

ROBOTIC ASSISTANCE IMPROVES MINIMALLY INVASIVE SURGERY FOR ENDOMETRIAL CANCER

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ABSTRACT

Objectives: We conducted a feasibility study employing the DaVinci® Robotic Surgical System in the treatment of clinical Stage I endometrial cancer to determine whether or not hysterectomy with pelvic and para-aortic lymph node dissection could be performed with acceptable surgical and pathologic outcomes.

Methods: We performed 43 hysterectomies with staging for women with endometrial cancer using the DaVinci® Robotic System. Patient demographics, operative details, complications, pathology results and post-operative course were documented prospectively and compared with a historical cohort of patients from our institution who underwent laparoscopic hysterectomy with staging.

Results: The average patient age was 61 for both patient groups, and the average quietlet index was 32.2 for the robotic cohort versus 29.2 for the laparoscopic cohort (p=0.008). There were no conversions to laparotomy in the robotic group compared with 3% in the laparoscopy group. Pelvic and para-aortic lymphadenectomy was completed in 95% and 91% in the robotic group as compared with 96% and 94% in the laparoscopy group (p=NS). There were significantly more lymph nodes recovered in the robotically staged patients 29.8 versus 23.2 (p=0.004). In addition, a mean of 7 left para-aortic nodes were recovered in the robotic cohort compared to no attempted left para-aortic node dissections in the laparoscopy group. The mean blood loss in the robotic group was 63 mL (25-300 mL) with 45% of patients having no measurable blood loss compared with 142 mL (50-700) in the laparoscopy group (p=0.0001). Mean operative time was 163 minutes compared with 213 in favor of the robotic cohort (p=0.002). Hospital stay was 1.0 versus 1.2 in favor of robotic cohort (p=0.04). There was a 4.6% major complication rate in the robotic group compared with 12.8% in the laparoscopy group.

Conclusions: Robotic assisted hysterectomy with staging for endometrial cancer is feasible and safe. When compared with laparoscopy, robotic assistance significantly shortens operative time and hospital stay, decreases blood loss, improves lymph node recovery and is associated with fewer major complications.

INTRODUCTION

Uterine corpus cancers are the most common malignancies in the United States with approximately 41,200 women being diagnosed and 7,350 women succumbing to their disease in 2006¹. The majority of the corpus cancers are of endometrial origin and in these women, surgical staging has been adopted as the primary treatment for endometrial cancer as clinicians are better able to tailor adjuvant treatment with radiation and chemotherapy. Thus, treatments designed based upon uterine factors alone are typically excessive for many women and not enough for others. In addition, gynecologic oncology patients are often elderly and have medical co-morbidities such as obesity, hypertension, diabetes and cardiovascular disease, which increase their surgical risk. Efforts to reduce surgical morbidity are needed to improve outcomes in this patient population.

The most significant advancement in reducing surgical morbidity in gynecologic oncology over the last fifteen years has been an increased application of minimally invasive surgical (MIS) techniques for performing simple hysterectomy, radical hysterectomy, pelvic and para-aortic lymph node dissection. Patients treated laparoscopically have been shown to experience less intra-operative blood loss, less post-operative pain and shorter hospital stays. Despite these patient advantages, MIS for the treatment of gynecologic malignancies is still the exception and not the rule. Naumann et al surveyed members of the Society of Gynecologic Oncologists to evaluate treatment patterns for endometrial cancer. They observed that while 49% of gynecologic oncologists that responded to the survey stated that they used laparoscopy to stage endometrial cancer, less than 8% laparoscopically staged at least half of their patients². Some reasons cited for such limited use of laparoscopy in gynecologic oncology include longer operative times, a steep learning curve to adopt minimally invasive techniques, lack of training for surgeons who have already completed formal medical training and perceived inferiority of some of the procedures.

