

available at www.sciencedirect.com
journal homepage: www.europeanurology.com



Platinum Priority – Bladder Cancer

Editorial by Oliver W. Hakenberg on pp. 202–203 of this issue

Prospective Randomized Controlled Trial of Robotic versus Open Radical Cystectomy for Bladder Cancer: Perioperative and Pathologic Results

Jeff Nix, Angela Smith, Raj Kurpad, Matthew E. Nielsen, Eric M. Wallen, Raj S. Pruthi*

Division of Urologic Surgery, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

Article info

Article history:

Accepted October 13, 2009
Published online ahead of
print on October 20, 2009

Keywords:

Urothelial carcinoma
Bladder cancer
Cystectomy
Laparoscopic
Robotic

EU*ACME
www.eu-acme.org/
[europeanurology](http://europeanurology.com)

Please visit
www.eu-acme.org/europeanurology to read and
answer questions on-line.
The EU-ACME credits will
then be attributed
automatically.

Abstract

Background: In recent years, surgeons have begun to report case series of minimally invasive approaches to radical cystectomy, including robotic-assisted techniques demonstrating the surgical feasibility of this procedure with the potential of lower blood loss and more rapid return of bowel function and hospital discharge. Despite these experiences and observations, at this point high levels of clinical evidence with regard to the benefits of robotic cystectomy are absent, and the current experiences represent case series with limited comparisons to historical controls at best.

Objective: We report our results on a prospective randomized trial of open versus robotic-assisted laparoscopic radical cystectomy with regard to perioperative outcomes, complications, and short-term narcotic usage.

Design, setting, and participants: A prospective randomized single-center noninferiority study comparing open versus robotic approaches to cystectomy in patients who are candidates for radical cystectomy for urothelial carcinoma of the bladder. Of the 41 patients who underwent surgery, 21 were randomized to the robotic approach and 20 to the open technique.

Intervention: Radical cystectomy, bilateral pelvic lymphadenectomy, and urinary diversion by either an open approach or by a robotic-assisted laparoscopic technique.

Measurements: The primary end point was lymph node (LN) yield with a noninferiority margin of four LNs. Secondary end points included demographic characteristics, perioperative outcomes, pathologic results, and short-term narcotic use.

Results and limitations: On univariate analysis, no significant differences were found between the two groups with regard to age, sex, body mass index, American Society of Anesthesiologists classification, anticoagulation regimen of aspirin, clinical stage, or diversion type. Significant differences were noted in operating room time, estimated blood loss, time to flatus, time to bowel movement, and use of inpatient morphine sulfate equivalents. There was no significant difference in regard to overall complication rate or hospital stay. On surgical pathology, in the robotic group 14 patients had pT2 disease or higher; 3 patients had pT3/T4 disease; and 4 patients had node-positive disease. In the open group, eight patients had pT2 disease or higher; five patients had pT3/T4 disease; and seven patients had node-positive disease. The mean number of LNs removed was 19 in the robotic group versus 18 in the open group. Potential study limitations include the limited clinical and oncologic follow-up and the relatively small and single-institution nature of the study.

Conclusions: We present the results of a prospective randomized controlled noninferiority study with a primary end point of LN yield, demonstrating the robotic approach to be noninferior to the open approach. The robotic approach also compares favorably with the open approach in several perioperative parameters.

© 2009 European Association of Urology. Published by Elsevier B.V. All rights reserved.

* Corresponding author. Division of Urologic Surgery, The University of North Carolina at Chapel Hill, 2140 Biometrics Bldg, CB7235, Chapel Hill, NC 27599, USA. Tel. +1 919 966 2574; Fax: +1 919 966 0098.
E-mail address: rpruthi@med.unc.edu (R.S. Pruthi).

1. Introduction

Radical cystectomy remains the gold standard of treatment for patients with invasive bladder cancer and for those with high-risk recurrent noninvasive disease, providing efficacy with regard to local control and long-term disease-free survival [1]. In recent years, surgeons have begun to report case series of minimally invasive approaches to radical cystectomy including laparoscopic and robotic-assisted techniques [2]. Recent robotic cystectomy case series have demonstrated the surgical feasibility of this procedure with the potential of lower surgical blood loss, more rapid return of bowel function, and even hospital discharge [3,4]. Notwithstanding these experiences and observations, it must be clearly recognized that at this point, high levels of clinical evidence with regard to benefits of robotic cystectomy are absent in peer-reviewed literature, and the current experiences represent single-institution case series with limited comparisons to historical controls at best.

