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ORIGINAL PAPER

Outcomes of continent and incontinent external urinary diversion in management of patients with refractory non-malignant lower urinary tract dysfunction

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Summary *Objective: To evaluate the early and late outcomes of continent and incontinent external urinary diversion in management of patients with refractory non-malignant lower urinary tract dysfunction (LUTD).*
Materials and methods: The charts of patients with refractory non-malignant LUTD who underwent continent or incontinent external urinary diversion at University of Cincinnati hospitals in the period between March 2012 and December 2019 were retrospectively reviewed. The demographic and baseline characteristics, surgery indications, operative data, early and late outcomes were collected, analyzed, and compared.
Results: A total of 78 patients including 55 patients with neurogenic bladder (NGB) and 23 patients with non-neurogenic bladder (non-NGB) refractory non-malignant LUTD were included. Fifty-three patients underwent incontinent urinary diversions (IUD), while 25 patients underwent continent urinary diversions (CUD). During the first 4 postoperative weeks, 53.85% (n=42) of patients developed complications, and the incidence was non-significantly higher in patients with NGB than those with non-NGB (56.36% vs 47.83%, p-value=0.490). Fever was exclusively encountered in patients with NGB earlier, while stomal retraction occurred only in patients with non-NGB later. More non-NGB patients had early wound infection. There was an overall improvement of urological symptoms in 52 patients (66.67%), and the rate was non-significantly higher in non-NGB patients than NGB patients (78.26% vs 61.82%, p-value=0.160). Late complications were reported in 47 patients and were more encountered in those with non-NGB than those with NGB (65.22% vs 58.18%). Stomal leakage and stenosis occurred more with CUD than with IUD (52% vs 0% and 28% vs 3.77%, respectively).
Conclusions: External urinary diversion can achieve a reasonable level of urological symptoms control in patients with refractory non-malignant LUTD, but with associated adverse outcomes. Although non-significantly, these complications tend to be higher in patients with IUD and/or NGB during the early postoperative period and higher with CUD and/or non-NGB on the long-term.

KEY WORDS: *Continent Urinary Diversion (CUD); Incontinent Urinary Diversion (IUD); Neurogenic bladder (NGB); Non-neurogenic bladder (non-NGB); lower urinary tract dysfunction (LUTD).*

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INTRODUCTION

The lower urinary tract can be affected by multiple benign conditions that can eventually lead to significant *lower urinary tract dysfunction* (LUTD). These benign conditions can generally be classified into two main categories; *neurogenic bladder* (NGB) that results from the permanent loss of neuronal control over the bladder due to a neurological disorder such as *spinal cord injuries* (SCI), *multiple sclerosis* (MS), *Parkinson's disease* (PD) or *spina bifida* (SB) and *non-neurogenic bladder* (non-NGB) that results from structural or functional bladder damage rather than loss of neuronal control of the bladder and that can occur with urinary tract fistulas, radiation-induced lower urinary tract damage, refractory urinary incontinence or *bladder pain syndrome* (BPS) (1-4).
Based on the underlying disorder, the presenting symptoms of these benign conditions can vary widely from continuous urinary leakage to urinary retention, recurrent urolithiasis, bladder pain, and recurrent *urinary tract infections* (UTIs). These disorders can ultimately lead to a significant quality of life deterioration and have a detrimental effect on the upper urinary tract (3-5).
The main goal of management of these benign lower urinary tract conditions is to protect the upper urinary tract, keep the patients socially dry, eliminate the recurrent urosepsis episodes, and maintain the act of urination whenever possible. This is mainly achieved by conservative and/or minimally invasive measures (5, 6).
A well-established procedure in the management of bladder cancer, urinary diversion is usually considered the last resort for treating these non-malignant lower urinary tract conditions (7-9). External urinary diversions are generally classified into incontinent diversions such as ileal conduit and colonic conduit and continent diversions such as Indiana Pouch and continent urinary diversion using the ileum (10-13).
The primary aim of this study is to report the early and late outcomes of external urinary diversion in patients with refractory non-malignant LUTD. The secondary aim is to evaluate these outcomes independently based on both the underlying condition and the type of external urinary diversion.

