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ORIGINAL ARTICLE

Robotic radical hysterectomy in early-stage cervical carcinoma patients, comparing results with total laparoscopic radical hysterectomy cases. The future is now?

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Abstract

Background We evaluated the feasibility and efficacy of robotic-assisted laparoscopic radical hysterectomy and bilateral pelvic lymph node dissection for early cervical carcinoma, comparing the results with those from conventional total laparoscopic radical hysterectomy.

Methods Type II and III radical hysterectomies were performed in 15 patients with early-stage cervical carcinoma as a pilot case-control study at a comprehensive cancer center–university teaching hospital setting. The adequacy of the operations was determined and documented in DVD/video.

Results All operations were performed according to a well-established study protocol. No conversions or technical incidents were observed in the robotic group. Median operation time was 241 and 300 min in the robotic and conventional laparoscopic groups, respectively ($p = 0.165$). The histopathological results concerning the number of lymph nodes, the parametrial tissue and vaginal cuff size were similar in both groups. Less bleeding and a shorter hospital stay were observed in the robotic-assisted group ($p = 0.038$ and $p = 0.004$, respectively).

Conclusions Although the benefits of this technique have not yet been established in a prospective randomized manner, we showed the technical feasibility of robotic-assisted laparoscopic radical hysterectomy in early-stage cervical carcinoma cases and better results than with traditional total laparoscopic radical hysterectomy. Copyright © 2007 John Wiley & Sons, Ltd.

Keywords robotic-assisted radical hysterectomy; total laparoscopic radical hysterectomy; early stage cervical carcinoma; case-control pilot study

Introduction

Evaluation of the pelvic lymph nodes by retroperitoneal pelviscopy was started on 1986 by Daniel Dargent (1). Thereafter several reports showed the role of laparoscopy in the management of cervical carcinoma, both for staging purposes (2,3) and for surgical treatment by laparoscopic-assisted radical vaginal hysterectomy (4–6). Even though Canis *et al.* (7) and Nezhat *et al.* (8) formally described laparoscopic radical hysterectomies, both groups used vaginal incision at the end of the operation,

with culdotomy and removal of the paracolpion pedicle below. Spirtos *et al*. (9) and Ostrzenski (10) were the first to describe total laparoscopic radical hysterectomy Piver type III without vaginal approach. They both completed the procedure by closing the vagina as described above

The routine practice of laparoscopy has led to the development of devices designed to assist the surgeon, and one objective is to improve the quality of the operative procedure. Robotic assistance, currently under development, is an aspect of this technological improvement. For further development of this technique, we report our experience with robotic laparoscopic radical hysterectomy and bilateral pelvic lymph node dissection in early-stage cervical carcinoma patients and compare the results with those from total laparoscopic radical hysterectomy patients.

Materials and methods

During April 2004–August 2005 we performed eight conventional total laparoscopic radical hysterectomies for early-stage cervical carcinoma patients. On the other hand, during November 2005–March 2006 seven consecutive patients underwent robotic laparoscopic radical hysterectomies for early-stage cervical carcinoma. The results of these operations were compared using the Mann–Whitney test, owing to the small numbers and to independent groups. In the conventional laparoscopic radical hysterectomy group, one procedure was converted in conventional laparatomy due to equipment failure and was excluded from the analyses. All the operations were performed by the same surgeon (B.S.) and all surgical specimens were studied by the same senior pathologist (V.A.).

Stage and histological distributions are shown in Tables 1 and 2. In the conventional laparoscopy group; two patients with Stage IA1 LVSI were operated by Type II radical hysterectomy and bilateral pelvic lymph node dissection. In the robotic group three cases with Stage IA2 were operated by Type II radical hysterectomy and bilateral pelvic lymph node dissection. All the other patients were Stage IB1 and were operated by Piver Type III radical hysterectomy. Pre-operative patient characteristics and pathological results in the two groups are shown in Table 3. Our technique of total laparoscopic radical hysterectomy and bilateral pelvic lymph node dissection (external iliac, obturator and common iliac) has already been described elsewhere (11).