Indeed, early in our own experience patients undergoing robotic cystectomy represented a highly selected population as compared with concurrent patients undergoing an open approach [5]. A more meaningful comparison of the two modalities is that of a randomized controlled trial. We therefore present our data of a prospective randomized controlled clinical trial comparing robotic versus open radical cystectomy.

2. Methods

2.1. Patients

In accordance with the principles and practices of the University of North Carolina institutional review board and in recognition of and compliance with the US Health Insurance Portability and Accountability Act of 1996, a prospective randomized controlled trial of robotic versus open radical cystectomy was performed at our institution. This trial was designed as a randomized noninferiority single-center study with lymph node (LN) yield selected as the primary end point used for power analysis. Inclusion criteria included those patients with clinically localized urothelial carcinoma of the bladder. The following patients were excluded from the trial: (1) those not considered to be surgical candidates for either approach, (2) those not allowing randomization, and (3) those with preconceived preference for a specific surgical modality. Decision for surgical candidacy was based on the patient's overall health status primarily with regard to ability to tolerate the pneumoperitoneum and steep Trendelenburg position associated with the robotic approach.

2.2. Surgical procedure

Our surgical technique with regard to robotic-assisted radical cystectomy, bilateral pelvic lymphadenectomy, and extracorporeal diversion has been previously described in detail [6]. All patients in this study underwent the same lymphadenectomy template, which included removal of the obturator, external iliac, hypogastric, and common iliac LN chains (did not include a para-aortic or paracaval dissection). All patients, irrespective of procedural group, were placed on the same clinical care pathway that includes aspects of early diet advancement [7].

2.3. Outcome measures

Several outcome measures were used in comparing our two groups. Perioperative measures such as estimated blood loss (EBL), operative time, complications, recovery of bowel function, narcotic usage, and length of stay were assessed. Pathologic measures such as margin status, LN count, and time to adjuvant chemotherapy were also assessed. Our complications were measured using the Clavien classification system [8]. This system has been well utilized in the general surgery and urologic literature, and it provides a more standardized approach to the reporting of complications across different institutions [9,10].

2.4. Randomization

Randomization was performed at the time of preoperative assessment. Those patients that appropriately met our inclusion criteria were randomly assigned to undergo either an open or robotic-assisted laparoscopic approach. The randomization schema was performed with five sequential patients undergoing an approach before alternating surgical modality. This schema was chosen, as opposed to randomizing each sequential patient, for the purpose of resident education. We believed that alternating each sequential surgery as to approach would make it significantly more difficult for residents to progress through their knowledge and acquisition of proficiency in each of the individual procedures.

2.5. Statistical analysis

This trial was designed as a randomized noninferiority single-center study [9]. LN yield was selected as the primary end point used for power analysis. The sample size was therefore calculated to show noninferiority between open and robotic cystectomy. The null hypothesis was that mean LN yield for open cystectomy was higher than that for robotic cystectomy. A sample size of 20 patients per arm was calculated to provide 80% power and a 0.05 type 1 error rate to demonstrate the noninferiority of open to robotic cystectomy with respect to LN count based on a critical difference of four LN. The 90% one-sided confidence interval (CI) of this difference is reported because of the 5% significance used for the sample size calculation. If the upper level of this CI is >4 , the null hypothesis cannot be rejected and noninferiority has not been achieved.

Secondary outcomes included perioperative and oncologic parameters such as operative time, EBL, return of bowel function, time to discharge, in-house analgesia, and positive margin status. This was an intention-to-treat analysis, with all eligible patients in whom surgery was attempted included in the study. Univariate comparisons of data were performed using the student *t* test for continuous variables and the Fisher exact test for categorical variables. Multivariate analyses were performed using generalized linear models with separate subanalyses conducted for the primary end point (LN yield) as well as all secondary outcomes. Adjusted means were calculated as well as mean differences with corresponding CIs between open and robotic cystectomy arms. The covariates included in the final model were age, body mass index, and pathologic stage. A *p* value of < 0.05 was interpreted as significant. All analyses were conducted using SAS v.9.2 (SAS Institute Inc., Cary, NC).

