Increasing Body Mass Index Negatively Impacts Outcomes Following Robotic Radical Prostatectomy

Michael P. Herman, MD, Jay D. Raman, MD, Steven Dong, MD, David Samadi, MD, Douglas S. Scherr, MD

ABSTRACT

Objective: To clarify the impact of increasing body mass index (BMI) on outcomes following robotic radical prostatectomy.

Methods: From January 2003 to May 2005, 132 patients with clinically localized prostate cancer underwent a robotic radical prostatectomy. Patients were divided into 3 cohorts based on BMI: 38 normal (range, 18 to 24.9), 60 overweight (range, 25 to 29.9), and 34 obese (BMI > 30).

Results: The operative time was significantly longer in obese (304 min) men compared with overweight (235 min) and normal (238 min) BMI patients (P < 0.001). Estimated blood loss was significantly greater in both the obese (316 mL) and overweight (318 mL) groups compared with men with normal BMI (234 mL) (P < 0.005). Three patients (1 obese and 2 overweight) required conversion to open surgery. Twenty-three of 132 men (17%) had a positive surgical margin, with obese (21%) and overweight (20%) men at a greater risk compared with normal BMI men (11%). No significant differences existed between groups with regard to final pathologic stage, Gleason score, biochemical recurrence at 1-year, and postoperative complication rate.

Conclusion: Overweight and obese men had a longer operative duration, greater blood loss, longer hospital duration, and higher positive surgical margin rate. Robotic prostatectomy in men with elevated BMI is technically more challenging and is associated with more operative morbidity.

Key Words: Body mass index, BMI, Prostate cancer, Robotic prostatectomy, Urologic oncology.

INTRODUCTION

Over 70% of men over age 40 are obese or overweight, with current trends suggesting that these numbers will only increase with time. Numerous studies suggest that body mass index (BMI) plays an important role in the natural history of prostate cancer. Obesity has been associated with an increased risk of aggressive disease and death from prostate cancer. Several studies have further demonstrated that BMI correlates with an increased risk of biochemical failure after radical prostatectomy. Although this may be attributable to aggressive cancer biology, it is also possible that operative considerations contribute to these poorer outcomes. Several groups have previously demonstrated that increasing BMI correlates with a higher likelihood of positive surgical margins and capsular incision in both open and minimally invasive radical prostatectomies.

Given the increasing incidence of overweight and obese men, it is imperative to understand the impact of BMI on surgical outcomes for prostate cancer.

Minimally invasive surgery offers several advantages compared with traditional open methods, including decreased blood loss, less perioperative pain, and analgesic requirements, shorter hospital stays, faster convalescence and return to work, and improved cosmesis. Robotic radical prostatectomy is becoming a well-accepted component of prostate cancer therapy. However, the impact of BMI on surgical outcomes in robotic radical prostatectomy has not been well defined. Two recent studies have attempted to characterize this effect with somewhat conflicting results. While Ahlering and colleagues found that obese men had significantly more complications than men with normal BMI did, Mikhail et al noted no difference in peri-operative morbidity despite an increased operative time and blood loss.

Here then, we attempt to clarify the impact of BMI on operative outcomes from robotic radical prostatectomy by describing our single institution experience with 132 consecutive patients, 71% of whom were overweight or obese.
METHODS

Patient Selection

Between January 2003 and May 2005, 132 consecutive patients with clinically localized prostate cancer underwent a robotic radical prostatectomy performed by 2 surgeons (DSS and DS) at the New York-Presbyterian Hospital. All patients had biopsy proven adenocarcinoma of the prostate and were staged according to the 2002 American Joint Committee on Cancer (AJCC) classification. BMI was calculated as weight in kilograms divided by height in meters squared. Patients were categorized into 3 groups based on preoperative BMI: normal (BMI 18 to 24.9), overweight (BMI 25 to 29.9), and obese (BMI > 30).

