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Authors

Ahlering, T E

Eichel, L

Edwards, R

et al.

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ADULT UROLOGY

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IMPACT OF OBESITY ON CLINICAL OUTCOMES IN ROBOTIC PROSTATECTOMY

THOMAS E. AHLERING, LOUIS EICHEL, ROBERT EDWARDS, AND DOUGLAS W. SKARECKY

ABSTRACT

Objectives. To assess the preoperative parameters and clinical outcomes of patients undergoing robotic laparoscopic radical prostatectomy with specific attention to the body mass index (BMI). Little is known about the impact of obesity (BMI greater than 30) on the clinical outcomes of patients undergoing radical prostatectomy.

Methods. The data of 100 men undergoing robotic laparoscopic radical prostatectomy between June 2002 and October 2003 were prospectively entered into a database. The standard clinical characteristics (eg, prostate-specific antigen, Gleason score) and perioperative and postoperative parameters were evaluated. Additionally, all were assessed preoperatively and postoperatively for American Urological Association symptom and bother scores, uroflowmetry, postvoid residual urine volume, and sexual function.

Results. Nineteen men were obese (BMI greater than 30) and 81 were not (BMI less than 30). The two groups had a similar need for transfusion, length of stay, and pathologic outcome. However, the obese men had poorer baseline urinary function (peak flow rate 13.9 versus 18.3 mL/s; voided volume 306 versus 454 mL; $P \leq 0.05$) and sexual function (Sexual Health Inventory in Men score 14.1 versus 18.2; $P \leq 0.05$). Obese men had significantly more complications (26.3% versus 4.9%; $P = 0.01$) and required more time to return to baseline activities (7 versus 4.3 weeks; $P = 0.09$) and urinary function. Finally, at 6 months, only 47% of obese patients versus 91.4% of nonobese patients had achieved pad-free urinary continence ($P \leq 0.001$).

Conclusions. In this study, obese patients had significantly worse baseline urinary and sexual function, had complications, and did not recover urinary function as quickly or as well as nonobese patients. Obese patients also demonstrated a strong trend toward a delay in recovery time. UROLOGY **xx:** xxx, xxxx. © 2005 Elsevier Inc.

Obesity is, and for the foreseeable future will be, a major health issue in the United States. Obesity is defined as a body mass index (*BMI = weight in kilograms/height in meters squared*) greater than 30 kg/m^2, and a rising trend has been documented during the past 30 years.[1] The prevalence of obesity was estimated at approximately 30% in the United States in 1999 and 2000.[1] Observations that obesity is accounting for an increase in the overall incidence of cancer, especially cancers of the kidney, esophagus, and stomach, have been reported.[2] Although reports vary as to whether obesity increases the risk of prostate cancer, a growing body of evidence has shown a correlation between prostate cancer aggressiveness and obesity.[3-6] Additionally, obesity has been linked to hypertension, vascular disease, diabetes, and other serious medical conditions.

Remarkably, very little has been reported specifically on the surgical and clinical outcomes of obese patients undergoing radical prostatectomy. Boczko and Melman[7] apparently reported the first study specifically focusing on clinical issues in obese patients undergoing radical perineal prostatectomy. Some reports have implied that although heavier patients seem more difficult, the operative times, blood loss, and other parameters have not been obviously adversely affected.[8-10] We report an evaluation of obese patients with specific regard to baseline urinary and sexual function, perioperative complications, and clinical outcomes in men undergoing robot-assisted laparoscopic radical prostatectomy.

From the Department of Urology, University of California, Irvine, Medical Center, Orange, California

Reprint requests: Thomas E. Ahlering, M.D., Department of Urology, University of California, Irvine, Medical Center, 101 The City Drive, South, Building 26, RT 81, Orange, CA 92868. E-mail: tahlerin@uci.edu

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Table I. *Demographic and clinical data for obese and nonobese groups*