3. Results

Between April 2008 and January 2009, 55 patients presented for consideration for cystectomy. Fourteen patients were ineligible after initial evaluation: Five were excluded because of preference for the robotic approach, whereas the remaining nine patients were precluded

Table 1 – Patient characteristics

	Robotic (n = 21)	Open (n = 20)	p value
Age, yr			
Mean	67.4	69.2	0.5976
Range	33–81	51–80	–
Sex (n)			
Male	14	17	0.2772
Female	7	3	–
BMI, kg/m ²	27.5	28.4	0.5798
ASA classification	2.71	2.70	0.9244
Clinical stage (n)			0.6787
cT1 or lower	6	5	–
cT2	12	14	–
cT3	3	1	–
Diversion type (n)			0.7821
Neobladder	7	6	–
Ileal conduit	14	14	–

ASA = American Society of Anesthesiologists; BMI = body mass index.

secondary to medical comorbidity rendering them unsuitable candidates for the robotic approach—principally, severe cardiopulmonary compromise in which a pneumoperitoneum and steep Trendelenburg position associated with the robotic approach was deemed unsafe. Thus 41 patients were consented and enrolled into the trial and underwent randomization. Twenty-one patients were randomized to the robotic approach and 20 patients to the open approach. Among these patients, only one patient in the open arm of the trial was found to be unresectable at the time of surgery. Of the 21 patients who underwent robotic cystectomy, none required conversion to open. Table 1 lists the demographic data of our patient population. On univariate analysis, no statistically significant differences were found between the two groups with regard to age, sex, body mass index, American Society of Anesthesiologists classification, clinical stage, or diversion type.

Also on univariate analysis, patients undergoing robotic cystectomy had a longer operative time open (4.2 vs 3.5 h; $p < 0.001$) and lower EBL (258 vs 575 ml; $p < 0.001$) than patients undergoing the open approach (Table 2). The robotic cohort demonstrated a more rapid return of bowel function as evidenced by time to flatus ($p = 0.001$) and bowel movement ($p = 0.001$). Mean length of stay was 5.1 d in the robotic group compared with 6.0 d in the open group,

but this difference was not statistically significant ($p = 0.239$). Patients in the robotic arm also required less in-house analgesia (milligrams of morphine equivalents) compared with their open counterparts (89 vs 147 mg; $p = 0.019$).

The two groups did not differ with respect to absolute number of complications with 7 (33%) complications in the robotic group and 10 (50%) complications in the open group ($p = 0.2789$). Complications in the robotic group included ileus (two), urinary tract infection (UTI) (two), deep venous thrombosis (one), acute renal failure (one), and new-onset incarcerated inguinal hernia (one). In the open group, complications included ileus (three), UTI (one), acute renal failure (one), altered mental status (one), urinary leak (one), dehydration (one), new diagnosis leukemia (chronic myeloblastic leukemia; one), and death secondary to aspiration and myocardial infarction (one). When comparing complications using the Clavien system, no significant difference was observed between the robotic and open groups on univariate analysis ($p = 0.2789$). The mean number of LN removed in the robotic group was 19 (median: 18; range: 12–30) compared with 18 removed in the open group (median: 18; range: 8–30; $p = 0.515$) (Table 3). No patient in either group had a positive soft tissue margin on surgical pathology.

Adjuvant chemotherapy is typically recommended for extravesical or node-positive disease at our institution. All patients with these characteristics are reevaluated at our multidisciplinary genitourinary oncology program at 4 wk postoperatively by our medical oncologist, at which time decisions for adjuvant chemotherapy are undertaken. In this trial, adjuvant chemotherapy was provided to six patients undergoing robotic cystectomy and eight patients undergoing open cystectomy. Mean time to initiation of adjuvant chemotherapy was 6.7 wk versus 8.8 wk in the robotic and open groups, respectively ($p = 0.033$).

On multivariate analysis, the adjusted mean difference of LN yield comparing open to robotic cystectomy was -1.32 (90% CI, -3.33 – 1.69) with an open cystectomy adjusted mean of 19.14 and robotic adjusted mean of 17.83 LNs. Because the upper limit of this CI was less than the prespecified critical value of four, a conclusion of non-inferiority was reached. Table 4 lists the mean differences, corresponding 95% CIs, and p values for secondary outcomes. Cystectomy type was a significant predictor for estimated blood loss ($p = 0.0003$), days to flatus ($p = 0.0044$), days to bowel movement ($p = 0.0033$), opera-

Table 2 – Perioperative outcomes

	Robotic (n = 21)	Open (n = 20)	p value
Mean EBL, ml (median)	258 (200)	575 (600)	<0.0001
OR time, h (median)	4.20 (4.2)	3.52 (3.4)	<0.0001
Time to flatus, d (median)	2.3 (2)	3.2 (3)	0.0013
Time to BM, d (median)	3.2 (3)	4.3 (4)	0.0008
Length of stay, d (median)	5.1 (4)	6.0 (6)	0.2387
In-house analgesia, mg (morphine equivalents)	89.0 (87.5)	147.4 (121.5)	0.0044
Clavien units (median)	2.3 (2)	2.6 (2)	0.5622

BM = bowel movement; EBL = estimated blood loss; OR = operating room.

