Robot-assisted radical cystectomy versus open radical cystectomy: assessment of postoperative pain

Khurshid A. Guru, MD,[1,4] Gregory E. Wilding, PhD,[3,6] Pamela Piacente, PA,[1] Jannah Thompson, MD,[4] Wei Deng,[6] Hyung L. Kim, MD,[1,4] James Mohler, MD,[1,4] Kathleen O'Leary, MD[2,5]

[1]Department of Urologic Oncology, Roswell Park Cancer Institute, Buffalo, New York, USA
[2]Department of Anesthesia, Roswell Park Cancer Institute, Buffalo, New York, USA
[3]Department of Biostatistics, Roswell Park Cancer Institute, Buffalo, New York, USA
[4]Department of Urology, State University of New York at Buffalo, Buffalo, New York, USA
[5]Department of Anesthesia, State University of New York at Buffalo, Buffalo, New York, USA
[6]Department of Biostatistics, State University of New York at Buffalo, Buffalo, New York, USA

GURU KA, WILDING GE, PIACENTE P, THOMPSON J, DENG W, KIM HL, MOHLER J, O'LEARY K. Robot-assisted radical cystectomy versus open radical cystectomy: assessment of postoperative pain. The Canadian Journal of Urology. 2007;14(6):3753-3756.

Introduction: *To date, no study has compared postoperative pain and requirement for pain medications in open versus robot-assisted radical cystectomy. Patient reported pain and opiate use were reviewed retrospectively using prospectively collected data from postoperative day one to day of discharge.*

Materials and methods: *Twenty consecutive robot-assisted radical cystectomy patients were compared to the prior 20 patients who underwent open radical cystectomy. Data was collected prospectively to determine opiate requirements and pain scores in each group. Daily opiate use was converted to morphine sulfate equivalents (MSE) to facilitate comparison. A Likert pain perception scale was used to assess perceived pain. Statistical models were used to test for differences in opiate usage and pain perception between groups of patients who underwent open versus robot-assisted surgery.*

Results: *Seven patients were excluded from the study (three from the open group, and four from the robotic group): five due to preoperative opiate usage, one due to missing pain data, and one whose procedure was aborted due to unresectable disease. All patients were similar with respect to age, body mass index and pathological parameters. Average MSE usage differed significantly between the two groups on all postoperative days ($p < 0.007$) whereas average pain scores were similar in the two groups.*

Conclusion: *Patients who underwent robot-assisted radical cystectomy achieved similar pain control but required less opiates than those who underwent open radical cystectomy.*

Key Words: robotic surgery, bladder, cystectomy, pain, postoperative pain, robot-assisted

Introduction

One third of 63210 newly diagnosed cases of bladder cancer in 2005 had muscle invasion at presentation and 15 to 30 percent of superficial bladder cancers will progress to muscle invasion within 5 years of diagnosis.[1] Radical cystectomy is the standard treatment for patients with invasive bladder cancer, since local control is excellent and cure is possible. However, recovery from a prolonged open surgical procedure is slow, leading to restricted activity immediately after surgery until sufficient muscle strength and adequate pain control are attained. Possible benefits of minimally invasive surgery include

Accepted for publication October 2007

Address Correspondence to Dr. Khurshid A. Guru, Department of Urologic Oncology, Roswell Park Cancer Institute, Elm & Carlton Streets, Buffalo, NY 14263 USA

decreased blood loss, insensible fluid loss (direct result of closed abdominal cavity) and postoperative pain, which hasten return to normal daily activities.[2] These advantages may be more important in patients with advanced bladder cancer since they are often elderly (peak incidence in the seventh decade of life), have multiple associated co-morbid conditions and may also require adjuvant therapy.

The robot-assisted radical cystectomy program began at Roswell Park Cancer Institute (RPCI) October 2005[3] and used the Henry Ford technique reported by Menon.[4] To our knowledge, no study has compared postoperative pain control and analgesic requirements between robot-assisted radical cystectomy and open radical cystectomy. We report a retrospective comparison of analgesic requirements and patient pain scales between a consecutive series of robot-assisted radical cystectomy and open cystectomy patients.

