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A multi-institutional experience with robotic-assisted radical hysterectomy for early stage cervical cancer

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ABSTRACT

Objective. The purpose of the study is to report a multi-institutional experience with robotic-assisted radical hysterectomy to treat patients with early stage cervical cancer with respect to perioperative outcomes.

Methods. A multi-institutional robotic surgical consortium consisting of five board-certified gynecologist oncologist in distinct geographical regions of the United States was created to evaluate the utility of robotics for gynecologic surgery (benign and malignant). Between April 2003 and August 2008, a total of 835 patients underwent robotic surgery for benign gynecologic disorders and/or gynecologic malignancies by a surgeon in the consortium. IRB approval was obtained and data was collected in a prospective fashion at each institution. For the purposes of the study, a multi-institutional HIPPA compliant database was then created for all patients that underwent robotic-assisted surgery between the April 2003 and August 2008. This database was queried for all patients who underwent a robotic-assisted type II or III radical hysterectomy for Stage IA1 (+vsi)-IB2 cervical carcinoma. Forty-two patients were identified. Records were then reviewed for demographic data, medical conditions, prior abdominal or pelvic surgeries, and follow-up. The perioperative outcomes analyzed included: operative time (skin–skin), estimated blood loss (EBL), length of hospital stay, total lymph node count, conversion to laparotomy, and operative complications.

Results. From a database of 835 patients who underwent robotic surgery by a gynecologic oncologist, a total of 42 patients who underwent a robotic-assisted type II ($n=10$) or type III ($n=32$) radical hysterectomy for early stage cervical cancer were identified. Demographic data demonstrated a median age of 41 and a median BMI of 25.1. With regard to stage, seven patients (17%) were Stage IA2, twenty-eight patients (67%) were Stage IB1 and six patients (14%) were Stage IB2. There was a single patient with Stage IA1 cervical cancer with vascular space invasion who underwent a type II radical hysterectomy. The overall median operative time was 215 min. The overall median estimated blood loss was 50 cc. No patient received a blood transfusion. The median lymph node count was 25. The median hospital stay was 1 day. Positive lymph nodes were detected in 12% of the patients. Pelvic radiotherapy or chemo-radiation was given to 14% of the patients based on final surgical pathology. Intraoperative complications occurred in 4.8% of the patients and included one conversion to laparotomy (2.4%) and one ureteral injury (2.4%). Postoperative complications were reported in 12% of the patients and included a DVT (2.4%), infection (7.2%), and bladder/urinary tract complication (2.4%) The conversion rate to laparotomy was 2.4%.

Conclusions. Robotic-assisted radical hysterectomy is associated with minimal blood loss, a shortened hospital stay, and few operative complications. Operative time and lymph node yields are acceptable. This data suggests that robotic-assisted radical hysterectomy may offer an alternative to traditional radical hysterectomy. This series contributes to the growing literature on robotic-assisted radical hysterectomy and prospective comparisons with traditional radical hysterectomy are needed.

Introduction

The use of minimally invasive surgery (laparoscopy) for the treatment of endometrial and cervical cancer was first described in the early 1990s. These initial experiences demonstrated the safety and feasibility of minimally invasive surgery to treat these disorders [1–6].

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In addition, it has been demonstrated that minimally invasive surgery is associated with less blood loss, shorter hospital stay, less post-operative pain, improved cosmesis, and a faster recovery when compared to traditional approaches [7–11]. Yet despite these advantages, recent surveys of practicing gynecologic oncologist revealed that most respondents believed minimally invasive surgery (conventional laparoscopy) had only a minimal role in the management of cervical cancer [12]. It is likely that well-known barriers to the utilization of advanced minimally invasive procedures such as association with a long learning curve, lack of training, complexity of operations, limitation of technology and instrumentation, and the necessity of an expert assistant were responsible for this sentiment.

Recent advances in the field of minimally invasive surgery have focused on the incorporation of robotic technology for the treatment of gynecologic malignancies. The da Vinci surgical system is a robotic surgical platform that was FDA approved in April 2005 for gynecologic applications. Since that time, a small number of investigators have reported limited series documenting their experience with robotic surgery for the treatment of endometrial and cervical cancers [13–19]. Boggess et al. recently reported the largest series to date documenting the outcomes of 51 consecutive patients who underwent robotic radical hysterectomy with excellent outcomes [20]. In these initial reports, it appears that the barriers to conventional laparoscopy can be overcome with robotic surgery for complex operations. For example, the robotic system incorporates a 3-D stereoscopic vision system and wristed instrumentation that provides improved dexterity and precision. The system allows for complex procedures to be completed by a single surgeon with a novice bedside assistant alleviating the need for an expert assistant. It more mimics traditional surgical approaches to pelvic surgery as compared to conventional laparoscopy and has recently been associated with a shortened learning curve [16,18]. These advantages potentially make it the ideal tool for performing complex oncologic procedures such as a radical hysterectomy that requires delicate dissection (cardinal ligament, ureter, and pelvic vessels) while maintaining oncologic radicality.

