Augmentation Cystoplasty: Experience in the Developing World

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Abstract

Objective To assess functional outcomes and classify postoperative complications of augmentation cystoplasty by the Clavien-Dindo classification system.

Methods A total of 197 adult patients undergoing augmentation cystoplasty between January 2016 and December 2020 at the Department of Urology, Sindh Institute of Urology and Transplantation (SIUT), were included in the study after obtaining approval from the ethics review committee. Patients' records were reviewed for assessment of complications up to 3 months of follow-up. Functional outcomes were assessed by comparing preoperative video urodynamics study (VUDS) findings with follow-up VUDS findings at 1 year. IBM SPSS v23 was used to record and analyze all the complications, treatments, and pre- and postoperative VUDS data.

Results Of the 197 patients included in this study, 127 (64.5%) were male and 70 (35.5%) were female. The mean age of the patients was 38.4 ± 9.92 years. Eighty-seven patients (44.2%) remained complication-free, 64 patients (32.5%) had grade I-II complications, 44 patients (22.3%) had grade III and IV complications, and only 2 patients (1%) had grade V complications. Stomal stenosis was the most frequent complication, occurring in 14.7% of patients, followed by renal function deterioration and high-grade fever, each noted in 13.7% of patients. Mean preoperative bladder capacity was 144.3 ± 63.09 mL, mean preoperative filling pressure was 43.34 ± 26.92 cm^3 H_2O, while mean postoperative bladder capacity was 460.83 ± 70.69 mL and mean postoperative filling pressure was 7.47 ± 5.79 cm^3 H_2O.

Conclusion Augmentation cystoplasty can increase bladder capacity and improve bladder function. Because of the potential for complications, it is essential to carefully choose patients for surgery and provide proper preoperative counseling. Additionally, it is crucial to give proactive postoperative care.

Introduction

The bladder, aided by pelvic floor muscles, the external urethral sphincter, and the bladder neck, plays a crucial role in continence and releasing urine through the urethra[1,2]. On average, the bladder holds 400 mL of urine[3,4].

The best course of treatment for bladder dysfunction depends on the degree of discomfort and the risk for upper tract injury. The most common treatment for incomplete bladder emptying is intermittent self-catheterization, while antimuscarinic medications are used to treat storage dysfunction. Neuromodulation and intradetrusor injections of botulinum toxin are 2 intriguing alternatives[5].

Augmentation cystoplasty (AC) is a complex and uncommon urological procedure used to treat refractory bladder dysfunction. The goal of AC is to provide adequate urine storage and continence, to prevent upper tract injury from

Key Words

Clavien-Dindo classification system, augmentation cystoplasty, ileocystoplasty

Competing Interests

None declared.

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Abbreviations

AC augmentation cystoplasty
CIC clean intermittent catheterization
CISC clean intermittent self-catheterization
VUDS video urodynamics study

high pressure, and to improve bladder compliance in patients with low-capacity, high-pressure, or poorly compliant bladder[6].

Tizzoni and von Mikulicz were the first to describe augmentation cystoplasty in dogs and humans, respectively[7,8]. But the procedure wasn't used very often until the 1950s, when Couvelaire popularized its use for treatment of the tiny, contracted bladder from genitourinary tuberculous (TB)[9].

Patients undergoing AC may encounter one or more complications, like with any other surgical procedure. Fever, pain, sepsis, wound infection, anastomotic leak, and a decline in electrolytes and renal function are some of the short-term complications linked to AC. Stomal stenosis, the necessity for further surgery, metabolic consequences, stone formation, declining renal function, and recurring infections are examples of long-term consequences. The majority of these complications are attributed to the complexity of surgery and the absorptive nature of the bowel mucosa[10,11].

Outcomes are measured using 2 main parameters: complication rate and improvement in overall functional capacity and compliance with follow-up video urodynamic study (VUDS).

Benefits and complications associated with augmentation cystoplasty are well documented, but data from our region is scarce. A systematic method was previously lacking for evaluating morbidity and mortality in the immediate postoperative period. The Clavien-Dindo classification system is now used around the world as a standard tool to classify and calculate the rates of complications after surgery[12].

In this study, we examine early (within 3 months) postoperative complications using the Clavien-Dindo classification system and functional outcomes in terms of improvement in VUDS after ileocystoplasty with or without a catheterizable channel.

