

Radical cystectomy with ileal conduit diversion: early prospective evaluation of the impact of robotic assistance

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OBJECTIVE

To compare the performance of radical cystectomy with ileal conduit diversion by standard methods with that using the assistance of the daVinci robotic system (Intuitive Surgical, Sunnyvale, CA, USA).

PATIENTS AND METHODS

From November 2003 to August 2005, we performed 30 radical cystectomies with ileal conduit urinary diversions on patients with bladder cancer. Seven patients (one woman) had a cystectomy with the daVinci system and 23 (nine women) had a standard cystectomy.

Data were collected prospectively, including estimated blood loss (EBL), transfusion requirement, operative duration, hospital stay and body mass index (BMI), and compared.

RESULTS

The mean EBL and transfusion requirements for standard and daVinci-assisted cases was 1109 and 479 mL ($P=0.002$) and 2.7 and 1.6 units ($P=0.14$), respectively. Four of seven patients received a transfusion in the robotic group, and 20 of 23 in the standard group ($P=0.084$). The mean operative duration was 638 and 507 min ($P=0.005$) for the daVinci and standard group, respectively, with

respective mean hospital stays of 11 and 13 days ($P=0.52$). There was no difference in patient BMI between the groups ($P=0.22$).

CONCLUSION

The daVinci-assisted cystectomy appears to offer some advantages over standard cystectomy. Larger randomized studies are needed to confirm these findings.

KEYWORDS

bladder, surgery, carcinoma, transitional cell, cystectomy, instrumentation, robotics, survival analysis, outcome

INTRODUCTION

Bladder cancer is the fourth most common cancer in men and the eighth most common cancer in women in the USA [1]. While superficial tumours can be treated effectively with transurethral resection with or without intravesical chemotherapy, muscle-invasive bladder cancer is commonly treated with radical cystectomy, with excellent regional control of disease [2]. In addition, the advent of nerve-sparing cystectomy [3] and orthotopic bladder substitution [4] has provided many patients with an excellent quality of life.

Nevertheless, radical cystectomy requires a significant abdominal incision and this procedure is associated with complications, even when carried out by expert surgeons [2]. For example, up to 82% of women and 55% of men required a blood transfusion after surgery [5] in one study, while the overall transfusion rate was 30% with a median requirement of 2 units in another [6].

Laparoscopic approaches to radical cystectomy have the potential to further improve the quality of life of patients after

radical cystectomy, as they have for patients undergoing other minimally invasive procedures [7]. However, the laparoscopic approach when applied to radical cystectomy can be lengthy [8] and difficult to learn, especially when intracorporeal diversion is used. Because robotic-assisted laparoscopic approaches are apparently easier to learn than conventional laparoscopy in radical prostatectomy [9], we sought to prospectively evaluate the clinical outcomes of such a procedure when applied to radical cystectomy, and compare them with those associated with the conventional open operation.

PATIENTS AND METHODS

During the period from November 2003 to August 2005, 30 radical cystectomies with ileal conduit urinary diversions were carried out in patients with clinical Ta-T3N0M0 bladder cancer, at the University of Virginia Health System, by three urological oncology fellowship-trained surgeons assisted by senior urology residents. Data on these patients were collected prospectively as part of a protocol approved by the Institutional

Review Board. Seven (mean age 60 years, range 44–71; one woman) of 30 patients had cystectomy with the daVinci surgical system (Intuitive Surgical, Sunnyvale, CA, USA, www.intuitivesurgical.com) as described below. Selection of the patient for robotic assistance was determined by the clinical tumour stage, $\leq T2$, and patient and surgeon preference. The remaining 23 patients (mean age 67 years, range 41–86; nine women) had a traditional standard open cystectomy with a midline incision.

The robotic radical cystectomy technique used was described previously in both men [10] and women [11]. After completing the cystectomy, the robot was undocked and an infra-umbilical midline incision only sufficient for specimen retrieval was made. A pelvic lymph node dissection was done bilaterally through this incision [12,13]. We then proceeded to find a suitable portion of terminal ileum for creating the ileal conduit. A Bricker or Wallace type uretero-intestinal anastomosis was used. Robotic-assisted cystectomy was initiated by a surgeon with experience in 17 robotic prostatectomies and >300 open radical cystectomies at the time of the first procedure.

Patient demographics and tumour characteristics (before and after surgery) were collected. In addition, the estimated blood loss (EBL), transfusion requirement, operative duration, hospital stay and body mass index (BMI) were collected. Summary statistics, including the mean (SD), were calculated for these variables.

The main objective was to investigate whether there was any difference in these variables in patients who had robotic-assisted vs completely open radical cystectomy. Student's *t*-test and the chi-square test of association were applied to determine statistical significance, with $P < 0.05$ considered to indicate statistical significance.