Table 3 – Pathologic outcomes

	Robotic (n = 21)	Open (n = 20)	p value
Pathologic stage			
T2N0 or lower	14	8	0.2248
T3N0–T4N0	3	5	–
TxN+	4	7	–
Positive margins	0	0	NA
Lymph node yield			0.5150
Mean	19	18	–
Range	12–30	8–30	–
NA = not applicable.			

tive time ($p < 0.0001$), and in-house analgesic requirement ($p = 0.0110$) when controlling for age, body mass index, and pathologic stage. Interestingly, a trend toward fewer complications was evidenced in the robotic compared with the open group when controlling for the covariates just listed ($p = 0.0503$). Sample size precluded the addition of further confounding variables without compromising the validity of results.

4. Discussion

In recent years, several authors have described the feasibility of laparoscopic and robotic approaches to radical cystectomy in patients with bladder cancer [4,11,12]. Techniques that have been described appear to duplicate the surgical principles of open radical cystectomy with regard to the extirpative portion of the procedure and to the ability to perform adequate lymphadenectomy. Potential benefits of laparoscopic and robotic approaches that have been described include lower surgical blood loss, early return of bowel function, and more rapid postoperative convalescence [13–16].

These early reports of robotic cystectomy have been single-institution case series, occasionally with retrospective comparisons to historical open experience. As such, these reports are susceptible to powerful selection biases in which only the most favorable candidates underwent the robotic procedure. Undoubtedly, such biases are likely to affect the interpretation of results and any perceived equivalence or benefit over the open approach. Such findings highlight the need for prospective and randomized study for robotic cystectomy and other novel surgical techniques in urologic oncology. The present report

represents such a prospective randomized study comparing robotic versus open radical cystectomy for bladder cancer. Such a trial seeks to avoid selection bias and surgeon and site influence to provide a more scientifically rigorous evaluation over retrospective case series that have to date been the published evidence on this topic and procedure.

Several authors have looked to LN yield as an indicator of surgical quality with cystectomy [1,17]. Based on this premise, the present trial used LN yield as the basis for sample size determination and to serve as the primary end point for statistical comparison between robotic versus open approaches. To this end, the present study demonstrated noninferiority of LN yield between robotic and open radical cystectomy. With regard to the impact of surgical technique on positive soft tissue margins, another potential metric of surgical quality, no differences were observed because neither group had a positive margin. Such findings appear to demonstrate the noninferiority of the robotic approach, given the preexisting statistical conditions of this study, with regard to these important measures of surgical quality.

The present trial also evaluated perioperative outcomes as secondary end points. Outcomes demonstrated that EBL and inpatient narcotic requirement were lower in the robotic as compared with the open approach. These findings support similar observations of prior case series in which lower blood loss and narcotic requirement was encountered with robotic cystectomy [15,18,19]. Such results may support the belief that the smaller incisions and absence of abdominal wall retraction that are characteristic of robotic approaches may help reduce postoperative pain and the resultant analgesic requirement. Longer term effects on such recovery are not yet known, but short- and long-term quality of life assessments are presently being conducted as part of this trial and may help determine differences, if any, between the two surgical approaches.

The trial also demonstrated a significantly longer operating room (OR) time in the robotic group (4.20 h) versus the open cohort (3.51 h). Although a prior study has shown that a significant breakpoint in the learning curve exists at case 20, the potential for gradual reduction in OR times is ongoing [5]. The present trial was performed after a prior experience of >75 robotic cystectomy cases and of >400 open cystectomy procedures with the same primary surgeon and experienced surgical team in both groups. It is unclear whether the robotic procedural times will ever equal that of open times. Nevertheless, the longer surgical

Table 4 – Secondary outcomes on multivariate analysis

	Mean difference (95% CI)	Open adjusted mean	Robotic adjusted mean	p value
EBL, ml	292 (144, 439)	564	273	0.0003
Time to BM, d	11.1 (0.4, 1.7)	4.3	3.2	0.0033
In-house analgesia, mg (morphine sulfate equivalents)	57.9 (14.1, 101.7)	151.6	93.6	0.0110
OR time, h	–0.70 (–0.88, –0.52)	3.5	4.2	<0.0001
Clavien units	1.13 (0.00, 2.27)	2.8	1.7	0.0503
Length of stay, d	0.59 (–0.88, 2.05)	6.0	5.4	0.4210

BM = bowel movement; CI = confidence interval; EBL = estimated blood loss; OR = operating room.

times associated with robotic cystectomy is a common finding in prior case series [15,20].

