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ORIGINAL ARTICLE

Factors influencing intraoperative conversion from planned orthotopic to non-orthotopic urinary diversion during radical cystectomy

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Abstract

Objectives To determine and investigate the intraoperative factors that contribute to a change in plan from continent orthotopic neobladder to ileal conduit or continent cutaneous diversion at the time of radical cystectomy.

Subjects and methods A retrospective review of our prospectively maintained bladder cancer database was performed. Of the 711 patients who underwent radical cystectomy from 2012 to 2016, 387 (54.4%) had given consent to have a NB. Of these 387 patients, 348 (89.9%) ultimately received a neobladder while 34 (8.8%) received an ileal conduit and 5 (1.3%) continent cutaneous diversion. The factors involved in the intraoperative change of plan were examined in this study.

Results Patients who ultimately received a neobladder were significantly more likely to have clinical node-negative disease ($p = 0.045$), negative soft tissue margins ($p = 0.001$), lower body mass index ($p = 0.045$) and higher volume surgeons ($p < 0.001$). Oncologic reasons for intraoperative conversions were more common than technical reasons (58.3% vs 35.9%), in both robotic and open surgical techniques. The choice of surgical approach (open vs robotic) did not influence the rate of intraoperative conversion.

Conclusion The factors influencing intraoperative decision not to perform neobladder are predominantly oncologic rather than technical. A clear understanding of the factors involved in influencing the intraoperative change in the urinary diversion plan may improve shared decision making in patients undergoing radical cystectomy in the future.

Keywords Radical cystectomy · Urinary diversion · Orthotopic neobladder · Ileal conduit

Introduction

Radical cystectomy with pelvic lymph node dissection and urinary diversion remains the preferred treatment for muscle invasive bladder cancer and high-risk non-muscle invasive cancer in select cases. Advances in surgical technique and perioperative care now provide patients with several options of urinary diversion after the extirpative part of the procedure: orthotopic neobladder (NB), ileal conduit (IC) or continent cutaneous diversion (CCD) [1]. The preoperative choice of urinary diversion is likely to depend on medical factors, patient preference and surgeon experience. While orthotopic diversion is a preferred option at many academic centers [2], population-based studies indicate that non-continent diversions predominate [3, 4]. While these studies address the choice of the planned diversion after physician–patient discussion preoperatively, scant data exist to the incidence of intraoperative change from planned NB to either an IC or CCD and factors affecting such a change. Herein, we reviewed our institutional experience with radical cystectomy and urinary diversion to compare those who received NB after consenting for such on preoperative consultation to those who alternatively received either IC or CCD.

Subjects and methods

We reviewed records on all patients who underwent radical cystectomy for bladder cancer from 2012 to 2016 using our IRB approved, prospectively maintained Bladder Cancer Database. All procedures were performed by eight experienced surgeons via either an open or robotic approach as

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previously described [5, 6]. We identified patients who were preoperatively consented for NB as their first choice of urinary diversion and reviewed their records to determine the diversion type that they ultimately received. Absolute contraindications for performing NB at our institution include a positive urethral margin, extensive extravesical disease, renal or hepatic dysfunction, known urethral stricture disease and a physical or mental impairment to perform self-catheterization. At the time of surgical consent for NB, alternative types of urinary diversion (IC or CCD) are reviewed and listed in order of patient preference should a NB not be feasible intraoperatively. All patients were staged prior to surgery with computed tomography of the abdomen and pelvis as well as with transurethral resection (TUR). Preoperative biopsy of the urethra was performed at the discretion of the surgeon. All patients had intraoperative frozen section analysis of the urethral margin. From this cohort, we reviewed operative reports for all patients who received either IC or CCD in lieu of the preoperatively planned NB. We recorded the surgeon-reported factor(s) that led to the intraoperative change in plan and categorized them as either oncologic (positive urethral margin, nodal involvement, extravesical disease spread), technical (short/fat mesentery, adhesions/difficult dissection, non-oncologic urethral problem) or undocumented. The cohort that had a change in planned diversion from NB to IC or CCD was compared to the control group that received a NB as planned. Both groups were compared for demographics, pathologic factors, and type of surgical approach. Differences were assessed using the *t* test for continuous variables and Chi square test for categorical variables. All *p* values reported were two-sided and $p < 0.050$ was considered statistically significant. Statistical analysis was performed using statistical software SAS, version 9.3 (SAS Institute Inc., Cary, NC).