Methods

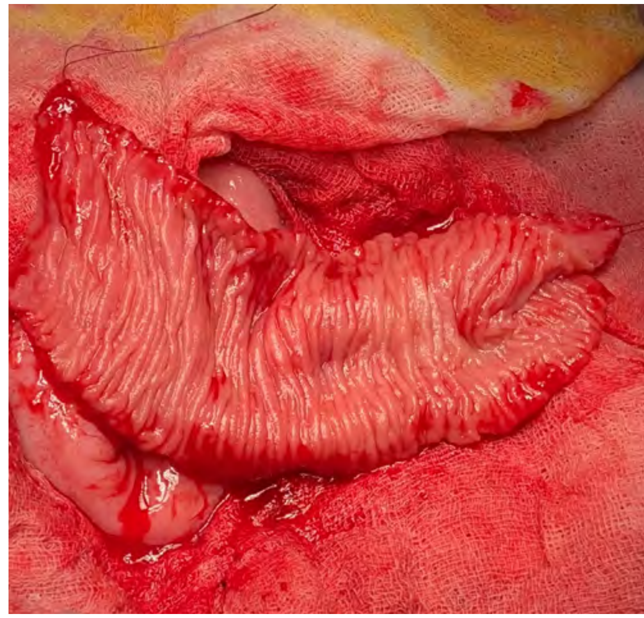
This observational study was conducted at the Department of Urology, Sindh Institute of Urology and Transplantation (SIUT), following permission of the institutional ethics review committee (ERC reference number: SIUT-ERC-2021/A-344). The medical records of all 197 adult patients undergoing augmentation cystoplasty between January 2016 and December 2020 were evaluated. In contrast to the 181 (91.9%) patients who received concurrent Mitrofanoff procedure, only 16 (8.1%) patients (who did not consent to Mitrofanoff and agreed to clean intermittent self-catheterization [CISC] per urethra) underwent augmentation cystoplasty alone. Before surgery, extensive preoperative diagnostic workup was carried out. Initial workup included detailed history, physical examination, bladder diary, ultrasound kidney ureter and bladder pre- and post-void, blood urea and nitrogen, uroflowmetry (UFM), and voiding cystourethrogram (VCUG). Acid fast bacillus urine smear and GeneXpert were performed in patients suspected of having genitourinary (GU) tuberculosis (TB). VUDS was performed in all patients with bladder dysfunction, except for thimble bladder on VCUG or genitourinary fistulae. Augmentation cystoplasty was performed in patients with refractory bladder dysfunction who had either small capacity, high pressure (posing risk for upper tract), and/or reduced compliance on VUDS. Patients with GU tuberculosis and extremely small capacity (thimble bladder) were also subjected to augmentation cystoplasty after completion of anti-tuberculosis treatment. Patients with deranged renal function were first kept on continuous drainage with either suprapubic catheterization or urethral drainage. If renal function improved to within normal range, then augmentation cystoplasty was performed straightaway. All those patients with refractory bladder dysfunction in whom renal function did not improve below 2.5 mg/dL on continuous drainage were counseled to increase awareness of potential postoperative risk for rapid renal function deterioration and renal insufficiency subsequently requiring renal replacement therapy or transplant. Patients who did not wish for future renal transplant and serum creatinine was more than 2.5 mg/dL were kept on conservative therapy with anticholinergics and CISC every 2 to 3 hours or suprapubic catheterization. A multidisciplinary approach was adopted involving a neurologist, psychologist, and nephrologist (where required). Each patient received thorough counseling regarding the entire procedure with the help of audiovisuals. Patients were admitted the day before surgery, and a prophylaxis regimen of broad-spectrum antibiotics was started at admission. No patient received vigorous preoperative bowel preparation. Patients were advised to consume clear liquids for 24 hours with overnight fasting prior to surgery. All patients underwent ileocystoplasty. An ileal segment of 25 to 60 cm depending upon the preoperative bladder capacity assessed by cystometry and video urodynamics was harvested with intact blood supply 20 cm proximal to the ileocecal junction (**Figure 1**). The ileal segment was then detubularized over the anti-mesenteric border to create an ileal plate (**Figure 2**). The plate was

FIGURE 1.

Selected part of the ileum being harvested along with the mesentery

FIGURE 2.

