The impact of stapling devices use on patients with increased body mass index treated with radical cystectomy

Vassilios Tzortzis, MD,[1] Konstantinos Dimitropoulos, MD,[1] Stavros Gravas, MD,[1] Anastasios Karatzas, MD,[1] Ioannis Zachos, MD,[1] Ioannis Gkialas, MD,[2] Georgios Papadopoulos, MD,[2] Michael Melekos, MD[1]

[1]Department of Urology, University of Thessaly, School of Health Sciences, Faculty of Medicine, Larissa, Greece
[2]Department of Urology, "Georgios Gennimatas" General Hospital of Athens, Athens, Greece

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Introduction: *The aim of this retrospective study was to evaluate the impact of stapling devices use on overweight and obese bladder cancer patients treated with radical cystectomy (RC).*

Materials and methods: *Fifty-two overweight and 24 obese patients underwent open RC for muscle invasive bladder cancer. Bladder removal was performed using standard suture technique (SST) or multifire autosuture articulated vascular Endo-GIA (eG). Twenty-three overweight and 11 obese patients formed the SST arms and the remaining 29 overweight and 13 obese patients formed the eG arms. Intra and postoperative parameters and early postoperative complications (30 days) using the Clavien-Dindo classification were recorded.*

Results: *SST and eG arms of overweight and obese patients were comparable in intra and postoperative parameters. Both overweight and obese eG arms had significantly lower estimated blood loss, lower number of transfused packed red blood cells units (PRBC) and lower cystectomy intraoperative time compared with the SST ones ($p < 0.05$). In obese patients, staplers use led to significantly lower total length of stay compared with SST ($p = 0.041$). Complications rate was significantly higher in the obese group compared with the overweight group (58.33% versus 30.77%, $p = 0.042$). No difference in complications was found between the SST and eG arms of the overweight and obese patients. No deaths occurred.*

Conclusions: *Staplers use in RC in overweight/obese patients is accompanied by significantly shorter intraoperative time, lower blood loss and lower number of transfused PRBC units, compared with SST. In obese patients, eG use led to shorter length of stay.*

Key Words: obese, bladder, cancer, radical cystectomy, stapling devices, staplers, high BMI, overweight

Introduction

Radical cystectomy (RC) with pelvic lymphadenectomy provides excellent local control and long term survival and remains one of the most effective and widely used surgical interventions for muscle invasive bladder cancer.[1] Open radical cystectomy remains the gold standard surgical procedure, although laparoscopic and robot assisted cystectomy emerge as alternative means of surgical treatment. However, it is often accompanied with several intra and postoperative complications. Bleeding during pelvic dissection is one of the most frequent complications, necessitating blood transfusion in 30%-80% of the cases. In addition,

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Address correspondence to Dr. Konstantinos Dimitropoulos, Department of Urology, University Hospital of Larissa, GR-41110, Larissa, Greece

complications following surgery are associated with substantial resource use as manifested by excess mortality, length of hospital stay and charges attributable to these consequences of treatment.[2] In an attempt to reduce bleeding and operative time, stapling devices have been used in open radical cystectomies because of their safety and efficacy.[3,4]

High body mass index (BMI) has been proved to have a negative impact on intra and postoperative cystectomy parameters. In specific, BMI has been proved to be a significant risk factor for intraoperative complications such as long surgical time and blood loss,[5] postoperative complications such as postoperative blood loss[4] and paralytic ileus[6,7] and worse oncological outcomes[8] while its association with increased costs remains debatable.[9] Therefore, stapling devices could gain valuable position in the surgical therapy of overweight/obese bladder cancer patients due to their proved effects in reducing intraoperative complications.

The aim of the present study is to evaluate whether use of stapling devices in overweight or obese patients submitted to open radical cystectomy offers significant benefits compared with the standard suturing technique.

Materials and methods

The present retrospective study was approved by the scientific board of the University Hospital of Larissa, Greece. We reviewed the medical records of 175 (122 men and 53 women) patients who underwent RC from January 2005 to February 2013 in the departments of Urology of the two participating hospitals (University Hospital of Larissa, Greece and "G. Gennimatas" General Hospital of Athens, Greece), with the aim to identify overweight/obese patients. The standard WHO definitions of BMI were used (normal = less than 25 kg/m^2, overweight = 25 kg/m^2 to 29.9 kg/m^2 and obesity = 30 kg/m^2 or greater). BMI was calculated by dividing patient weight in kilograms by patient height in meters squared.[10]

Exclusion criteria were prior pelvic radiation and other procedure required during radical cystectomy (urethrectomy, nephrectomy etc). In addition, in order to have better comparable groups female patients were also excluded from the study.