MATERIALS AND METHODS

After approval by *University of Cincinnati Institutional Review*

No conflict of interest declared.

Board, we started reviewing the charts of all patients who underwent continent and incontinent external urinary diversion procedures for refractory non-malignant LUTD at *University of Cincinnati Hospitals* in the period between March 2012 and December 2019. All surgeries were performed via open surgery by one surgeon (AM) who is well-trained in genitourinary reconstructive surgeries. Inclusion criteria included all patients with refractory non-malignant LUTD who underwent external urinary diversion. Exclusion criteria included patients who were diagnosed with lower urinary tract malignancies and those who did not complete a minimum follow-up of 6 months. We collected the demographic and baseline characteristics, surgery indications and operative data.

Furthermore, we reported early postoperative outcomes that occurred within the first 4 postoperative weeks including fever, pelvic infection or abscess, wound infection, pneumonia, UTI, paralytic ileus (defined by abdominal pain other than incisional, abdominal distension, failure to pass stool and/or flatus in addition to radiological findings suggestive of obstruction), sepsis, blood loss (defined by hemoglobin drop that required blood transfusion), cardiac complications, and re-operation rate. Late postoperative outcomes that manifested more than 6 months after surgery including urological symptom control, stomal complications, anastomotic ureteric strictures, stone formation, wound complications, hydronephrosis with renal function impairment, and need for re-operation were also reported. Urological symptom control was assessed based on the successful resolution of the specific urological symptoms related to patients' preoperative urological conditions that were the main drive for intervention. Resolution of these symptoms in terms of resolution of hydronephrosis, reduction in urosepsis episodes, alleviation of bladder pain, reduction in urolithiasis, social dryness, and independence was confirmed based on both history taking and clinical examination after a minimum follow-up of 6 months postoperatively.

Statistical analysis

All statistical analyses were conducted using the SPSS software (*SPSS, Inc., Chicago, IL, USA; version 26*). Quantitative variables are presented as means ± standard deviation, and qualitative variables are expressed as frequencies with percentages. Results were compared between two groups using Student's t-test and Mann-Whitney U test for quantitative variables and chi-square test and McNemar's test for qualitative variables. A p-value of < 0.05 was considered significant.

Results

After fulfilling the inclusion and exclusion criteria, 78 patients were included in the study. Fifty-five patients (70.51%) had NGB while 23 patients (29.49%) suffered from non-NGB. Most non-NGB patients had radiation-induced urinary tract damage (39.13%, n = 9), followed by refractory overactive bladder (OAB) (21.74%, n = 5), stress urinary incontinence (SUI) (17.39%, n = 4), BPS (17.39%, n = 4), and finally traumatic urethral rupture (4.35%, n = 1). Fifty-three patients (67.95%) underwent IUD, while CUD was performed for 25 patients (32.05%). CUD procedures included cutaneous catheterizable ileocystoplasty (19 patients), CUD using ileal catheterizable stoma via Yang-Monte technique (4 patients), and Indiana pouch (2 patients). On the other hand, IUD procedures included cystectomy with ileal conduit (22 patients), ileovesicostomy (21 patients), and cystectomy with colon conduit (10 patients). The cystectomy was done via a simple supratrigonal approach without concomitant prostatectomy in males to avoid the associated increased morbidity in those patients with benign conditions. Although ileum is the most commonly used bowel segment for IUD, 10 patients needed a colon conduit in our study to avoid the use of the irradiated devitalized small bowel in those with prior pelvic irradiation and to avoid the need for bowel re-anastmosis in those with a colostomy.

