Robotic-assisted minimally invasive surgery and ovarian cancer

"The improved visualization and dexterity obtained by robotics increases the proportion of patients that can benefit from the minimally invasive surgical approach."

Zvi Vaknin

Division of Gynecologic Oncology, McGill University Segal Cancer Center, Jewish General Hospital, Montreal, Quebec, Canada

Walter H Gotlieb

Author for correspondence: Division of Gynecologic Oncology, McGill University Segal Cancer Center, Jewish General Hospital, Montreal, Quebec, Canada
Tel.: +1 514 340 8222 ext. 3114
Fax: +1 514 340 8619
walter.gotlieb@mcgill.ca

Ovarian cancer is the fifth most common cancer in women, and the most lethal gynecologic malignancy in western countries. Approximately 70% of malignant ovarian cancers are diagnosed with diffuse intraperitoneal spread. The treatment algorithm for ovarian cancer consists of the combination of maximal cytoreductive surgery and chemotherapy [1]. Advanced stages, requiring major tumor debulking, represent a different challenge for the minimally invasive surgical approach compared with early ovarian cancer that requires removal of the tumor and staging.

The surgical approach for the treatment of ovarian cancer has classically been performed through a midline incision. Treatments include: hysterectomy, bilateral salpingo-oophorectomy, omentectomy with or without pelvic and/or para-aortic lymphadenectomy, pelvic washings, peritoneal and diaphragmatic biopsies and removal of any macroscopic resectable disease. This is then followed by adjuvant chemotherapy either intravenously or intraperitonealy with a platinum derivative and a taxane. Following presentation of the EORTC-GCG/NCIC-CTG randomized trial comparing primary debulking surgery with neoadjuvant chemotherapy in advanced ovarian cancer, neoadjuvant cytoreductive chemotherapy followed by interval surgery has become an alternative approach to major upfront debulking surgery. This has paved the way for the introduction of minimally invasive surgery in the treatment algorithm of advanced ovarian cancer [2].

Laparoscopy in the management of ovarian cancer

The basic concept of minimally invasive surgery lies in the ability to perform a full surgical procedure by introducing a camera and the surgical instruments through a series of small abdominal incisions (mostly 5–12 mm). The advantages of laparoscopy over traditional laparotomy include improvement of vision, reduction of perioperative morbidity, shorter hospitalization, less postoperative pain and earlier return to daily activities.

Laparoscopy is the mainstay for the evaluation of adnexal masses, as most of these masses are benign. In the event an ovarian cancer is found, most surgeons will convert to laparotomy. In selected centers with highly skilled laparoscopists, apparent early ovarian cancers are treated with minimally invasive surgery. The largest study of laparoscopic primary staging procedures for early invasive ovarian carcinoma included 36 patients with no fatalities after a mean follow-up of 55.9 months [3]. This study, as well as a small case–control study comparing laparotomy versus laparoscopy for early ovarian cancer, suggests that minimally invasive surgery is safe and efficacious in the treatment of early ovarian cancer [4].

"Improved flexibility and decreasing bulkiness of the robotic arms associated with increased usage of the da Vinci computer interface, as well as the development of improved translational therapies, is expected to further expand the indications of robotics in the treatment algorithm of ovarian cancer."

In advanced ovarian cancer, four applications have emerged for the use of minimally invasive surgery. Laparoscopy has been used as a triage tool for resectability, an evaluation tool for second-look surgery, an adjunct in the placement of intraperitoneal catheters for the delivery of intraperitoneal chemotherapy, and occasionally as the main surgical approach for debulking by expert laparoscopists in highly selected cases [5]. Recently, a case series of 32 selected patients demonstrated the feasibility of laparoscopic debulking yielding an 80% rate of optimal debulking, with acceptable short-term outcome [6].

part of future medicine fsg

Robotic-assisted minimally invasive surgery & gynecologic cancer

Despite the well-established improvement of quality of life in patients undergoing laparoscopy compared with laparotomy, this surgical approach has not gained widespread usage in view of the long learning curve, limited degree of instrument motion, counterintuitive hand movements, 2D vision and ergonomic difficulty.

By contrast, minimally invasive surgery using robotic assistance offers 3D high-definition vision, greater dexterity of the instruments mimicking the natural wrist movements, tremor-free movements, smaller instruments and ergonomic positioning for the surgeon.

Disadvantages include the cost of this new technology, the lack of haptics and the fact that once the robot is docked to the patient the bed cannot be moved [7].