Results

We reviewed records of 711 patients who underwent radical cystectomy for bladder cancer from 2012 to 2016 at our institution. Of these, 387 (54.4%) were preoperatively consented for NB as their preferred choice of urinary diversion. The median time from diagnosis to surgery was 85 days for those who did not receive chemotherapy and 260 days for those who did receive neoadjuvant chemotherapy. Of the 387 consented for NB as preferred choice, 348 (89.9%) ultimately received NB while 34 (8.8%) received IC and 5 (1.3%) CCD (Fig. 1). The specific or dominant factor that led to the intraoperative decision to change the type of diversion from NB was stratified by the robotic and open approach (Table 1).

Of the 306 patients undergoing open radical cystectomy with planned NB, 22 (7.2%) received IC (12 for oncologic, 8 for technical, and 2 for undocumented reasons) and 5 (1.6%) patients received CCD (3 for oncologic, 1 for technical, and 1 for undocumented reasons). Of the 81 patients undergoing robotic surgery with planned NB, 11 (13.6%) patients received IC (5 for oncologic, 5 for technical, and

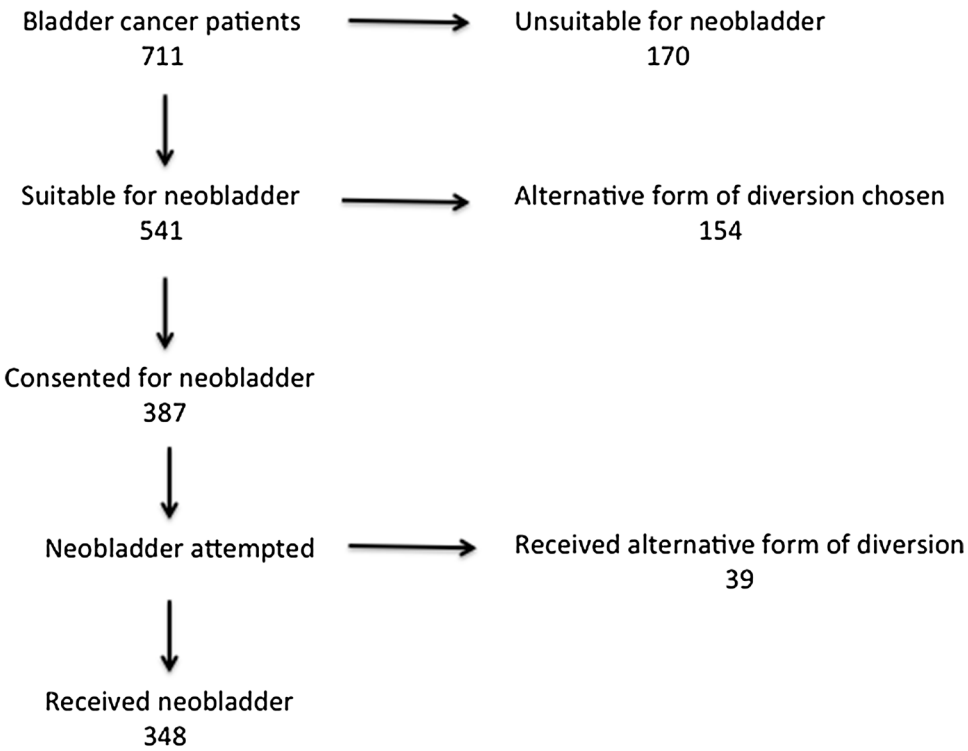

Fig. 1 Flowchart of neobladder candidate selection and diversions received

Table 1 Intraoperative factors resulting in conversion from planned orthotopic neobladder to other forms of urinary diversion

	Open NB to IC ($N=22$) *n* (%)	Open NB to CCD ($N=5$) *n* (%)	Robotic NB to IC ($N=11$) *n* (%)	Robotic NB to CCD ($N=1$) *n* (%)	Total percentage of intraoperative changes ($N=39$)
Oncologic					
Positive urethral margin	8 (36.4)	1 (20.0)	0 (0)	0 (0)	23.1
Nodal involvement	3 (13.6)	0 (0)	4 (36.4)	0 (0)	17.9
Extravesical disease	1 (4.5)	2 (40.0)	1 (9.1)	1 (100)	12.8
Total oncologic	12 (54.5)	3 (60.0)	5 (45.5)	1 (100)	53.8
Technical					
Short/fat mesentery	4 (18.2)	0 (0)	3 (27.3)	0 (0)	17.9
Adhesions or difficult dissection	1 (4.5)	0 (0)	1 (9.1)	0 (0)	5.1
Non-oncologic urethral problem (stricture)	1 (4.5)	1 (20.0)	1 (9.1)	0 (0)	7.7
Other technical difficulties (bleeding, ureters)	2 (9.1)	0 (0)	0 (0)	0 (0)	5.1
Total technical	8 (36.6)	1 (20.0)	5 (45.5)	0 (0)	35.9
Not documented	2 (9.1)	1 (20.0)	1 (9.1)	0 (0)	10.3