Most of the study population were overweight with BMI of 27.77 ± 7.06 and 29.44 ± 7.29 for IUD and CUD groups respectively, female (62.82%) and white (79.49%) with no significant differences between the IUD and CUD groups regarding the demographic and baseline characteristics (Table 1).

Based on the underlying condition, there was no significant difference in early and late postoperative complications and urological symptoms control between NGB and non-NGB patients with p-values of 0.490, 0.563, and 0.160, respectively. Noticeably, fever was exclusively encountered in patients with NGB with p-value of 0.011, while more non-NGB patients had early wound infection (p-value = 0.007). The only significant difference in the late outcomes between the two groups was the incidence

Table 1.
Demographic and baseline characteristics of the two groups.

Variables	Incontinent Urinary Diversion (IUD) (n = 53)	Continent Urinary Diversion (CUD) (n = 25)	P-value
▪ **Age in years (mean ± SD)**	51.45 ± 15.44	52.04 ± 16.52	0.996
▪ **Follow-up duration in months (mean ± SD)**	25 ± 18	26 ± 17	0.951
▪ **Gender**			
1) Female n (%)	30 (56.60%)	19 (76%)	0.098
2) Male n (%)	23 (43.40%)	6 (24%)	
▪ **Race**			
1) White n (%)	39 (73.58%)	23 (92%)	0.296
2) Black n (%)	12 (22.64%)	2 (8%)	
3) Hispanic n (%)	1 (1.89%)	0 (0%)	
4) Native American n (%)	1 (1.89%)	0 (0%)	
▪ **BMI (mean ± SD)**	27.77 ± 7.06	29.44 ± 7.29	0.370
▪ **Smoking n (%)**	11 (20.75%)	3 (12%)	0.347
▪ **Concomitant Comorbidities**			
1) DM n (%)	11 (20.75%)	4 (16%)	0.619
2) HTN n (%)	25 (47.17%)	9 (36%)	0.353
▪ **Hospital stay (days)**	9.89 ± 6.32	8.04 ± 2.62	0.825
▪ **Indications for surgery**			
I) Neurogenic bladder (NGB) n (%)	40 (75.47%)	15 (60%)	0.162
II) Non-neurogenic bladder (non-NGB) n (%)	13 (24.53%)	10 (40%)	

Table 2.
Demographic and baseline characteristics of the two groups.