RESULTS

There was no significant difference in age between the groups ($P = 0.23$), although the open cystectomy group was a mean of 7 years older. The standard patient demographics, tumour characteristics and other variables are shown in Table 1. Importantly, there were no positive surgical margins in any of the robotic-assisted cases. In addition, despite the more advanced tumours selected for open surgery, there were no positive margins in that group either. Positive surgical margins are exclusive of the presence of carcinoma *in situ* at the ureteric margin, which occurred in one open case, despite significant proximal resection of the ureter. Furthermore, there were significant differences in pathological stage, as would be expected from the selection criteria used.

The mean EBL in the robotic-assisted group was significantly lower than with open cystectomy ($P = 0.002$). Interestingly, while there was a statistically significant difference in the EBL between the groups, the overall transfusion volumes were not significantly different (Table 1). However, the number of patients requiring transfusion tended to significance, with four of seven and 20 of 23 patients receiving blood transfusions for the robotic vs open cystectomy, respectively ($P = 0.084$).

The operative duration for robotic-assisted cystectomy was significantly longer than with the open approach (Table 1, $P = 0.005$). The longer operation for robotic-assisted cystectomy included the time required before docking the daVinci robot. The times for the

Characteristic	Robotic	Open	P*	TABLE 1 Comparison of robotic and open cystectomy
Number of:				
Patients	7	23		
Men	6	14	0.22	
Women	1	9	0.03	
Mean (SD) age, years	60 (9)	67 (13)	0.23	
Pathological tumour stage, n†				
Ta-T1	3	5	0.15	
T2	3	5	0.23	
T3-4	1	13	0.01	
Surgical margins (positive)	0	0	-	
Mean (SD):				
Estimated blood loss, mL	479 (551)	1109 (398)	0.002	
Transfusion needs, units	1.6 (1.9)	2.7 (1.8)	0.14	
N patients with transfusion	4	20	0.084	
Mean (SD):				*Student's <i>t</i> -test or chi-square test of association.
Operating time, min	638 (46)	507 (110)	0.005	†According to 2002 UICC/AJC.
Hospitalization, days	11 (5)	13 (11)	0.52	
BMI, kg/m ²	28 (4)	25 (5)	0.22	

node dissection and diversions were similar among the open and robotic-assisted groups. More importantly, time is needed to gain experience with the daVinci system and the surgery might thus become quicker. As noted, the surgical team had carried out <20 robotic cases overall before initiating this study. The operative duration from skin incision to closure of the skin for the patients in chronological order is shown in Fig. 1. The mean hospital stay and BMI were not significantly different between the approaches (Table 1).

DISCUSSION

Laparoscopic surgery in urology has developed significantly during the past 5 years. In radical cystectomy, the laparoscopic approach has been compared with the open procedure in the hope that using laparoscopic approaches will result in less blood loss, decreased transfusion needs, less postoperative discomfort and a shorter hospital stay. Basillote *et al.* [14] found no statistically significant difference in operative duration, blood loss or complication rates between laparoscopically assisted radical cystectomy and their series of open procedures. After the first reported case of laparoscopic hand-assisted cystectomy with an ileal conduit [15], several institutions compared hand-assisted cystectomy with a completely open approach. Taylor *et al.*

[16] showed that there was no statistically significant difference between hand-assisted cystectomy and an open procedure in terms of blood loss, hospital stay or postoperative pain. Although they showed no statistical difference in EBL, patients with the hand-assisted approach had less blood loss than patients with an open approach (637 vs 975 mL, respectively). They also found no difference in hospital stay. The only variable that seemed to have any significance was the requirement for pain medication after surgery.

