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SURGICAL TECHNIQUE

Robotic-assisted laparoscopic radical cystectomy: Evaluation of functional and oncological results

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Cystectomy;
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Abstract
Objective: Radical cystectomy remains the most effective treatment for patients with localized, invasive bladder cancer and recurrent non-invasive disease. We report our experience with 84 consecutive cases of robotic-assisted laparoscopic radical cystectomy with regard to perioperative results, pathological outcomes and surgical complications.
Materials and methods: A total of 84 consecutive patients (70 male and 14 female) underwent robotic radical cystectomy and urinary diversion at our institution from January 2007 to August 2010 for clinically localized bladder cancer. Outcome measures evaluated included operative variables, hospital recovery, pathological outcomes and complication rate.
Results: The mean age of this cohort was 65.5 years (range 28 to 82). Of the patients 62 underwent ileal conduit diversion, 22 received a neobladder. The mean operating room time for all patients was 261min. (range: 243-618min.) and the mean surgical blood loss was 298ml (range: 50-2000ml). 29%of the cases were pT1 or less disease, 38%were pT2, 26%and 7%were pT3 and T4 disease respectively, 15%were node positive. Mean number of lymph nodes removed was 15 (range 1 to 33). In 2 cases (2.4%) there was a positive surgical margin. Mean days to flatus were 2.12, bowel movement 2.87 and discharge from hospital 17.7 (range: 10-33). There were 45 postoperative complications with 11.9% having a major complication (Clavien grade 3 or higher). At a mean follow-up of 16.7 months 10 patients (11%) had disease recurrence and 2 died of disease.
Conclusions: Our experience with robotic radical cystectomy for the treatment of bladder cancer suggests that in proper hands, this procedure provides acceptable surgical and pathological outcomes.

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PALABRAS CLAVE
Cistectomía;
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Cistectomía radical laparoscópica asistida por robot: evaluación de los resultados funcionales y oncológicos

Resumen

Objetivo: Presentamos nuestra experiencia en cistectomía radical robótica informando sobre los resultados quirúrgicos, tanto desde el punto de vista oncológico como funcional.

Material y método: Entre enero de 2007 y agosto de 2010 fueron operados en nuestra institución un total de 84 pacientes (70 hombres y 14 mujeres) con diagnóstico histopatológico de cáncer de vejiga invasor no metastásico. Evaluamos variables quirúrgicas, el tiempo de recuperación intrahospitalario, los hallazgos patológicos y las complicaciones peri y postoperatorias.

Resultados: La edad media de la población en estudio fue 65,6 años (rango: 28-82). En 62 pacientes se realizó derivación urinaria con ureteroileostomía tipo Wallace, los 22 pacientes restantes recibieron una neovejiga ileal tipo Studer. El tiempo promedio de cirugía fue de 261 minutos (rango: 243-618) y la pérdida promedio de sangre intraoperatoria fue de 298 ml (rango 50-2.000). Un 29, 38, 26 y 7% presentaron estadios histopatológicos postoperatorios pT1, pT2, pT3 y pT4, respectivamente. El 15% de los pacientes operados presentó metástasis locales a nivel ganglionar. El número de ganglios linfáticos resecados por procedimiento quirúrgico fue de 14,47 (rango: 1-33). En dos casos (2,4%) se registraron márgenes quirúrgicos positivos. El tiempo promedio de aparición de flatos fue 2,12 días, evacuación intestinal postoperatoria 2,87 y alta médica 17,710-33. Un total de 45 pacientes presentaron complicaciones perioperatorias. De estos sólo un 11,9% tuvo complicaciones mayores (Clavien III o mayor) que necesitaron de un tratamiento más invasivo. El tiempo promedio de seguimiento fue de 16,7 meses. Durante ese período 10 pacientes (11%) presentaron recidiva del tumor vesical, de los cuales dos (2,38%) fallecieron.

Conclusión: Nuestra experiencia con cistectomía radical robótica en el tratamiento del cáncer de vejiga sugiere que en manos adecuadas este procedimiento proporciona resultados quirúrgicos y patológicos aceptables.