All patients were placed on the same postoperative clinical care program that included aspects of early/aggressive ambulation and early diet advancement [7]. Still, postoperative return of bowel function, as evidenced by time to flatus and bowel movement, was more rapid in the robotic group. The mechanism of reduced ileus in the robotic group remains uncertain but could reflect both less bowel manipulation and desiccation and less fluid imbalances that may be associated with the intracorporeal extirpative procedure. Furthermore, increased narcotic usage in the open group may contribute to a delay in bowel function. Despite the modest improvements observed in this regard, no significant differences were found with regard to length of stay. Accordingly, the clinical significance of more rapid return of bowel function remains in question.

Complication rates were also similar between the two procedural groups. Rigorous assessment using the Clavien system likely accounts for the relatively high rate of complications as compared with historical reports, but this is consistent with a more recent series in which a meticulous assessment of complications was performed [21,22]. Interestingly, although direct statistical comparison between robotic and open groups failed to show any significant difference with regard to mean Clavien units (2.3 vs 2.6, respectively), multivariate analysis showed a trend toward less complications in the robotic group when controlling for other known variables ($p = 0.0503$). Perhaps a larger cohort would more conclusively determine if a true difference in complications between the robotic versus open approaches exists.

This trial has several noteworthy limitations. First, an important shortcoming is the limited clinical and oncologic follow-up at the present time. Bladder cancer is a potentially lethal and unforgiving disease in which true measures of success lie not in short-term surgical end points but in longer-term disease-free survival rates. At the present time, conclusions about the defined study end points can be made. Second, study design assumed that a difference in LN yield of four or more was not clinically significant. The value of four was chosen because it was less than the standard deviation (SD) of past studies (SD: 5), and an even number would be reflective of the bilateral nature of lymphadenectomy. The authors acknowledge there is no consensus for what constitutes a significant difference in LN yield. Third, the present trial is a relatively small and single-institution study and in patients whose medical condition allow for either a robotic or open approach. This restriction on medical condition may therefore not be broadly applicable to all patients who may undergo cystectomy. However, the single-institution nature may help limit surgeon and site influences and provide a rigorous initial evaluation to this important surgical question. Moreover, the prospective randomized construct seeks to limit the selection biases and other confounders that affect and detract from prior case series and historical comparisons. We believe that it is essential to assess this procedure in

such a scientifically rigorous manner. This sentiment was echoed in a recent editorial by Montorsi [23]: “Every surgeon involved in clinical research should realize that the era of retrospective studies is definitely over. Answers to crucial questions can only come from prospective studies. Whenever possible, a ‘prospective randomized trial’ design should be used.”

5. Conclusions

We present the results of a prospective randomized controlled noninferiority study with a primary end point of LN yield. The present results demonstrate the robotic approach to be noninferior to the open approach with respect to this primary study end point. The robotic approach also compares favorably with the open approach in several perioperative parameters including blood loss and inpatient narcotic requirements while also demonstrating a statistically longer OR time. Because this represents the only prospective randomized controlled trial, it should serve as a reference for future meaningful comparisons between these two surgical approaches to radical cystectomy.

Author contributions: Raj S. Pruthi had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Wallen, Pruthi, Nielsen.

Acquisition of data: Pruthi, Nix, Wallen, Neilsen.

Analysis and interpretation of data: Smith, Nix, Pruthi.

Drafting of the manuscript: Kurpad, Smith, Nix, Pruthi.

Critical revision of the manuscript for important intellectual content: Pruthi, Wallen, Nielsen.

Statistical analysis: Smith.

Obtaining funding: None.

Administrative, technical, or material support: Kurpad, Smith, Nix.

Supervision: Pruthi.

Other (specify): None.

Financial disclosures: I certify that all conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript (eg, employment/affiliation, grants or funding, consultancies, honoraria, stock ownership or options, expert testimony, royalties, or patents filed, received, or pending), are the following: None.