Variables	Total (n = 78) (n (%)	Neurogenic bladder (NGB) (n = 55) (n (%)	Non-neurogenic bladder (non-NGB) (n = 23) (n (%)	P-value
· Early outcomes within the first 4 postoperative weeks				
Patients with early complications	42 (53.85%)	31 (56.36%)	11 (47.83%)	0.490
Fever	13 (16.67%)	13 (23.63%)	0 (0%)	0.011
Pelvic infection/abscess	4 (5.13%)	4 (7.27%)	0 (0%)	0.184
Wound infection	11 (14.10%)	4 (7.27%)	7 (30.43%)	0.007
Pneumonia	2 (2.56%)	2 (3.64%)	0 (0%)	0.354
Urinary tract infection (UTI)	4 (5.13%)	4 (7.27%)	0 (0%)	0.184
Ileus	21 (26.92%)	18 (32.73%)	3 (13.04%)	0.074
Sepsis	1 (1.28%)	1 (1.82%)	0 (0%)	0.515
Blood Loss+ Transfusion	4 (5.13%)	4 (7.27%)	0 (0%)	0.184
Cardiac Complications (Arrythmias/NSTEMI)	3 (3.85%)	1 (1.82%)	2 (8.70%)	0.150
Reoperation (Acute Surgical Complications)	2 (2.56%)	2 (3.64%)	0 (0%)	0.354
· Late Outcomes after 6-month follow-up				
Urological symptoms control	52 (66.67%)	34 (61.82%)	18 (78.26%)	0.160
Resolution of hydronephrosis, social dryness, and independence/patients with voiding dysfunction and/or hydronephrosis	40/57 (70.18%)	32/44 (72.73%)	8/13 (61.54%)	0.438
Reduction in urosepsis episodes/patients with recurrent urosepsis episodes	38/55 (69.09%)	25/34 (73.53%)	13/21 (61.90%)	0.365
Alleviation of bladder pain and reduction in urolithiasis/patients with recurrent urolithiasis and bladder pain	28/45 (62.22%)	20/30 (66.67%)	8/15 (53.33%)	0.384
Patients with late complications	47 (60.26%)	32 (58.18%)	15 (65.22%)	0.563
Stomal complications				
1) Stomal leakage	13 (16.67%)	7 (12.73%)	6 (26.09%)	0.149
2) Stomal stenosis	9 (11.54%)	6 (10.91%)	3 (13.04%)	0.788
3) Stomal hernia	10 (12.82%)	6 (10.91%)	4 (17.39%)	0.435
4) Stomal site pain/Bleeding	1 (1.1)	1 (1.82%)	0 (0%)	0.515
5) Stomal retraction	2 (2.56%)	0 (0%)	2 (8.70%)	0.027
Anastomotic Ureteric Stricture	2 (2.56%)	2 (3.64%)	0 (0%)	0.354
Stones (Ureters, Kidneys)	15 (19.23%)	12 (21.82%)	3 (13.04%)	0.370
Wound complications				
1) Wound separation/Incisional hernia	7 (8.97%)	3 (5.45%)	4 (17.39%)	0.093
2) Sinus/Fistula formation	3 (3.85%)	2 (3.64%)	1 (4.35%)	0.882
3) Recurrent wound infection/Abscess	2 (2.56%)	1 (1.82%)	1 (4.35%)	0.519
Hydronephrosis/Renal impairment	6 (7.69%)	3 (5.45%)	3 (13.04%)	0.251
Reoperation (Persistent Symptoms)	10 (12.82%)	7 (12.73%)	3 (13.04%)	0.970

of stomal retraction which occurred only in patients with non-NGB (p-value = 0.027) (Table 2).

The mean times to stomal complications, anastomotic ureteric strictures, renal and ureteric urolithiasis, wound complications, and hydronephrosis or renal impairment were 23.34 ± 9.54, 14.32 ± 2.13, 13.45 ± 6.74, 12.67 ± 5.64, and 14.56 ± 5.78 months, respectively. The average number of complications per patient was 0.83 for early complications, and 1.03 for late complications.

Based on the type of urinary diversion, no significant difference was observed between patients who underwent IUD and those who underwent CUD in terms of early and late postoperative complications and urological symptoms control with p-values of 0.822, 0.146, and 0.732, respectively.

The incidence of stomal leakage and stenosis was significantly higher in the CUD group than in the IUD group (52% *vs* 0%, p-value = < 0.001 and 28% *vs* 3.77%, p-value = 0.002, respectively) (Table 3).

Interestingly, none of the patients experienced grade V complications based on modified Clavien-Dindo classification system.

The majority of patients with early complications had grade I and II complications (29.49% and 14.10% of patients, respectively), while most patients with late complications suffered from grade IIIa and II complications (21.79% and 15.38%, respectively) (Table 4).

Discussion

A well-established treatment of bladder cancer, external urinary diversion can also be used for management of benign urinary conditions that cause significant LUTD. The management of such conditions is primarily achieved by conservative and/or minimally invasive measures. If these measures fail, surgical interventions are indicated (7, 8, 14, 15). These surgical interventions, however, have a significant impact on patients' quality of life. In an interesting study by *Borghi et al*. 2021 (16), they discussed orthotopic urinary diversion as a feasible surgical intervention in refractory non-malignant LUTD and its impact on quality of life and sexual function particularly in females. They reported that although orthotopic neobladder improves physical and mental health in patients with refractory non-malignant LUTD, urinary symptoms were frequently encountered affecting general health and sexual function in females as compared to males (16). The optimal surgery prevents recurrent episodes of symptomatic UTIs or urosepsis, prevents urinary stone formation, provides satisfactory continence between voids, and prevents upper urinary tract damage (9, 12, 13). In this study, we analyzed the outcomes of external urinary diversion in refractory non-malignant lower urinary tract conditions aiming to evaluate their effectiveness and complications.