Variable	BMI > 30	*SE*	BMI < 30	*SE*	*P* Value
Patients (n)	19		81		
Age (yr)	62.6 (53–70)	1.4	62.3 (43–78)	0.8	0.88
Preoperative PSA (ng/mL)	7.4 (0.1–21.9)	1.2	8.1 (1.1–62)	0.9	0.71
AUA symptom score	10.4 (1–25)	1.5	8.8 (0–32)	0.9	0.43
Urinary bother score	2.5 (0–6)	0.4	1.8 (0–6)	0.2	0.06
SHIM	14.1 (3–25)	1.7	18.2 (1–25)	0.8	0.03
Peak flow rate (mL/s)	13.9 (2–23)	1.6	18.3 (2–50)	1.1	0.05
Voided volume (mL)	306 (31–721)	44.9	454 (54–972)	25.0	0.01
Postvoid residual urine volume (mL)	72.9 (0–493)	21.4	91.2 (0–316)	12.4	0.51
Non-nerve sparing (%)	5 (26)	0.10	13 (16)	0.04	0.32*
Unilateral nerve sparing (%)	5 (26)	0.10	20 (25)	0.05	1.00*
Bilateral nerve sparing (%)	9 (48)	0.11	48 (59)	0.05	0.44*

AQ: 5 *Key: BMI = body mass index; SE = standard error; PSA = prostate-specific antigen; AUA = American Urological Association; SHIM = Sexual Health Inventory in Men. Data presented as mean, with ranges in parentheses, unless otherwise noted.*
** Two-sided Fisher's exact test.*

MATERIAL AND METHODS

The data of 100 men undergoing robot-assisted laparoscopic radical prostatectomy between June 2002 and October 2003 were prospectively entered into an electronic database. Before surgery, all men were evaluated and the following data entered: age, height, weight, clinical T stage and Gleason score, prostate-specific antigen (PSA) level, American Urological Association symptom score, urinary
AQ: 4 bother score, Sexual Health Inventory in Men (SHIM) score, and pertinent medical history. Patients were also evaluated for the peak urinary flow rate, voided volume, and postvoid residual urine volume. Standard perioperative and postoperative parameters were evaluated. Urinary and functional outcomes, including the time to return to work, were attained by self-administered questionnaires, including the 7-item International Prostate Symptom Score, the 5-item SHIM, and selected questions from the 26-item Expanded Prostate Cancer Instrument Composite, at the routine 3-month and 9-month follow-up visits. The questionnaires asked whether they wore pads, how many weeks did it take to not need pads, how many weeks to return to work, and how many weeks to return to baseline energy levels. A nonclinical research associate (D.W.S.) collected the follow-up information. Complications were defined by the need for prolongation of hospitalization, the need for a secondary procedure, or rehospitalization within 30 days. All statistical comparisons between the obese and nonobese groups were two-sided using Fisher's exact test, Student's *t* test for means, and the non-parametric Wilcoxon rank sum test (Statistical Analysis Systems, version 8.2, statistical package). Multivariate analysis was performed with stepwise logistic regression analysis using the preoperative continuous variables of BMI, PSA level, American Urological Association score, bother score, age, peak flow rate, postvoid residual urine volume, and prostate weight as independent variables in the prediction of pad-free status at 6 months. We tested for an association between nerve sparing and pad-free continence using a two × three contingency table.

Ongoing institutional review board approval has been in place since 1998. Pathologic review and reporting was performed according to standards described by the TNM classification.[11] One pathologist (R.E.) reviewed the surgical margins and were considered positive if tumor was present at the inked prostatic margins.

RESULTS

Demographic and Clinical Data

Tables I and II present the initial clinical and AQ: 6 pathologic data for the obese and nonobese patients. Of the 19 obese men, 15 had a BMI of 30 or greater but less than 35 and 4 had a BMI of 35 or more. The mean follow-up for all patients was 10.9 months. The groups were comparable for the standard clinical factors such as age, preoperative PSA level, clinical Gleason score, and so forth. The clinical stage for the groups (data not shown) demonstrated nearly identical results. The obese patients had significantly poorer baseline SHIM scores, bother scores, urinary peak urinary flow rates, and voided volumes. All comparisons made by the Student *t* test were also examined using the nonparametric Wilcoxon rank sum test, with similar conclusions.

Operative Outcomes

No patient required conversion to open surgery, and no complications (such as bleeding) occurred that required an emergent return to the operating room in either group. Although a significant increase occurred in blood loss and hospital stay, AQ: 7 these were not clinically relevant. Neither group required a transfusion. The operative times were significantly longer in our obese patients by approximately 1 hour. The pathologic Gleason score, stage, and margin status results (Table II) demon- AQ: 8 strated no significant differences.

