hysterectomy was significantly longer (3 days vs 1 day,  $p < 0.0001$ ). Adjusting for age, comorbidity score, income quintile and type of hospital (community versus academic), the probability of admission or emergency room visit within 30 days of surgery was significantly higher in patients with abdominal surgery (OR 1.61) (95% CI 1.36–1.92) ( $p < 0.0001$ ). The odds of having laparoscopic surgery was higher with a gynecologic oncologist (OR 2.85, 95% CI 1.61–5.85) or a general gynecologist at an academic hospital (OR 2.07, 95% CI 1.09–3.95) compared to a general gynecologist at a community hospital.

**Conclusions.** This population-based cohort study confirms the increased use over time of laparoscopic surgery to treat endometrial cancers in Ontario, and demonstrates the benefits of decreased hospital stay and decreased patient morbidity.

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### 1. Introduction

Uterine cancer is the fourth most common cancer in Canadian women, with an estimated incidence of 4200 cases and 790 disease-related deaths in 2008 [1]. Surgical treatment and staging, to establish

the extent of extra-uterine disease includes hysterectomy, bilateral salpingoophorectomy, bilateral pelvic and/or para-aortic lymphadenectomy and peritoneal cytology [2]. This was traditionally performed using an abdominal approach (laparotomy); however, with the advent of laparoscopy, it became feasible to carry out the procedure using a minimally invasive technique [3–6].

Surgical staging, specifically lymphadenectomy, is part of the management of endometrial cancer and consultation with a gynecologic oncologist should occur in all cases. In cases deemed very low risk for

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lymphatic spread such as histologically confirmed grade 1 endometrioid cancers centrally reviewed by an expert gynecologic pathologist, the lymphadenectomy may be omitted from the procedure and the hysterectomy and bilateral salpingo-oophorectomy may be performed by either general gynecologists or gynecologic oncologists [7].

A recent Cochrane review and meta-analysis found that laparoscopic management of early stage endometrial cancer is associated with reduced operative morbidity and hospital stay, while yielding similar overall and disease-free survival as laparotomy [8]. The largest randomized controlled trial by the Gynecologic Oncology Group (GOG) compared laparotomy with laparoscopy for the comprehensive surgical staging of uterine cancer. Laparoscopy resulted in fewer postoperative adverse events and shorter hospitalization than laparotomy, with no difference in overall detection of advanced stage disease [9].

There is only one previous population-based study that has examined the trends over time in the utilization of laparoscopy compared to laparotomy for the treatment and staging of endometrial cancer, but it only analyzed up to 2005 [10]. In this study, the rate of laparoscopy was only 8% by 2005. Although there is high quality evidence from clinical trials demonstrating the benefit of this technique, there are no studies to determine if this has translated to increased utilization over the last decade.

The aim of this study was to determine the rates of minimally invasive surgery compared to laparotomy for the treatment of endometrial cancer in the province of Ontario, Canada and to determine factors associated with having minimally invasive surgery. We also wanted to determine if the differences in the use of minimally invasive hysterectomy compared to abdominal hysterectomy over time has impacted the length of hospital stay and patient morbidity.

## 2. Methods

### 2.1. Study design

This was a population-based retrospective cohort study, conducted using the Ontario health administrative databases. The study was approved by the Research Ethics Board at Sunnybrook Health Sciences Centre.

### 2.2. Data sources

Four healthcare databases were used: the Ontario Health Insurance Plan (OHIP), the Canadian Institute for Health Information-Discharge Abstract Database (CIHI-DAD), the National Ambulatory Care and Reporting System (NACRS) and the Ontario Cancer Registry (OCR). These databases are routinely used for research purposes and their quality has been previously demonstrated [11]. In the province of Ontario OHIP is a single payer universal health care insurance plan. The OHIP dataset contains all of the claims paid for by OHIP from July 1991 onward. The CIHI-DAD is a national database of all admissions to acute care institutions. The quality of CIHI-DAD for coding accuracy has been demonstrated with re-abstraction studies [12]. The NACRS dataset contains data on all patient visits to hospitals and community based ambulatory care centers, including outpatient clinics and emergency departments (ED) starting from July 2000. A re-abstraction study has also confirmed the NACRS dataset accuracy [13]. The OCR includes information about all newly-diagnosed cases of invasive neoplasia in Ontario.