Although complications were higher in NGB patients in

Table 3.
Early and late outcomes based on the type of urinary diversion.

Variables	Total (n = 78) (n (%)	Incontinent Urinary Diversion (IUD) (n = 53)	Continent Urinary Diversion (CUD) (n = 25)	P-value
· Early outcomes within the first 4 postoperative weeks				
Patients with early complications	42 (53.85%)	29 (54.72%)	13 (52%)	0.822
Fever	13 (16.67%)	10 (18.87%)	3 (12%)	0.448
Pelvic infection/abscess	4 (5.13%)	4 (7.55%)	0 (0%)	0.158
Wound infection	11 (14.10%)	6 (11.32%)	5 (20%)	0.304
Pneumonia	2 (2.56%)	1 (1.89%)	1 (4%)	0.582
Urinary tract infection (UTI)	4 (5.13%)	3 (5.66%)	1 (4%)	0.756
Paralytic ileus	21 (26.92%)	16 (30.19%)	5 (20%)	0.344
Sepsis	1 (1.28%)	1 (1.89%)	0 (0%)	0.489
Blood Loss+ Transfusion	4 (5.13%)	4 (7.55%)	0 (0%)	0.158
Cardiac Complications (Arrythmias/NSTEMI)	3 (3.85%)	2 (3.77%)	1 (4%)	0.961
Reoperation (Acute Surgical Complications)	2 (2.56%)	2 (3.77%)	0 (0%)	0.325
· Late Outcomes after 6-month follow-up				
Urological symptoms control	52 (66.67%)	36 (67.92%)	16 (64%)	0.732
Resolution of hydronephrosis, social dryness, and independence/patients with voiding dysfunction and hydronephrosis	40/57 (70.18%)	25/40 (62.5%)	15/17 (88.24%)	0.052
Reduction in urosepsis episodes/patients with recurrent urosepsis episodes	38/55 (69.09%)	24/34 (70.59%)	14/21 (66.67%)	0.760
Alleviation of bladder pain and reduction in urolithiasis/patients with recurrent urolithiasis and bladder pain	28/45 (62.22%)	16/26 (61.53%)	12/19 (63.16%)	0.912
Patients with late complications	47 (60.26%)	29 (54.72%)	18 (72%)	0.146
Stomal complications				
1) Stomal leakage	13 (16.67%)	0 (0%)	13 (52%)	<0.001
2) Stomal stenosis	9 (11.54%)	2 (3.77%)	7 (28%)	0.002
3) Stomal hernia	10 (12.82%)	6 (11.32%)	4 (16%)	0.564
4) Stomal site pain/ Bleeding	1 (1.28%)	0 (0%)	1 (4%)	0.143
5) Stomal retraction	2 (2.56%)	1 (1.89%)	1 (4%)	0.582
Anastomotic ureteric stricture	2 (2.56%)	2 (3.77%)	0 (0%)	0.325
Stones (Ureters, Kidneys)	15 (19.23%)	13 (24.53%)	2 (8%)	0.084
Wound complications				
1) Wound separation/ Incisional hernia	7 (8.97%)	6 (11.32%)	1 (4%)	0.291
2) Sinus/Fistula formation	3 (3.85%)	3 (5.66%)	0 (0%)	0.225
3) Recurrent wound infection/Abscess	2 (2.56%)	1 (1.89%)	1 (4%)	0.582
Hydronephrosis/Renal impairment	6 (7.69%)	6 (11.32%)	0 (0%)	0.080
Reoperation (Persistent Symptoms)	10 (12.82%)	8 (15.09%)	2 (8%)	0.382

Table 4.
Modified Clavien-Dindo classification of complications.