Materials and methods

RPCI offered open radical cystectomy and robot-assisted radical cystectomy beginning October 2005 and all patients selected the minimally invasive approach. Thus, no demographic, oncological or clinical criteria were used to select surgical approach. Twenty consecutive patients who underwent robot-assisted radical cystectomy between October 2005 and June 2006 were compared to 20 consecutive patients who had undergone open radical cystectomy between April 2004 and September 2005. Data was collected from a retrospective review of medical records.

Prior to the initiation of the robotic cystectomy program, all radical cystectomy patients were given epidural analgesia for postoperative pain control unless there was an absolute contraindication or the patient refused an epidural analgesic. This practice was continued with the robotic cases. However early on, it became apparent that patients did not necessarily require epidural analgesia postoperatively. Therefore the option of epidural analgesia was left to the discretion of the anesthesiologist at the time of the preoperative visit.

Patients undergoing open radical cystectomy underwent a midline incision with a self-retaining retractor. During robot-assisted radical cystectomy a six-port transperitoneal approach was employed.[3] After completion of robot-assisted radical cystectomy and pelvic lymph node dissection, the specimen was extracted by extending the umbilical port incision and per vagina in female patients. A Jackson Pratt drain and a urethral foley were used as drains in all patients.

All open radical cystectomy patients were offered epidural analgesia as the primary consideration for pain control at the time of their preanesthestic evaluation. Those who refused or were not considered for epidural analgesia were given intravenous morphine or hydromorphone for postoperative analgesia. In the robot-assisted radical cystectomy group, patients were offered either epidural or intravenous analgesia use for postoperative analgesia, as the anesthesia staff had uncertain expectations of the need for postoperative analgesia in this patient population. Epidural analgesia was stopped once the individual patient demonstrated decreasing opiate requirements. All patients were converted to oral analgesics prior to discharge. Opiate use during hospitalization was converted to morphine sulfate equivalents (MSE).[5]

As all opiate use was accounted for (epidural, intravenous and oral) by conversion to MSE's, the actual length of time of epidural use is not critical to the results.

Ketorolac use was converted into MSE using a ratio of ketorolac 30 mg IV to morphine 10 mg IV. Patient reported pain was collected by nursing staff using a Likert pain perception scale (visual analog pain scale). Pain scales were reported every 8 hours. The average of the highest pain score for each day was collected throughout the postoperative period.

Age and body mass index were compared between surgery groups using a two-sample t-test. Differences in clinical stage were tested using Fisher's exact test. To statistically compare the longitudinal patterns of MSE, the method proposed by Tooze et al[6] was used. This approach allows for the simultaneous modeling of the probability of opiate use and the amount of opiate used (given some opiates were used) through the inclusion of correlated random subject effects. A logistic model was used in the modeling of the probability of some opiate use and a lognormal model was used in the modeling of the amount of opiate use. Initially terms representing the days after surgery, surgery group, and days after surgery by surgery group interaction were included in the modeling of both aspects of MSE. Backward elimination was used to eliminate non significant effects. To statistical test for difference in pain score, a marginal model with auto-regressive covariance structure was used. A log transform was applied to pain score in order to meet statistical assumptions. Standard diagnostic tools were used to assess model fit and identify statistical outliers. All hypothesis testing was done at a 0.05 level of significance. All statistical analyses were performed using SAS version 9.1 statistical software (Cary, NC).

