

Impact of Body Mass Index on Robot-Assisted Radical Cystectomy

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ABSTRACT

Background and Objectives: Obesity is a major comorbidity in the Western world and influences outcomes of patient care. A minimally invasive approach towards radical cystectomy has been increasing in popularity. We sought to determine the influence of body mass index (BMI) on robot-assisted radical cystectomy.

Methods: Fifty-one consecutive patients underwent robot-assisted radical cystectomy for bladder cancer from October 2005 to April 2007 and were categorized into 3 groups based on their weight: normal (BMI <25), overweight (BMI=25 to 29) and obese (BMI= 30 to 39.9). Effect of BMI on intraoperative, pathologic, and postoperative outcomes was assessed by retrospective review of the robot-assisted radical cystectomy database.

Results: Mean BMI was 28.0, and 71% of the patients were overweight or obese. BMI did not correlate with age, sex, or American Society of Anesthesiologists (ASA) score. Overweight and obese patients had similar operative times and estimated blood loss compared with patients with normal BMI. Overweight and obese patients with bulky disease (pT3–4) had significantly higher rates of positive surgical margins (P=0.05). Complication rates were similar.

Conclusion: Robotic-assisted radical cystectomy can be considered for patients of all body mass indices. Wider excision should be performed in patients with higher BMI.

Key Words: Bladder cancer, Cystectomy, Obesity, Robotics.

INTRODUCTION

Obesity has emerged as a major healthcare problem in the United States and a common comorbid factor in surgical patients. Data from the two National Health and Nutrition Examination Surveys (NHANES) demonstrate that the prevalence of obesity increased from 15.1% in 1980 to 31.1% in 2002 among patients 20 to 74 years of age.¹

Elevated BMI has been thought to be associated with poorer surgical outcomes, especially after procedures of increased technical complexity. Numerous studies have classified overweight and obese individuals into higher preoperative risk categories. Chang et al² reported increased perioperative blood loss and prolonged operative times in patients with elevated BMI undergoing open radical cystectomy.

In the current study, the affect of elevated BMI on intraoperative parameters and postoperative and pathologic outcomes was evaluated in 51 consecutive patients who underwent robot-assisted radical cystectomy.

METHODS

An institutional review board-approved retrospective chart analysis was performed of 51 consecutive patients who underwent robot-assisted radical cystectomy for carcinoma of the bladder from October 2005 to April 2007. All patients were offered open radical cystectomy or robot-assisted radical cystectomy, and all chose the robotic procedure. Data were collected prospectively using medical record committee-approved forms and entered into a database required as part of an institutional quality assurance initiative. Appropriate patients were given the choice of orthotopic continent diversion, cutaneous continent diversion, and ileal conduit urinary diversion. All diversions were performed in extracorporeal fashion, except for one neobladder that was created robotically. Patients were divided into 3 cohorts: normal weight (BMI <25), overweight (BMI=25 to 29) and obese (BMI=30 to 39.9) for the purpose of comparison. The effect of BMI on preoperative variables, intraoperative parameters and early postoperative results was evaluated.

Binary variables were summarized by calculating frequencies and relative frequencies. Fisher's exact test was used

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to study the association between categorical variables and BMI group. Numeric variables were summarized using means and standard deviations. The Kruskal-Wallis test was used to compare BMI group and numeric variables. Secondary analyses, based on ungrouped BMI values, were performed using either the exact test corresponding to the Spearman rank correlation or logistic regression depending on the nature of the outcome variables. A 0.05 nominal significance level was used in all testing. All statistical analyses were carried out using SAS (version 9.1).

RESULTS

Mean BMI was 28, and 71% of the patients were overweight or obese. Two patients were converted to an open cystectomy: one patient was unable to tolerate a steep Trendelenberg position and one patient had a large posterior tumor extending into the rectum. Three fourths of patients were male, and sex distribution was similar in each BMI group. Age and ASA scores were similar across groups with mean age 67 and mean ASA score 2.3 (**Table 1**).

The mean operative time from incision to bladder extirpation was 180 minutes. A trend was found towards decreased extirpation time in patients with elevated BMI. The time to create a urinary diversion was proportional to the BMI. The mean operative time for pelvic lymph node dissection was 44 minutes and was similar in all cohorts. No intraoperative complications were seen. Mean blood loss was 546.4 mL. Blood loss varied among the 3 groups but did not correlate with BMI (**Table 2**).