Funding/Support and role of the sponsor: None.

References

- [1] Huang GJ, Stein JP. Open radical cystectomy with lymphadenectomy remains the treatment of choice for invasive bladder cancer. *Curr Opin Urol* 2007;17:369–75.
- [2] Haber G-P, Crouzet S, Gill IS. Laparoscopic and robotic assisted radical cystectomy for bladder cancer: a critical analysis. *Eur Urol* 2008;54:54–64.
- [3] Guru KA, Kim HL, Piacente PM, Mohler JL. Robot-assisted radical cystectomy and pelvic lymph node dissection: initial experience at Roswell Park Cancer Institute. *Urology* 2007;69:469–74.
- [4] Hemal AK. Robotic and laparoscopic radical cystectomy in the management of bladder cancer. *Curr Urol Rep* 2009;10:45–54.

- [5] Pruthi RS, Smith A, Wallen EM. Evaluating the learning curve for robot-assisted laparoscopic radical cystectomy. *J Endourol* 2008;22:2469–74.
- [6] Pruthi RS, Wallen EM. Robotic-assisted laparoscopic radical cystoprostatectomy. *Eur Urol* 2008;53:310–22.
- [7] Pruthi RS, Chun J, Richman M. Reducing time to oral diet and hospital discharge in patients undergoing radical cystectomy using a perioperative care plan. *Urology* 2003;62:661–5, discussion 665–6.
- [8] Dindo D, Clavien PA. What is a surgical complication? *World J Surg* 2008;32:939–41.
- [9] Fueglistaler P, Adamina M, Guller U. Non-inferiority trials in surgical oncology. *Ann Surg Oncol* 2007;14:1532–9.
- [10] Constantinides CA, Tyritzis SI, Skolarikos A, Liatsikos E, Zervas A, Deliveliotis C. Short- and long-term complications of open radical prostatectomy according to the Clavien classification system. *BJU Int* 2009;103:336–40.
- [11] Fergany AF, Gill IS. Laparoscopic radical cystectomy. *Urol Clin North Am* 2008;35:455–66, viii–ix.
- [12] Novara G, Ficarra V. Robotic-assisted laparoscopic radical cystectomy: where do we stand? *Int J Clin Pract* 2009;63:185–8.
- [13] Wang GJ, Barocas DA, Raman JD, Scherr DS. Robotic vs open radical cystectomy: prospective comparison of perioperative outcomes and pathological measures of early oncological efficacy. *BJU Int* 2008;101:89–93.
- [14] Guru KA, Nyquist J, Perlmutter A, Peabody JO. A robotic future for bladder cancer? *Lancet Oncol* 2008;9:184.
- [15] Pruthi RS, Wallen EM. Robotic assisted laparoscopic radical cystoprostatectomy: operative and pathological outcomes. *J Urol* 2007;178:814–8.
- [16] Khan MS, Shah SS, Hemel A, Rimington P, Dasgupta P. Robotic-assisted radical cystectomy. *Int J Med Robot* 2008;4:197–201.
- [17] Buscarini M, Josephson DY, Stein JP. Lymphadenectomy in bladder cancer: a review. *Urol Int* 2007;79:191–9.
- [18] Murphy DG, Challacombe BJ, Elhage O, et al. Robotic-assisted laparoscopic radical cystectomy with extracorporeal urinary diversion: initial experience. *Eur Urol* 2008;54:570–80.
- [19] Guru KA, Wilding GE, Piacente P, et al. Robot-assisted radical cystectomy versus open radical cystectomy: assessment of postoperative pain. *Can J Urol* 2007;14:3753–6.
- [20] Rhee JJ, Lebeau S, Smolkin M, Theodorescu D. Radical cystectomy with ileal conduit diversion: early prospective evaluation of the impact of robotic assistance. *BJU Int* 2006;98:1059–63.
- [21] Lowrance WT, Rumohr JA, Chang SS, Clark PE, Smith Jr JA, Cookson MS. Contemporary open radical cystectomy: analysis of perioperative outcomes. *J Urol* 2008;179:1313–8, discussion 1318.
- [22] Frazier HA, Robertson JE, Paulson DF. Complications of radical cystectomy and urinary diversion: a retrospective review of 675 cases in 2 decades. *J Urol* 1992;148:1401–5.
- [23] Montorsi F. A plea for integrating laparoscopy and robotic surgery in everyday urology: the rules of the game. *Eur Urol* 2007;52:307–9.