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Surgery in Motion

Robotic Intracorporeal Orthotopic Ileal Neobladder: Replicating Open Surgical Principles

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Abstract

Background: Robotic radical cystectomy (RC) for cancer is beginning to gain wider acceptance. Yet, the concomitant urinary diversion is typically performed extracorporeally at most centers, primarily because intracorporeal diversion is perceived as technically complex and arduous. Previous reports on robotic, intracorporeal, orthotopic neobladder may not have fully replicated established open principles of reservoir configuration, leading to concerns about long-term functional outcomes.
Objective: To illustrate step-by-step our technique for robotic, intracorporeal, orthotopic, ileal neobladder, urinary diversion with strict adherence to open surgical tenets.
Design, setting, and participants: From July 2010 to May 2012, 24 patients underwent robotic intracorporeal neobladder at a single tertiary cancer center. This report presents data on patients with a minimum of 3-mo follow-up ($n = 8$).
Surgical procedure: We performed robotic RC, extended lymphadenectomy to the inferior mesenteric artery, and complete intracorporeal diversion. Our surgical technique is demonstrated in the accompanying video.
Outcome measurements and statistical analysis: Baseline demographics, pathology data, 90-d complications, and functional outcomes were assessed and compared with patients undergoing intracorporeal ileal conduit diversion ($n = 7$).
Results and limitations: Robotic intracorporeal urinary diversion was successfully performed in 15 patients (neobladder: 8 patients, ileal conduit: 7 patients) with a minimum 90-d follow-up. Median age and body mass index were 68 yr and 27 kg/m^2, respectively. In the neobladder cohort, median estimated blood loss was 225 ml (range: 100–700 ml), median time to regular diet was 5 d (range: 4–10 d), median hospital stay was 8 d (range: 5–27 d), and 30- and 90-d complications were Clavien grade 1–2 ($n = 5$ and 0), Clavien grade 3–5 ($n = 2$ and 1), respectively. This study is limited by small sample size and short follow-up period.
Conclusions: An intracorporeal technique of robot-assisted orthotopic neobladder and ileal conduit is presented, wherein established open principles are diligently preserved. This step-wise approach is demonstrated to help shorten the learning curve of other surgeons contemplating robotic intracorporeal urinary diversion.
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1. Introduction

The benchmark of surgical treatment for muscle-invasive and high-risk recurrent or refractory non–muscle-invasive urothelial carcinoma of the bladder is open radical cystectomy (RC), extended lymphadenectomy, and urinary diversion. The procedure remains complex, with significant morbidity, relatively long convalescence time, and negative nutritional balance in a typically older patient population [1,2].

In the past decade, laparoscopic RC and, recently, robotic RC have emerged as minimally invasive alternatives to open RC in an effort to reduce morbidity and enhance recovery. Data from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample inform that robotic RC comprised 13.3% of all RC surgeries in the United States in 2009 [3]. We have noted similar trends at our tertiary cancer center [4]. Early to intermediate perioperative and oncologic outcomes of robotic RC and lymphadenectomy are promising and appear comparable to open surgery [5–7].

Despite the increasing use of robotic RC [8,9], the majority of centers perform extracorporeal urinary diversion due to perceived difficulties with intracorporeal bowel reconstruction and concerns about time efficiency compared to open surgery. As experience in robotic surgery has expanded, a few reports of intracorporeal orthotopic neobladder have recently emerged [10–12]. To improve efficiency and decrease operative time, several modifications to standard open pouch configurations have been used (Table 1). One modification has been the use of laparoscopic staplers using nonabsorbable titanium staples instead of absorbable sutures [10]. Another is using a shorter length of bowel and a modified pouch configuration that may not conform to a sphere, unlike that created during open surgery [11,13]. Such technical circumventions have raised concerns regarding long-term efficacy.

We present a detailed step-by-step description of our technique of robotic, intracorporeal, orthotopic, ileal neobladder that adheres to the established dimensions and configuration of the Studer orthotopic neobladder as performed by open surgery at our institution. We describe technical challenges and tips to optimize performance of this complex operation.

2. Methods and patients

Robotic RC, high-extended lymphadenectomy to the inferior mesenteric artery, and intracorporeal, orthotopic, ileal neobladder was performed in 24 patients with bladder cancer. From this cohort, data are reported on eight patients who had completed 90-d follow-up. Data are also presented for seven patients undergoing robotic, intracorporeal, ileal conduit diversion for comparison. All data were entered prospectively into an institutional review board–approved database and queried retrospectively.

Our inclusion criteria for robotic RC are similar to those for open cystectomy. We offer robotic RC to obese patients (body mass index [BMI] $\leq$40), those who have had prior pelvic surgery and/or prior pelvic radiation, and following neoadjuvant chemotherapy in patients with locally advanced disease and/or low-volume nodal involvement.

Our technique of robotic RC and high-extended lymphadenectomy was described recently [14]. In this paper, we focus on the robotic, intracorporeal, urinary diversion.

2.1. Positioning

In steep Trendelenburg position, a six-port transperitoneal approach is used (Fig. 1). In contrast to robotic prostatectomy, all ports are moved cephalad during RC, wherein the camera port is positioned approximately two fingerbreadths above the umbilicus with the right and left working ports placed at the level of the umbilicus. Cephalad port placement facilitates proximal ureteral mobilization, nodal dissection along the infrarenal aorta/vena cava, and small bowel manipulation during intracorporeal diversion.

2.2. Bowel isolation and reanastomosis

To construct the neobladder, we select approximately 60 cm of distal ileum (44 cm for the pouch, 16 cm for the chimney) about 15 cm proximal to the ileocecal junction (Fig. 2). A Penrose drain, premarked at 10, 15, and 22 cm, is inserted intra-abdominally to facilitate measurement of bowel segment length for pouch creation. Atraumatic Cardiere forceps (Intuitive Surgical Inc, Sunnyvale, CA, USA) are used in the right

Table 1 – Detailed comparison of published techniques of robotic intracorporeal neobladder vis-à-vis Studer's original description

Series	Studer's original description [15]	Goh et al. (current series)	Pruthi et al. [10]	Canda et al. [21]	Jonsson et al. [11]
Length of ileum used, cm	60	60	Not stated	50	50
Method of ileal detubularization	Scissors	Scissors	Stapler	Scissors	Scissors
Pouch construction	Sewn	Sewn	Titanium staples	Sewn	Sewn
Rotation of the pouch	90°	90°	None	None	None
Equal cross-folding	Yes	Yes	No	No	No
Urethroileal anastomosis	After pouch completion	After posterior wall completion	After pouch completion	Start of reconstruction	Start of reconstruction
Ureteroileal anastomosis	Bricker	Bricker	Bricker	Wallace	Wallace
Stenting	Directly, externalized	Percutaneous, internalized	Per urethra, internalized	Percutaneous, internalized	Percutaneous, externalized
Afferent limb	Yes	Yes	No	Yes	Yes
Shape	Globular	Globular	U-shaped tube	Amorphous	Amorphous
Redocking	N/A	No	Yes	Yes	Yes

N/A = not applicable.

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