Robotic technology offers the promise of overcoming many of the shortcomings of laparoscopy by providing 3-D imaging with depth perception, and increased dexterity with wristed instruments providing seven degrees of freedom. The DaVinci® Surgical System (Intuitive Surgical Inc., Sunnyvale, California) is currently the only one robotic surgical platform commercially available and FDA approved for performing gynecologic oncology procedures. Introduced in 1999, the DaVinci® is comprised of three components: the patient side surgical cart, the vision system and the surgeon console. The surgical cart is composed of three to four arms for controlling a 12mm 3-D camera, and two to three surgical instruments (Figure 1). The surgical cart is "docked" to proprietary laparoscopic trocars placed in the patient's abdomen. The video signal from each of two CCD cameras is then processed independently by the vision cart and delivered to the surgeon console and displayed on two separate monitors. These two monitors are focused for the surgeon at the console and viewed as "right" and "left" eye to reconstruct a three dimensional, immersive view of the surgical field. The robotic instruments are "wristed", providing 7 degrees of freedom compared with 4 with traditional laparoscopy (Figure 2). We conducted a feasibility study employing the DaVinci® Surgical System in the treatment of clinical Stage I endometrial carcinoma.



Figure 1: DaVinci® Surgical System (Photo courtesy of Intuitive Surgical, Sunnyvale, California)

MATERIALS AND METHODS:

Patient Selection

With Institutional Review Board approval, we collected demographic, operative, post-operative and pathology data. Patient selection criteria were identical to our standard treatment parameters for clinical stage I endometrial carcinoma. All patients received a mechanical bowel prep and prior abdominal/pelvic surgery was not considered a contraindication. Our control group consisted of 101 women who underwent total laparoscopic hysterectomy, bilateral salpingo-oophorectomy, bilateral pelvic and right para-aortic lymphadenectomy between 2000-2004.

Port Placement and Docking

Port placement is shown in Figure 3. It is important to place the patient in maximum trendelenburg and to insufflate the abdomen prior to marking and inserting the robotic instrument and assistant ports as patient abdominal position will change and these relationships are critical for successful operation of the robotic system. The DaVinci® robot is then docked to the patient at the foot of the bed. Once docked, the bed is locked into position and cannot be moved while the system is docked. The robotic Endo Wrist® instruments are then placed within the abdomen under direct visualization.

Surgical Procedure

While there is reference to staging of gynecologic malignancy in an early series of robotic assisted hysterectomy cases, there were no published or unpublished descriptions of technique or standardized approaches to performing robotic assisted hysterectomy or lymphnode dissection when we began our program in May, 2005^{3,4}. We therefore, translated an already familiar technique of total laparoscopic hysterectomy described by Koh et al in 1998 for performing simple hysterectomy, which incorporates a Zumi uterine manipulator, KOH colpotomizer rings, and a pneumo-occluder balloon to the DaVinci® (Cooper Surgical, Trumbull, Connecticut)⁵. The KOH system facilitates para-cervical dissection when performing simple hysterectomy and has been reviewed in many clinical series. Trans-peritoneal lymph node dissection was performed per FIGO guidelines for the staging of endometrial cancer (Figure 4). All surgical techniques adhered to the same approaches taken with traditional laparotomy with respect to anatomic planes and surgical margins, with the exception that clamps and sutures were replaced with bipolar and monopolar energy sources for vessel sealing. Meticulous prospective collection of operative times broken down into components, including induction of anesthesia and patient positioning, trocar placement and docking of the robotic surgical system, as well as the individual components of performing hysterectomy and lymph node dissection was performed for each case in order to track progress and critically assess areas for refinement of technique.

Statistics

Chi-square and Fisher's exact test were used to identify differences between groups for categorical variables. P-value <0.05 was considered statistically significant.



Figure 2: EndoWrist® robotic instrument. (Photo courtesy of Intuitive Surgical, Sunnyvale, California)