TABLE 1. **Clinical descriptors**

Variable	Open	Robotic
No. pts.	17	16
Mean age (yr)	69	72
Mean BMI	27	26
Pathological stage		
T0.Ta/T1/CIS	4	5
T2	3	1
T3	6	5
T4	4	5

TABLE 2. **Drugs and type of postoperative analgesia**

	Open	Robotic
Immediate postoperative analgesia		
Morphine PCA	2	7
Hydromorphine PCA	1	6
Epidural PCA	13	3
None	1	0
Subsequent oral analgesic selection		
Hydrocodone aceteminophen	9	10
Ibuprofen and/or aceteminophen	3	1
None	5	5

Results

Three patients from the open group were excluded because of prior opiate dependence. Four patients from the robotic group were excluded (one case aborted due to unresectable disease, two excluded due to prior opiate dependence, and one had missing postoperative pain data). One robot-assisted radical cystectomy patient required open conversion due to ventilatory difficulty in steep trendelenberg position; this patient was included in the robotic group as 85% of the procedure was completed with robotic acceptance.

The open and robotic groups of patients were comparable ($p > 0.5$) in age, body mass index and pathological stage, Table 1. The probability of some opiate use was similar between groups (interaction and main group effect $p > 0.67$). The need for opiate use was only related significantly to days after surgery ($p < 0.0001$). The amount of MSE, if used, differed between the groups (main effect, $p = 0.007$), Figure 1. Differences in average pain scores in both groups were not significant ($p = 0.4174$), Figure 2. Thirteen of 16 open radical cystectomy patients had epidural analgesia (PCEA) in comparison to 3 of 16 robotic patients, Table 2.

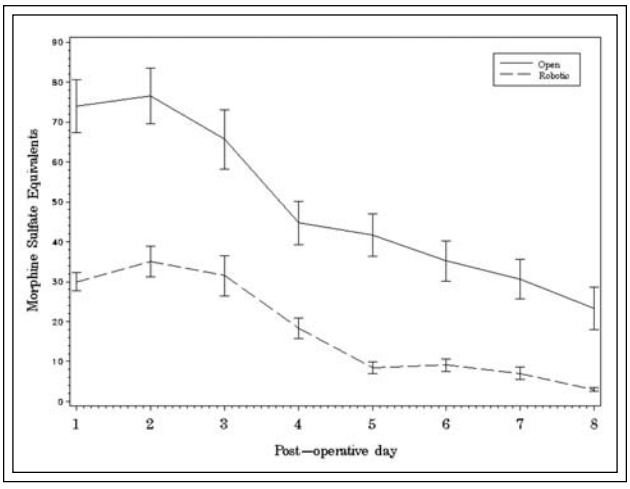

Figure 1. Comparison of morphine sulfate equivalent (MSE) between open and robotic-assisted radical cystectomy.

Discussion

Advances in surgical techniques and perioperative management have decreased the morbidity and mortality associated with radical cystectomy. These improvements are especially important since patients with invasive bladder cancer often present at advanced age with significant co-morbid conditions. Radical cystectomy offers local oncologic control, palliation of symptoms and a chance for prolonged survival, which must be balanced with the patient's ability to recover successfully from surgery.

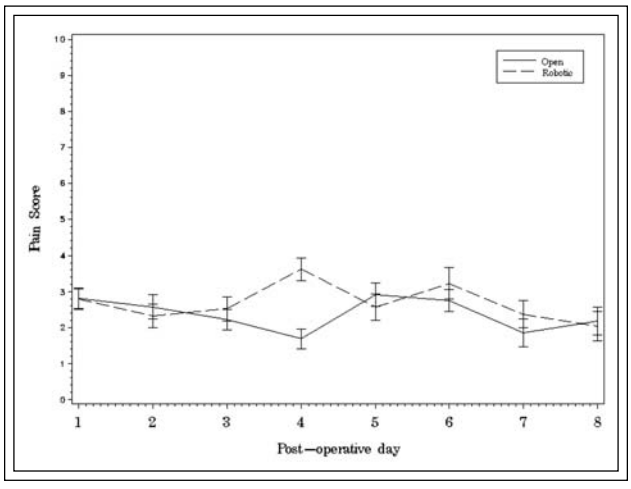

Figure 2. Comparison of Likert pain perception scores between open and robot-assisted radical cystectomy.