Variables	Total (n = 78) (n (%)	Incontinent Urinary Diversion (IUD) (n = 53)	Continent Urinary Diversion (CUD) (n = 25)	P-value
· Early outcomes within the first 4 postoperative weeks				
Procedures with early complications, n (%)	42 (53.85%)	29 (54.72%)	13 (52%)	0.822
I, n (%)	23 (29.49%)	17 (32.08%)	6 (24%)	0.465
II, n (%)	11 (14.10%)	5 (9.43%)	6 (24%)	0.084
IIIa, n (%)	2 (2.56%)	2 (3.77%)	0 (0%)	0.325
IIIb, n (%)	2 (2.56%)	2 (3.77%)	0 (0%)	0.325
IV, n (%)	4 (5.13%)	3 (5.66%)	1 (4%)	0.756
V, n (%)	0 (0%)	0 (0%)	0 (0%)	---
· Complications after 6-month follow-up				
Procedures with late complications, n (%)	47 (60.26%)	29 (54.72%)	18 (72%)	0.146
I, n (%)	8 (10.26%)	5 (9.43%)	3 (12%)	0.727
II, n (%)	12 (15.38%)	6 (11.32%)	6 (24%)	0.147
IIIa, n (%)	17 (21.79%)	10 (18.87%)	7 (28%)	0.362
IIIb, n (%)	10 (12.82%)	8 (15.09%)	2 (8%)	0.382
IV, n (%)	0 (0%)	0 (0%)	0 (0%)	---
V, n (%)	0 (0%)	0 (0%)	0 (0%)	---

the early postoperative period and higher in non-NGB patients on the long-term, the differences were generally non-significant and can possibly be attributed to the difference in numbers of patients between the two groups (55 patients with NGB versus 23 patients with non-NGB). In contrast to our study, *Cohn et al.*, 2014 (7) reported fewer overall complications in patients with NGB than with other non-neurogenic conditions. During the early postoperative period, we reported paralytic ileus as the most common complication, with an overall incidence of 26.92%, and the rate was non-significantly higher in patients with NGB than those with non-NGB which can be attributed to the fact that NGB patients usually have a baseline neurogenic bowel making them vulnerable to paralytic ileus. Fever, pelvic infections with or without abscesses, pneumonia, and UTI were reported only in patients with NGB, a finding explained by higher rates of UTIs, stone formation and lung complications in NGB population in general. However, the overall long term complication rate (60.26%) was comparable to that reported by *Erfan et al.*, 2015 in patients who underwent urinary diversion after radical cystectomy for bladder cancer (60%) (17). Surprisingly, although considered major procedure, urinary diversion is not usually associated with major blood loss with proper handling of the bowel and its mesentery. The overall rate of postoperative blood loss that required transfusion

in our study was low (5.13%) and only reported in patients with NGB unlike the higher rate of perioperative blood transfusion (28%) reported by *Osborn et al.*, 2014 (18) following cystectomy with urinary diversion for benign conditions and *Schiavina et al.*, 2013 (19) who reported 6.5% transfusion rate after radical cystectomy with urinary diversion for bladder cancer.

Although adequately studied following malignancies, the outcomes of external urinary diversions following benign urinary conditions have not been sufficiently addressed. Compared to our study, *Osborn et al.*, 2014 (18) reported a slightly lower rate of postoperative ileus, pneumonia, blood loss requiring transfusion, and stoma complications in patients who underwent cystectomy with urinary diversion for benign conditions. *Cohn et al.*, 2014 (7) reported a higher rate of urinary symptom resolution (73%) in 26 patients who underwent cystectomy with urinary diversion for refractory benign conditions. However, they reported a higher rate of infections and wound complications (35% and 23% respectively) than in our study. In contrast to our study results, *Andersen AV et al.*, 2012 (20) reported a moderate rate of complications after bladder augmentation and/or cystectomy with urinary diversion for 41 patients with BPS while attributing this rate mainly to stomal and intestinal issues. Another study done by *Al Hussein Al Awamlh B et al.*, 2015 (21) investigated the quality of life in 29 patients with refractory benign conditions who underwent cystectomy with urinary diversion, and reported a significant rate of early postoperative complications of 65.5% which they attributed to pelvic pain, infections, and gut disturbances. Additionally, the cumulative physical health domain and cumulative mental health domain used to assess the quality-of-life revealed worsening in 26% and 21% of patients respectively.