Introduction

RRC has become a surgical option for the treatment of patients with invasive bladder cancer. This technique, besides offering the advantages of reduced intraoperative blood loss, faster postoperative recovery of intestinal peristalsis and general condition, it would apparently yield similar results and oncological surgery when compared with those reported in open surgery.[1-6] Beyond this promising concept, adequately designed comparative studies are needed to verify this assumption. We present our experience in treating patients with invasive bladder cancer using the robotic technique. We describe the functional and oncological results achieved at the same university hospital.

Material and methods

All patients were evaluated with routine laboratory studies and imaging studies including chest radiograph and abdominopelvic CT scan. The histopathological diagnosis was obtained after transurethral resection of the relevant bladder tumor. None of the patients underwent neoadjuvant chemotherapy treatment. Table 1 shows the characteristics of the patients studied.

Robotic radical cystectomy was performed in all patients using the da Vinci ® surgical system (fig. 1). This

Table 1 Preoperative characteristics of patients

Mean age (range)	65.5 (28-82)
Distribution by sex (n)	
Men	70
Women	14
Mean body mass index (kg/m²)	26.5
Mean score of the American Society of Anesthesiologists (ASA)	2.21
Distribution by clinical stage (n)	32
cT1 or less	42
cT2	2
cT3-T4	5
Other tumors	3

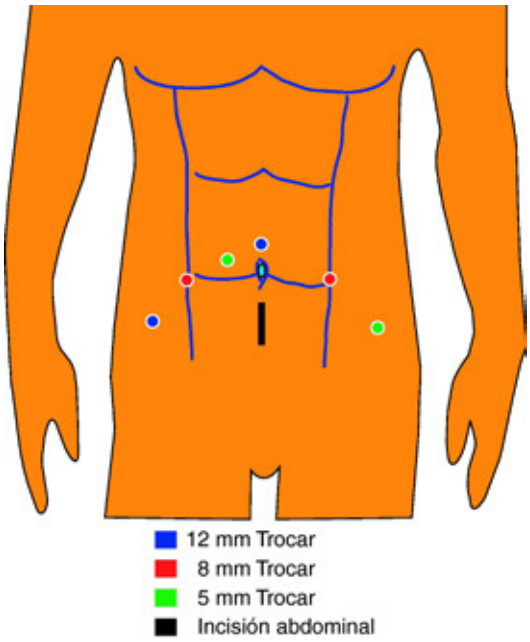

Figure 1 Layout of trocars for the robotic radical cystectomy.

system was used to perform both cystoprostatectomy with bilateral pelvic lymphadenectomy, and for prior thread placement after urethral anastomosis in cases of patients with ileal neobladder. After completing these steps, the robot was removed and urinary diversion, either ureteroileostomy or ileal neobladder was performed by means of an infraumbilical laparotomy averaging 6-8cm in length. We preserved the neurovascular bundles using titanium clips and scissors, as Menon et al.[7] described for the technique of robotic radical prostatectomy. Robotic pelvic lymphadenectomy included the removal of lymph nodes belonging to the external, internal and common iliac vessels.[8] A detailed technical report is presented in the video accompanying this report.

After surgery, patients were taken to a Urological Intensive Care Unit, with standardized postoperative follow-up, which included early removal of the nasogastric catheter after surgery, treatment with prokinetic agents and non-opioid analgesics, as well as early initiation of a diet in accordance with the *fast-track* rehabilitation concept.

The stents were removed in those cases without significant postoperative complications, between postoperative days 10 and 11. In patients with neobladder, we also performed a control cystography on postoperative day 14. In the cases with a urethrovesical anastomosis without contrast extravasation, the catheter was removed immediately after completing the study. Patients with extravasation at anastomosis level continued with the catheter to check its tightness.

In this work, we evaluated surgical variables such as total time of surgery (cystectomy, bilateral pelvic lymphadenectomy and urinary diversion) and intraoperative blood loss. We also evaluated aspects of the patient's postoperative recovery, such as the average time of onset of flatus, length of postoperative bowel movement and the time of discharge. We also studied the postoperative pathologic findings, with special emphasis on the pathologic stage of disease, surgical margin status and number of lymph nodes removed. Additionally, we analyzed the rate of postoperative complications in the medium-term, i.e., within 30 days after surgery.