Perioperative Complications

As noted in Table III, significantly more postop- T3 erative complications occurred in the obese group. In addition, the complications were more severe and were associated with more long-term sequelae. The obese group had one deep venous thrombosis AQ: 9

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Table II. ***Comparison of clinical and pathologic staging results for both groups***

	BMI > 30		BMI < 30	
Pathologic outcome	**Clinical**	**Pathologic**	**Clinical**	**Pathologic**
Gleason score				
≤6	11 (58)	12 (63)	44 (54)	43 (53)
3 + 4	4 (21)	5 (27)	19 (23)	17 (21)
4 + 3	1 (5)	1 (5)	7 (9)	7 (9)
8–10	3 (16)	1 (5)	11 (14)	14 (17)
Stage				
pT2a-T2b	16 (84)	59 (73)		
pT3a-T3b, T4	3 (16)	22 (27)		
Positive surgical margins				
Total (%)	3 (16)	22 (27)		
Stage				
pT2a-T2b	2 (13)	8 (14)		
Stage				
pT3a-T3b, T4	1 (33)	14 (64)		

KEY: BMI = body mass index.
Data presented as number of patients, with percentage in parentheses.
Positive surgical margins and clinical stage not statistically significant (all P ≥ 0.38).

and one pulmonary embolus (10.5%), one prolonged compression nerve injury, and two bladder neck disruptions. The bladder neck disruptions presented 7 to 10 days after catheter removal. Both men presented acutely with complaints of an inability to urinate after doing well initially. Both required emergent cystoscopic placement of a catheter and required prolonged catheterization. In contrast, the nonobese group had one prolonged ileus and two urine leaks, which were identified by cystography. All three resolved or healed completely with simple conservative therapy. The one pulmonary embolus (1.2%) occurred in a patient with a pre-existing history of spontaneous deep venous thrombosis and had no long-term sequelae. AQ: 10

CLINICAL OUTCOMES

The patients were asked to fill out the self-administered questionnaires regarding continence and when they were able to return to work, or, if retired, when they returned to normal activities (Table III). Although not quite reaching statistical significance, obese patients did not recover as quickly as their nonobese counterparts. Continence was defined as the need for no pads, and the nonobese patients had superior urinary continence results at 3 and 6 months postoperatively (Fig. 1). Multivariate analysis demonstrated that only BMI predicted for pad-free continence at 6 months of follow-up ($P = 0.016$). Consistent with these continence findings, the voided volumes and urinary bother scores were significantly worse for obese patients. We found no significant association between nerve sparing and pad-free continence. The sexual outcomes were too immature to report; however, only 4 of the 19 obese patients had SHIM scores of 22 or greater. Of these, 2 F1

Table III. ***Perioperative and postoperative data for obese and nonobese groups***

Variable	BMI > 30	*SE*	BMI < 30	SE	*P* Value
Operative time (min)	295.8 (186–645)	13.2	236.1 (160–490)	4.6	0.04
Estimated blood loss (mL)	183 (50–400)	24.9	105 (25–350)	8.6	0.007
POD 1 Hb change (g/dL)	1.5 (−0.1 to +3.0)	0.8	1.6 (−0.2 to +3.4)	0.8	0.72
Hospital stay (hr)	41 (18–96)	4.9	28.4 (18–168)	2.4	0.09
Prostate size (g)	62.4 (21.8–163)	7.9	49.5 (12.5–135)	2.4	0.14
Total complications (%)	5/19 (26.3)	0.10	4/81 (4.9)	0.02	0.01*
Return to work/usual activities (wk)	7.0	2.4	4.3	1.0	0.09
Continence at 6 mo (0 pads) (%)	9/19 (47)	0.13	74/81 (91)	0.03	≤0.001*
Urinary bother score at 3 mo	3.3 (0–6)	0.6	1.8 (0–5)	0.2	0.003
Urinary bother score at 9 mo	3.2 (1–6)	0.6	1.6 (0–3)	0.2	0.04
Voided volume at 3 mo (mL)	214 (54–384)	34.8	379 (39–929)	26.5	0.011

KEY: BMI = body mass index; POD = postoperative day; Hb = hemoglobin; SE = standard error.
Data presented as mean, with range in parentheses, unless otherwise noted.
** Two-sided Fisher's exact test.*

