

LONG-TERM FOLLOWUP OF AUGMENTATION ENTEROCYSTOPLASTY AND CONTINENT DIVERSION IN PATIENTS WITH BENIGN DISEASE

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ABSTRACT

Purpose: We evaluated long-term outcomes in patients undergoing augmentation enterocystoplasty (AC) (with or without an abdominal stoma) or continent urinary diversion in patients with benign urological disorders.

Materials and Methods: This was a retrospective study of 76 consecutive adults who underwent AC (with or without an abdominal stoma) or continent urinary diversion because of benign urological conditions. The outcomes assessed were a patient satisfaction questionnaire, continence status, catheterization status, bladder capacity, bladder compliance, detrusor instability, maximum detrusor pressure, upper tract status, significant postoperative morbidity, need for reoperation, persistent diarrhea and vitamin B12 deficiency.

Results: The 76 patients (18 men and 58 women) were 19 to 80 years old (mean age 49). Followup was 1 to 19 years (mean 8.9). Preoperative diagnoses were neurogenic bladder in 41 patients, refractory detrusor overactivity in 9, interstitial cystitis in 7, end stage bladder disease in 7, radiation cystitis in 3, exstrophy in 3, postoperative urethral obstruction in 3 and low bladder compliance in 3. A total of 50 patients underwent simple AC, 15 underwent AC with an abdominal stoma and 11 underwent continent supravescical diversion. Of the 71 evaluable patients 49 (69%) considered themselves cured, 14 (20%) considered themselves improved and 8 (11%) considered treatment to have failed. All 7 patients with interstitial cystitis had failed treatment. Mean bladder capacity increased from 166 to 572 ml and mean maximum detrusor pressure decreased from 53 to 14 cm H₂O. Serum creatinine improved or remained normal in all patients. Five patients experienced persistent diarrhea requiring intermittent antispasmodics but none had vitamin B12 deficiency, pernicious anemia or malabsorption syndrome. Long-term complications were stomal stenosis or incontinence in 11 of 26 patients (42%) with stomas, de novo bladder and renal stones in 2 of 71 (3%) and 1 of 71 (1%), respectively, and recurrent bladder stones in 6%. Small bowel obstruction occurred in 5 of 71 patients (7%), requiring surgical exploration in 4 (6%).

Conclusions: AC and urinary diversion provide a safe and effective long-term therapy in patients with refractory neurogenic bladder but stomal problems in patients with continent diversion continue to be a source of complications.

KEY WORDS: urinary diversion, bladder, urodynamics, salvage therapy, postoperative complications

Enterocystoplasty (with or without an abdominal urinary stoma) and continent urinary diversion (CD) are procedures suitable for carefully selected patients with refractory overactive bladder and end stage bladder disease who have failed to respond to more conservative methods of treatment.¹ Their role in patients with interstitial cystitis is controversial and until the last 2 decades they were thought to be contraindicated in patients with neurogenic bladder and renal failure.² Although they are rarely done in patients with renal failure, neurogenic bladder has become the most common indication for these surgeries but concerns about potential surgical complications, the need for intermittent catheterization, diarrhea, fecal incontinence, vitamin B12 deficiency and a lack of surgical training have limited their application.³ In this study we describe our long-term experience with these procedures in adults with benign disease and specifically address the issues alluded to.

METHODS

This is a retrospective study of 76 consecutive adults who underwent augmentation enterocystoplasty (AC) (with or without an abdominal stoma) or continent urinary diversion (CD) because of benign conditions. Preoperative evaluation consisted of history and physical examination, voiding diary, pad test, complete blood count, chemistry profile, videourodynamics, cystoscopy and upper tract imaging with ultrasound, computerized tomography scan or excretory urography. Postoperative evaluations were scheduled at 6-month intervals after year 1, namely videourodynamics alternating with renal and bladder ultrasound. All preoperative laboratory studies were scheduled to be repeated every 6 months and after 5 years vitamin B12 levels were added. Postoperative cystoscopy was done only for specific indications, that is hematuria, refractory incontinence or recurrent infections.

Continence status was assessed by a modification of the previously validated, simplified incontinence outcome score (SIOS) described by Groutz et al using a diary and questionnaire but not a pad test because many patients were wheelchair bound and the pad test proved to be impractical.⁴ Other outcomes were catheterization status, bladder capacity, bladder compliance, detrusor instability, maximum detrusor pressure (pdetmax), upper tract status, significant postoperative morbidity, need for reoperation, persistent diarrhea and vitamin B12 deficiency.

