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Comparison between 155 cases of robotic vs. 150 cases of open surgical staging for endometrial cancer

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ABSTRACT

Objective. To compare the outcomes of 155 cases of endometrial cancer who had robot-assisted surgical staging to 150 open cases.

Methods. Retrospective chart review of cases of endometrial cancer that underwent staging two different ways by two surgeons at an academic institution.

Results. Mean age was 62.4 years in the robotic arm and 65 ($P=0.04$) in the open arm. Mean body mass index was 34.5 Kg/m^2 in the robotic arm and 33 Kg/m^2 in the open arm ($P=0.2$). Pelvic and para-aortic lymph node dissection were performed in 94.8% and 67.7% of the robotic cases versus 95.3% and 74% of the open cases, respectively. Mean operative time was 127 min in the robotic arm, and 141 min in the open arm ($P=0.0001$). Mean lymph node count was 20.3 in the robotic arm, and 20 in the open arm ($P=0.567$). Mean estimated blood loss was 119 ml in the robotic arm and 185 in the open arm ($P=0.015$). Mean hospital stay was 1.5 days in the robotic arm, and 4 days in the open arm ($P=0.0001$). The incidence of postoperative ileus (0.6% vs. 10.7%, $P=0.0001$), infections (5.2% vs. 24%, $P=0.0001$), anemia/transfusion (1.3% vs. 7.7%, $P=0.005$), and cardiopulmonary complications (3.2% vs.14.7%, $P=0.003$) was significantly lower in the robotic arm vs. the open arm. There was one death in the robotic arm attributed to pre-existing cardiac condition.

Conclusion. Robotic-assisted staging reaps the benefits of minimally invasive surgery without compromising the adequacy of the procedure. Dedication to the technique shortens the operative time.

Introduction

Endometrial cancer accounts for 6% of all cancers in women. It is the most common female genital tract malignancy in the United States, with an incidence of 40,100 new cases and 7470 deaths annually [1]. Most cases are readily diagnosed at an early stage by an endometrial biopsy following abnormal uterine bleeding. Surgery alone is often adequate for cure, and the five-year survival rates for localized, regional, and metastatic disease are 96, 66, and 24%, respectively [1].

According to the International Federation of Gynecology and Obstetrics (FIGO) total extrafascial hysterectomy and bilateral salpingo-oopherectomy with pelvic and paraaortic lymph node dissection is the standard staging procedure for endometrial cancer [2].

An increased interest in minimally invasive surgery has resulted in multiple studies comparing laparoscopic staging of endometrial cancer, confined to the uterus, to staging via laparotomy. A recent meta-analysis of four randomized controlled trials found laparoscopic staging to be as effective as open surgery and, except for a longer operative time, laparoscopy was shown to have an advantage in terms of blood loss, hospital stay, and postoperative complications [3]. In an update of the same meta-analysis, the authors concluded that the laparoscopic approach is an effective procedure for treating early stage endometrial cancer in terms of long term survivals [4]. A large Gynecologic Oncology Group randomized controlled study reached similar favorable conclusions regarding safety, feasibility and short term outcomes of laparoscopic staging of uterine cancer [5]. Survival outcomes, however, from this and other well designed studies are pending before definitive conclusions can be drawn.

The da Vinci Surgical System (Intuitive Surgical, Inc, Sunnyvale, CA) was approved by the U.S. Food and Drug Administration (FDA) for use in gynecologic procedures in 2005. Though some have concerns about the cost of acquiring and maintaining the robotic system as well as the time needed to train a surgeon, advantages of this minimally invasive technology include high definition 3-dimentional field of vision, instruments with wrist-like range of motion, tremor filtration, better ergonomics, and a faster learning curve compared to laparoscopy [6,11]. This robotic surgical system hence offers many advantages over traditional laparoscopy, and has been widely, and rapidly, embraced in gynecologic oncology as it was shown to be feasible, safe, and facilitates performing complex procedures such as retroperitoneal lymph node dissection [7–9].

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When compared to laparoscopy, robotic-assisted staging for endometrial cancer was more feasible in patients with higher BMI. It was associated with less operative time, blood loss, and length of operative stay. There was no significant difference in lymph node yield or in cost [6,10].

When compared to laparotomy, robotic-assisted staging for endometrial cancer retained all the advantages of minimally invasive surgery while maintaining the achievability of the surgical procedure. While published studies reported equal number of retrieved lymph nodes, the robotic surgical system was associated with reduced blood loss, less peri-operative complications, shorter hospital stay, faster return to normal activity, and less cost [6,10–13]. Though some studies have shown an improvement with experience [7,8], thus far robotic-assisted staging for endometrial cancer seems to have a longer reported operative time than laparotomy.

Our objective is to review the experience of a single surgeon with robotic-assisted surgical staging for endometrial cancer, and to compare patients treated with this modality to those treated with laparotomy by another surgeon. To our knowledge this is the largest series thus far reported by a single surgeon using the robotic system.