Those patients with an advanced pathological stage (pT3, pT4 or N +) were re-evaluated at our center after surgery to determine the possibility of adjuvant chemotherapy. We defined the timing of the application of such treatment individually, depending on the postoperative condition of each patient. In most cases in which we decided to perform adjuvant therapy, we used a combination of gemcitabine-cisplatin.

We defined perioperative and postoperative complications using the Clavien classification system.[9] This system allows a better comparative analysis of inter-related surgical complications and is widely accepted in both general and urological surgery.[10,11]

Results

The average age of patients that underwent robotic radical cystectomy was 65.6 years (range 28-82). The male / female ratio was 5:1. The *American Society of Anesthesiologists score* (ASA *score)* was 2.21. From a clinical viewpoint, most of the series (42 patients, 35%of total) were diagnosed and treated for clinical stage cT2. A total of 32 patients (27%) were considered cT1. Only 7 patients (5.9%) were treated as cT3, cT4 unlike tumor or

Table 2 Postoperative surgical and pathological results

Types of urinary diversion (n/%)	
Ileal conduit	62 (73.8)
Neobladder	22 (26.2)
Mean surgical time (min) (range)	261 (243-618)
Pathological results (n/%)	
pT1 or less	24 (28.6)
pT2	32 (38.1)
pT3	22 (26.2)
pT4	6 (7.1)
Mean lymph nodes extracted (range)	14.48 (1-30)
No. of patients with lymph node metastasis (%)	13 (15.5)
No. of patients with positive surgical margins (%)	2 (2.4)
Mean time (days) before onset of flatus (range)	2.12 (1-6)
Mean time (days) before bowel movement (range)	2.87 (1-7)
Mean time (days) before discharge (range)	17.7 (10-33)

Table 3 Percentage of postoperative complications in accordance with the Clavien classification

No. of patients with postoperative complications (%)	45 (53.5)
No. of patients with greater postoperative complications (Clavien III or more) (%)	10 (11.9)
No. of complicated patients according to the Clavien (%)	
I	14 (16)
II	21 (24)
III	6 (6.9)
IV	2 (2.3)
V	2 (2.3)

transitional cell carcinoma (table 1). The average follow-up was 16.7 (range: 3-44) months.

In terms of surgical variables analyzed, we found that the estimated average blood loss was 298ml by surgical procedure (range: 50-2.000ml) and the mean operative time was 260 minutes (range: 243-618).

The average time of postoperative onset of flatus and bowel movement was 2.12 days (range: 1-6) and 2.87 days (range: 1-7), respectively. A total of 25 patients (29.7%) were discharged between days 9 and 13, 26 patients (31%) between days 14 and 18 and 16 patients (19%) between days 18 and 22, and 17 patients (20.3%) after postoperative day 22. The average discharge time was 17.7 days (range: 9-36).

Table 2 shows the surgical results, including the final pathological stage (pT and pN) and the likelihood of coincident prostatic adenocarcinoma, the probability of positive surgical margins and clinical data of bowel recovery and hospital discharge. In only 2 patients (2.4%) positive surgical margins were identified in one case at urethral level and in the other case due to locally advanced bladder cancer in pathological stage pT4. We removed an average of 15 lymph nodes (range: 1-33), following a standard dissection technique and reaching the bifurcation of the common iliac vessels. In summary, 66.7% of patients presented histopathological findings of bladder cancer confined to the organ. Additionally, there were 28 patients (33%) with simultaneous combination of bladder and prostate tumors.

Table 3 describes postoperative complications of patients in accordance with the Clavien classification. A total of 45 patients (53.6%) had postoperative complications in the medium-term, i.e., within less than 30 days after surgery. Of the most significant postoperative complications we quote: postoperative bleeding, readmission due to nausea / vomiting, mechanical and/or functional intestinal ileus, severe urinary tract infections accompanied by fever, deep venous thrombosis of lower limbs, cardiopulmonary complications due to postoperative compensation, obstruction due to mucus blocking of the ileal neobladder and incarcerated inguinal hernia. However, only 10 patients (11.9%) had major postoperative complications (Clavien III or greater), who required more invasive treatment for control. Only one patient died of severe epilepsy in cardiopulmonary arrest. Another patient died one month after chemotherapy due to fulminant metastatic progression of bladder cancer. In this sense, the metastatic proliferation in this patient was not related to the type of technique, but to aggressive tumor biology inherent in the high grade and stage of the tumor.

