



The short-term complications of augmentation cystoplasty: A single center experience

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Abstract

Aim: To evaluate the short-term complications of various cystoplasty techniques in pediatric population and determine the predicting factors.

Materials and Methods: The data of 206 patients (94 males, 112 females) who underwent augmentation cystoplasty between 1991-2016 were analysed retrospectively. Short-term complications within 30 days were evaluated according to the modified Clavien classification system. Grade III, IV, and V were grouped major complications. Chronic renal Disease (CRD) was defined as increasing serum creatinine levels above the normal age-adjusted values. Clinical factors and associated procedures to the surgery (Mitrofanoff procedure, bladder outlet procedures, ureteral anti-reflux surgery) were evaluated to predict overall and major complications.

Results: The mean age was 9.8 ± 4.7 years and female/male ratio was 112/94. Overall complication rate was 32% (66 patients) and distributed to Clavien class I, II, IIIb, IVa as 18 (8,7%), 33(16%), 14 (6,81%), 1 (0,48%) patients; respectively. There was no mortality. Age, PUV aetiology and CRD were significant predictor of complication on univariate analysis ($p=0.026$, $p=0.048$ and $p=0.045$, respectively). Age and preoperative CRD were significant on multivariable analysis ($p=0.015$, $OR=0.918$ and $p=0.046$, $OR=2.134$). Major complications occurred in 15 (7,3%) patients. Bladder exstrophy epispadias complex (BEEC), preoperative CRD, anti-reflux surgery, ileal augmentation were significant parameters on univariate analysis ($p=0.007$, $p=0.003$, $p=0.043$, and $p=0.022$, respectively). For major complications where BEEC, CRD and ileal AC were significant parameters on multivariate analysis ($p=0.009$, $OR=7.837$; $p=0.003$, $OR=9.649$, $p=0.047$, $OR=4.241$, respectively).

Conclusion: Augmentation cystoplasty and associated procedures have acceptable complication rate for pediatric group. Preoperative renal disease and younger age are associated with complications. For major complications, Bladder exstrophy epispadias complex, ileal augmentation and preoperative renal disease are risk factors.



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Introduction

Augmentation cystoplasty (AC) is the main surgical procedure to treat detrusor overactivity, low bladder capacity and low bladder compliance. AC is the final and gold standard treatment modality if clean intermittent catheterization (CIC), pharmacotherapy (anticholinergics) and intravesical injection of botulinum toxin A (BTXA) fail. Augmentation cystoplasty aims to protect the upper urinary tract, preserve renal function and provide continence and to increase quality of life. Augmentation cystoplasty is a challenging procedure which has a range of complications within short and long term. There are a few studies about

AC complications in pediatric population in the literature [1-3]. However, few studies worked to determine complications related factors [3, 4]. Predicting the complications will be a valuable advantage for the surgeon and parents to be ready for and handle them. Predicting them will give advantage for eliminating risk factors in preoperative period and for evaluating them successfully in perioperative period. The aim of this study is to focus on the short-term (postoperative 4 weeks) complications of various AC techniques, classify them objectively and to find the factors predicting composite and major complications.

Materials and Methods

The data of 206 patients who underwent augmentation cystoplasty between 1991-2016 were analyzed retrospec-

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tively. The study was approved by our Institutional Review Board with (Hacettepe University Ethics Boards and Commissions, Non- Interventional Clinical Researches Ethics Board; acceptance number: GO15/621).

All patients in the study had a detailed history, serum biochemistry, urinary system ultrasound and videourodynamic evaluation including documentation of vesicoureteral reflux according to the International Reflux Study Classification System [5]. All patient urine cultures are revived and treated if needed.

Patients with adverse or unexpected events within 30 days were detected. These complications were graded according to the modified Clavien classification system [6]. Grade III, IV, and V were grouped as major complications. Chronic renal disease (CRD) was defined as increasing serum creatinine levels above the normal age-adjusted values.

Sex, age, AC indication (neurogenic bladder, exstrophy epispadias complex (BEEC), posterourethral valve (PUV), Hinman's Syndrome), presence of vesicoureteral reflux (VUR), preoperative CRD, time of AC (before vs after 2003), type of AC (ileal, auto, gastric and ureteral), ureteral anti-reflux surgery, Mitrofanoff procedure, bladder outlet procedures (sling or bladder neck reconstruction) were evaluated for prediction of complications.