Methods

After acquiring approval from the Yale University Human Investigative Committee (HIC), we performed a retrospective chart review of one hundred-fifty five patients who underwent robotic-assisted surgical staging for endometrial cancer by a single surgeon (MA) from September 2006 to September 2010. The control group comprised one hundred-fifty consecutive cases of endometrial cancer that were surgically staged via a laparotomy by a different surgeon (TJR) during the same period. Both surgeons are board certified gynecologic oncologists with more than 15 years of experience.

Robotic operative data were prospectively maintained by Robot coordinators. We reviewed patients' medical history, operative and anesthesia records, discharge summaries, office notes, pathology reports and imaging studies.

During the study period, we used both the *da Vinci S®* and the *da Vinci Si®* surgical systems. Patients were excluded if imaging studies revealed disease outside of the uterus, or if there were concerns about anesthesia due to a compromised cardio-pulmonary status. It is our policy to perform comprehensive surgical staging for all endometrial cancer patients, and all cases were started with this intent.

For the purposes of data analysis, a blood loss of 100 cc or less was recorded as 100 cc. Operative time was recorded from skin incision to skin closure. Time in the room was recorded from entry into the OR to exit. Postoperative complications were defined as those occurring within 30 days of surgery. Ileus was defined as any slow return of bowel function necessitating active management or delaying discharge. Infectious complications were defined as wound infections or dehiscence, abdominal/pelvic abscesses, and vaginal cuff cellulitis. Cardiopulmonary complications were defined as atelectasis, pneumonia, pulmonary congestion/edema, heart failure, arrhythmias and coronary artery events. Renal complications were defined as urinary retention, severe/persistent hematuria, acute tubular necrosis, and urinary tract infections.

Statistical analysis was performed using SPSS software (IBM Corporation, Somers, NY). Chi square test was used to analyze nominal variables. The two-tailed student's *t*-test was used to compare relationships between variables. Values with $p \leq 0.05$ were considered significant.

Results

During the study period, one hundred-fifty five patients with endometrial cancer underwent robotic-assisted surgical staging by a single surgeon (MA). Comparison was made to one hundred fifty consecutive cases that were surgically staged via laparotomy by a different surgeon (TJR) during the same period. The mean age was 62.4 years in the robot group, and 65 years in the laparotomy group ($p = 0.04$). The mean BMI was 34.5 Kg/m^2 in the robot group, which was comparable to a BMI of 33 Kg/m^2 in the laparotomy group. Mean hospital stay was 1.5 days in the robotic group, and 4 days in the laparotomy group (Table 1).

Table 1
Patient characteristics.

	Mean	Median	Range	STDEV	P value*
Age (years)					0.04
Robot	62.4	61	39–85	9.9	
Open	65	65	29–88	12	
BMI (Kg/m^2)					0.2
Robot	34.5	32.9	19–63	9.2	
Open	33	32	19–58	9	
Hospital stay (days)					0.0001
Robot	1.5	1	0–9	2	
Open	4	3	1–32	3	

BMI, Body Mass Index. *Student t test.

Eighty-one percent of cases in the robot group had early stage disease (I–II) which was comparable to 82% in the laparotomy group. Eighty-one percent of cases in the robot group and 67% of cases in the laparotomy group had endometrioid histology. The remainder of cases had uterine papillary serous adenocarcinoma, clear cell carcinoma, or rarely carcinosarcoma. Non-endometrioid high-risk histology was designated grade-3. Seventy-seven percent of cases in the robot group, and 57% in the laparotomy group had grade 1–2 histology. All patients underwent a total hysterectomy and bilateral salpingo-oopherectomy except for one case in the robot group that had retroperitoneal lymphadenectomy after an incidental carcinoma was discovered on a hysterectomy specimen. Ninety five percent of patients in both groups underwent pelvic lymph node dissection. Sixty-eight percent of cases in the robotic group and 74% in the laparotomy group underwent para-aortic lymph node dissection. Lymph node dissection was omitted due to obesity, comorbidities, lack of myometrial invasion, or a combination of the above (Table 2).

Mean number of lymph nodes retrieved was 20 in both groups. The mean uterine weight was 147 grams in the robot group, and 194 g in the open group ($P = 0.008$). The mean estimated blood loss was 119 ml in the robot group and 185 ml in the open group ($P = 0.015$) (Table 3).

Mean operative time was 127 min in the robot group, and 141 min in the laparotomy group ($P = 0.0001$). Mean time in the room was 184 min in the robot group and 191 min in the laparotomy group ($P = 0.44$) (Table 4).

Table 2
Tumor characteristics.

Variable	Robot (N = 155)	Open (N = 150)
Histology		
Endometrioid	80.6%	67.3%
Other	19.4%	32.7%
Stage		
I–II	81.3%	82%
III–IV	19.7%	18%
Grade		
1–2	76.8%	57.3%
3	23.2%	42.7%
Procedure		
T(R/A)HBSO	99.4%	100%
+ PLND	94.8%	95.3%
+ PALND	67.7%	74%

T(R/A)HBSO, Total Robotic/Abdominal Hysterectomy.
Bilateral Salpingoopherectomy.
PLND, Pelvic Lymph Node Dissection.
PALND, Para-aortic Lymph Node Dissection.