NB neobladder, *IC* ileal conduit, *CCD* continent cutaneous diversion

1 for undocumented reasons) and 1 (1.2%) patient received CCD for oncologic reasons (Table 1). The most prevalent oncologic factor for conversion in patients undergoing an open approach was a positive urethral margin (9/306, 2.9%). Two of these patients had negative prostatic urethral biopsies at the time of TUR, two were females with no urethral biopsy and the remaining were men without preoperative urethral biopsy. Gross nodal involvement was the most common oncologic factor for conversion in those undergoing a robotic-assisted approach (4/81, 4.9%). A short immobile small bowel mesentery was the most common technical reason for conversion in patients undergoing either an open (4/306, 1.3%) or robotic-assisted approach (3/81, 3.7%).

Cohort characteristics for the patients who ultimately received NB and those who received either IC or CCD are listed in Table 2. Patients who ultimately received NB were significantly more likely to have lower BMI (median 27.2 vs 29.7, $p=0.005$), and pathologically organ confined disease (74.7% vs 56.4%, $p=0.022$) and less likely to have clinical node-positive disease (8.1% vs 20.5%, $p=0.019$) or positive surgical margins (2.3% vs 12.8%, $p=0.005$) when compared to those who received an alternative urinary diversion (IC or CCD), respectively. There was no significant difference in age, comorbidities, receipt of neoadjuvant chemotherapy or type of surgical approach between the two groups. There was variation in conversion rate amongst the eight surgeons in our cohort (range 5.1%–27.3%) and this difference was significant on Chi square analysis ($p<0.001$).

A stepwise multivariate logistic regression was performed using all significant univariate variables and found that surgery performed by the five lower volume surgeons during the study period (mean 25.8 vs 85.3 cases), a greater BMI, clinical node-positive disease and positive surgical margins were all associated with an intraoperative conversion to an alternative urinary diversion (Table 3).

Discussion

Radical cystectomy with urinary diversion for bladder cancer is known to have significant impact on body image for patients postoperatively [7]. Orthotopic diversion with NB is the preferred diversion option at many major academic centers [8–10]. The decision to perform cystectomy with NB requires thorough preoperative counseling with consideration of patient preference as well as patient-related oncologic, functional and metabolic characteristics [1, 11]. While this counseling will preclude patients with absolute contraindications from receiving a NB, evidence from large centers shows that up to 75% of patients are eligible for orthotopic diversion [2]. Whether or not an open or robotic approach is used, series have shown that 55% of patients at academic centers receive an orthotopic diversion [12], similar to the 54% in this study. Despite this, population-based studies note as few as 8–20% of patients actually receive a NB [3, 4, 9, 13].

The disparity in type of urinary diversion after radical cystectomy between academic center reports and population-based studies may be a function of surgeon comfort level with orthotopic diversion. In our series, we found that intraoperative conversion from planned NB was dependent on the surgeon ($p<0.001$) despite the fact that all surgeons were well experienced. Furthermore, the introduction of robotic cystectomy and intracorporeal diversion may lead to a preconception of a higher chance of intraoperative conversion to IC diversion in patients who choose NB as their preferred