Discussion

In accordance with our experience with the results obtained at our institution, we can report that oncological and surgical principles are maintained with the use of robotics. Some authors have suggested that the total number of lymph nodes removed, along with the incidence of positive margins, define the surgical quality of radical cystectomy. In this regard, the removal of at least 10 lymph nodes with positive margin rates below 10% has been recommended. Some centers even favor positive margin rates below 5% to define the quality of the surgery.[1,12,13]

In our work we removed an average of 15 lymph nodes by surgery and only two patients (2.4%) had positive surgical margins. In a recent comparative study between open and robotic cystectomy, conducted by Ng et al.,[14] it was found that the robotic technique was associated with less intraoperative blood loss, similar surgical times and comparable results with regard to positive surgical margins and number of lymph nodes removed by surgery (7.2 and 17.9% lymph nodes, respectively). Haber and Gill described positive surgical margins in 5% of the cases studied, with an average of 14 lymph nodes removed in patients that underwent laparoscopic radical cystectomy.[15] According to the foregoing, it appears that in appropriately selected patients, radical cystectomy with minimally invasive techniques, whether laparoscopic or robotic, delivers results, both surgically and oncologically, which are similar to those described for open surgery.

Our mean operating time was 260 minutes. These results are similar to those already published by other authors using the same technique.[1-6] In this regard, we found that the last 40 surgical procedures were performed far faster than the first 40, and that probably in the future, it will be possible to improve operating times and at the same time improve the learning curve.

Our work also confirms that intraoperative blood loss is very low with the use of robotics, except a few exceptions of patients with greater intraoperative bleeding that occurred at the beginning of our series. This same finding has been described in other works.[1-6,16-20] We also believe here that with the improvement of the technique there will be fewer incidences of patients with significant intraoperative bleeding.

As for postoperative evolution, we describe favorable results regarding the average time of onset of flatus, as well as regarding the time of bowel movement. However, we cannot say the same about the mean time of hospitalization. Perhaps this fact is not directly related to poor postoperative

outcome in patients, but rather to the functioning of the German health system. The German health care system requires that patient hospitalization continue until all catheters and surgical sutures have been removed, which significantly extends the average time of hospitalization of each patient. Added to this, at discharge, most patients are referred to a rehabilitation clinic to help improve their general condition, and this itself may further delay the actual time of discharge for organizational reasons.

We used the Clavien system to define our postoperative complications. We observed a postoperative complication rate of 53.6%, where 11.9%of patients were found to have major complications (Clavien III or higher), which required more invasive treatment. We can say that this range of complications, both in quantity and severity did not differ greatly from those described in the literature for open surgery.[21,22] Taking into account that robotic technology is in a phase of constant improvement, we believe that these complications will decrease substantially as RRC reaches a standard of quality.

In relation to the benefits that robotics entails with regard to laparoscopy, we agree with Palou Redorta et al.[6] in asserting that the former requires a shorter learning curve, with competitive operating times from the first cases. Robotic surgery also provides better quality of vision and gesture for the surgeon with better ergonomic conditions, allowing to perform the surgical procedure reducing fatigue and improving precision of movements, which may all result in better outcomes.

Our work has significant limitations. Although the article reviews a relatively large number of patients, describing surgical and oncological results, there is no clear evidence that robotics is a superior technique in oncology in comparison to open surgery. Additionally, this study does not assess the long-term monitoring of the patients operated and, therefore, does not provide information on their survival data in relation to the cancer concerned. This fact is of fundamental importance when determining the oncological efficacy of a surgical technique.

Conclusions

Our experience suggests that robotic radical cystectomy offers the same surgical and pathological findings. The postoperative course of patients in the short term appears to be similar to the cases operated on by open approach. Added to this is that the mean surgery times are lower, mean intraoperative blood loss is significantly lower and the mean intestinal peristalsis activation time is faster compared with laparoscopic and open surgery.

Adequately designed and valid studies with more patients are required to assess the surgical and oncological efficacy of robotic radical cystectomy to be taken into account as the main option for the treatment of patients with non-metastatic invasive bladder cancer.

Conflict of interest

The authors declare that they have no conflict of interest.

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