Statistical analysis

SPSS 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp) program was used for statistical analysis. The normality of the data distribution was evaluated with the Shapiro Wilk test. Parametric quantitative data were summarized as the mean \pm standard deviation (SD). Comparisons between groups were done using Chi-square test (nominal values). Variables that were statistically significant on univariate analysis were evaluated by multivariate logistic regression analysis. Statistical significance was defined as a p value < 0.05 .

Results

The mean age at the time of surgery was 9.8 ± 4.7 years and female/male ratio was 112/94. The mean postoperative hospitalization time was 9.3 ± 3.1 days. Cystoplasty indications were neurogenic bladder, BEEC, PUV, Hinmann's syndrome and others (75.7%, 11.6%, 5.3%, 3.8% and 3.4% respectively). Of all patients, 128 (62.1%) ileocystoplasty, 64 (31%) auto-augmentation, 7 (3.4%) ureteral augmentation, 5 (2.4%) gastrocystoplasty, 2 (1%) dural augmentation were performed. There were 37 (18%) patients with preoperative CRD and 115 (55.8%) patients with preoperative VUR. Mitrofanoff procedure, anti-reflux surgery, sling and bladder neck reconstruction were performed in 104 (50.5%), 41 (19.9%), 36 (17.5%), 11 (5.3%) patients, respectively. Demographic and clinical characteristic of the patients were given Table 1.

Overall complication was noted at 66 (32%) patients. There were 18 (8.7%) grade I complications (14 (6.7%) wound infection and 4 (2%) persistent pain (requiring radiologic examinations and not being associated with pathology despite routine analgesic) and 33 (16%) grade II complications (11 (5.5%) blood transfusion perioperatively, 21

Table 1. Demographic and clinical characteristic of the patients.

Variable	Value
Mean age (years)	9.8 \pm 4.7
Mean postoperative hospitalization time (days)	9.3 \pm 3.1
Male (n,%)	94 (45.6%)
Female (n,%)	112 (54.4%)
Preoperative renal disease (n,%)	37 (18%)
Preoperative reflux (n,%)	115 (55.8%)
Etiology for AC (n,%)	
Neurogenic bladder (spina bifida, spinal cord tumors, spinal cord trauma)	156 (75.7%)
Exstrophy epispadias complex (BEEC)	24 (11.6%)
PUV	11 (5.3%)
Hinman Syndrome	8 (3.8%)
Others	7 (3.4%)
Augmentation type (n,%)	
Ileocystoplasty	128 (62.1%)
Autoaugmentation	64 (31%)
Ureterocystoplasty	7 (3.4%)
Gastrocystoplasty	5 (2.4%)
Others	2 (1%)
Additional procedures (n,%)	
Mitrofanoff procedure	104 (50.5%)
Antireflux surgery	41 (19.9%)
Sling	36 (17.5%)
Bladder neck reconstruction	11 (5.3%)

(10%) febril urinary tract infections, 1 (0.5%) patient convulsion related with electrolyte imbalance). Age, Hinmann's syndrome etiology and preoperative CRD were significant predictor of overall complication on univariate analysis ($p=0.041$, $p=0.048$ and $p=0.045$, respectively) (Table 2). Younger age and preoperative CRD were significant on multivariable analysis ($p=0.015$, OR=0.918 and $p=0.046$, OR=2.134, respectively) (Table 3).

Major complications were noted in 15 (7.3%) patients. Fourteen patients were re-operated (4 drainage problems, requiring cystoscopy to irrigate and catheter change, 2 intestinal anastomosis leakage, 1 bowel obstruction, 3 urinary leakage, 1 wound debridement and closure, 1 nephrostomy due to progressive hydronephrosis, 2 removal abdominal drainage catheter under general anaesthesia). The only patient in grade IVA was a girl with severe hypotension in the first postoperative day. She was followed in intensive care unit with aggressive fluid resuscitation and wide spectrum antibiotic treatments due to sepsis, and stabilized at 3rd day. There was no mortality. BEEC, preoperative CRD, anti-reflux surgery, ileal augmentation were significant parameters on univariate analysis ($p=0.007$, $p=0.003$, $p=0.043$, $p=0.010$ and $p=0.003$, respectively) (Table 2). BEEC, CRD and ileal AC were significant parameters on multivariate analysis ($p=0.009$, OR=7.837; $p=0.003$, OR=9.649, $p=0.047$, OR=4.241, respectively) (Table 3).