Ileal plate after detubularization



then configured into either a "U" or "W" configuration to anastomose with the already opened (bivalve) bladder with polydioxanone suture 3/0 (**Figures 3** and **4**). For the Mitrofanoff procedure, we utilized the patient's appendix (appendicovesicostomy) (**Figure 5**). The Monti procedure (**Figure 6**) was performed if the appendix was not healthy, short in length, or had a narrow lumen preventing the 14-French catheter to be negotiated. All Mitrofanoff procedures were done by creating a submucosal tunnel into the bladder wall (**Figure 7**) according to Paquin's law and exteriorized at McBurney's point by VQZ plasty (**Figure 8**). Following surgery, each patient remained in hospital for at least 5 days. The drain was removed on the third postoperative day (POD) once the drain output was down to 0 to 50 mL per 24 hours. The patient was followed

FIGURE 3.

"U" configuration of the ileal plate

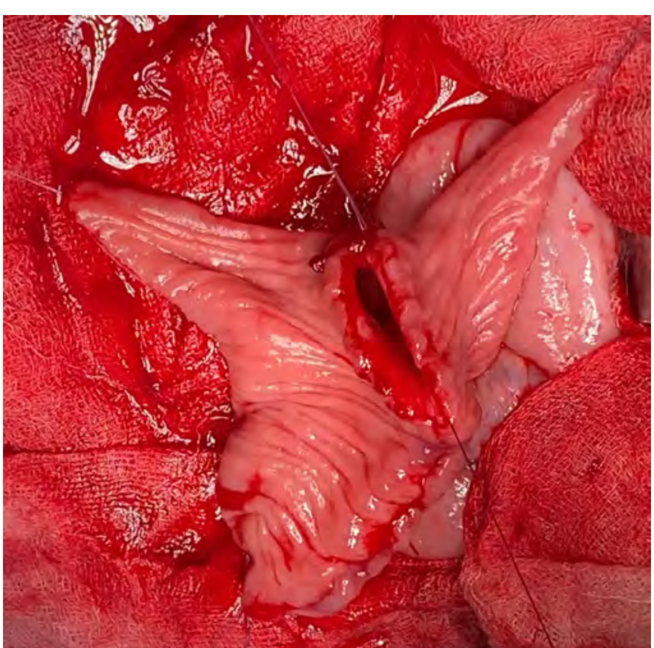


FIGURE 4.

Anastomosis of the ileal plate with the bivalved urinary bladder

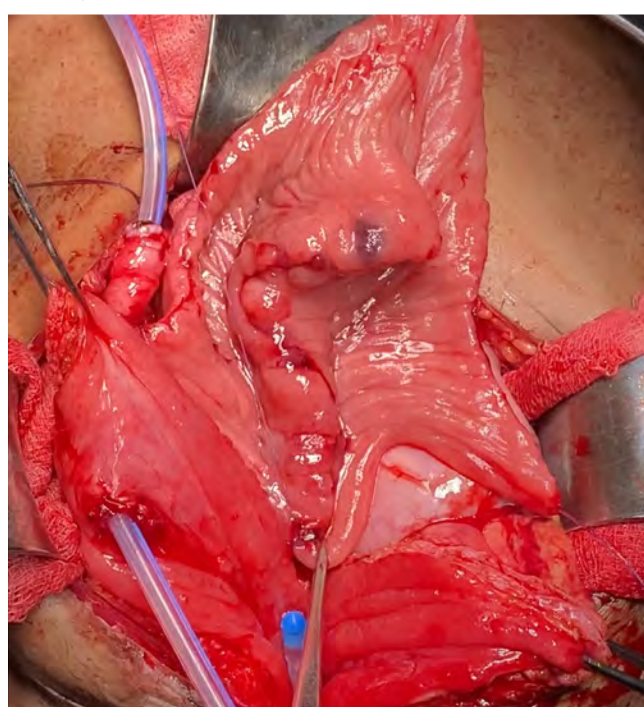


FIGURE 5.

Healthy appendix with good length and adequate blood supply for appendicovesicostomy

FIGURE 6.