Benefits of a shorter hospital stay, reduced postoperative pain and shorter convalescence have been demonstrated with laparoscopic nephrectomy and adrenalectomy.[7,8] Indications for a minimally invasive approach to urological procedures are expanding rapidly. Significant advantages with robotic assistance in major pelvic surgery have led to both cystectomy and hysterectomy being performed robotically.[4] These advantages include potential improvement in pain control, shorter hospital stays and earlier return of bowel function and normal activity. Inadequate pain control has been found to correlate with decreased quality of life.[9] A decreased need for opiate analgesia can improve opiate-associated complications such as ileus, decreased mental status and impaired pulmonary function.

In a VA study of 1021 patients,[10] those patients who received combined epidural and general anesthesia with postoperative epidural analgesia had better pain control than those who received general anesthesia and postoperative systemic opioids. Liu et al[11] also demonstrated the superiority of epidural analgesia compared to traditional systemic or intravenous patient-controlled opiate analgesia for control of postoperative pain. Our open patients with epidural analgesia (in whom local anesthetic was used in conjunction with opiates) still had higher overall opiate requirements in comparison to our robotic group. The results of our study showed lower requirements for postoperative analgesia in the robotic group compared to the open group.

Limitations of this report include its retrospective nature and small sample size. However, it appears that MSE use was lower in the robotic group while postoperative pain was well controlled for both groups.

Despite the possible advantages in postoperative pain control and return to normal daily activity, robot-assisted radical cystectomy must demonstrate comparable oncologic results in margin status and adequate lymph note yield before it is accepted as an equivalent surgical technique to the gold standard of open radical cystectomy. Further studies from other centers need to confirm this preliminary study and compare oncologic outcomes between robot-assisted radical cystectomy and open cystectomy before robot-assisted radical cystectomy can secure a place in the armamentarium against muscle invasive bladder cancer.

Conclusion

To our knowledge, this is the first study comparing postoperative pain control in robot-assisted radical cystectomy and open radical cystectomy patients. Patients who underwent robot-assisted radical cystectomy had lower opiate requirements than those who underwent open radical cystectomy, while achieving satisfactory pain control.

Further studies are required to determine whether decreased opiate use will translate into improved patient outcomes. □

References

1. Herr HW, Dotan Z, Donat SM et al. Defining optimal therapy for muscle invasive bladder cancer. *J Urol* 2007;177:437.
2. Savage SJ. Radical cystectomy: the minimally invasive approach. *Urol Oncol* 2004;22:262.
3. Guru KA, Kim HL, Piacente PM et al. Robot-assisted radical cystectomy and pelvic lymph node dissection: initial experience at Roswell Park Cancer Institute. *Urology* 2007;69:469.
4. Menon M, Hemal AK, Tewari A et al. Nerve-sparing robot-assisted radical cystoprostatectomy and urinary diversion. *BJU Int* 2003;92:232.
5. Wylie W, Healy TEJ, Knight P et al. Wylie and Churchill-Davidson's a practice of anesthesia. xxii, 2003.
6. Tooze JA, Grunwald GK, Jones RH. Analysis of repeated measures data with clumping at zero. *Stat Methods Med Res* 2002;11:341.
7. Dunn MD, Portis AJ, Shalhav AL et al. Laparoscopic versus open radical nephrectomy: a 9-year experience. *J Urol* 2000;164:1153.
8. Gill IS. The Case for Laparoscopic Adrenalectomy. *Journal of Urology* 2001;166:429.
9. Wu CL, Rowlingson AJ, Partin AW et al. Correlation of postoperative pain to quality of recovery in the immediate postoperative period. *Reg Anesth Pain Med* 2005;30:516.
10. Woo HO, Youn HS, Park ES. *Annals of Surgery* 2001;239.
11. Liu S, Carpenter RL, Neal JM. Epidural anesthesia and analgesia. Their role in postoperative outcome. *Anesthesiology* 1995;82:1474.