In our robotic technique, we used the three-armed da Vinci© robotic surgical system (Intuitive Surgical, Mountain View, CA, USA; Figure 1). Five trocars were inserted through the anterior abdominal wall, one 12 mm trocar through the umbilicus, with an open technique for the scope (Figure 2). Two 8 mm robotic trocars were located at the lateral border of the rectus sheath (10 cm from the umbilicus on a horizontal plan). Instruments passed through these trocars were connected to the robot; these instruments included scalpel, electrocautery, forceps and needle drivers. There were two additional trocars for the assistant, one 5 mm trocar was inserted 3 cm away from the umbilicus on the right side and another (10–12 mm) 3 cm away from the umbilicus on the left side. These two trocars were used by an assistant who had sufficient practice in assisting with haemostasis in laparoscopies, including suction and irrigation, application of ligatures and exposing the operative fields when necessary. Figure 3 shows our operation room setting and trocar positions. Figure 4 shows some instruments, including vaginal apple probes, which are very helpful for cutting the vaginal edge, and a balloon, which keeps the vagina tight to provide intra-abdominal pressure. At the end of the procedure the specimen was removed through the vagina. Finally, the vagina was closed with CT-1 zero vicryl suture. Photographs were taken immediately after removal of the specimen, showing the size of the vaginal cuff, the parametrium and the cervical tumour. A Type III robotic radical hysterectomy specimen is shown in Figure 5, the vaginal cuff in Figure 6, the left parametrium in Figure 7 and the right parametrium in Figure 8. Our first robotic radical hysterectomy case specimen is shown in Figure 9 and this figure was previously published in a case report in 2006 (12).

Mean operation (console) time for the robotic group was 241 (range 160–445) min, and for the conventional laparoscopy group it was 300 (range 225–375) min (not counting time for double J stent insertion), which was not significant ($p = 0.165$). Docking time for the robotic group was 25 min.

Table 1. Stage distributions

	Group		
Stage	Laparoscopy	Robotic	Total
IA1	2	0	2
IA2	0	3	3
IB1	5	4	9
Total	7	7	14

Table 2. Final histology results

	Group		
Histology	Laparoscopy	Robotic	Total
Squamous epithelium	5	6	11
Adenocarcinoma	2	1	3
Total	7	7	14

Table 3. Operative and post-operative complications

	TLRH ($n = 7$)	RLRH ($n = 7$)
UTI	1	1
Lymphocyst	3	2
Cystostomy	1	1
Compartment syndrome	1	–

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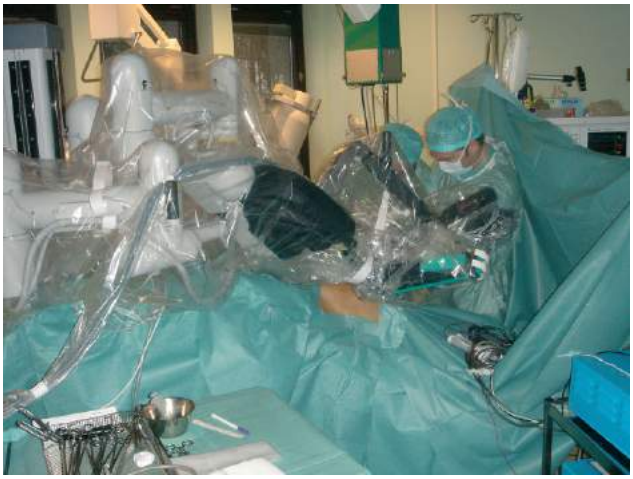

Figure 1. Three-armed da Vinci© robotic surgical system (Intuitive surgical, Mountain View, CA, USA)