The Monti procedure. **(A)** Both ileal plates are anastomosed at the short limb to form a long plate; **(B)** the ileal plate is tabularized over a 16-French catheter to form a tube for the Mitrofanoff procedure

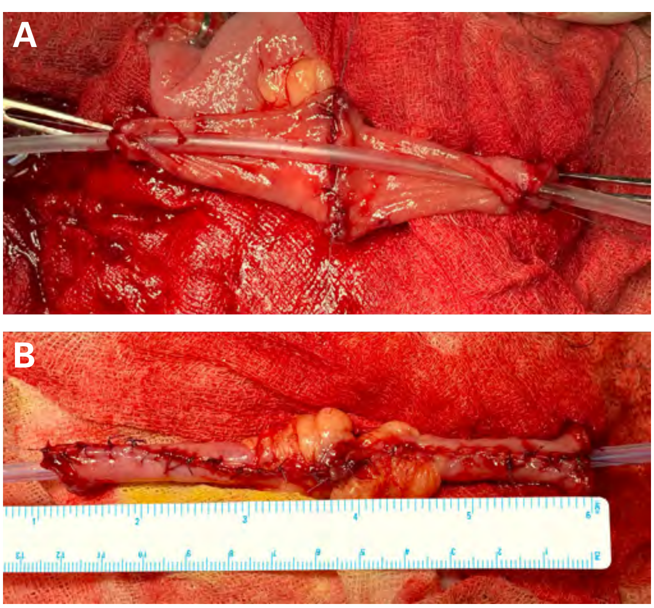


FIGURE 7.

Appendicovesicostomy by creating a submucosal tunnel in the bladder wall

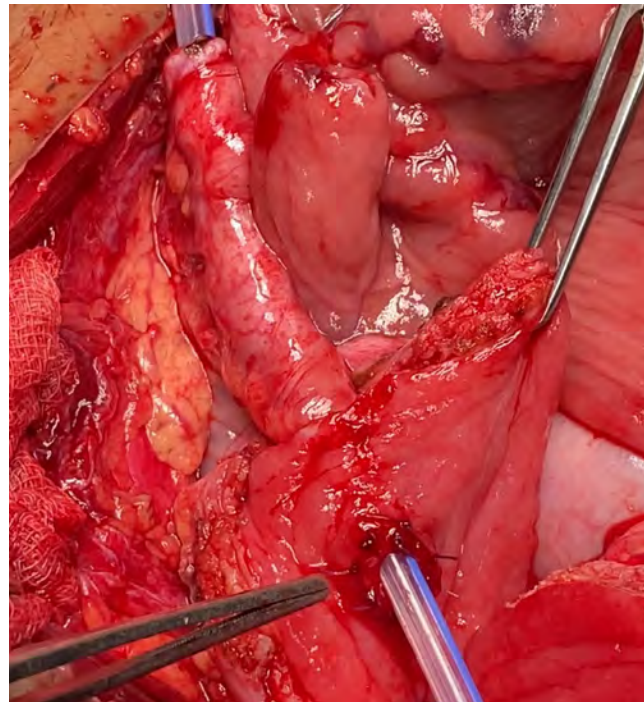
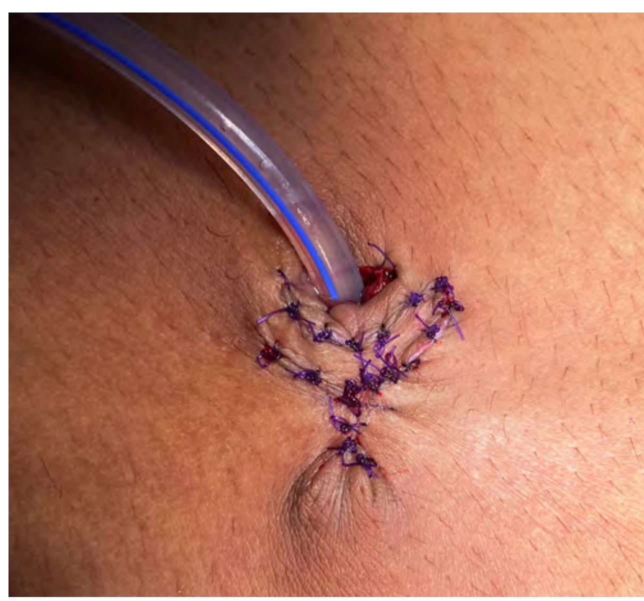


FIGURE 8.

VQZ plasty final result



up for 3 months with regular physical examination, serum electrolytes, serum creatinine, and urine analysis where indicated. On the 7th POD, the Foley catheter was removed and on the 14th POD, the Mitrofanoff tube was removed, and the patient was trained for CISC. On day 21, the suprapubic catheter was removed after clamping for a few days until the patient was fully trained for CISC, which was performed every 3 hours in daytime with nighttime continuous drainage for next 3 months. After 3 months, the patient then followed every 6 months with advice to perform regular CIC every 3 to 4 hours and a bladder wash once a week. Repeat follow-up VUDS of each patient was performed at 1 year to compare functional outcomes. A predesigned proforma was used to record patient information such as age, sex, diagnosis, preoperative VUDS findings, procedure performed, and postoperative VUDS findings. The number and frequency of complications encountered within the first 3 months as well as the treatment provided were recorded in the proforma. For data analysis, IBM SPSS v23.0 was used. For categorical variables, frequencies were computed, but for continuous variables, the mean and standard deviation were calculated. The chi-square test was used to stratify effects modifiers. *P*-values below 0.05 were considered significant.

