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ORIGINAL RESEARCH

Intraoperative Complications and Conversion to Laparatomy in Gynecologic Robotic Surgery

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ABSTRACT

Introduction: In this study our objective was to document complications encountered during our initial experience with the robotic system and also state the cases in which conversion to laparotomy was necessary.

Material and Methods: This study is a retrospective analysis of robotically performed gynecological and gynecologic oncology procedures at a single center from July 2016 to July 2018. Patient demographics and preoperative indications were obtained from the electronic medical records.

Results: The patients had a mean age of 53.6 years (range, 25–84 years). The operative time ranged from 1 h and 50 min to 9 h (mean, 5 h and 2 min). Most of the complications were managed within minutes and with robotic assisted suturing when necessary. Five patients out of 83 patients needed a surgical conversion from robotic surgery. Conversion rate was 6.02%.

Conclusion: During the study period we were able to manage complications uneventfully without requiring conversion to laparotomy most of the time. Vascular complications encountered during robotic surgery can be managed without requiring conversion to laparatomy.

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KEYWORDS
Robotic surgery; minimally invasive surgery; conversion; complications; surgery

Introduction

Minimally invasive surgery (MIS) has reformed the way we deal with gynecologic diseases over the last decades. Furthermore, the most significant advancements have been initiated with the arrival of robotic surgery [1]. Before the advent of robotics, compared to open surgery, laparoscopy enabled a less invasive approach to gynecologic surgery. Nonetheless, not all gynecologists are competent with laparoscopic surgery owing to its arduous learning curve.

The robotic surgical system has revolutionized solutions for numerous restrictions of laparoscopy which include lack of tissue depth perception, limited range of motion, and unsteady camera view [2]. Robotic surgery is a tele-surgical system that enables the surgeon to operate at a console away from the patient. The 3 D image provided by the lens allows the surgeon to obtain a virtual view of the surgical area with the supplementary gain of tissue magnification [3].

In Istanbul Turkey, Umraniye Research and Training hospital the Da Vinci Xi surgical system (Intuitive Surgical, Sunnyvale, CA, USA) has been used since 2015. The gynecology department started utilizing it in 2016. In this study our objective was to document complications encountered during our initial experience with the robotic system and also state the cases in which conversion to laparotomy was necessary.

Material and methods

This study is a retrospective analysis of robotically performed gynecological and gynecologic oncology procedures at a single center from July 2016 to July 2018. A single surgeon with advanced skills in robotic surgery (GK) performed all procedures. An Institutional Review Board approval was obtained by Bezmialem Vakif University and Umraniye Research and Training Hospital approval No: 383/2020). The primary endpoint was surgical complications and conversion to laparotomy. Conversion to laparotomy included any incision other than those required for trocar placement or incision for delivery of the specimen.

All surgeries were performed with the da Vinci Xi surgical system (Intuitive Surgical Corporation, Sunnyvale, California, USA) incorporating either two or three arms depending on surgeon preference. A Rumi II uterine manipulator (Cooper Surgical Inc, Trumbull, CT) was placed prior to starting the surgery in each case. A resident physician assisted these cases for uterus manipulation and specimen retrieval when needed [4].

Patient demographics and preoperative indications were obtained from the electronic medical records. The Clavien-Dindo system [5] does not have a grade for intraoperative complications therefore complications were defined and recorded as follows:

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- Failed entry: inability to enter the peritoneum after three trials of Veress needle entry.
- Vascular injury: damage to any pelvic or abdominal blood vessels.
- Nerve injury damage to pelvic or intraabdominal nerves.
- Visceral injury: serosal or full-cut damage to the viscera including the bowel, ureter and bladder.
- Solid organ injury: damage of a solid abdominal/ pelvic organ
- Tumor fragmentation: inadvertent dissemination of tumoral tissue
- Anesthetic complication: any complication due to the anesthetic management of the patient.

Patient demographics, indication for surgery, type of surgery, total surgery time, complications encountered, management of complications and conversion from robotic surgery were collated into an Excel spreadsheet for analysis. The median and range (minimum – maximum) were used to report continuous variables. Absolute frequency and percentages were used to report categorical variables.

Results

Surgeries were performed from January 2016 to July 2018. A total of 83 women underwent robotic surgery at the gynecology and the gynecologic oncology department of the Umraniye Research and Training Hospital.