Radical cystectomy was performed through a midline incision with a wide excision of the bladder. The obliterated hypogastric arteries and the vasa deferentia were ligated and divided. Then the ureters were identified, dissected and divided close to the bladder. The distal parts of the ureters were sent for frozen section. The posterior peritoneum in the cul-de-sac was incised and the plane between rectum and bladder was developed sharply. At this point the two groups of the study were created. In the standard technique arm (SST group) the posterior and lateral pedicles of the bladder were ligated using a right angle clamp and dissected. In the modified technique arm (eG group) the multifire autosuture articulated vascular Endo-GIA (EndoGia Universal, Tyco Healthcare), and the ETS Flex Endoscopic Articulating Linear Cutter, (Ethicon) were used to divide the posterior and lateral bladder pedicles to the level of the puboprostatic ligaments and the lateral prostatic pedicles after the dissection of the endopelvic fascia. The selection between the standard and the modified technique was based on the personal decision of the surgeon. Then the procedure was completed in the same manner in the two groups. The dorsal venous plexus was ligated and the urethra was divided at the apex of the prostate and the whole specimen removed. A bilateral lymphadenectomy was performed after the removal of the bladder. The choice of urinary diversion was determined by patients' characteristics and the preference of the surgeon. In general, an ileal conduit (Bricker ileal conduit) or orthotopic diversion (orthotopic bladder replacement with Studer pouch) were selected in both groups. Continuous epidural anesthesia was administered during the first 72 hours after surgery, to control postoperative pain.

The examined intraoperative variables included operative time (time from skin incision to bladder removal), estimated blood loss (EBL) at the time of the removal of the bladder and the number of packed red blood cells (PRBC) units used in intraoperative transfusion. Attending anesthesiologists were responsible for blood transfusions and all used common protocol to evaluate and manage hemodynamic instability. Estimation of blood loss was based on the difference in hemoglobin (Hgb) on blood gas analysis at the beginning and at the completion of the cystectomy, taken by the attending anesthesiologist. Length of stay and prior abdominal surgery history were also recorded for all patients. Early postoperative complications (30 days) were recorded and graded using a scale from I to V, according to the classification of surgical complications proposed by Clavien.[11]

Kolmogorov-Smirnov-Lilliefors one-sample test was used to check for normality of variables. Variables with skewed distributions are reported as median (1st-3rd quartile). Mann-Whitney U test and Fisher's exact test were used for comparisons between quantitative and categorical variables respectively. The level of statistical significance was set to 0.05. SPSS software was used for all statistical analyses.

Results

Of the 122 men available, BMI information was found in 117. In addition, 12 patients underwent additional removal of kidney or urethra and were excluded. In final, 105 patients were evaluated; 29 (28%) of them had normal weight, 52 (49%) were overweight and 24 (23%) were obese. The overall prevalence of overweight or obese patients in the cohort was 72%, which is consistent with reported national trends.[12]

Among the 52 overweight patients, 23 were operated with the standard suture technique (SST) and 29 with the endo-GIA (eG). In the group of obese patients, standard suture technique was used in 11 patients and endo-GIA in the remaining 13 ones. The subgroups of overweight and obese patients operated with SST and eG were comparable in age and BMI, pathological stage, neoadjuvant chemotherapy and previous abdominal surgeries and in preoperative hemoglobin levels. Regarding length of hospitalization, no significant differences were found between the subgroups of overweight patients; in obese patients, eG arm had significantly lower median (1st-3rd quartile) total length of stay (LOS) compared with the SST one (9.0 (7.0-11.0) versus 11.0 (9.0-13.0) days, p = 0.041), Table 1.

The impact of stapler use on intraoperative bleeding control and cystectomy duration in the overweight and obese patients of our study are shown in Table 2. In both groups, patients operated with endo-GIA device had significantly lower hemoglobin difference (hence lower EBL) and significantly lower cystectomy intraoperative time compared with patients operated with SST ($p < 0.05$). Regarding the number of intraoperatively transfused PRBC units, eG arms of both overweight and obese patients had significantly lower number of transfused PRBC units compared with the SST arms (p = 0.037 and p = 0.046 respectively).

