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CLINICIAN'S WORKSHOP

Male Health

Robot-assisted radical cystectomy and intracorporeal orthotopic neobladder: 1-year functional outcomes

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Complete intracorporeal urinary diversion (ICUD) with an orthotopic neobladder is an emerging procedure. The objective of this article was to assess retrospectively the urodynamic and continence results after robot-assisted radical cystectomy (RARC) and ICUD with a modified orthotopic Studer neobladder. After a median follow-up time of 11 months, all patients were socially continent (≤1 pad) at daytime. Median Pouch capacity was 404 ml with a median postvoid residual volume of 0 ml. All patients stated that they would choose the same type of urinary diversion again. RARC and ICUD with orthotopic neobladder provides promising functional and urodynamic results with high patient satisfaction.

Radical cystectomy (RC) with pelvic lymph node dissection and urinary diversion is the treatment of choice in the curative management of muscle-invasive bladder cancer (MIBC).[1] The robot-assisted radical cystectomy (RARC) with extracorporeal urinary diversion (ECUD) is a hybrid technique that has been used increasingly worldwide with the minimal invasive approach intended to improve perioperative recovery while minimizing pain and complications compared to open radical cystectomy.[2] Oncological outcomes seem to be comparable for both techniques.[3] With the raise of RARC, the intracorporeal urinary diversion (ICUD) is getting more and more popular in many institutions as a feasible alternative to the ECUD. Therefore, not only oncologic and survival parameters, but also urodynamic results of ICUD with orthotopic neobladder as well as patient satisfaction are of major clinical interest.

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PATIENTS AND TECHNIQUE

We follow a standard six-port transperitoneal approach using the daVinci® Si System (Intuitive Surgical, Sunnyvale, CA, USA) after creating a pneumoperitoneum under general anesthesia. To prevent intraoperative neuromuscular damage, both calves are regularly controlled by intermitted calf compression and the use of a pulse oximeter at the toe. In a first step, we dissect the ureter on both sides toward the ureterovesical junction and divide them at the distal end between Hem-o-lock clips. After dissecting the plane between the rectum and prostate as distally as possible, the resection of the posterior and lateral pedicles to the bladder is performed and the endopelvic fascia is incised. Before cutting the dissected urethra, it is important to empty the bladder to prevent spillage of urine.[4] After radical cystectomy, an extended pelvic lymph node dissection (ePLND) was performed. The limits included the aortic bifurcation cranially, the genitofemoral nerve laterally, the presacral lymph nodes and those of the internal iliac artery medially, and the lymph node of Cloquet (Rosenmüller) distally.

The next step is the reconstructive part of the ICUD. First, the left ureter is transpositioned tension free to the right side to create the Wallace plate. To prepare the formation of the neobladder, we isolate a 50 cm ileal segment. The opened ileum portion is closed by doing a side to side ileoileal anastomosis. Next is the crucial step of a sufficient mobilization of the ileal segment to achieve a tension-free urethro-ileal anastomosis and correct placement of the neobladder in the small pelvis. For a good overview, the ileal loop is preliminarily fixed to the rectourethral muscle. After the detubularization of the distal 40 cm of the isolated ileum, we fold the neobladder as illustrated in **Figure 1**. Before performing the ureterointestinal anastomosis and closing the reservoir as the final step of the procedure, two single-J ureteric stents are introduced through separate 4-mm incisions at the lower part of the abdominal wall.

Study protocol and outcome measures

The goal of this study was to assess 1-year functional outcome and patient satisfaction after RARC with ICUD. From November 2015 to November 2017, a total of 14 patients who underwent RARC and ICUD with orthotopic neobladder consented to this study. Inclusion criteria were histologic confirmed MIBC or nonmuscle-invasive bladder tumors who are at the highest risk of progression according to the updated EAU guidelines,[1] minimum age of 18 years, negative biopsy of the prostatic urethra, and a follow-up period of at least 6 months. Exclusion criteria were distant metastasis, conversion to open surgery, and severe, preoperative urethral sphincter-related incontinence. Two of the fourteen patients were excluded, as one patient had a conversion to open surgery and one patient had died during follow-up. All patients provided informed consent. The study was approved by the ethical institutional review board (Cantonal Institutional Review Board Zurich, BASEC –Nr. 2017-01260).