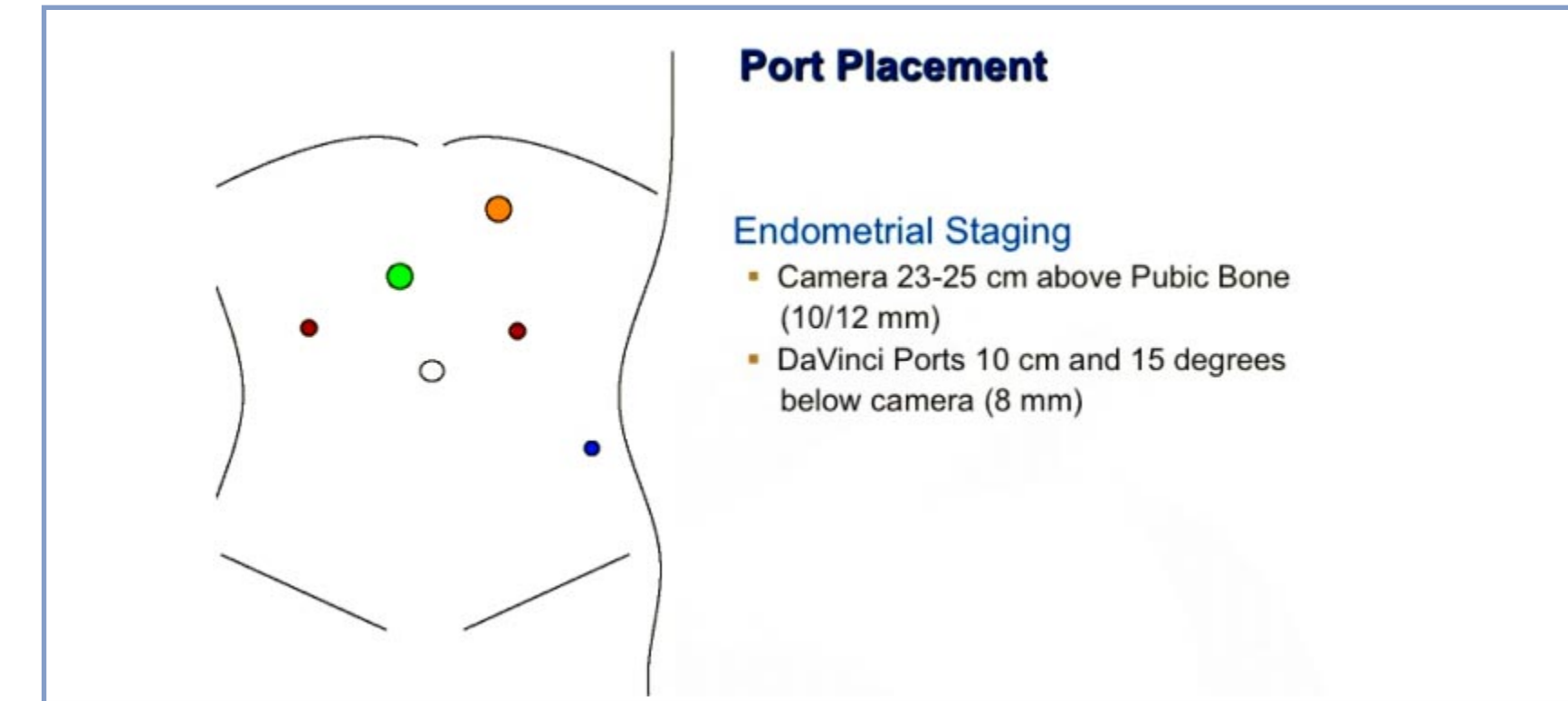


Figure 3: Port placement for endometrial cancer staging with the DaVinci® Surgical System

RESULTS

Patient demographics are shown in Table 1. None of the robotic patients were converted to laparotomy vs. 3% for the laparoscopy group, we retrieved significantly more nodes (30 vs. 23, p=0.004), lost less blood (63 vs. 142 cc, p = 0.0001), required less operative time (163 vs. 213 minutes, p = 0.002), and sent patients home faster (1 vs. 1.2 days, p = 0.04) compared with our laparoscopy cohort. What may be most significant is that we were able to perform comprehensive staging on larger women (BMI 32 vs. 29, p = 0.008).

SURGICAL PROCEDURE

	Total laparoscopic (n=101)	Robotic assisted (n=43)	p-value
Age (years)	61	61	NS
Quietlet Index	29.2	32.2	0.008
Estimated blood loss (mL)	142	63	0.0001
OR time (min)	213	163	0.002
Lymph nodes (pelvic and right para-aortic)	23.2	29.8	0.004
Left para-aortic lymph nodes	0	7	
Hospital stay (days)	1.2	1.0	0.04
% complications	12.8%	4.6%	
% conversion to laparotomy	3%	0%	