Thirty out of a total of 76 patients (39.47%) had 51 events of early postoperative (30 days) complications. The incidence of complications was significantly higher in the obese group compared with the overweight group (14/24 obese patients, 58.33% versus 16/52 overweight patients, 30.77%, p = 0.042). In the

TABLE 1. **Demographic and clinical, intra and postoperative parameters of patients**

	Overweight patients			Obese patients		
	SST (23)	**eG (29)**	**p value**	**SST (11)**	**eG (13)**	**p value**
Age (years)	68.10 (64.90-69.80)	68.90 (65.00-70.10)	0.778	63.80 (62.00-68.30)	65.10 (62.10-68.20)	0.801
BMI (kg/m^2)	27.37 (26.03-28.91)	27.88 (26.34-28.73)	0.849	33.10 (31.10-33.95)	32.89 (31.44-33.81)	0.884
Pathological stage						
T2	6 (26%)	7 (24%)	1.000	1 (9%)	2 (15%)	1.000
T3a	6 (26%)	11 (38%)	0.392	3 (27%)	3 (23%)	1.000
T3b	6 (26%)	7 (24%)	1.000	4 (36%)	5 (38%)	1.000
T4	5 (22%)	4 (14%)	1.000	3 (27%)	3 (23%)	1.000
Neoadjuvant chemotherapy	4 (17%)	6 (21%)	1.000	6 (55%)	7 (54%)	1.000
Previous abdominal surgery	7 (30%)	8 (28%)	1.000	3 (27%)	4 (31%)	1.000
Pre-cystectomy hemoglobin (g/dL)	12.75 (11.26-13.49)	13.10 (11.48-13.63)	0.592	12.42 (11.54-13.66)	12.88 (11.92-13.47)	0.608
Type of diversion						1.000
Ileal conduit	13 (57%)	17 (59%)	1.000	6 (55%)	7 (54%)	
Orthotopic neobladder	10 (43%)	12 (41%)		5 (45%)	6 (46%)	
Length of stay (days)	8.5 (5.5-11.5)	8.0 (5.5-11.0)	0.893	11.0 (9.0-13.0)	9.0 (7.0-11.0)	0.041

SST = standard suture technique; eG = Endo-GIA; BMI = body mass index

TABLE 2. **Intraoperative parameters in overweight and obese patients**

	Overweight patients			Obese patients		
	SST (23)	**eG (29)**	**p value**	**SST (11)**	**eG (13)**	**p value**
Bladder removal time (min)	98.4 (89.4-111.2)	88.0 (80.9-95.6)	0.017	108.4 (92.2-119.8)	94.7 (85.6-99.3)	0.007
Difference in hemoglobin (g/dL)	2.24 (1.93-2.48)	1.86 (1.75-2.22)	0.028	2.41 (2.13-2.54)	1.97 (1.71-2.18)	0.019
Transfused PRBC (units)	2.00 (2.00- 3.00)	2.00 (1.00-2.00)	0.037	3.00 (2.00-4.00)	2.00 (2.00-2.50)	0.046

SST = standard suture technique; eG = Endo-GIA; PRBC = packed red blood cells

subgroup analysis, no significant differences were found in the incidence of complications in the SST and eG arms of the overweight (9/23 patients, 39.13% versus 7/29, 24.14%, p = 0.365) and obese patients of our study (8/11, 72.73% versus 6/13, 46.15%, p = 0.240), Table 3.

In total, minor complications represented the 88.23% of all events in our patients. Grade I was the majority of complications (27 out of 51 events, 52.94%), followed by Grade II events (18/51, 35.29%). Grade III and IV events were 5/51 (9.80%) and 1/51 (1.96%), respectively. No deaths (Grade V) occurred.

Minor complications (Clavien Grades I and II) comprised postoperative fever conservatively managed (11 patients), pain managed with Grade I allowed analgesics (11 patients), transient increase in serum creatinine conservatively managed (5 patients), paralytic ileus (6 patients), need for blood transfusions (7 patients) and wound infections treated with antibiotics (5 patients). Regarding major complications (Clavien Grades III-V), three patients developed wound dehiscence that was managed under general anesthesia (Clavien Grade IIIb). Enterocutaneous fistula was diagnosed in one patient and was surgically corrected under general anesthesia (Clavien Grade IIIb). Surgical correction under general anesthesia was also performed in one patient with stricture of ureteroileostomy (Clavien Grade IIIb). Anastomotic urine leakage was diagnosed in one patient and led to uroperitoneum, formation of intra-abdominal abscess and sepsis. Emergency surgical management was needed and patient was admitted to intensive care (Clavien Grade IVb). No deaths occurred, Table 4.

Discussion

Body weight increases with age reaching its highest levels at about 60-65 years old, the median age of bladder cancer diagnosis, with more than two thirds of the population above the age of 65 having a BMI more than 25 kg/m^2.[13] Furthermore, percentages of overweight and obese people have increased considerably from 56.5% for men and 52.3% in women in 1988 to 65.8% and 62.6%, respectively in 2006.[13] Thus, clinicians commonly have to address complex medical problems in overweight or obese patients.