Treatment

All patients underwent a robotic radical prostatectomy using the da Vinci surgical system (Intuitive Surgical Inc., Sunnyvale, CA). The procedure was performed as described by Menon et al8 with a few minor modifications.9 Briefly, to optimize nerve sparing, all prostatic pedicles were clipped and sharply divided without using electrocautery. Judicious use of intraoperative frozen sections was utilized to help decrease the incidence of positive surgical margins. A bilateral pelvic lymph node dissection was performed following completion of the urethrovesical anastomosis in patients with a greater than 2% chance of positive lymph nodes as obtained from the Partin predictive tables.

Follow-up

Patients were seen approximately one week postoperatively for catheter removal. Cystograms were not routinely obtained before catheter removal. Postoperative PSA values were evaluated 6 weeks postoperatively, every 3 months for the first year, every 6 months for the second year, and yearly thereafter.

Outcomes and Statistical Analysis

Prospectively collected data included patient age, clinical T stage, biopsy Gleason score, and PSA. Operative outcomes studied included operative time, estimated blood loss (EBL), and nerve sparing. Postoperative outcomes were length of hospital stay, interval to catheter removal, pathology, margin status, complications, and PSA recurrence. Excel 2000 (Microsoft, Redmond, Washington) software and SAS for Windows, version 9.1 (SAS Institute, Cary, North Carolina) were used to perform all statistical calculations with P < 0.05 considered statistically significant. The chi-square (χ²) log-rank test with the Yates correction factor and the unpaired, 2-tailed Student t test were used to compare variables between normal, overweight, and obese men.

RESULTS

Table 1 outlines the preoperative data on the study patients. Of the 132 men, 38 (29%) had normal BMI, 60 (45%) were overweight, and 34 (26%) were obese. These percentages reflect the relative BMI distribution seen in the general population. There were no significant differences in preoperative data between the groups regarding age, baseline PSA, or biopsy Gleason score. Obese patients were noted to have a higher percentage of clinical T1c cancers compared with overweight and normal BMI patients.

The mean operative duration for obese patients was significantly longer than for normal and overweight patients (Table 2). The mean operative duration for normal patients was 60 minutes, for overweight patients was 72 minutes, and for obese patients was 80 minutes. The mean length of hospital stay was 6 days for normal patients, 9 days for overweight patients, and 11 days for obese patients. The mean interval to catheter removal was 3 days for normal patients, 5 days for overweight patients, and 7 days for obese patients. The mean PSA recurrence rate was 14% for normal patients, 19% for overweight patients, and 25% for obese patients.

| Table 1. Preoperative Data |
|---------------------------|
| Normal | Overweight | Obese | Mean | P Value |
| Number of Patients | 38 | 60 | 34 | |
| Age (range) | 62 (47–73) | 61 (48–75) | 59 (47–75) | 60 | 0.88 |
| Preop PSA (range) | 8.2 (1–60) | 7.3 (1–46) | 6.9 (2–45) | 7.2 | 0.36 |
| Clinical Stage (%) | | | | | |
| T1c | 21 (55) | 40 (67) | 29 (84) | 90 (68) | <0.05* |
| T2 | 17 (45) | 19 (31) | 5 (16) | 41 (31) | <0.05* |
| T3 | 0 (0) | 1 (2) | 0 (0) | 1 (1) | 0.42 |
| Biopsy Gleason Score (range) | 6.9 (6–9) | 6.8 (6–9) | 7.0 (6–10) | 6.9 | 0.78 |

*Obese patients had a significantly higher percentage of clinical T1c cancers and lower percentage of T2 cancers compared with overweight and normal patients.
cantly longer than that for normal and overweight men (304 vs 238 and 235 minutes, respectively) (P < 0.001). The estimated blood loss was also significantly higher in overweight and obese men compared with that in men with normal BMIs. Of the 132 robotic prostatectomies, bilateral nerve sparing was performed in 90% of the cases. No significant difference existed between the groups, although there was a trend towards decreased bilateral nerve sparing as BMI increased (94% vs 90% vs 82%). Three cases required conversion to open prostatectomy; one in the obese group secondary to a large intravesical median lobe and 2 in the overweight group for bleeding and dense adherence to the rectum. None of the patients with a normal BMI required conversion to open surgery.