The patients had a mean age of 53.6 years (range, 25–84 years). Patient demographics are presented in Table 1. The operative time ranged from 1 h and 50 min to 9 h (mean, 5 h and 2 min). The indications for surgery were atypical endometrial hyperplasia (n = 11), endometrial carcinoma (n = 50), early-stage cervical cancer (n = 8), ovarian cancer (n = 1), malignancy of unknown origin (n = 1), uterine myoma (n = 9), cervical insufficiency (n = 1), vaginal agenesis (n = 1) and endometriosis (n = 1). Surgeries included myomectomy, tubal reanastomosis, hysterectomy, radical hysterectomy, unilateral and bilateral salpingo-oophorectomy, paraaortic and pelvic lymph node dissection (PA + PLND) and Davydov procedure for vaginal agenesis. The procedures are demonstrated in Table 2.

Most of the complications were managed within minutes and with robotic assisted suturing when necessary. After three attempts of failed Veress needle entry, a 10 mm trocar entry was accomplished successfully in all cases. There were 9 cases of vascular injury. Six of these were venous of origin (left common iliac vein (n = 1), inferior vena cava (n = 3), external iliac vein (n = 1), and trocar site bleeding (n = 1)). Three cases of bleeding were of arterial origin (uterine artery (n = 1), inferior mesenteric artery (n = 1), and abdominal aorta (n = 1)). All bleeding was managed with robotic instruments utilizing either bipolar coagulation, suturation or surgical clip placement. There was one case of nerve injury. The genitofemoral nerve was cut during lymphadenectomy. It was sutured robotically. All cases of visceral injuries were serosal and managed with suturing There were 4 cases in which uterine rupture (solid organ injury) happened; these were either due to initial manipulator placement or excessive manipulation during surgery. There were no other intraabdominal solid organ injuries. The intraoperative complications are presented in Table 3.

Five patients out of 83 patients needed a surgical conversion from robotic surgery (Table 4). The conversion rate in our cohort was 6.02%. One case was converted to laparoscopy because of intractable hypercapnia, the other four cases were converted to laparotomy. Table 4 defines the reasons and details for conversion. For patient 1; the patient had ovarian cancer. Upon surgical exploration a tumoral implant embedding the aorta was observed. The decision to turn to laparotomy was made in fear of major vessel injury. The second case was a patient with advanced stage endometrial carcinoma. Whilst performing paraaortic lymphadenectomy, the visceral fat content and patients BMI obscured the surgical field. The third patient was undergoing a Wertheim operation with a diagnosis of cervical cancer. It is important to resect the surgical specimen including the uterus and the parametriums en bloc. This could not be accomplished due to poor visualization. During the fourth patient's operation a robotic arm malfunction occurred.

Table 1. Patient demographics.

Age	53.6(25-84)
Operative time (minutes)	302(110-540)
Body Mass Index	28.2 (22-45)
Race	Caucasian*

*All patients in our study group were of Turkish nationality and were born in Turkey.

Table 2. Robotically performed procedures.

Procedure	N	%
Myomectomy	6	7.1
Myomectomy + tubal reanastomosis	1	0.01
Hysterectomy	1	0.01
Hysterectomy + BSO	22	26.2
Hysterectomy + BSO + PLND	8	9.5
Hysterectomy + BSO + PLND + PALND	32	39.3
Radical Hysterectomy + BSO + PLND + PALND	10	11.9
Hysterectomy + Ovarian transposition	1	0.01
Endometriosis resection	1	0.01
Vaginal agenesis- Davydov procedure	1	0.01

Table 3. Intraoperative complications and management.

Complication	Management	N(%)
Failed Veress Entry	Direct trocar entry	5 (5.95)
Vascular injury	Suturation, coagulation, surgical clip	9 (10.71)
Nerve injury	Primary suturation	1(1.19)
Visceral injury	Primary suturation	8(9.52)
Solid organ injury	Primary suturation	4(4.76)
Hypercapnia	Conversion to laparoscopy	1(1.19)
Tumor fragmentation	Irrigation	1(1.19)

Table 4. Reasons for conversion.