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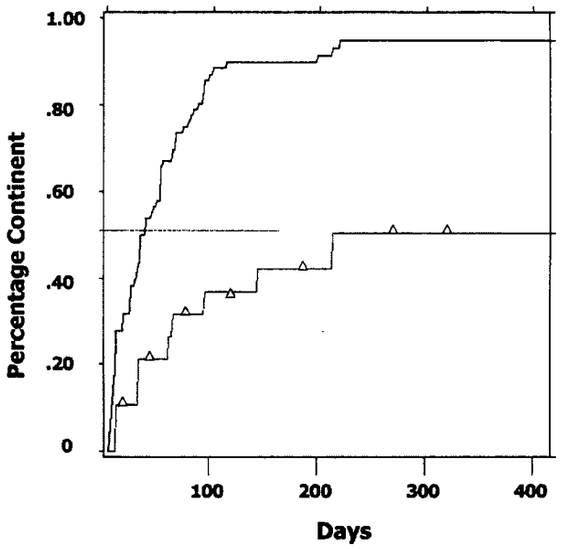

AQ: 15 FIGURE 1. *Kaplan-Meier comparison of nonobese (straight line) versus obese (triangle line) subjects in time to achieve continence (no pads). Both log-rank and Wilcoxon P values ≤0.0003. Median time (dotted line) was 35 days for nonobese men and 215 days for obese men.*

patients had undergone bilateral preservation of the neurovascular bundle and 2 unilateral.

COMMENT

There is no question that obesity is a major health problem confronting the United States. Obesity is generally defined using the BMI, calculated by dividing an individual's weight in kilograms by their height in meters squared.[12] A BMI less than 25 is considered normal, 25 to 30 is considered overweight, 30 to 35 is obese, and greater than 35 is considered morbidly obese. The evidence is overwhelming that obesity is directly related to the development of diabetes mellitus, hypertension, coronary artery disease, hyperlipidemia, cancer, arthritic conditions, and others. The complications associated with obesity are directly responsible for a reduction in life expectancy.[12] The development of obesity is multifactorial; however, inactivity and overeating are the cornerstones; hence, weight loss is dependent on physical activity and not overeating. With the present knowledge of obesity, it is counterintuitive that obesity would not or could not be a contributor to complications of radical prostatectomy.

Remarkably, the impact of obesity on the outcome of radical prostatectomy has had limited
AQ: 11 evaluation. Hsu *et al.*[9] reported no obvious impact on surgical outcomes with increasing body weight. However, it is important to note that they did not evaluate obesity but rather body weight. Body weight is not a surrogate for BMI. For example, a patient who weighs 225 lb and is 70 in. tall has a BMI of 31.7. In contrast, a patient who also weighs 225 lb but is 76 in. tall has a BMI of 26.9. Donnellan and associates[10] reported a prospective assessment of incontinence; however, obesity was not strictly evaluated per se, as they reported their results in kilograms per meter rather than kilograms per meter squared. In late 2003, Boczko and Melman[7] indicated that their report on obesity and radical perineal prostatectomy was the first such published report for radical prostatectomy, and we have found no evidence to refute this point. The focus of their report was limited to 7 obese patients (BMI greater than 30) of 103 total patients. They found no obvious differences in perioperative complications in their patients who had undergone radical perineal prostatectomy. However, they did note that just 66% of their obese patients were continent at 1 year. However, they did not define continence or compare this result with that of their nonobese patients. Also, the results were culled retrospectively from the doctors' office charts. The advantage of our study was that our data were collected prospectively using validated tools to assess the baseline sexual and urinary function. We also used self-administered questionnaires to assess urinary and sexual function regularly in the postoperative period. However, to assess fully the sexual outcomes, we will need to continue the follow-up for at least 18 months for all patients.

Overall, our obese and nonobese patients had remarkably similar clinical parameters for prostate cancer, including age, PSA level, and so forth. However, because of our knowledge of obesity, it was not surprising that a difference in baseline urinary and sexual function was identified for the obese patients. Using the standard cutpoint for obesity (BMI greater than 30), we found significantly poorer baseline parameters, including sexual function (SHIM), urinary bother, peak urinary flow rate, voided volume, and comorbidities (data not shown). Consistent with these findings, obese patients also had a trend toward poorer baseline American Urological Association scores. Similar findings have been reported by Kane and associates[13] using the large CaPSURE database for baseline physical function and general health.