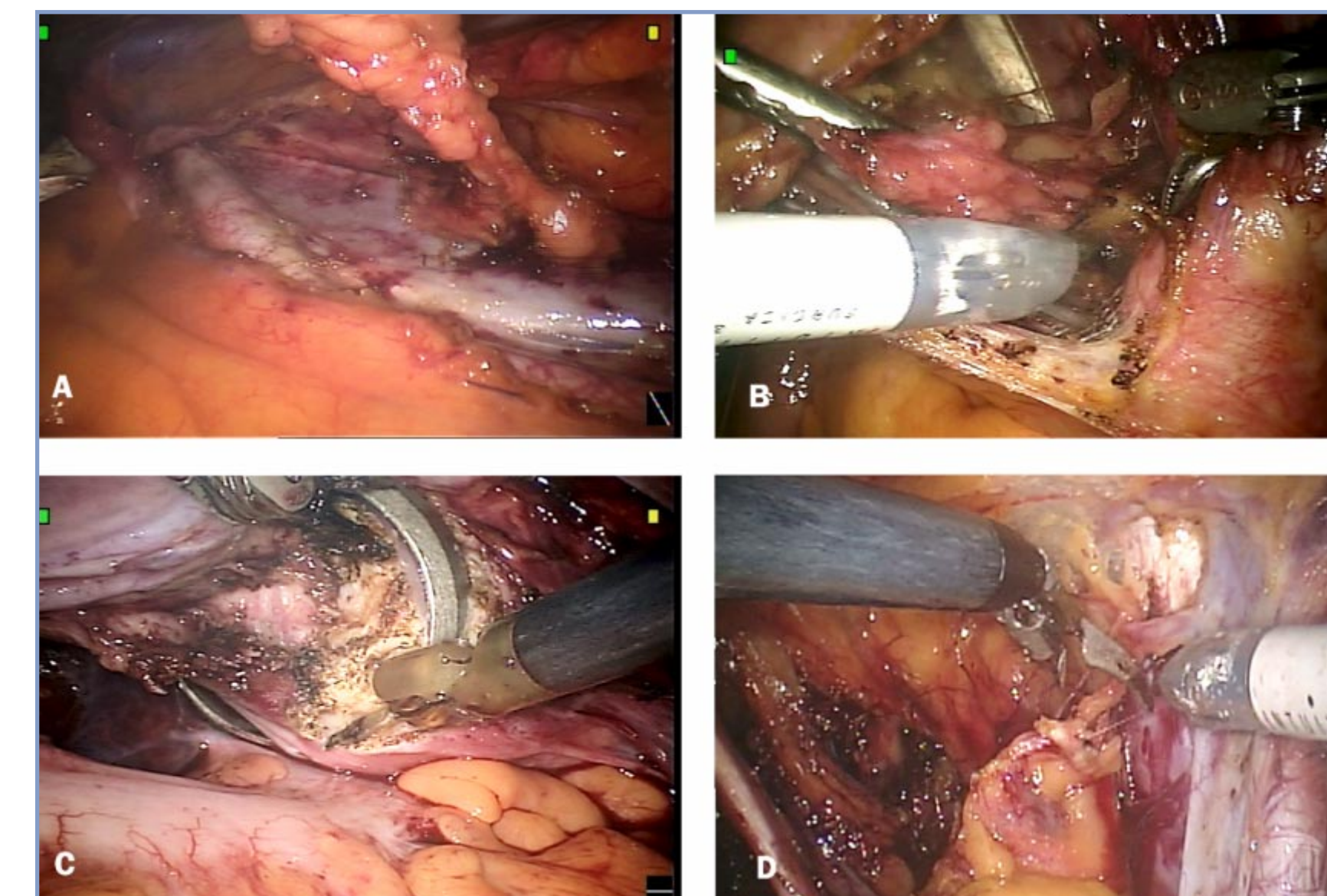


Figure 4: Lymphadenectomy performed with the DaVinci® Surgical System (A: Right para-aortic nodes; B: Left para-aortic nodes; C: Hysterectomy with Koh colpotomy ring; D: Right pelvic nodes)

CONCLUSIONS

1. Robotic assisted hysterectomy with staging for endometrial cancer is feasible and safe.
2. When compared with laparoscopy, robotic assistance significantly shortens operative time and hospital stay, decreases blood loss, improves lymph node recovery and is associated with fewer major complications.
3. Widespread adoption of MIS will depend on more broad incorporation into training of residents and fellows. As has been seen in Urology, robotics should allow us to experience shallower learning curves and greater generalizability to more practitioners previously discouraged by the limitations of standard laparoscopy.
4. Issues such as certification of graduating trainees will need to be standardized as training programs grow. The Society of Gynecologic Oncologists as well as the American College of Obstetricians and Gynecologists should take a proactive role in standardizing training and certification.

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