Figure 2. Trocar placement in the abdominal wall

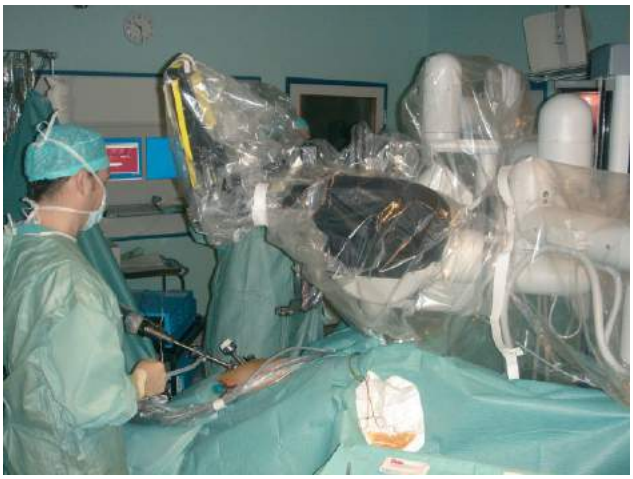

Figure 3. Operation room setting. Assistant standing to the right of the patient and nurse to the left

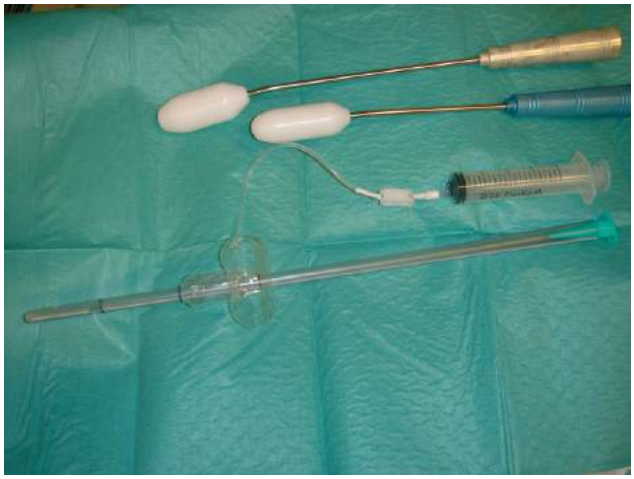

Figure 4. Some instruments including vaginal probe and balloon, which are very useful tools during robotic surgery

Figure 5. Robotic radical hysterectomy specimen

Figure 6. Vaginal cuff

Double J stent time was also 25–30 min in the conventional laparoscopy group. In the robotic group two patients presented with post-operative lymphoceles, revealed in one patient by deep venous thrombosis and in the other patient by obturator pain. In the conventional laparoscopy group, three patients presented with symptomatic lymphoceles and were treated by percutaneous

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Figure 7. Left parametrium

Figure 8. Right parametrium

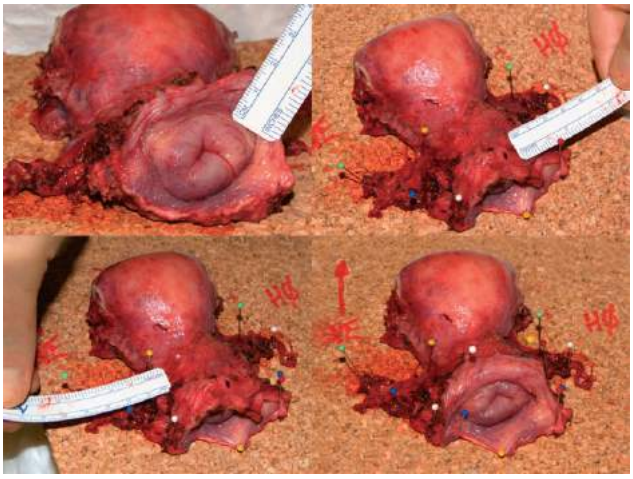

Figure 9. Our first robotic radical hysterectomy specimen

drainage. In addition, one patient developed acute compartment syndrome and was treated by bilateral anterior fasciotomy. All operative and post-operative complications are reported in Table 4. The histological results concerning the number of pelvic lymph nodes (including common iliac) removed were similar in both groups ($p = 0.383$). The removed parametrium tissue and right and left and vaginal edges were also similar in the two groups ($p = 0.165$, 0.073 and 0.710, respectively). The most significant findings were less bleeding ($p = 0.038$) and shorter hospital stay ($p = 0.004$) in the robotic group. The follow-up periods until May 2007 are shown in Table 5. There were no recurrences until May 2007 in either group.