Twenty-one patients had organ-confined bladder cancer, 18 patients had tumor extending into perivesical adipose tissue, and 10 patients had tumor extending into surrounding organs. No significant difference was noted in the primary tumor stage between the 3 groups. Six pa-

tients (12%) had positive surgical margins. Five positive surgical margins occurred in the overweight cohort, and one positive margin occurred in the obese cohort ($P=0.05$). All pathologic stage T0-T2 patients had negative surgical margins. Two surgical margins were positive (11%) in pT3 patients, and 4 (40%) surgical margins were positive in pT4 patients. The greatest numbers of lymph nodes were extracted from obese patients, but no significant difference existed among the 3 groups.

Thirteen postoperative complications occurred; 3 developed in the normal weight cohort, 6 in the overweight cohort, and 4 in the obese cohort ($P=0.77$). One death occurred in the overweight group (**Table 4**).

DISCUSSION

Obese patients have increased risk for multiple medical problems that can adversely affect surgical outcomes. In the Common Toxicity Criteria for Adverse Events of the Cancer Therapy Evaluation Program, being overweight ($BMI > 25$) is graded as a moderate risk of an adverse event, obesity ($BMI = 30$ to 39.9) is graded as a severe risk, and morbid obesity ($BMI > 40$) is considered life threatening.³ Obesity with or without comorbidities can lead to deranged cardiovascular physiology leading to eccentric left ventricular hypertrophy that significantly increases the risk for future perioperative cardiovascular events, such as acute myocardial ischemia, myocardial infarction, congestive heart failure, and sudden death.⁴⁻⁶ These events are even more pronounced when hypertension is present.⁷ Pulmonary compromise can predispose the obese patient to pneumonia and atelectasis.^{8,9} Several series have reported an increased incidence of obesity in patients with pulmonary embolism and deep venous thrombosis.¹⁰ In-

Table 1.
Demographics/Cohort Characteristics*

Parameter	Entire Cohort n = 49	BMI < 25 n = 14	BMI = 25.29 n = 18	BMI ≥ 30 n = 17
Age	67 (12)	68 (13)	69 (13)	65 (9)
Sex				
Male	37 (76)	8 (57)	15 (83)	14 (82)
Female	12 (25)	6 (43)	3 (17)	3 (18)
ASA Score	2.3 (0.5)	2.1 (0.4)	2.4 (0.5)	2.4 (0.5)
Previous Abdominal/Pelvic Surgery	30 (61)	8 (57)	13 (72)	9 (53)

*For numerical variables, statistics represent mean (SD); for categorical variables, statistics represent frequency (relative frequency).

Table 2.
Intraoperative Parameters*

Parameter	Entire Cohort n = 49	BMI < 25 n = 14	BMI = 25-29 n = 18	BMI ≥ 30 n = 17	P Value
Total Operative Time					
a. Incision RRC‡	180 (63)	192 (57)	178 (57)	172 (74)	0.40
b. PLND‡	44 (13)	40 (8)	45 (18)	45 (12)	0.46
c. Diversion	142 (96)	127 (36)	143 (123)	154 (100)	0.79
No. of Diversion Types					
a. Ileal Conduit	46 (94)	14 (100)	16 (89)	16 (94)	0.78
b. Neobladder	3 (6)	0 (0.0)	2 (11)	1 (6)	
Open Conversion	2 (4)	0 (0)	1 (6)	1 (6)	1.0
Intraoperative Complication	0	0	0	0	1.0
Blood Loss	546 (437)	630 (620)	496 (365)	532 (332)	0.81

*For numerical variables, statistics represent mean (SD); for categorical variables, statistics represent frequency (relative frequency). †RRC=robotic-radical cystectomy. ‡ PLND=pelvic lymph node dissection.

Table 3.
Pathology*

Parameter	Entire Cohort n = 49	BMI < 25 n = 14	BMI = 25-29 n = 18	BMI ≥ 30 n = 17	P-Value
Organ Confined/pT0-pT2	21 (43)	9 (64)	5 (28)	7 (41)	
Nonorgan Confined					0.25
pT3	18 (37)	4 (29)	9 (50)	5 (29)	
pT4	10 (20)	1 (7)	4 (22)	5 (29)	
Positive Surgical Margins	6 (12)	0 (0.0)	5 (28)	1 (6)	0.05
Number of nodes	17 (9)	16 (6)	16 (9)	18 (11)	0.81

*For numerical variables, statistics represent mean (SD); for categorical variables, statistics represent frequency (relative frequency).

creased incidence of bodily infections, including wound infections, have been reported in obese patients.^{11,12}