Results

Of the 197 patients included in this study, 127 (64.5%) were male and 70 (35.5%) were female. The mean age of the patients was 38.4 ± 9.92 years (**Table 1**). Of the 197 patients, 128 (65%) had a diagnosis of neurogenic bladder, mostly secondary to spinal pathology. In 45 patients (22.8%), the definitive cause of bladder dysfunction could not be established (**Table 2**). A total of 181 patients (91.9%)underwent Mitrofanoff formation along with ileocystoplasty, and 16 (8.1%) had ileocystoplasty alone. No patient with augmentation cystoplasty without Mitrofanoff experienced bladder rupture.

Of the 197 patients, 87 (44.2%) remained complication-free; the majority, 64 (32.5%), had complications of grade I-II requiring observation and pharmacological management. Grade III complications were observed in 38 (19.3%) patients requiring intervention, 24 (12.2%) without general anesthesia and 14 (7.1%) under general anesthesia. Of the 8 patients who suffered more severe complications, 6 (3%) had grade IV complications, and 2 (1%) had grade V complications and succumbed to death due to multiorgan failure secondary to sepsis and peritonitis (**Tables 3** and **4**).

Stomal stenosis (14.7%) was the most frequent complication, followed by renal function deterioration

and high-grade fever (13.7% each) (**Table 4**). Most of the decline in renal function was seen in patients who had a low glomerular filtration rate before surgery.

Preoperative VUDS was performed in 196 patients and 1 patient had genitourinary fistulae and urodynamic study was not possible. Mean preoperative bladder capacity was 144.3 ± 63.09 mL and mean preoperative filling pressure was 43.34 ± 26.92 cm^3 H_2O, while mean postoperative bladder capacity was 460.83 ± 70.69 mL with mean postoperative filling pressure of 7.47 ± 5.79 cm^3 H_2O (**Table 1**). Of the 197 patients, 185 (94.4%) patients had reduced compliance preoperatively, while 11 (5.6%) patients had normal compliance. Postoperatively, normal compliance was observed in 195 (99%) patients.

TABLE 1.

Descriptive statistics of age, preoperative and postoperative creatinine (mg/dL), and pre- and postoperative VUDS findings

	n	Minimum	Maximum	Mean	SD
Age	197	18	60	38.40	9.927
Preoperative serum creatinine	197	0.30	6.00	1.4620	0.73751
Postoperative serum creatinine	197	0.10	7.00	1.3930	0.93390
Preoperative filling pressure	196	6	185	43.51	26.883
Preoperative capacity	196	25	400	144.44	63.231
Preoperative Pdet at Qmax	196	0	100	20.74	18.057
Preoperative flow rate	196	0	23	5.50	4.303
Postoperative filling pressure	197	0	54	7.47	5.795
Postoperative capacity	197	283	690	460.83	70.609
Postoperative Pdet at Qmax	197	0	61	7.07	6.745
Postoperative flow rate	197	0	19	3.17	3.028

TABLE 3.

Frequency of complications based on the Clavien-Dindo classification

Complication grade	Frequency, n	Percentage
None	87	44.2
Grade I	42	21.3
Grade II	22	11.2
Grade IIIa	24	12.2
Grade IIIb	14	7.1
Grade Iva	4	2.0
Grade IVb	2	1.0
Grade V	2	1.0
Total	197	100.0

TABLE 4.

Frequency of postoperative complications

Complication	Frequency, n	Percentage
Fever	27	13.7
Urinary leak/Bladder perforation	7	3.6
Bowel anastomotic leak	1	0.5
Ileus	16	8.1
Drain dislodgement	2	1.0
Sepsis	9	4.6
Intra-abdominal bleeding	1	0.5
Wound site bleeding	0	0
Deterioration of renal functions	27	13.7
Electrolyte imbalance	13	6.6
Dislodgement of splints/catheters	9	4.6
Surgical site infection (SSI)	21	10.7
Wound dehiscence	3	1.5
Urinary tract infection	25	12.7
Stomal stenosis	29	14.7
Incisional hernia	2	1.0
Per urethral incontinence	4	2.0
Stomal incontinence	2	1.0
Death	2	1.0

Complication rate stratified by age and sex yielded no statistically significant association (P = 1.00 and P = 0.393, respectively).