Regular patient follow-up at our institution was performed according to the international guidelines.[1] Among

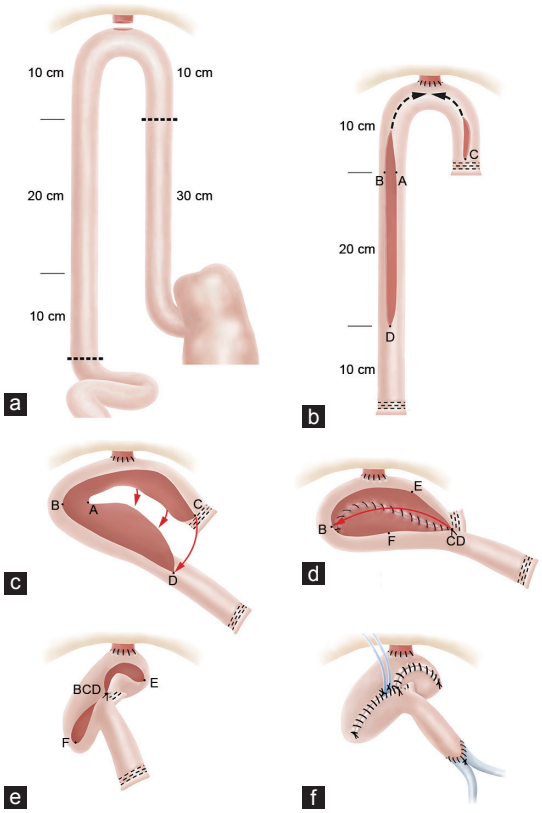

Figure 1: Stepwise folding technique of the modified orthotopic Studer neobladder. (**a**) Isolation of 50 cm of Ileum; (**b**) fixation of the Ileum at the rectourethral muscle and opening of the Ileum; (**c**) reconstruction of the posterior wall of the neobladder; (**d**) the anterior wall of the neobladder is formed; (**e**) the last step before closing the neobladder; (**f**) introduction of 2 Mono-J stents and closure of the neobladder.

other regular postoperative follow-up consultations, the consultation between 9 and 12 months included urodynamic measurements and quality of life assessment. Urodynamic measurement includes pouch capacity, bladder pressure at maximum filling, functional urethral length with and without stress, bladder compliance as well as uroflowmetry, and postvoid residual (PVR). Quality of life was assessed using established questionnaires.[5,6] Urinary continence was assessed using the International Consultation on Incontinence (ICIQ) questionnaire.[7] Continence status was assessed using pad count method. Clinical, oncologic, and metabolic variables were assessed.

Results

Of 14 eligible patients, 12 (85.7%) patients met the inclusion criteria and were included in this study. **Table 1** illustrates the baseline characteristics. One patient included in the study died of a cancer-specific cause after the urodynamic evaluation. No perioperative deaths occurred.

Functional and urodynamic outcomes are shown in **Table 2**. All patients had a compliance >12.5 ml per cmH_2O, which is suggested to be the lower limit of normal despite lacking definition of a normal compliance.[8] Involuntary leakage during cystometry occurred in 1 of 12 (8.3%) patients. None of the patients required intermittent self-catheterization (ISC). All 12 patients were socially continent defined using one pad or less per day. However, when looking at the questionnaire items concerning interference with the patient's everyday life due to incontinence on a scale from 0 to 10 (0 = not at all, 10 = a great deal), all patients gave a value between 0 and 5. Despite some degree of incontinence, none of them was severely bothered by the incontinence in their everyday life. Overall, 12/12 (100%) patients would choose the ICUD with orthotopic neobladder again as treatment.

Renal function in terms of estimated glomerular filtration rate (eGFR) at 6–12 months after surgery was not significantly different (median eGFR pre- and postoperatively with 82 ml per min per 1.73 m^2 as compared to 83 ml per min per 1.73 m^2, P = 0.37). Venous blood gas analysis at 6 months showed a median pH value of 7.38 (range: 7.27–7.41) and a median base excess of 0.15 (range: −2.5–4.4). Two (16.7%) patients required bicarbonate substitution.

COMMENTS

RARC and ICUD with orthotopic neobladder remains a technically high-demanding procedure with long operating times whose primary aim is to yield comparable results in terms of negative surgical margins and lymph node dissection compared to open series.[9] The RAZOR trial showed that RARC is not inferior to open cystectomy in terms of 2-year progression-free survival.[3] Furthermore, the Pasadena Consensus Panel (PCP) summarized in a systematic review that RARC appears to be broadly equivalent to open radical cystectomy (ORC) in terms of morbidity and mortality, oncologic outcomes, and complication rates.[9]

A database review of the International Robotic Cystectomy Consortium of 18 international centers showed that the robot-assisted ICUD could be accomplished safely, with comparable outcomes to open urinary diversion.[10] With the rise of RARC with ICUD, not only oncologic and survival parameter should be looked at, but also functional and urodynamic results of ICUD with orthotopic neobladder as well as patient satisfaction and quality of life. To this date, only few studies have been published to assess functional outcomes with focus on urodynamics of orthotopic neobladder after RARC with ICUD.[8]

The current study analyzed the urodynamic findings and quality of life among patients who underwent robot-assisted radical cystectomy with complete intracorporeal orthotopic ileal neobladder reconstruction. The median bladder capacity was at 400 ml, which is comparable to data published on open reconstruction with Studer orthotopic neobladder[11,12] and data published on robotic intracorporeal neobladder.[8] This is close to the physiological capacity of the human bladder of 500 ml. In combination with the low-pressure reservoir, the high volume leads to a high compliance and therefore to the favorable low-pressure reservoir. When looking at the maximal flow rates as well as PVR observed in the current study, these functional results are satisfactory and furthermore comparable to previously published results of open reconstruction as well as ICUD.[8,13,14]