The pathologic features and postoperative data are shown in Table 3. No significant difference existed in Gleason sum score or pathologic stage among the various cohorts. There was a trend, however, towards fewer capsule-confined (T2) tumors in the overweight and obese groups (P = 0.13). Further, normal BMI patients had fewer positive surgical margins (11%) when compared with the overweight (20%) and obese (21%) patients. Normal BMI patients also had a shorter hospitalization than did the overweight and obese men, but there were no differences in duration to Foley removal (data not shown) or postoperative complications. Eight of 132 (6%) patients had a complication, with 3 being major (2 anastomotic leaks and 1 postoperative bleed requiring transfusions). At a short interval follow-up of 1-year, no difference was found in biochemical recurrence rates between the groups.

At 1-year follow-up, 95% (126/132) of men were fully continent without the requirement of any pads. Our early data noted no difference in continence rates between the 3 groups (normal 96%, overweight 94%, and obese 92%).

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### Table 2.
Operative Data

|                  | Normal  | Overweight | Obese   | Overall | P Value |
|------------------|---------|------------|---------|---------|---------|
| OR Duration* (min) (range) | 238 (110–450) | 235 (120–540) | 304 (120–478) | 271 (120–540) | <0.001 |
| EBL† (mL) (range) | 234 (20–900) | 318 (10–1800) | 316 (20–800) | 286 (20–1800) | <0.005 |
| Bilateral nerve sparing (%) | 35/38 (94) | 54/60 (90) | 28/34 (82) | 117/132 (90) | 0.21 |
| Open conversion (%) | 0 (0) | 2 (3) | 1 (3) | 3 (2) | 0.26 |

*Obese patients had a significantly longer operative duration when compared to normal and overweight patients.
†Normal body mass index (BMI) patients had a significantly lower estimated blood loss (EBL) than overweight or obese patients.

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### Table 3.
Pathologic and Postoperative Data

| Pathologic Stage (%) | Normal | Overweight | Obese | Overall | P Value |
|----------------------|--------|------------|-------|---------|---------|
| T0                   | 0      | 1 (1)      | 1 (1) | 2 (2)   | 0.88    |
| T2                   | 35 (92)| 49 (82)    | 27 (79)| 111 (84)| 0.13    |
| T3                   | 3 (8)  | 9 (15)     | 6 (18) | 18 (14) | 0.21    |
| T4                   | 0      | 1 (1)      | 0 (0) | 1 (1)   | 0.90    |
| Pathology Gleason Score | 6.8 (6–9) | 7.0 (6–9) | 7.0 (6–10) | 7.0 (6–10) | 0.82 |
| Positive Margins (%) | 4 (11) | 12 (20)    | 7 (21) | 23 (17) | 0.18    |
| Hospital Stay (days)* | 1.1 (1–6) | 1.6 (1–8) | 1.7 (1–10) | 1.4 (1–10) | <0.05 |
| Undetectable PSA (%)* | 37/38 (97) | 59/60 (98) | 32/34 (98) | 128/132 (97) | 0.75 |
| Complications (%)‡ | 3/38 (8) | 3/60 (5) | 2/34 (6) | 8/132 (6) | 0.56 |

*Normal BMI patients had a significantly shorter hospitalization than did overweight or obese patients.
†1-year post robotic prostatectomy.
‡Normal BMI (3): bladder neck contracture, hematuria, lower extremity paresthesia; overweight (3): anastomotic leak, postoperative bleed, urinary retention; obese (2): anastomotic leak; fever.
DISCUSSION

Obesity is one of the most pressing issues facing the US healthcare system. Beyond its known associations with diabetes, coronary artery disease, and hypertension, obesity also has a significant impact on mortality in cancer patients. With over 70% of US men over age 40 overweight and obese, urologists will have to deal with the ramifications of this epidemic. In particular, prostate cancer is one disease in which elevated BMI likely plays a significant role. Although there have been some conflicting studies, obesity appears to correlate with higher grade and more aggressive disease, as well as an increased likelihood of death from prostate cancer.