Table 2. Univariate analysis for prediction of overall and major complications.

Parameters		Overall Complication Rates (%)		Major Complications Rates (%)		
		Yes	p	Yes	p	
Sex	Female	31.2%	0.791	8%	0.644	
	Male	33%		6.4%		
Age	<9.5	31.8%	0.041	7.1%	0.902	
	>9.5	24.7%		7.5%		
Etiology	Neurogenic Bladder	Yes	34.6%	0.162	0.126	
		No	24%			12%
	BEEC	Yes	41.7%	0.282	20.8%	0.007
		No	30.8%		5.5%	
	PUV	Yes	9.1%	0.094	0%	0.114
		No	33.3%		7.7%	
	Hinmann’s Syndrome	Yes	0%	0.048	0%	0.339
		No	33.3%		7.6%	
	Preoperative renal disease	Yes	45.9%	0.045	18.9%	0.003
		No	29%		4.7%	
	Preoperative VUR presence	Yes	33.9%	0.517	9.6%	0.156
		No	29.7%		4.4%	
Augmentation Cystoplasty type*	Ileal	36.7%	0.0641	10.9%	0.022*	
	Auto	23.4%		1.6%		
Time of Augmentation Cystoplasty	<2003	29.5%	0.430	7.6%	0.849	
	>2003	34.7%		6.9%		
Additional procedure	Bladder Outlet Procedure	Yes	38.3%	0.791	12.8%	
		No	30.2%		5.7%	
	Anti-reflux surgery	Yes	34.1%	0.747	14.6%	0.043
		No	31.5%		5.5%	
	Mitrofanoff procedure	Yes	32.7%	0.829	8.7%	0.444
		No	31.4%		5.9%	

*The others procedures were excluded.

Table 3. Multivariate analysis for prediction of overall and major complications.

Overall Complications		
Parameters	OR (95% CI)	p
Age, years	0.918 (0.858-0.984)	0.015
Presence of preoperative renal disease	2.134 (1.012-4.499)	0.046
Etiology, Hinmann’s Syndrome	1.013 (0.514-1.253)	0.916
Major Complications		
Etiology: BEEC	7.837 (1.666-36.864)	0.009
Presence of preoperative renal disease	9.649 (2.213-42.070)	0.003
Augmentation Type, ileal	4.241 (1.502-35.853)	0.047
Addition of anti-reflux surgery	1.777 (0.529-5.968)	0.352

Discussion

Augmentation cystoplasty is complex procedure used for small capacity, high-pressure, poorly compliant bladder when conservative treatments and botulinum toxin injection fail. Because it includes different etiology and addi-

tional procedures and is performed relatively rare, complications and complications rates vary. All of these factors are associated to few studies evaluated to predict postoperative complications. In addition, there is not agreed standardization of complications in pediatric urology. A study published Dwyer et al. evaluated whether the Clavien-Dindo classification of surgical complications was applicable to pediatric urological population and they reported that its accuracy was significantly decreased compared to adult surgical cases [7]. However, the Clavien classification system was used for validating a scoring system to determine major complications within postoperative 30 days in children [8]. Moreover, the modified Clavien classification has been used to categorize complications in pediatric population recently [3, 9, 10]. So we used the modified Clavien classification for grading complications of AC and grouped grade III, IV and V complications as major complications.

The use of ureter may be first option for bladder augmentation in patients had renal atrophy with ureteral dilatation [11, 12]. Unless the ureter is available for augmentation, the use of intestinal segments is ideal for bladder augmentation such as ileum, gastric and colon. It is expected

that the use of intestinal segment may be related to increased complication rate. In our study, there were small number of ureteral augmentations. So, we analysed only two major augmentation procedures (auto and ileal) and excluded the others procedures when analyzing impact of procedures on complications. On the other hand, auto augmentation and ileal AC has similar overall complications rates. But, ileal AC was predictor of major complications. The reasons why it increased major complications were catheter obstruction due to mucus accumulation and intestinal complications.