> "*The faster recuperation following surgery is associated with an improved quality of life and enables the treating physician to (re)initiate chemotherapy earlier.*"

The emergence of robotic-assisted minimally invasive surgery as a far more feasible minimally invasive approach, which overcomes the obstacles of traditional laparoscopic surgery, has allowed gynecologic oncologists to provide minimally invasive surgery to a greater percentage of patients [7,8]. We have noticed that in our institution, within 2 years of introduction of the da Vinci® system, the percentage of patients with endometrial and cervical cancer that have been surgically treated using minimally invasive surgery has increased to greater than 95%, compared with less than 20% in the years prior to robotics. In parallel, we performed most surgical treatments and restaging procedures for early ovarian cancer with the robot, similar to the data reported by Cho and Nezhat [9]. In advanced ovarian cancer, the data has remained sparse. Bandera and Magrina, in their review of the literature [10], mentioned their limited experience in 12 cases of primary debulking and staging procedures, four-interval debulking postneoadjuvant chemotherapy and an additional five secondary debulking procedures. Their data were encouraging with less than 300 ml of blood loss and only minimal complications [10]. Since the introduction of the robotics program, we have performed 39 robotic surgeries for known ovarian cancers or suspicious complex masses [Gotlieb WH, Lau S, Unpublished Data]. Nine patients had borderline ovarian tumors and 15 cases had ovarian cancer. A total of 12 out of these had advanced disease, 11 with primary ovarian cancer and one with metastatic breast cancer. Five patients underwent primary debulking, four patients underwent interval debulking postneoadjuvant chemotherapy, while two patients had secondary debulking. Optimal debulking was achieved in all patients, and in one case an intraperitoneal port was placed during the robotic procedure using the existing incisions. While most patients had only minimal morbidity, one 88-year-old patient passed away from complications of sepsis due to a small bowel perforation.

Consistent with the published data [10], advanced ovarian cancer surgeries remain challenging procedures due to the need to operate in all four abdominal quadrants. This often necessitates repositioning of the robot so that the arms gain better access to the surgical field.

Conclusion

The improved visualization and dexterity obtained by robotics increases the proportion of patients that can benefit from the minimally invasive surgical approach. This is most prevalent in uterine body, endometrial and cervical cancers. In ovarian cancer, in addition to the treatment of early disease and staging procedures, patients with advanced disease following neoadjuvant chemotherapy and selected patients with recurrent tumors have become candidates for a minimally invasive approach. The faster recuperation following surgery is associated with an improved quality of life and enables the treating physician to (re)initiate chemotherapy earlier. Improved flexibility and decreasing bulkiness of the robotic arms associated with increased usage of the da Vinci computer interface, as well as the development of improved translational therapies, is expected to further expand the indications of robotics in the treatment algorithm of ovarian cancer.

Financial & competing interests disclosure

WH Gotlieb has served as a proctor for robotics in Canada. The fellowship in gynecologic oncology of Z Vaknin is, in part, supported by grants from the Israel Cancer Research Foundation, the Greenbaum fund, the American Physicians Fellowship for Medicine in Israel, the Israel Cancer Association and the Dr Sima Visman fund. The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript apart from those disclosed.

No writing assistance was utilized in the production of this manuscript.

Bibliography

1 Bristow RE, Tomacruz RS, Armstrong DK, Trimble EL, Montz FJ: Survival effect of maximal cytoreductive surgery for advanced ovarian carcinoma during the platinum era: a meta-analysis. *J. Clin. Oncol*. 20, 1248–1259 (2002).

2 Vergote I, Tropé CG, Amant F *et al.*: EORTC-GCG/NCIC-CTG randomised trial comparing primary debulking surgery with neoadjuvant chemotherapy in stage IIIC–IV ovarian, fallopian tube and peritoneal cancer (OVCA). Presented at: *International Gynecologic Cancer Society Meeting*. Bangkok, Thailand, 25 October 2008.

3 Nezhat F, Ezzati M, Rahaman J *et al.*: Laparoscopic management of early ovarian and fallopian tube cancers: surgical and survival outcome. *Am. J. Obstet. Gynecol.* 200, 83 e1–e6 (2009).

4 Chi DS, Abu-Rustum NR, Sonoda Y *et al.*: The safety and efficacy of laparoscopic surgical staging of apparent stage I ovarian and fallopian tube cancers. *Am. J. Obstet. Gynecol*. 192, 1614–1619 (2005).

5 Liu CS, Nagarsheth NP, Nezhat FR: Laparoscopy and ovarian cancer: a paradigm change in the management of ovarian cancer? *J. Minim. Invasive Gynecol.* 16(3), 250–262 (2009).

6 Nezhat FR, Datta MS, Lal N *et al.*: Laparoscopic cytoreduction for primary advanced or recurrent ovarian, fallopian tube, and peritoneal malignancies. *Gynecol. Oncol.* 108, S60 (2008).

7 Visco AG, Advincula AP: Robotic gynecologic surgery. *Obstet. Gynecol.* 112(6), 1369–1384 (2008).

8 Boggess JF: Robotic surgery in gynecologic oncology: evolution of a new surgical paradigm. *J. Robotic Surg.* 1, 31–37 (2007).

9 Cho JE, Nezhat FR: Robotics and gynecologic oncology: review of the literature. *J. Minim. Invasive Gynecol.* 16(6), 669–681 (2009).

10 Bandera CA, Magrina JF: Robotic surgery in gynecologic oncology. *Curr. Opin. Obstet. Gynecol*. 21(1), 25–30 (2009).