There was considerable resolution of urological symptoms in 66.67% of patients, and the rate of improvement was non-significantly higher in non-NGB patients than in NGB patients. These findings were supported by several studies such as *Cohn et al.*, 2014 (7) and *E. Brown et al.*, 2015 (6) who reported that cystectomy and urinary diversion procedures were successful management options for benign lower urinary conditions. Relevant to that, the re-operation rate for uncontrolled symptoms and/or acute surgical complications including wound complications and stomal complications such as stomal retraction, recurrent stomal stenosis, and stomal leakage was 12.82% and 2.56%, respectively with non-significant difference between NGB and non-NGB groups.

Generally, incontinent diversions were associated with higher rates of early postoperative complications, while continent diversions were associated with more late postoperative complications, although the differences were non-significant. Many studies previously investigated the outcomes of bladder reconstruction and urinary diversion surgeries (12, 22, 23). One of the most well-structured studies was conducted by *Cody et al.*, 2012 (12) who concluded that, based on a pool of five studies, there was no significant difference in the outcomes among continent diversion, incontinent diversion, and bladder augmentation. On the other hand, *Clark et al.,* 2005 (22) demonstrated higher rate of complications in patients with continent diversion than in patients who underwent ileal conduit.

Study strengths

We investigated the outcomes of external urinary diversion exclusively in patients with refractory non-malignant LUTD. Additionally, we highlighted the distinctive outcomes based on both the underlying condition and the type of external urinary diversion.

The included cases in our study were performed by one surgeon who is well trained in urinary reconstructive surgeries eliminating bias related to technical issues.

Study limitations

Besides being a single-center single-surgeon experience, this is a retrospective study that represented a heterogeneous group of population including NGB and non-NGB. Additionally, the underlying pathology usually determines the type of surgery; therefore, the urinary diversions are indicated for more complicated cases which can skew the patient population in our study.

A standardized questionnaire was not used in the follow-up to report patient's satisfaction regarding the urological symptoms; However, this was related to the multiple social and demographic factors that could limit those patients' ability to return accurately filled questionnaires.

Conclusions

External continent and incontinent urinary diversion can be utilized as the last resort for patient with refractory non-malignant LUTD. These procedures can achieve a reasonable level of urological symptoms control, but with associated adverse outcomes. The most commonly reported complication during the early postoperative period is paralytic ileus, while stomal complications and recurrent urolithiasis are the most frequently encountered complications on the long-term. Fever is more likely to be encountered in patients with NGB, while early wound infection and late stomal retraction are more associated with non-NGB. Stomal leakage and stenosis are more encountered with CUD. Although the differences were non-significant, complications tend to be higher with IUD and in NGB patients during the early postoperative period and higher with CUD and in non-NGB patients on the long-term.

References

1. Pozza G, Iafrate M, Mancini M, et al. Outcome and quality of life of patients with augmented bladder or urinary diversion after kidney transplantation. Arch Ital Urol Androl. 2020; 92:286-290.

2. Ginsberg D. The epidemiology and pathophysiology of neurogenic bladder. Am J Manag Care. 2013; 19(10 Suppl):s191-6.

3. Shingleton WB, Bodner DR. The development of urologic complications in relationship to bladder pressure in spinal cord injured patients. J Am Paraplegia Soc. 1993; 16:14-7.