All study datasets were held securely in a linked, de-identified form and analyzed at the Institute for Clinical Evaluative Sciences.

### 2.3. Cohort identification

Incident cases of endometrial cancer in women over age 18 years old, from April 2002–March 2011, were identified in the OCR. Using the databases listed above, we also determined the year of diagnosis, comorbidities (using the Adjusted Clinical Groups Score (ACG)), location of residence (rural or urban), income quintile, presence of obesity,

surgeon type (general gynecologist or gynecologic oncologist) and hospital type (community or academic). The ACG is a population/patient case-mix adjustment system that provides a relative measure of the individual's expected consumption of health services, with a higher score representing increased comorbidities [14,15]. The histologic type was determined and was classified as endometrioid, sarcoma or high-risk type (serous, clear cell, Mullerian mixed tumor or carcinosarcoma).

## 2.4. Outcome measures

### 2.4.1. Primary outcome

The primary outcome was the use of minimally invasive (laparoscopic, laparoscopic-assisted vaginal or vaginal) versus abdominal hysterectomy ( $\pm$  staging) for the treatment of endometrial cancer over time. This was determined using the CIHI-DAD database.

### 2.4.2. Secondary outcomes

The secondary outcomes included the length of hospital stay and admission or emergency room visit within 30 days of surgery. Hospital readmission rate was determined using the CIHI-DAD and emergency room visit rate was determined using the NACRS dataset.

## 2.5. Statistical analysis

Statistical analysis was completed with SAS version 9.3. Regression analysis was used to determine how the rate of laparoscopic hysterectomy changed over time. Multivariate regression analysis was used to determine factors predictive for having laparoscopic surgery. A generalized estimating equation (GEE) model was used to estimate the association of year of diagnosis with proportion of patients undergoing laparoscopic hysterectomy, clustered by institution. Regression analysis was also used to determine if the probability of admission or emergency room visit within 30 days of surgery was significantly different after minimally invasive hysterectomy versus abdominal, adjusting for age, comorbidity score, socioeconomic status, and type of hospital (community or academic). A combined variable based on rural/urban location of residence and neighborhood income quintile was used to represent socioeconomic status.

## 3. Results

We identified 14,105 patients with endometrial cancer diagnosed between April 2002 and March 2011. Of those, 12,104 underwent elective surgical management with hysterectomy, 2116 had laparoscopic surgery (17.5%) and 9988 underwent abdominal surgery (82.5%). See Fig. 1 for a flow chart of patient selection and management.

Table 1 shows the characteristics of the study population. Overall, there were similarities in the laparoscopy group compared to the abdominal surgery group with regards to age, comorbidity score, histology, and rural/urban residence. Only 1% of the study population was identified as obese in the administrative databases, which was not considered an accurate measurement. There was a higher proportion of patients with abdominal surgery when a general gynecologist was identified as the primary surgeon (59.8% vs 38.4%), and a higher proportion of abdominal surgery in the community hospitals (55.1% vs 37.6%). Staging, which included pelvic and/or para-aortic lymph node dissection, occurred in 28.1% of the laparoscopy group and 21.5% of the abdominal surgery group.

Rates of laparoscopy increased over time from 6.5% in 2002 to 30.2% in 2011 with a significant p-value testing the trend ( $p < 0.0001$ ). The effect remains significant after controlling for other factors (Fig. 2). The median length of hospital stay after abdominal hysterectomy was significantly longer overall (3 days vs 1 day,  $p < 0.0001$ ). Fig. 3 demonstrates how the length of hospital stay has decreased over time. The mean stay in hospital was 4.5 days (SD 3.3) for abdominal surgery in 2002 compared to 2.5 days (SD 1.3) for laparoscopic surgery, and this

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