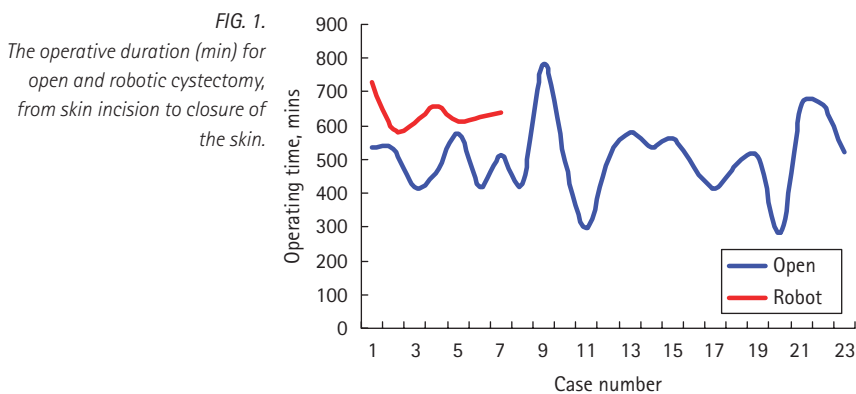
Robot-assisted radical cystectomy and radical cystoprostatectomy are difficult robotic procedures [17]. The technical aspects of this procedure were described previously [10,11,17-19]. A summary of the published series is shown in Table 2 [10,11,17-20]. Robotic-assisted radical cystectomy can be combined with different forms of urinary diversion (W-pouch or ileal conduit). The first case of daVinci-assisted cystectomy and ileal neobladder was by Binder *et al.* [21] in Frankfurt, Germany, in 2002, completed in 510 min with an EBL of <200 mL. Nevertheless, while a neobladder can be created *in situ*, the operative duration can be reduced if this is done extracorporeally through the incision used to deliver the cystectomy [22].

Most patients undergoing robotic-assisted cystectomy were eating within 24-36 h and discharged from the hospital in 4-5 days [17].

TABLE 2 Published articles on robotic radical cystectomy and urinary diversion

Ref	N cases	Ports placed	Mean operative time, min	Mean blood loss, mL	Urinary diversion	Surgical margin	Lymph-adenectomy	Complications or conversion
[18]	1 man	5	510	200	Hautmann ileal neobladder	Negative no metastases	BP	None
[10]	14 men 3 women (NSA)	6	RRCP, 140 Ileal conduit 120 Neobladder 168	<150	Ileal conduit 3, W-pouch 10, Double chimney 2, T pouch 2	Negative, N1 disease in 1	BP; 4–27 nodes removed	Not completed in 1, malfunction of lens. 1 port-site haematoma
[20]	2 men	5	660	1117.5	Ileal conduit 2	Perivesical invasion 1	BP	None
[11]	3 women (anterior approach 1 new tech 2)	6	RRC 160 Ileal conduit 130 Neobladder 180	<100	Ileal conduit 1, W-pouch 1, T pouch 1	Negative	BP; 3–21 nodes removed	None
[19]	2 men 1 woman	5	691	250	Ileal conduit 3 (all intracorporeal)	Negative	BP	1 self-limiting ileus, resolved with conservative treatment
[17]	21 men, 2 women (NSA in men new tech in 2 women)	6	RRC + RRCP 140 Urinary diversion 150	200	Ileal conduit 4, W-pouch 16, Double chimney 2, T-pouch 2	Negative N1 disease in 1	BP; 3–27 nodes removed	None

NSA, nerve sparing approach; RRC(P), robot radical cystectomy (cystoprostatectomy); BP, bilateral pelvic.



Furthermore, Menon *et al.* [10,11] proposed a nerve-sparing procedure in men and a minimally invasive technique in women, allowing preservation of the reproductive organs. In women so treated, the mean (range) hospital stay was 6.7 (5–8) days [11]. In a study of intracorporeal robot-assisted laparoscopic ileal conduit urinary diversion, the mean (range) hospital stay was 7.3 (5–10) days [19].

Concerns about intraoperative blood loss and the subsequent need for transfusion have

always been associated with open radical cystectomy [5]. In one robotic cystectomy series, Hemal *et al.* [17] reported that none of the patients were given an intraoperative blood transfusion. The present data support the notion that robotic cystectomy is associated with significantly less intraoperative blood loss than the open procedure. However, despite this, there was no difference in the number of patients requiring a transfusion at the 0.05 significance level, although there was a trend in this direction ($P=0.08$).

Some authors concluded that the ability to replicate open cystectomy with the same adequacy of lymph node dissection and oncological control (avoiding tumour spillage) might still prove to be major challenges [21] in laparoscopic radical cystectomy. In a series of laparoscopic cystectomies, at a mean of 18 months of follow-up for 84 patients, there were no cases of trocar-site recurrences, and 83% of patients remained disease-free [23]. However, this latter complication was reported once with robotic laparoscopic cystectomy [24]. In addition, depending on the extent of the desired node dissection [12,13], anatomical variation and habitus of the patient, the robotic technique might not be adequate in all cases. We carried out all the node dissections in our series through the incision used for specimen removal, to allow adequate comparability of the surgical series in terms of lymph node dissection.

In conclusion, in this small series, robotic-assisted radical cystectomy appears to have benefits in terms of blood loss for the patient. However, the economics of robotic cystectomy and the long-term oncological equivalence of this technique remain to be

determined. Larger prospective studies will be needed to answer these questions.

CONFLICT OF INTEREST

None declared.

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Abbreviations: EBL, estimated blood loss; BMI, body mass index.