In the literature, number of studies on factors affecting the complications rates are limited. In 2016, a study published by Onur et al. evaluated complications related factors [3]. They found complications rate 24.7% and graded them according to the modified Clavien classification (11.1% grade I, 5.1% grade II, 4.2% grade III and 2.5% grade IV). They found hydronephrosis, bladder neck reconstruction, and serum creatinine greater than 1.0 mg/dL to predictor of perioperative complication of AC within postoperative 30 days. Other study evaluating the American College of Surgeons National Surgical Quality Improvement Program Pediatric database was published by McNamara et al [4]. in 2015. They reported complication in 87/461 (18.9%) patients. The most common complication was urinary tract infection seen in 43/87 (49.4%) patients. Wound infection and transfusion were seen in 35/87 (40.2%) and 19/87 (21.8%) patients, respectively. Longer operative time, procedure count and high surgical risk scores (which was developed by Rhee [13] were found as predictors of complication.

In our study, overall complications were noted at 32% (66/206); 8.7% was grade I (wound infection and pain), 16% was grade II (5.5% blood transfusion perioperatively, 10.2% febril urinary infections, 0.5% convulsion related with electrolyte imbalance), 7.2% was grade III, and 0.5% was IVA. Grades I and II comprised majority of complications. Blood transfusion and febril urinary tract infection were frequently seen in perioperative period. Because AC is complex surgery included different additional procedure, transfusion resulted of bleeding is inevitable during surgery or postoperative period. Many of the patients had VUR and AC is not a clean surgery. Therefore, the development of postoperative febrile infections was not surprising. We found that younger age and CRD were predictor of overall complications. Younger age is probably associated with more difficult surgery, limitations on postoperative care and susceptibility to electrolyte deficiency. Additionally, little size bladder catheter associated with obstruction due to mucus accumulation might increase intrabladder pressure. So it might increase the complications. In patients with CRD, coagulation disorders, infections and electrolyte imbalance related complications are seen.

In our study, grade \geq III complications were defined as major complications. They occurred in 15 (7.3%) patients and of the all them, 14 patients underwent reoperations; 3 were intestinal problems, 3 were urinary leakage, 4 were drainage problems, 2 were removal abdominal drainage catheter, 1 was nephrostomy, 1 was complex wound closure. Only 1 patient who had grade IVA complication followed in intensive care due to sepsis. There was not

mortality. BEEC, CRD and ileal AC were found independent predictor of major complications. There is absence of midline abdominal tissue in patients with BEEC. Patient with BEEC has previous complex surgery including bladder, bladder neck, urethral reconstructions and osteotomy. Bladder mucosal changes and bacterial colonization in especially BEEC are other problems. Because of these factors, patients with BEEC might be associated with major complication more. Similarly, McNamara et al evaluated predictor of readmission and/or reoperation in their study and reported that longer operation time had found significant [4].

The management of VUR is controversial issue. Although some authors suggested reimplantation simultaneously, others suggested that decreasing intravesical pressure could decrease reflux grade and even provides the resolution of VUR [14, 15]. We performed additional anti-reflux surgery if it had started at low pressure on urodynamic. Preoperative VUR and additional reflux surgery did not have impact on perioperative complications.

Retrospective nature is the main limitation of our study. The study included a widely range period (1991-2016); therefore, surgical and postoperative care team might have been changed, clinical approach and patient care might have varied within that period. Yet, when we compared the first half of the study period with the second half there was no difference. Etiology and procedure groups had different number of patients. Although there were limitations of presented study, we think that it predicts which complications will likely to occur and factors are associated with complication.

Conclusion

Although augmentation cystoplasty is complex surgery, it is performed safely in pediatric populations. Younger age and preoperative renal disease are predictors of overall complications. Preoperative renal disease, BEEC etiology and ileal augmentation are predictors of major complication. Our data can be help surgeons to stratify complications and to properly inform parents.

Ethics approval

Hacettepe University Ethics Boards and Commissions, Non- Interventional Clinical Researches Ethics Board; acceptance number: GO15/621.

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