Elevated BMI has been associated with biochemical failure after radical prostatectomy. Whether this is due to aggressive disease biology or to technical limitations is not fully clear. Freedland and colleagues attempted to determine whether the increased rate of biochemical failure in obese patients was due to technically inferior surgery. Using capsular incision on the pathological specimen as a proxy for a worse technical operation, they found that mildly obese patients had a 30% increased chance of capsular incision and moderately to severely obese men had a 57% increased risk. Several other studies have further noted a trend towards increased positive surgical margins in the overweight and obese patients. Interestingly, however, in a study of postprostatectomy patients with negative surgical margins, the SEARCH database study group still found an increased risk of biochemical failure in patients with elevated BMI. This observation led to the conclusion that a technically inferior operation cannot fully account for the outcome differences.

Robotic radical prostatectomy has been shown to be a reasonable and effective treatment modality for prostate cancer. However, the impact of BMI on the effectiveness of this surgical procedure has yet to be fully elucidated. To date, there are only 2 studies that have investigated surgical outcomes of robotic prostatectomy in overweight and obese men compared with men with normal BMI. We add to this literature by contributing our experience with a large series of patients from a single academic institution. Similar to the 2 prior studies, we failed to note any statistical difference in age, baseline PSA, clinical T stage, or biopsy Gleason score among our cohorts. Of note, the disease characteristics of patients in all of these studies may reflect a selection bias towards men who are surgically fit for an operative procedure. We acknowledge that our study, as well as others, may therefore be selecting the “healthiest” of the heavy patients. Our series demonstrated that obese men had a significantly longer operative duration (by almost 60 minutes) compared with overweight and normal BMI men. It is likely that this prolonged operative time is at least partly related to the increased blood loss seen in obese men in all 3 studies. Other factors that may contribute to this increased surgical time include suboptimal port placement, robotic arm positioning, dissection of fat planes, and closure.

In addition to the prolonged operative time and increased blood loss, trends towards decreased bilateral nerve sparing, increased open conversions, and longer hospitalization in overweight and obese patients all point to a technically more challenging operation. Despite this, there was no difference in complication rates between the cohorts suggesting that even with a technically more challenging operation, overweight and obese patients were not at increased risk from the surgery itself.

Beyond the perioperative variables discussed above, oncologic control is of paramount importance. Our data noted no difference in biochemical recurrence rates between the 3 groups at relatively short 1-year follow-up. Although the ultimate measure of an intervention is the ability to prolong long-term survival, surgical technique can be assessed in the short-term by analyzing pertinent oncological variables such as pathologic margin status. It is generally agreed that a positive margin is indicative of incomplete tumor resection and bears significant prognostic importance. Several institutions have demonstrated the independent prognostic significance of positive surgical margins across all stages of disease. In our series, there was a trend towards increased positive surgical margins between normal (11%), overweight (20%), and obese (21%) men. While this could reflect the inherent technical difficulties of operating on heavy patients, it may also be due to the advanced disease noted among men with elevated BMI. Indeed, in our series, the obese and overweight patients had an increased incidence of pT3 cancers than did normal BMI men (15% and 18% vs 8%, respectively). This increase in locally advanced disease, though not significant, further confirms observations in the literature that these men are at increased risk of aggressive cancer. Future studies with larger cohorts of patients that control for pathologic stage will be needed to explore the
causative factor behind the increased positive surgical margin rates.

Finally, postoperative quality of life is an important consideration when counseling patients. Our preliminary data (not shown) suggests that potency and continence rates are similar among the study groups. Interestingly, we did note a trend towards better bilateral nerve sparing in patients in the normal BMI group. This may eventually translate into better erectile function, though longer-term data are needed. Clearly, both issues require further investigation with patient-based validated questionnaires, and we are waiting for our data to mature before commenting more definitively. Indeed, spontaneous improvements in continence and potency continue up to 2 years following radical prostatectomy, thus emphasizing the evolving nature of these variables.19,20

CONCLUSION

Compared with men with normal BMIs, overweight and obese patients had a longer operative time, greater blood loss, increased probability of open conversion, higher positive surgical margin rate, and a longer hospitalization. While robotic radical prostatectomy is an acceptable treatment modality for men with elevated BMI, it is technically more challenging and is associated with more operative morbidity. Future studies will need to assess the impact of increasing BMI on long-term prostate cancer outcomes, continence, and potency.

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