Cost Analysis of Robotic Versus Open Radical Cystectomy for Bladder Cancer

Angela Smith, Raj Kurpad, Anjana Lal, Matthew Nielsen, Eric M. Wallen and Raj S. Pruthi*

From the Division of Urologic Surgery, The University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

Purpose: Recently robotic approaches to cystectomy have been reported, and while clinical and oncological efficacy continues to be evaluated, potential financial costs have not been clearly evaluated. In this study we present a financial analysis using current cost structures and clinical outcomes for robotic and open cystectomy for bladder cancer.

Materials and Methods: The financial costs of robotic and open radical cystectomy were categorized into operating room and hospital components, and further divided into fixed and variable costs for each. Fixed operating room costs for open cases involved base cost as well as disposable equipment costs while robotic fixed costs included the amortized machine cost as well as equipment and maintenance. Variable operating room costs were directly related to length of surgery. Variable hospital costs were directly related to transfusion requirement and length of stay. The means of the prior 20 cases of robotic and open cystectomy were used to perform a comparative cost analysis.

Results: Mean fixed operating room costs for robotic cases were $1,634 higher than for open cases. Operating room variable costs were also higher by a difference of $570, directly related to increased operating room time. Hospital costs were nearly identical for the fixed component while variable costs were $564 higher for the open approach secondary to higher transfusion costs and longer mean length of stay. Based on these findings robotic cystectomy is associated with an overall higher financial cost of $1,640 (robotic $16,248 vs open $14,608). Cost calculators were constructed based on these fixed and variable costs for each surgical approach to demonstrate the expected total costs based on varying operating room time and length of stay.

Conclusions: Robotic assisted laparoscopic radical cystectomy is associated with a higher financial cost (+$1,640) than the open approach in the perioperative setting. However, this analysis is limited by its single institution design and a multicenter followup study is required to provide a more comprehensive analysis.

Key Words: cystectomy, urinary bladder neoplasms, robotics, costs and cost analysis

Abbreviations and Acronyms

OR = operating room

Submitted for publication May 23, 2009.

Study received institutional review board approval.

* Correspondence and requests for reprints: Division of Urologic Surgery, The University of North Carolina at Chapel Hill, 2113 Physicians Office Bldg CB 7235, 170 Manning Dr., Chapel Hill, North Carolina 27599-7235 (telephone: 919-966-2571; FAX: 919-966-0098; e-mail: rpruthi@med.unc.edu).

See Editorial on page 421.

In recent years surgeons have begun to report single institution case series of minimally invasive approaches to radical cystectomy including laparoscopic and, more recently, robotic assisted techniques, building on the increasing experiences of this surgical modification in prostate cancer. Recent robotic cystectomy case series have demonstrated the surgical feasibility of this procedure with the potential of lower surgical blood loss,

0022-5347/10/1832-0505/0
THE JOURNAL OF UROLOGY®

Vol. 183, 505-509, February 2010
Printed in U.S.A.
DOI:10.1016/j.juro.2009.09.081

more rapid return of bowel function and decreased length of stay, while maintaining the pathological and short-term clinical outcomes observed with the open technique.[1–5]

While investigators continue to evaluate the potential role and benefits of robotic cystectomy from a clinical and oncological perspective, what remains unclear is the potential financial cost of robotic assisted approaches to cystectomy. Careful analysis of the monetary burden of this procedure must be performed to justify its application if it is to be adopted on a widespread basis. Although some investigators have addressed the cost-effectiveness of robotics in prostate cancer surgery, the applications to cystectomy have been lacking. This report includes a financial analysis using current cost structures and clinical outcomes for robotic and open cystectomy for bladder cancer.

METHODS

The analysis focused on fixed and variable accounting costs of each procedure, and included the OR component and the hospital component. The OR component of both approaches had 2 associated costs, fixed and variable. The OR fixed costs for open cases included base OR costs per case as well as OR disposable equipment costs (ENDO GIA™ stapler/cutter [1], 60 mm ENDO GIA staple load [4], GIA stapler [1], 75 mm GIA staple load [2]) ($2,076 per case). For robotic cases this included base OR costs per case and equipment for robotic cases (ENDO GIA stapler/cutter [1], 60 mm ENDO GIA staple load [2], GIA stapler [1], 75 mm GIA staple load [2], trocars/ports [3]) ($1,635 per case) and costs of the robotic machine ($2,303 per case). This latter cost included the amortized purchase cost (during 5 years) and maintenance cost (distributed over 288 cases per year) which also included prostatectomy cases. Of note, initial capital costs for cases (eg Bookwalter™ retractors, OR beds) (except for robotic costs) were not included in this model. Variable OR costs were directly related to length of surgery and included the cost of OR personnel per time (including anesthesia resources per time).

Hospital costs were also divided into fixed and variable accounting costs. Fixed costs were maintained to be equivalent between the 2 groups because both were placed on the same postoperative clinical care pathway. Hospital variable costs included transfusion costs ($268 per unit) and costs related to length of stay ($940 per day).

Using the means of the previous 20 cases of robotic cystectomy (from a cohort of 85 since January 2006) and the means from the previous 20 cases of open cystectomy (from a cohort of 78 from January 2006) we performed a comparative cost analysis that included the variability of OR time, transfusion requirements and hospital stay to analyze the difference between open and robotic radical cystectomy. This information was obtained from a database constructed and maintained in accordance with the principles and practices of the University of North Carolina institutional review board, and in recognition of and compliance with United States Health Insurance Portability and Accountability Act of 1996 guidelines. Factors which were not expected or shown to be different between the 2 approaches were not included in the analysis, such as surgeon fees, base anesthesia fees for cystectomy (based on CPT code), hospital medication use/costs (as all patients were placed on the same clinical care pathway), and accounting costs that may be associated with clinic visits before and after hospitalization. In addition, our past studies have shown no differences in the rate, type or severity of complications and, therefore, perioperative complication costs were not included in the study.[6] As previously noted analysis was made using means from the previous 20 cases by each technique. In addition, a cost calculator was created to examine the effects of variability in OR time and hospital stay with each technique.

RESULTS

For the previous 20 open radical cystectomies average OR time was 3.8 hours (228 minutes) and mean hospital stay was 5.3 days. For the previous 20 robotic radical cystectomies mean OR time was slightly longer at 4.1 hours (246 minutes) but average hospital stay was lower at 4.7 days. Mean blood transfusions were 1.2 units for open procedures and 0.4 units for robotic.

The total cost of robotic radical cystectomy was $1,640 more than open radical cystectomy. Mean fixed OR cost for robotic cases ($4,032) was $1,634 higher than for open cases ($2,398). Given the previously noted mean OR times the OR variable costs were higher for robotic cases ($7,798) than for open cases ($7,228) by a difference of $570 primarily due to the impact of increased OR time. Regarding hospital accounting costs there were no differences in fixed costs because both sets of patients were placed on the same clinical pathway with no cost differences. However, hospital variable costs were $564 higher with the open approach ($4,982 vs $4,418 robotic) due to higher transfusion costs associated with open vs robotic approach and costs related to a longer mean length of stay for open vs robotic cases.

We have also constructed a cost calculator based on the fixed and variable costs (OR time and hospital stay) associated with each surgical approach (see table). The calculator demonstrates the expected total costs at varying OR times and lengths of hospital stay that may be encountered.

DISCUSSION

Robotic assisted surgery is becoming increasingly prevalent in the field of urology. Less than a decade after the introduction of the robotic assisted laparoscopic prostatectomy by Binder and Kramer in Germany, this minimally invasive approach has represented a paradigm shift in the treatment of prostate