Patient	Diagnosis	Type of conversion	Reasons for conversion
#1	Ovarian cancer	Laparatomy	Poor visualization
#2	Endometrial cancer	Laparatomy	Poor visualization
#3	Cervical cancer	Laparatomy	Poor visualization
#4	Endometrial cancer	Laparatomy	Technical difficulty with robot
#5	Myoma	Laparoscopy	Hypercarbia and acidosis

Because the padding in robotic surgery does not enable access to the anesthesia team after docking, removal of the robot dock and adjusting the Trandelenburg position to enable laparoscopic instrumentation was sufficient management for this patient.

Discussion

During the study period we were able to manage complications uneventfully without requiring conversion to laparotomy most of the time. For vascular injuries the robotic system enabled easy hemostatic control and suturing. For the cases that a laparotomic conversion was necessary the major handicap was due to poor visualization. Bell et al described that, compared with laparoscopy, robotically assisted laparoscopy significantly reduced operative complications [3]. DeNardis et al. compared the results of 106 patients who underwent laparotomy with 56 patients who had undergone robotic surgery for endometrial cancer [6]. The procedure was converted to laparotomy in 5.4% of the cases due to intraoperative complications.

In our series none of the vascular injuries needed conversion to laparotomy. All vascular injuries were able to be sutured robotically. Major vascular lacerations lead to a rapid loss of hemodynamic status, and require speedy intervention in order to avoid mortality [7]. In an important study comparing laparoscopic surgery to laparotomy for uterine cancer staging, the incidence of patients with arterial hemorrhage was marginally more in the laparoscopy group than in the laparatomy group (1.8% v 0.7%) [8]. Similarly, in the report by Seamon et al comparing laparoscopic surgery to robotic surgery there were no patients needing conversion to laparotomy for vascular injury [9]. Likewise in our series we were able to avoid conversion to laparotomy with rapid robotic suturing and achievement of hemostasis. We propose that robotic management of bleeding is superior to laparoscopic management in such cases which might result in catastrophic outcomes if not acted immediately.

The overall prevalence of conversion from robotic surgery to laparotomy in our study (6.02%) was akin to results by Patzkowsky and colleagues who have reported that conversion from robotic surgery was lower compared to laparoscopic procedures (1.7% vs 6.2%) [10]. The lowest conversion rate in the literature is given by a large retrospective study encompassing 1155 patients who underwent robotic assisted gynecologic surgery which reported the incidence of conversion to laparotomy as 2.7% [11].

There was one patient in our cohort that required conversion due to anesthesia and/or hypercapnia complication. In the report by Badawy et al detailing anesthetic complications of robotic surgery, 24 patients (18%) developed hypercapnia defined by the end-tidal Co2 concentration >45 mm H20 [12]. These patients were managed successfully by the anesthesia team and there was no mention of conversion to laparoscopy or laparotomy. In our case series there was one incident of genitofemoral injury and this was encountered during lymphadenectomy. In a report by Nezhat et al, the obturator nerve is described to be inadvertently cut during pelvic lymphadenectomy. The injury was auspiciously repaired with 4-0 polyglactin sutures in 12 minutes [13]. We would also like to underline that besides the aforementioned case of genitofemoral nerve injury, there were no position related upper extremity or lower extremity neuropathies in our study population.

Surgical conversion has been used as an indicator of mastery of robotic skills [14] and it is promising to note that published studies state that robotic skills are somewhat easier to master than laparoscopic skills [15]. Lim and colleagues have stated that 25 robotic cases are required to reach proficiency in robotic surgery [16]. Another study by the same author concluded that the completion of the learning curve for robotic surgeries required half the number of cases compared to the same laparoscopy operations [17].

The major limitation in our series is that it is a retrospective and noncomparative study.Therefore we are not able to compare our results with laparoscopy. Additionally as we reported the results of procedures performed by a single surgeon at a single institution, these results may have limited application to other centers and operators. The strengths of our study include being the first report from our country to report both peroperative complications and conversions from robotic surgery in gynecologic surgery.

Conclusion

During the study period we were able to manage complications uneventfully without requiring conversion to laparotomy most of the time. Vascular complications encountered during robotic surgery can be managed without requiring conversion to laparotomy.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Precis

We conducted a medical chart review of robotic surgeries performed at a single instutition by a single surgeon and presented the intraoperative complications and conversions from robotic surgery.

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