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Urodynamic evaluation consisted of simultaneous measurement of intravesical, intra-abdominal and detrusor pressure, perineal electromyography with patch electrodes, cystography and voiding cystourethrogram. Cystometry was accomplished with room temperature radiographic contrast material at a medium filling rate. During bladder filling the patient was instructed to neither void nor try to inhibit micturition, but rather to report sensations to the examiner. Bladder compliance was calculated as change in volume divided by change in pressure for the select tracing segment, usually at 100 ml intervals. Bladder capacity was defined as a strong desire to void, uncomfortable fullness, or incontinence due to involuntary detrusor contraction or low bladder compliance. However, in the latter circumstance bladder filling was repeated 1 or more times and the largest volume infused was considered bladder capacity.

Two operative techniques were used for the enterocystoplasty. From 1984 to 1997 enterocystoplasty was performed using the ileocecal segment, which was mobilized to include about 6 cm of ileum and a varying length of cecum, sometimes including the hepatic flexure, depending on the size of the cecum. The entire segment was detubularized by opening it along the antimesenteric border. The bowel was then transformed into a wide patch by suturing the edges of the ileum to the cecum. Appendectomy was performed routinely. A U-shaped bladder incision was then made, starting approximately 2 cm cephalad to the vesical neck, extending lateral and posterior to the bladder base. The flap was reflected posterior and fixed to the psoas muscles. The ileocecal patch was then anastomosed to the splayed out bladder using single layer closure with zero chromic catgut. Drains included a Malecot cystotomy tube, a urethral catheter and a Jackson-Pratt to drain the perivesical space.

From 1997 until the current time the described technique or the ileocystoplasty technique first described by Goodwin et al⁵ was used, except the length of ileum that we used was generally longer (18 to 30 cm) and it was reconfigured into a W shape. A number of different techniques were used to create continent and incontinent cutaneous limbs using appendix, ileocecal valve, ileum or transverse colon depending on conditions during surgery. Stomas were placed in the umbilicus or abdominal wall using various techniques.⁶

In all patients a cystogram was performed on postoperative day 7 to 14 and, if there was no extravasation, the suprapubic catheter was removed. Until about 1997 all patients were treated with intermittent self-catheterization. Thereafter if the patient did not have a condition known to prevent micturition (areflexic neurogenic bladder or urethral obstruction), a voiding trial was begun and intermittent catheterization was started only if the voiding trial was not successful. Statistical analysis used CIs.

RESULTS

The 76 patients (18 men and 58 women) were 19 to 80 years old (mean age 49). Followup was 1 to 19 years (mean 9) and 56 patients were followed more than 5 years. Three patients were lost to followup, of whom all had quadriplegia. Two of these patients moved and left no forwarding address, while 1 refused followup but stated that she was "just fine" in a telephone interview. There was 1 postoperative death due

to aspiration pneumonia in a 36-year-old quadriplegic woman. One other morbidly obese woman died of dehydration and urosepsis in a nursing home 6 months postoperatively.

Six patients died 3 to 17 years postoperatively (table 1). One of these patients was a 71-year-old woman who died of metastatic transitional cell cancer of the bladder 11 years after ileocystoplasty because of radiation cystitis. She had undergone extensive radiation and chemotherapy for a gynecologic malignancy 20 years previously. She presented to another physician with gross hematuria, already had metastatic disease at presentation and died about 6 months later.

All except 3 of the remaining 71 evaluable patients, including those who died of unrelated causes, underwent postoperative videourodynamics, renal and bladder ultrasound, and blood evaluation at least 1 year postoperatively. Preoperative diagnoses were neurogenic bladder in 41 patients, refractory detrusor overactivity in 9, interstitial cystitis in 7, end stage bladder disease in 7, radiation cystitis in 3, exstrophy in 3, postoperative urethral obstruction in 3 and low bladder compliance in 3.

A total of 50 patients underwent simple AC, 15 underwent AC with an abdominal stoma and 11 underwent CD. The ileocecal bowel segment was used for reconstruction in 62 cases, ileum was used in 12 and transverse colon was used in 2. Eight patients with refractory sphincteric incontinence underwent a simultaneous pubovaginal sling (2) or sphincter prosthesis (1) procedure, or vesical neck closure (5).

Overall 49 of the 71 evaluable patients (70%) considered themselves cured, 13 (18%) considered themselves improved and 9 (13%) considered that treatment had failed. However, the SIOS score⁴ does not distinguish causes of failure and in fact in all 7 patients with interstitial cystitis treatment failed because of persistent pelvic pain and failure to achieve adequate bladder capacity, not because of incontinence. With respect to continence in the 68 evaluable patients, excluding 7 with interstitial cystitis and 1 postoperative death, the cured, improved and failed rates were 74%, 23% and 3%, respectively. Table 2 lists the cured/improved rate for each diagnosis. There were no urodynamic characteristics that proved to be of prognostic significance. The diagnosis of interstitial cystitis was a clinical as opposed to urodynamic predictor of outcome (failure in this case).