Discussion

Augmentation cystoplasty is a surgical procedure intended to increase bladder capacity and retention of larger volumes of urine without a significant increase in intravesical pressure or urinary leakage[13]. The goal of these procedures is to improve the patient's long-term health and quality of life. Before the advent of clean intermittent catheterization (CIC), which subsequently decreased morbidity, especially when used with anticholinergic drugs, quality of life was low.

Due to lack of detrusor contractility, augmented bladders cannot empty on their own, hence nearly every patient needs CIC through a newly formed Mitrofanoff or the urethra. It is crucial to conduct a multidisciplinary preoperative examination to ascertain the patient's motivation and capability for clean intermittent self-catheterization, as doing so helps to avoid serious problems, especially in the early postoperative period. The majority of patients are hesitant to perform CIC through the urethra, so with AC they also need a Mitrofanoff procedure[14].

Following surgery, most patients need basic care. Third space loss emphasizes the significance of fluid electrolyte control. Between 10 mL and 30 mL of saline is used to irrigate the bladder a minimum of 3 times daily in order to flush out mucus and maintain tube patency. After 2 to 3 weeks, if no extravasation is seen on a cystogram, the Foley catheter can be removed. Until the patient is comfortable with the technique of CIC, the suprapubic tube remains in place. Particularly in the first few months, daily irrigation to remove mucus is crucial. Studies of electrolytes, creatinine, and blood urea and nitrogen should be conducted at regular intervals[15].

The incidence of postoperative complications is used as a measure of surgical quality, but there is no consensus on what constitutes a complication and how severe it is, making it difficult to compare outcomes[16]. The majority of reports have evaluated postoperative complications using a non-standardized system and have not accounted for the severity of complications.

There have been uses of terms like “minor,” “moderate,” and “severe,” but they are arbitrary, unreliable, and frequently defined differently by each author[17].

The Clavien-Dindo classification (CDC) is a standardized system for the registration of surgical complications that has received international validation and acceptance. The CDC system’s key feature is that the degree of a complication’s severity is determined by the kind of therapy needed to manage the complication[18].

In some studies, the number of complications after augmentation enterocystoplasty was as high as 20% to 22%, and the number of deaths was between 0% and 3.2%[19]. The complication rate in our study was 35%, with the majority of complications being self-limiting and requiring no to minimal intervention. More severe complications were observed in patients who had low glomerular filtration rate before surgery.

The most common early effects[19,20] are prolonged postoperative ileus, temporary urinary fistula (0.4% to 4%), wound infection (5% to 6.4%), bleeding that requires further intervention (0% to 3%), and thrombo-embolic problems (1% to 3%).

In our study, stomal stenosis (14.7%) requiring endoscopic dilatation or surgical revision remained the most frequently observed complications, followed by fever (13.7%) and a rise in serum creatinine (13.7%). Deterioration of renal function and electrolyte imbalance were usually transient and managed pharmacologically. A few patients required hemodialysis.

In a study conducted at SIUT, the infection at the surgical site was reported as the most frequent complication of a catheterizable channel[14].

Patients with neurogenic bladder are more likely to experience perforation, and it is generally believed that the perforation location is at the anastomotic suture line between the bowel segment and native bladder[21,22].

In a study in 2016, investigators retrospectively evaluated postoperative complications according to the Clavien-Dindo classification and found wound infection in 42% of patients, wound dehiscence in 28%, and urinary leakage in 14%. All were grade I-III according to Clavien-Dindo classification. No major grade IV or V complications were observed[23].

In another study, the mortality rate from AC was reported to be 0% to 3.2%[24]. The mortality rate in our study was 1% (2 patients).

The main limitations of our study are lack of knowledge about the patient’s quality of life after augmentation cystoplasty and the long-term risk for complications. This study opens the door for more research into these areas in the future.

Conclusion

Augmentation cystoplasty has proved to be quite versatile for increasing bladder capacity and enhancing bladder function in patients. Unfortunately, augmentation enterocystoplasty is associated with various complications. Hence, selecting patients for the procedure and providing them with adequate preoperative counseling are crucial, as is provisioning of proactive postoperative care following surgery.

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