Numerous investigators have reported on the affect of an elevated BMI on various minimally invasive surgical procedures. Singh et al¹³ reported increased blood loss and operative times during laparoscopic prostatectomy in patients with elevated BMI. Mikhail et al¹⁴ reported similar findings in a study of 150 patients who underwent robotic prostatectomy. Dominguez et al¹⁵ revealed longer operative times and higher blood loss in patients with elevated BMI during laparoscopic splenectomy. However, other investigators did not find a significant difference in outcomes when operating on overweight or obese patients. Colombo et al¹⁶ demonstrated that BMI had no significant impact on outcomes after laparoscopic nephrectomy. Ro-

bot-assisted prostatectomy data from the Australian Institute of Robotic Surgery suggest that vesicourethral anastomotic times were greater in obese patients, but the overall operative times were similar regardless of BMI. Furthermore, the overall complication rates from the Australian series were similar during the immediate postoperative period.¹⁷ Boczeko et al¹⁸ reported similar findings in 375 patients who underwent robot-assisted radical prostatectomy.

Two large series specifically investigated the impact of elevated BMI on open radical cystectomy. Chang et al² reported that overweight and obese patients had elevated blood loss and longer operative times during open radical cystectomy. In their series, there was no difference in the complication rate among the different cohorts. Lee et al¹⁹ reported increased blood loss, prolonged operative times,

Table 4.
Postoperative Stay and Complications

Parameter	Entire Cohort n = 49	BMI < 25 n = 14	BMI = 25-29 n = 18	BMI ≥ 30 n = 17
Hospital Stay (Days) (SD)	9.4 (8.7)	11.8 (13.5)	7.7 (3.3)	9.1 (7.6)
Complications Rate (%)	13 (27)	3 (21)	6 (33)	4 (24)
Complications				
Dysrhythmia	1	1	0	0
Myocardial Infarction	1	0	1	0
Pulm Embolism/DVT	2	0	0	2
Renal failure	1	0	1	0
Wound Infection	1	1	0	0
Wound Dehiscence	1	1	0	0
Ureteral Stricture	1	1	0	0
Rectal Injury	0	0	0	0
Vascular Injury	0	0	0	0
Postop Hemorrhage	2	0	2	0
Postop Infection (<i>C. difficile</i>)	1	1	0	0
Sepsis	2	1	1	0
Ileus	1	1	0	0
Pneumonia		0	0	0
UTI	1	0	1	0
PSBO/SBO	3	0	1	2
Mortality	1	0	0	1

DVT=deep venous thrombosis, UTI=urinary tract infection, PSBO=partial small bowel obstruction, SBO=small bowel obstruction, *C. difficile*=Clostridium difficile

and increased complication rates in patients with elevated BMI in their open radical cystectomy series.

The current series is the first to evaluate the effect of BMI on robot-assisted radical cystectomy. Unlike the results reported by Chang et al² and Lee et al,¹⁹ operative time, blood loss, and the complication rate did not significantly differ among the 3 cohorts in our series, demonstrating the decreased impact of elevated BMI on the performance of robot-assisted radical cystectomy. Robot-assisted bladder extirpation was quicker in patients with BMI greater than 25, while extracorporeal urinary diversion took longer in obese and overweight patients ($P>0.05$). The overall operative time was similar among the 3 groups. Obese patients had lower blood loss than patients with normal BMI ($P=0.81$). The complication rates were similar across the 3 groups ($P=1.0$).

The only adverse affect of elevated BMI was an increase in the rate of positive surgical margins ($P=0.05$). All patients

with a normal BMI had negative surgical margins. All positive margins occurred in patients with pT3 or pT4 disease and 4 of the 6 patients with positive margins had nodal metastasis. The positive margin rate of 21% in patients with bulky tumors (pT3-4) was higher than the 12% positive margin rate for bulky disease noted by Herr et al.²⁰ Hafron et al²¹ demonstrated that while soft tissue margins impact overall survival, no significant difference in disease-specific survival or overall survival was seen in obese, overweight, and normal weight patient populations.

Limitations of our study included a small population size. Only 49 patients underwent robot-assisted radical cystectomy. However, to our knowledge, no large robot-assisted radical cystectomy series have been published to date. Another limitation is the retrospective nature of our study and the lack of a prospective, randomized comparison with open radical cystectomy. The analysis was per-

formed retrospectively, but the data were collected prospectively as part of an institutional quality assurance initiative.

CONCLUSIONS

Robotic-assisted radical cystectomy can be considered in patients with elevated BMI because complication rates, operative times, and blood loss were similar in patients from the average, overweight, and obese BMI categories. Our data suggest that wider surgical excision is needed in patients with elevated BMI to decrease the risk of a positive surgical margin.

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