Interestingly, with the physiological capacity as well as low-pressure reservoir, comes the fact that no ISC was necessary in our cohort. In contrast, the reported rate of

Table 1: Demographic and perioperative data

Variable	*Results (n=12)*
Male gender, *n* (%)	12/(100)
Age (year), median (range)	66.5 (40–75)
Follow-up (month), median (range)	11 (7–16)
BMI (kg m^{-2}), median (range)	27.5 (23.1–31.9)
ASA score, *n* (%)	
1–2	6 (50.0)
3–4	6 (50.0)
Charlson comorbidity score, median (range)	6 (2–10)
Neoadjuvant chemotherapy, *n* (%)	2 (16.7)
Postoperative tumor stage, *n* (%)	
pT1	5 (41.7)
pT2	6 (50.0)
pT3	1 (8.3)
High-grade tumor, *n* (%)	12 (100)
Operative time (min), median (range)	575 (420–662)
Nerve sparing surgery, *n* (%)	7 (58.3)
Blood loss (ml), median (range)	600 (200–1000)
Preoperative eGFR (ml per min per 1.73 m^2), median (range)	82 (70–146)
Postoperative eGFR (ml per min per 1.73 m^2), median (range)	83 (69–200)

BMI: body mass index; eGFR: estimated glomerular filtration rate; ASA: American Society of Anesthesiologists

Table 2: Urodynamic and continence results

Variable	*Results (n=12)*
Bladder capacity (ml), median (range)	403.5 (253–670)
Pressure at maximal capacity (cmH_2O), median (range)	15 (5–28)
Functional urethral length without stress (mm), median (range)	30 (20–76)
Functional urethral length with stress (mm), median (range)	28 (10–56)
Bladder compliance (ml per cmH_2O), median (range)	21.8 (15–59.6)
Postvoid residual volume (ml), median (range)	0 (0–30)
Maximal flow (ml s^{-1}), median (range)	19.6 (7.3–43.2)
Pads at daytime, *n* (%)	
0	7 (58.3)
1	5 (41.7)
Pads at nighttime, *n* (%)	
0	5 (41.7)
1	4 (33.3)
2	3 (25.0)
ICIQ-Score (maximum 21 points), median (range)	6 (1–11)
QLQ-C30, median (range)	
Overall health score (maximum 7 points)	6 (5–7)
Overall quality of life score (maximum 7 points)	6 (4–7)

ICIQ: International Consultation on Incontinence Questionnaire; QLQ-C30: quality of life questionnaire C30

ISC use is at 10% for robotic neobladder[8] and from 0% up to 26% for open neobladder.[13,15]

Daytime and nighttime continence rates in robotic orthotopic neobladder are poorly studied to date and only limited data are available.[8,16,17] However, our 1-year results are comparable to or better than the existing data, with a 100% of the patients with social continence at daytime. The increase in pad use during nighttime observed in the current study is consistent with previously published data on the subject.[18] All in all, continence rates were promising in the present study, especially considering that it takes at least 12 months after surgery to reach urinary continence plateau.[19]

Patient satisfaction was high in our series; unfortunately, there is a lack of data assessing the quality of life after RARC and ICUD with orthotopic neobladder with only one study assessing quality of life after the robotic technique so far, but using another measurement tool.[8]

Metabolic results in terms of acidosis and frequency of bicarbonate substitution are not widely studied. In a critical analysis of the literature, Soukup *et al.*[20] stated that metabolic acidosis in continent diversion can be expected to be ≤50%. Yadav *et al.*[13] reported 7.1% of patients requiring bicarbonate substitution. The percentage of 16.7% of patients in our cohort with a metabolic acidosis requiring bicarbonate substitution lays in the expected range.

This study has several limitations. First, we have a short follow-up period. Second, this is mainly a descriptive study and we compare our results to the existing literature, which of course reduces the validity. Third, we have a relatively small sample size.

CONCLUSION

Our results confirm that the intracorporeal modified orthotopic Studer neobladder yields similar urodynamic results and continence rates as compared to open neobladder reconstruction. Long-term function still has to be analyzed during a longer follow-up period.

AUTHOR CONTRIBUTIONS

FO carried out the data acquisition, analysis, and interpretation of the data and drafting of the manuscript. NAY carried out analysis and interpretation of the data and drafting of the manuscript as well as statistical analysis. CS designed this study and acquired data. OB carried out data acquisition and statistical analysis. MR carried out drafting of the manuscript and provided critical revision of the manuscript. CP provided technical support and helped design the study. PW provided critical revision of the manuscript. HJ supervised the study and provided critical revision of the manuscript. All authors read and approved the final manuscript.

COMPETING INTERESTS

All authors declared no competing interests.

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