4. Taweel WA, Seyam R. Neurogenic bladder in spinal cord injury patients. Res Rep Urol. 2015; 7:85-99.

5. Thuroff JW, Abrams P, Andersson KE, et al. EAU Guidelines on Urinary Incontinence. Actas Urol Esp. 2011; 35:373-88.

6. Brown ET, Osborn D, Mock S, et al. Temporal Trends in Conduit Urinary Diversion With Concomitant Cystectomy for Benign Indications: A Population-based Analysis. Urology. 2016; 98:70-4.

7. Cohn JA, Large MC, Richards KA, et al. Cystectomy and urinary diversion as management of treatment-refractory benign disease: the impact of preoperative urological conditions on perioperative outcomes. Int J Urol. 2014; 21:382-6.

8. Stein R, Schroder A, Thuroff JW. Bladder augmentation and urinary diversion in patients with neurogenic bladder: surgical considerations. J Pediatr Urol. 2012; 8:153-61.

9. Shreck E, Gioia K, Lucioni A. Indications for Augmentation Cystoplasty in the Era of OnabotulinumtoxinA. Curr Urol Rep. 2016; 17:27.

10. Cicala C. Classifications of urinary diversions. Urologia. 2012; 79(Suppl 19):20-3.

11. Davis I. Urinary Diversions: Reviewing the most common types of diversion. Can Fam Physician. 1991; 37:1485-90.

12. Cody JD, Nabi G, Dublin N, et al. Urinary diversion and bladder reconstruction/replacement using intestinal segments for intractable incontinence or following cystectomy. Cochrane Database Syst Rev. 2012:CD003306.

13. Stein R, Hohenfellner M, Pahernik S, et al. Urinary diversion--approaches and consequences. Dtsch Arztebl Int. 2012; 109:617-22.

14. Brown ET, Osborn D, Mock S, et al. Perioperative complications of conduit urinary diversion with concomitant cystectomy for benign indications: A population-based analysis. Neurourol Urodyn. 2017; 36:1411-6.

15. Jeong SJ, Oh SJ. The Current Positioning of Augmentation Enterocystoplasty in the Treatment for Neurogenic Bladder. Int Neurourol J. 2020; 24:200-10.

16. Borghi C, Manservigi M, Milandri ES, et al. The impact of orthotopic reconstruction on female sexuality and quality of life after radical cystectomy for non-malignant bladder conditions. Arch Ital Urol Androl. 2021; 93:255-61.

17. Amini E, Djaladat H. Long-term complications of urinary diversion. Curr Opin Urol. 2015; 25:570-7.

18. Osborn DJ, Dmochowski RR, Kaufman MR, et al. Cystectomy with urinary diversion for benign disease: indications and outcomes. Urology. 2014; 83:1433-7.

19. Schiavina R, Borghesi M, Guidi M, et al. Perioperative complications and mortality after radical cystectomy when using a standardized reporting methodology. Clin Genitourin Cancer. 2013; 11:189-97.

20. Andersen AV, Granlund P, Schultz A, et al. Long-term experience with surgical treatment of selected patients with bladder pain syndrome/interstitial cystitis. Scand J Urol Nephrol. 2012; 46:284-9.

21. Al Hussein Al Awamlh B, Lee DJ, et al. Assessment of the quality-of-life and functional outcomes in patients undergoing cystectomy and urinary diversion for the management of radiation-induced refractory benign disease. Urology. 2015; 85:394-400.

22. Clark PE, Stein JP, Groshen SG, et al. Radical cystectomy in the elderly: comparison of clincal outcomes between younger and older patients. Cancer. 2005; 104:36-43.

23. Boyd SD, Feinberg SM, Skinner DG, et al. Quality of life survey of urinary diversion patients: comparison of ileal conduits versus continent Kock ileal reservoirs. J Urol. 1987; 138:1386-9.

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