Radical surgery in bladder cancer patients with increased BMI is a great challenge for the surgeon. Apart from technical difficulties during the operation procedure, various studies indicate that high BMI

TABLE 3. **Incidence of complications in overweight and obese patients**

	Overweight patients			Obese patients		
	SST	**eG**	**p value**	**SST**	**eG**	**p value**
Number of patients with complications	9/23 (39%)	7/29 (24%)	0.365	8/11 (73%)	6/13 (46%)	0.240
Total number of patients with complications	16/52 (31%)			14/24 (58%)		0.042

SST = standard suture technique; eG = Endo-GIA

TABLE 4. **Postoperative complication events in overweight and obese groups**

Type of complication	Clavien-dindo grade	Overweight patients SST (23)	Overweight patients eG (29)	Obese patients SST (11)	Obese patients eG (13)
Fever	Grade I	2	2	3	4
Pain	Grade I	3	2	3	3
Transient increase in serum creatinine	Grade I	2	1	1	1
Ileus	Grade II	1	2	2	1
Blood transfusion	Grade II	2	1	3	1
Wound infection	Grade II	2	1	1	1
Grades I-II, total number of events		12	9	13	11
Wound dehiscence	Grade IIIb	0	1	2	0
Enterocutaneous fistula	Grade IIIb	0	1	0	0
Ureteroileostomy stricture	Grade IIIb	0	0	1	0
Anastomotic leakage-sepsis	Grade IV	0	0	1	0
Death	Grade V	0	0	0	0
Grades III-V, total number of events		0	2	4	0

SST = standard suture technique; eG = Endo-GIA

patients seem to have had significantly longer operative times and higher blood loss.[5,14,15] Moreover in these patients, high BMI is frequently accompanied with a higher incidence of postoperative complications, such as wound infections, ileus, lymphocele formation, thromboembolic incidents and cardiac and pulmonary dysfunction.[7,16] However, the relationship between BMI and complications remains unclear as some studies have shown similar complication rates in normal, overweight and obese patients submitted to open radical cystectomy.[2,9,15]

Stapling devices have been increasingly used in radical cystectomy during the last years, since their use has been proved to offer minimal blood loss, decreased transfusion demands and shorter intraoperative times, especially in low-volume surgeons.[3,4,17,18] However, to the best of our knowledge, no available data exist on the impact of stapling devices use on open radical cystectomy in high BMI patients.

Our findings show that use of endo-GIA in open radical cystectomy can offer significant benefits in intra and postoperative parameters. In the overweight and obese patients of our study, stapling devices led to shorter operation time, lower blood loss and lower intraoperative transfusion needs compared with SST. The impact of endo-GIA use on intraoperative parameters had direct reflection on postoperative course of obese patients, as patients operated with endo-GIA had significantly shorter LOS in comparison with the SST ones. Various studies conducted in mixed BMI populations have proved benefits of stapling devices in open radical cystectomy, similar to ours. Some studies shown minimized blood loss.[3,4,17,19] others, also report significant reduction in operation time.

According to our results, incidence of overall complications was significantly higher in obese patients in comparison with the overweight ones. Although eG arm of obese patients had lower complication rates compared with the SST one, difference was not significant. Previous findings have shown that high frequency of postoperative complications is associated with high BMI, high EBL, high number of transfusions and long hospitalization.[2,7,20] It is therefore possible that higher sample size could lead to significant difference in complications between our obese eG and SST arms, since our results show lower blood loss, lower intraoperative transfusion needs and shorter LOS in the eG arms of patients. In addition, it has to be noted that a significant proportion of our patients (41%-46%) underwent radical cystectomy with orthotopic bladder reconstruction; thus total operative time was prolonged. Since prolonged operative time has been well correlated with higher prevalence of complications, at least part of the observed complications in our group of patients can be attributed to neobladder construction.

The relatively small number of patients we used and lack of randomization can be considered as potential limitations of our study. The sample we used cannot be regarded as representative of the whole population of bladder cancer patients with BMI > 25kg/m^2, since it consisted of Greek patients only and female patients were not included in our study. Cost analysis was not performed in our study. Yet, our results could indicate lower cost in high BMI patients operated with endo-GIA due to lower blood loss, operation time, complication rate and length of stay. Bagrodia et al showed that cost of radical cystectomy is independent of BMI, however it is not clarified whether stapling devices were used.[9] More studies, multicenter, randomized and with larger sample sizes are needed to be conducted in overweight and obese bladder cancer patients to further confirm our findings.

Conclusions

Our study evaluated overweight and obese bladder cancer patients who underwent radical cystectomy with and without the use of stapling devices. In comparison with the standard surgical technique, staplers use in bladder removal in overweight and obese patients resulted in significantly shorter intraoperative time, lower estimated blood loss during the surgical procedure and lower number of transfused PRBC units. Also, endo-GIA use in obese patients led to shorter length of stay. Therefore, the benefits of stapling devices use in open radical cystectomy in patients with high BMI are highlighted. □

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