Of 15 patients who underwent AC with an abdominal stoma 14 (93%) considered themselves cured or improved based on SIOS but 2 of them had undergone ileovesicostomy and depended on a urostomy appliance for continence. In the 1 failed case a vaginal fistula developed due to failed bladder neck closure. Three of 11 patients (27%) who underwent CD had persistent incontinence. Three patients with persistent incontinence had stomal incontinence. Two of the 3 stomal failures occurred in morbidly obese patients treated with an indwelling stomal catheter for prolonged periods because of comorbidities while under the care of other physicians. One case was due to false passage after traumatic catheterization 8 days postoperatively, when the stomal catheter fell out and was replaced at a local emergency room.

Serum creatinine improved or remained normal in all except 2 patients. One patient had undergone radical hysterectomy, "massive doses of radiation" and chemotherapy for

TABLE 1. Unrelated causes of death

Sex — Age	Postop Yrs	Surgery Type	Cause of Death
M — 79	18	Ileocecal augmentation	Myocardial infarction
M — 36	5	Ileocecal augmentation	Suicide
F — 55	5	Ileocecal augmentation + ileal chimney	Leukemia
F — 74	11	Ileocecal augmentation	Metastatic bladder Ca
M — 56	3	Ileocecal augmentation	Metastatic squamous cell Ca of thigh
F — 49	11	Ileocecal augmentation	Sepsis after surgical exploration for recurrent sacral ependymoma

TABLE 2. Cured/improved rate according to diagnostic categories

Preop Diagnosis	No. Pts (%)	% Cured/Improved
Neurogenic bladder	41 (54)	98
Refractory detrusor overactivity	9 (12)	100
Interstitial cystitis	7 (9)	0
End stage bladder disease	7 (9)	100
Radiation cystitis	3 (4)	66
Exstrophy	3 (4)	100
Urethral obstruction	3 (4)	100
Low bladder compliance	3 (4)	100
Total No.	76	

leiomyosarcoma of the uterus 18 years previously. Severe radiation enteritis developed and she had recurrent problems with diarrhea. Five years postoperatively stomal incontinence developed and she was treated with a Foley catheter elsewhere. Stones, obstruction and azotemia developed and the patient died in a hospice. The second patient had de novo, grade 2 left hydronephrosis 7 years after continent diversion for detrusor overactivity. All patients with preexisting hydronephrosis showed upper tract improvement except as described.

Five of 71 evaluable patients (7%) experienced new onset, intermittent diarrhea requiring antispasmodics, of whom 4 were incontinent but only of diarrheal bowel movements. No patient had vitamin B12 deficiency, pernicious anemia or clinically relevant malabsorption syndrome.

Of patients with continent stomas long-term complications occurred in 11 of 24 (42%), including stomal stenosis in 8 of 24 (33%) and incontinence in 3 of 24 (13%). Reoperation was required in 4 of 24 patients (17%) with stomal stenosis. De novo bladder and renal stones developed in 2 of 71 (3%) and 1 of 71 (1%) cases, respectively. Bladder stones recurred in 4 of 71 patients (6%). Small bowel obstruction occurred in 5 of 71 patients (7%), requiring surgical exploration in 4 (6%). Table 3 shows urodynamic findings.

DISCUSSION

The last 2 decades have witnessed a dramatic change in the treatment of patients with refractory overactive bladder, incontinence and end stage bladder disease. The gold standard of the previous decade, that is the ileal conduit, in our judgment has been shown to have an unacceptably high complication rate and from a psychosocial standpoint it results in less than satisfactory quality of life compared with treatments that do not require an external appliance to manage incontinence.⁷ The results of this study confirm those of others that augmentation enterocystoplasty using a detubularized segment of ileum or cecum and continent urinary diversion are satisfactory methods of managing these refractory problems.⁸

In the 1980s neurogenic bladder was considered a relative contraindication to AC. Today it is one of the commonest indications due primarily to the widespread acceptance of intermittent self-catheterization as a means of bladder emptying.⁹ As ours and other studies attest, AC and CD are safe and effective treatments for refractory detrusor hyperreflexia

and low bladder compliance due to not only neurological conditions, but also to idiopathic conditions, iatrogenic urethral obstruction and incontinence, cystitis due to tuberculosis, radiation, chemical cystitis and schistosomiasis.^{10,11} However, in our hands enterocystoplasty was totally unsuccessful for interstitial cystitis and we abandoned it about a decade ago. We currently consider interstitial cystitis to be a contraindication for enterocystoplasty.