Table 2 Patient demographic and characteristics

	All patients $n=387$ (%)	Orthotopic neobladder $n=348$ (%)	Ileal conduit or continent cutaneous diversion $n=39$ (%)	p value
Age (median)	67.5	67.2	70.5	0.271
BMI (median)	27.6	27.2	29.7	0.005
Male, No. (%)	335 (86.5)	301 (86.5)	34 (87.2)	1.0
ASA score 3–4, No. (%)	286 (73.9)	252 (72.4)	34 (87.2)	0.054
Prior abdominal surgery, No. (%)	20 (5.2)	16 (5.1)	4 (11.4)	0.296
Clinical stage				
Organ confined disease (Tis, Ta, T1, T2), No. (%)	324 (83.7)	294 (84.5)	30 (76.9)	0.251
Extravesical disease, (T3, T4) No. (%)	63 (16.3)	54 (15.5)	9 (23.1)	
Node-positive disease, No. (%)	36 (9.3)	28 (8.1)	8 (20.5)	0.019
Pathologic stage				
Organ confined disease (Tis, Ta, T1, T2), No. (%)	282 (81.3)	260 (74.7)	22 (56.4)	0.022
Extravesical disease (T3, T4), No. (%)	105 (27.1)	88 (25.3)	17 (43.6)	
Node-positive disease, No. (%)	84 (21.7)	71 (20.4)	13 (33.3)	0.068
Positive margins, No. (%)	13 (3.4)	8 (2.3)	5 (12.8)	0.005
Operative time (hours)	6.2	6.1	6.6	0.105
Transfusion requirement, No. (%)	91 (23.5)	81 (23.3)	10 (25.6)	0.695
Neoadjuvant chemotherapy, No. (%)	130 (33.6)	120 (34.5)	10 (25.6)	0.290
Preoperative radiotherapy, No. (%)	5 (1.3)	4 (1.2)	1 (2.6)	0.414
Surgical approach				
Open, No. (%)	306 (79.1)	278 (79.9)	28 (71.7)	0.298
Robotic assisted, No. (%)	81 (20.9)	70 (20.1)	11 (28.2)	

Table 3 Multivariate logistic regression for receipt of alternative diversion

	Odds ratio	95% CI	p value
Lower volume surgeon	4.41	2.09–9.27	<0.001
BMI	1.07	1.00–1.15	0.045
cN+	2.63	1.02–6.77	0.045
Positive margins	5.42	1.98–14.84	0.001

diversion. However, we did not find a statistically significant difference in the overall rate of intraoperative conversion of the diversion choice from NB in the open and robotic cohorts (8.8% vs 14.8%, $p=0.298$). Although this difference was not statistically significant, our study was not powered to identify such a difference and larger studies may yield more definitive results.

Factors influencing the intraoperative change in the type of urinary diversion have not been adequately examined in prior studies. Despite the inherent technical difficulties of NB creation, the majority of conversions from planned NB to IC or CCD occurred due to non-modifiable oncologic reasons such as positive urethral margins, nodal involvement or locally advanced disease. As such, the patients who had an intraoperative conversion were more likely to have clinical node-positive disease and positive margins on multivariate analysis. While nodal involvement is not an absolute contraindication to NB, potential concerns to the surgeon with such adverse pathology include the potential need for adjuvant therapies such as radiation and the high risk of local or urethral recurrence that may impact patients who receive a NB.

The greatest technical challenge identified in this study was the short or fat mesentery. Such a finding would limit mobility of the pouch into the pelvis for anastomosis to the native urethra. Interestingly, we found that patients with higher BMI were more likely to have a conversion from planned NB to IC or CCD. A subset analysis of the patients with short/fat mesentery found a significant correlation with BMI ($p=0.03$) suggesting a possible relation between increased BMI and an immobile short mesentery. Surgeon experience is sure to affect the handling of a pouch in such a setting and familiarity with mobilization techniques may prevent the need to convert from NB to an alternative diversion. The robotic approach also has potential limitations due to Trendelenburg positioning, which may make the urethral anastomosis more difficult. However, intraoperative failure due to short/fat mesentery was not significantly different between the open and robotic groups (1.3% vs 3.7%, $p=0.17$). Again, our sample size was limited and conversion rate was low overall. Larger numbers may yield more significant differences.

Limitations of the study include the fact that this was a retrospective review with a limited number of events and the exact reason for change in intraoperative plan could not be identified in four patients. It is also important to consider that this was a review of our single institution experience involving eight surgeons. Given that the rate of individual surgeon conversion varied from 5 to 27%, surgeon experience, bias as well as variability in decision making such as in the face of clinical node-positive disease, may be an unmeasured component of the decision to change the type of diversion intraoperatively.

Conclusion

Patients undergoing radical cystectomy and NB have potential for intraoperative change of diversion type to either IC or CCD. The factors influencing intraoperative decision not to perform NB are predominantly oncologic rather than technical. Those with lower BMI, clinical node-negative disease, negative surgical margins, and higher volume surgeons were more likely to ultimately receive a NB. The choice of surgical approach (open vs robotic) did not change the rate of such intraoperative conversion in this study.

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Compliance with ethical standards

Conflict of interest None.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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