Although significant increases in estimated blood loss and operative times occurred, little objective evidence is available to support that obese patients are more difficult to operate on. For example, the obesity did not result in more problems with construction of a watertight urethrovesical anastomosis (as noted at surgery). However, consistent with our baseline data, our perioperative complication rates and clinical outcomes showed

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that obese patients had more complications (26.3% versus 4.9%; $P = 0.01$) and returned to baseline urinary and functional status more slowly. Specifically, the postoperative complications experienced by the obese group were more severe with long-term sequelae. The obese group had two deep venous thrombosis/pulmonary embolus complications and both anastomotic disruptions. The disruptions were managed with prolonged indwelling catheters (3 and 6 weeks). One patient at 9 months postoperatively had minor (one pad per day) stress incontinence and the other needs at least four pads per day. The nonobese group, in distinction, had fewer complications and these were temporary (ileus and temporary urine leaks) and resolved completely without long-term sequelae.

Of interest with regard to the urinary findings, our obese patients also had a trend toward having larger prostates (62.3 versus 49.5 g). Because obese patients start with more urinary problems, it is reasonably intuitive that they might have significantly more problems returning to a pad-free continence status (Fig. 1). At 6 months, only 47% of our obese patients were pad free versus 91% of the nonobese patients ($P < 0.001$). Consistent with these findings postoperatively, they had significantly greater bother scores at both 3 and 9 months (3.2 versus 1.6; $P = 0.04$) and lower voided volumes (214 versus 388 mL; $P = 0.01$).

It is now reasonably established that obesity adversely affects sexual function in the general population.[14-16] Sexual function is closely related to the overall health status of the vascular system and inversely related to hypertension and diabetes.[15,16] In the obese group, the average baseline SHIM score was just 14.1, and 15 (79%) had sexual dysfunction with scores less than 20. Four patients had SHIM scores of 22 or greater; two of these four had undergone a bilateral and two a unilateral nerve-preservation procedure. It is logical to presume that trauma to the neurovascular bundle during the course of radical prostatectomy would result in more severe permanent damage in this high-risk group. However, our potency follow-up was too immature for this report.

CONCLUSIONS

The findings of this report offer an evaluation of obesity in patients undergoing robotic laparoscopic radical prostatectomy. Our findings are internally consistent with the existing knowledge about obesity and have demonstrated that obese patients have lower baseline urinary and sexual function, are at greater risk of developing significant postoperative complications, and have a greater risk of postoperative incontinence. Patients who are obese may safely undergo surgery; however, the impact of obesity is significant and should be included in counseling.

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AQ15— please check figure 1 dotted line to be sure that the dots are visible. Please provide revised figure if necessary.

AQ1— does RT stand for Route? If yes, please spell out.

AQ2— Please note that the Objectives section of your abstract has been reworded to follow the Journal style of "To...." OK?

AQ3— SHIM spelled out correctly as "Sexual Health Inventory in Men"? If not, please provide correct expansion.

AQ4— SHIM defined correctly as "Sexual Health Inventory in Men"? If not, please provide correct definition.

AQ5— SHIM defined correctly in Table I footnote?

AQ6— please check stage listings in column 1 of Table II. Also check layout of table.

AQ7— does the following phrase refer to obese group: "Although a significant increase occurred in blood loss and hospital stay"? Please clarify.

AQ8— in Table II, Gleason score not included with other variables in statement regarding no statistical significance. Please check data and clarify.

AQ9— DVT spelled out correctly as "deep venous thrombosis"? If not, please provide correct expansion.

AQ10— DVT spelled out correctly as "deep venous thrombosis"? If not, please provide correct expansion.

AQ11— Hsu, not Lepor, first author of ref. 9.

AQ12— DVT/PE spelled out correctly as "deep venous thrombosis/pulmonary embolus"? If not, please provide correct expansion.

AQ13— please clarify "Int J Impot Res Mar 4 (Epub), 2004," ref. 14.

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AQ14— please clarify "Int J Impot Res Feb 26 (Epub), 2004," ref. 15.