The goal of AC is to create a low pressure, high capacity urinary reservoir that can be emptied by intermittent catheterization or voiding. When intermittent catheterization through the urethra is impractical or impossible, a continent catheterizable stoma proves to be effective but stomal complications are seen in almost half of the patients. If the patient is unable to catheterize, we believe that an incontinent stoma (ileal chimney) is far preferable to a urinary conduit but there are too few studies to corroborate this with any degree of confidence. What is clear is the significant incidence of renal deterioration with time in patients who have received a classic Bricker ileal conduit, which is presumed to be related to a combination of ureteral ischemia and high pressure in the intact ileal segment.¹²⁻¹⁴ The usual indications for creating an abdominal stoma include women with spasticity of the lower extremities who are wheelchair bound because of neurological conditions, patients of each sex with urethral obstruction and those with refractory sphincteric incontinence or fistulas.

The choice of intestinal segment to be used (sigmoid, ileum, cecum or ileocecum) does not appear to be an important factor for predicting success or complications and it can be determined at surgery.^{15,16} It has been well documented that detubularized ileum generates lower pressures than large bowel and ileum does not require as much dissection as large bowel.^{17,18} On the other hand, the ileocecal segment requires a much shorter segment, less reconfiguration is necessary and its use facilitates construction of a continent abdominal stoma. It has also been suggested that the absorption of urinary solutes and the amount of mucous secretion is less with large bowel.^{19,20}

Overall success was assessed by SIOS, which rates patients as cured, improved or failed but does not distinguish the reasons for failure, ie stress, urge, fistula, etc.⁴ However, in most patients pad tests were not done because the high incidence of neurological disorders made this impractical. Furthermore, no distinction was made between daytime incontinence and nocturnal enuresis. In all patients in whom stomal incontinence developed the condition occurred under the care of other physicians, who placed stomal catheters traumatically or for long periods (months). Whether these conditions could have been prevented by expert urological care is moot but we recommend percutaneous cystostomy in patients who require an indwelling catheter and, if catheterization proves difficult, we advocate passage of a guide wire through the stoma under direct endoscopic or radiographic vision for the facilitation of subsequent drainage catheter placement.

Stomal stenosis was another frequent complication, occurring in about 1 of 3 (31%) patients and requiring reoperation in half (15%). De Ganck et al reported a 36% rate of stomal complications in 53 patients who underwent Mitrofanoff or Monte-type continent mechanisms.⁶ Although they stated that these complications were "relatively easy to treat," mean time to occurrence was only 9 months and overall followup was only 2.8 years. In our series stomal complications occurred as long as 7 years after surgery and, although the procedures to repair stenosis have been simple enough (Y-V plasty), the results have often been less than satisfactory. Many patients required more than 1 procedure and retained some degree of stenosis. We expect more complications as time goes on and believe that we have a long way to go before

TABLE 3. Preoperative and postoperative urodynamic characteristics

	Mean	95% CI
Preop:		
Bladder capacity (ml)	166	137-194, 10-486
pdetmax (cm H ₂ O)	53	44-63, 2-138
Postop:		
Bladder capacity (ml)	572	517-626, 90-955
pdetmax (cm H ₂ O)	14	9-19, 1-123
Preop vs postop	<0.0001.	

we can confidently construct continent abdominal stomas with a low long-term complication rate.

Persistent or recurrent diarrhea was noted in 7% of cases but it was generally easy to treat with antispasmodics. There was no obvious correlation with the type of operation, underlying disease, or type or length of bowel used. Furthermore, neither vitamin B12 deficiency, malabsorption syndromes, nor clinically relevant electrolyte abnormalities were observed except in a few critically ill patients due to nonrelated disorders and in 1 with preexisting lithium induced diabetes insipidus.

Most cancers that have developed in patients undergoing cystoplasty have occurred in those with bladder exstrophy or tuberculous cystitis. Our only patient to have bladder cancer was a woman who died of transitional cell carcinoma of the bladder 11 years after ileocystoplasty, which was done because of radiation cystitis. She presented to another physician with gross hematuria and already had metastatic disease at presentation. This underscores the necessity of compulsive long-term followup in these patients. In conclusion, AC and urinary diversion provide safe and effective long-term therapy in patients with refractory neurogenic bladder and other benign conditions but stomal problems in patients with continent diversions continue to be a source of complications.

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