Finally, evidence has accumulated in the literature suggesting that a minimally invasive radical hysterectomy is associated with a similar oncologic outcome as traditional approaches [7,21–25]. Recognition of the underutilization of a minimally invasive (laparoscopic) approach for radical hysterectomy in the United States has led gynecologic oncologists to examine the use of robotic radical hysterectomy for early stage cervical cancer [16–20]. This study was undertaken to analyze a multi-institutional experience with robotic-assisted radical hysterectomy for cervical cancer.

Materials and methods

A multi-institutional robotic surgical consortium consisting of five board-certified gynecologist oncologists in distinct geographical regions of the United States was created to evaluate the utility of robotics for gynecologic surgery (benign and malignant). Regions of the United States represented included the Southeast, the Midsouth, and the Midwest. Between April 2003 and August 2008, a total of 835 patients underwent robotic surgery for benign gynecologic disorders and/or gynecologic malignancies by a surgeon in the consortium. IRB approval was obtained and data was collected in a prospective fashion at each institution. For the purposes of the consortium, a multi-institutional HIPPA compliant database was then created for all patients that underwent robotic-assisted surgery between the April 2003 and August 2008. This database was queried for all patients who underwent a robotic-assisted type II or III radical hysterectomy for Stage IA1 (+vsi)-IB2 cervical carcinoma. Forty-two patients were identified. Records were then reviewed for demographic data, medical conditions, prior abdominal or pelvic surgeries, and follow-up. The perioperative outcomes analyzed included: operative time (skin–skin), estimated blood loss (EBL), length of hospital stay, total lymph node count, conversion to laparotomy, and operative complications.

All members of the consortium were among early adopters of robotic technology for use in gynecologic surgical applications in their respective regions of the country. For credentialing and training purposes, each surgeon completed an on-line training course, a 1–2 day porcine surgical lab, case observations, and individual case proctoring (2–5 cases per surgeon) prior to receiving robotic surgical privileges at their respective institutions. The length of robotic surgical experience for all surgeons in the consortium ranged from 2–5 years for all surgeons at the time of data analysis. Prior experience with advanced laparoscopy also varied among the surgeons from no prior experience reported by one surgeon to another having served as a postgraduate instructor on advanced laparoscopy at SGO annual meetings. However, none of the surgeons had previously performed a laparoscopic radical hysterectomy prior to implementation of robotics at their respective institutions. All surgeons were well versed on the technique of traditional open type II and type III radical hysterectomy. Practice patterns varied among the members from private practice to university-affiliated private practice to university-affiliated academic practice. All radical hysterectomies were performed with either the da Vinci S or da Vinci Standard Surgical System.

Results

From a database of 835 patients who underwent robotic surgery for gynecologic diseases (benign and malignant), a total of 42 patients who underwent a type II or III robotic-assisted radical hysterectomy for cervical cancer were identified. Ten patients underwent a robotic-assisted type II radical hysterectomy and thirty-two underwent a robotic-assisted type III radical hysterectomy. All five members of the consortium had performed at least one robotic radical hysterectomy at the time of manuscript submission. With regard to patient demographics, the median age was 41 and the median BMI was 25.1. Cancer stage was analyzed and demonstrated that there was one patient with Stage IA1 disease with vascular space invasion, seven patients (17%) with Stage IA2 disease, twenty-eight patients (67%) with Stage IB1 disease, and six patients (14%) with Stage IB2 disease. One-half of the patients reported a prior abdominal surgery. One or more medical comorbidities such as diabetes, hypertension, chronic obstructive pulmonary disease and obesity were reported in approximately one-third of the patients.

Operative outcomes were analyzed for all cases identified. In addition, operative outcomes were analyzed for all type II and type III robotic-assisted radical hysterectomy, and individual surgeon experience. The overall median operative time was 215 min. The overall median estimated blood loss was 50 cc. No patient received a blood transfusion intraoperatively or postoperatively. The overall median lymph node count was 25. The median hospital stay was 1 day. Positive lymph nodes were detected in 12% of all patients. No positive parametrial or vaginal margins were reported. Adjuvant pelvic radiotherapy or chemo-radiation was given to 14% of all patients.

Table 1
Operative findings

Operative findings	Overall	Type II	Type III
	$n=42$	$n=10$	$n=32$
Median operative time	215 min (120–606)	166 min (120–243)	216 min (165–606)
Median estimated blood loss	50 cc (25–150)	40 cc (25–200)	50 cc (25–200)
Median nodal count	25 (12–60)	22 (12–25)	25 (12–60)
Median postoperative stay	1 day	1 day	1 day
Conversion to laparotomy	1	None	1
Transfusions	None	None	None