Discussion

Using the robotic system, surgeons can now operate in an ergonomic position with restoration of proper hand–eye coordination, improved quality of vision and enhanced dexterity, and with increased degrees of freedom. The surgical robot has the potential to enable a laparoscopic approach to procedures that are presently performed by laparotomy, due to technical difficulties intrinsic to laparoscopy.

We believe that the surgeon would have to be very comfortable with both radical open surgery and laparoscopic radical surgery before attempting robotic surgery. Generally speaking, it is obvious that it is very important to have a large volume of radical cancer surgery cases if you wish to obtain successful results. Our total Wertheim procedure numbers are shown in Table 6.

Table 4. Patient characteristics and final pathology outcomes

Parameter	Laparoscopic Wertheim	Robotic Wertheim	*p* Value
Operative time (min)	300	241	0.165
Bleeding (ml)	160	71	0.038
Right parametric (cm)	1.8	2.5	0.165
Left parametric (cm)	1.8	2.8	0.073
Vaginal edge (cm)	2.2	1.7	0.710
Lymph nodes (n)	15	13	0.383
Age (years)	45	41	1.000
Hospital stay (days)	8	4	0.004
BMI (kg/m^2)	22.5	24.6	0.710

Table 5. Follow-up periods until May 2007

Follow-up period (months)	TLRH ($n = 7$)	RLRH ($n = 7$)
Median	25	14
Range	20–36	13–18

Table 6. The number of Wertheim operations at NRH

Year	Total operations (*n*)	Wertheim (cervix) (*n*)	Wertheim (corpus) (*n*)	Total Wertheim (*n*)
2000	409	58	16	74
2001	467	56	27	83
2002	391	66	25	91
2003	358	65	18	83
2004	384	42	18	60
2005	400	44	31	75
2006	391	39	32	71
Total	2800	370	167	537

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Another important issue is to give the patient very detailed information about robotic surgery and possible conversion to laparoscopic surgery when and if any technical failure should happen with the robot, and not to convert to laparotomy right away but first to try to complete the operation laparoscopically if possible. We believe that this ethical issue must be discussed in detail with a patient who is willing to have minimally invasive surgery. It is also mandatory that proper laparoscopic equipment must be available in the operation room for patients' safety.

It is advantageous to be able to perform the procedure at a single institution with operating room staff who are familiar with the technique. Patient selection and preparation are extremely important factors. Particularly in view of the early stage of new robotic technology, we must be extraordinarily careful in patient selection and not accept advanced stage cases. In our cases the maximum tumour size was not more than 3 cm. Surgical margins and lymph node retrievals are comparable to those of laparoscopic surgery.

Operative time in these robotic series is also comparable to laparoscopic radical hysterectomy reported in the literature (7–9). This is the first case-control study that shows results comparing total laparoscopic radical hysterectomy (TLRH) with robotic laparoscopic radical hysterectomy (RLRH).

Conclusions

Robotic laparoscopic radical hysterectomy is a feasible and safe procedure. Long-term results and randomized studies with classical approaches are awaited (oncological efficiency, morbidity and quality-of-life issues). Although the benefit of this technique has not been established in a prospective randomized way, predictable technological improvements, such as three-dimensional visibilty and 360° articulation would suggest the development of robotic minimal invasive surgery and improved precision of the surgical procedure. Our pilot preliminary case-control study clearly showed the robotic approach to be more precise, with significantly lower blood loss and shorter hospital stay. All these results are comparable with data from open and conventional laparoscopic radical hysterectomy reports. Therefore, robot laparoscopic radical hysterectomy might well become the operative strategy of the future.

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