NEUROGENIC BLADDER DYSFUNCTION: OUTCOME FOLLOWING GASTROCYSTOPLASTY

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Abstract

Aims: Augmentation cystoplasty is the ideal therapy for children with neurogenic bladder dysfunction, who failed to respond to conservative treatment. Gastric patch is preferred over ileal, cecal or colonic patches as post-operative metabolic complications are less following gastrocystoplasty.

Patients and methods: Four children (1 male and 3 females; median age 45 months) presented with severe urgency, frequency and incontinence. Two patients had lumbosacral lipo-meningomyelocele, one had spina bifida with tethered cord and the 4th patient had caudal regression syndrome. All of them had moderate hydro-ureteronephrosis and thickened small capacity bladder with average bladder capacity of 50 ml. All the four patients were operated for correction of primary neurological problem followed by augmentation cystoplasty, ureteric re-implantation and Mitrofanoff’s procedure. Bladder neck repair or strengthening was needed in 3 patients.

Results: Two patients had early complications: one had prolonged urinary leak from suprapubic drain site, which eventually closed and the 2nd patient had temporary incontinence but achieved full continence in 6 months time. Bladder sensation returned to 3 patients and all 4 patients could achieve total continence and could hold urine from 1 to 2½ hours. All 4 patients could void using abdominal pressure and intermittent catheterization. Upper tract function was stable and bladder capacity was adequate in all of them and average post-void residue was less than 10 ml. Median follow up period was 50.6 months.

Conclusion: Gastrocystoplasty is an excellent method of treatment for children with neurogenic bladder dysfunction with renal insufficiency. Bladder neck strengthening may be necessary to achieve continence.

Keywords: neurogenic bladder, augmentation cystoplasty, gastrocystoplasty, complications.

Introduction
Children with various congenital abnormalities of the brain and the spinal cord presents with symptoms of neurogenic bladder and bowel incontinence. These symptoms may be due to a combination of functional or structural anomalies of the bladder, bladder neck or external sphincter. Timely management of the primary neurologic problem combined with clean intermittent catheterization, and pharmacologic therapy may alleviate symptoms in some patients. However, many such patients develop chronic renal insufficiency over time. So, reconstructive surgery of the bladder and/or bladder neck along with augmentation becomes necessary to achieve continence and to protect the renal function.

Patients and method
Four children, 1 male and 3 females with median age of 45 months presented with severe urgency, frequency and incontinence. Two of the patients had lumbosacral lipo-meningomyelocele, one had spina bifida with diastomatomyelia and tethered cord and the 4th patient had caudal regression syndrome (Fig. 1A and 1B). All of them had moderate hydro-ureteronephrosis and thickened small capacity blad-
Table I: Patient's profile in the presented series

<table>
<thead>
<tr>
<th>Name</th>
<th>Age (moment)/sex</th>
<th>Diagnosis</th>
<th>Urinary symptoms</th>
<th>S. Cr. mg%</th>
<th>Procedure done</th>
<th>Follow-up</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK</td>
<td>48 M/F</td>
<td>Lipo-MMC with TC</td>
<td>Urgency, incontinence constipation</td>
<td>2.6</td>
<td>Excision of lipoma with detethering, Gastrocystoplasty, Ureteric reimplantation</td>
<td>84 months. Chemoprophylaxis for 6 months, reported UTI twice, use CIC occasionally</td>
<td>Can hold urine for 2-3 hrs, remains dry</td>
</tr>
<tr>
<td>PK</td>
<td>36 M/F</td>
<td>SBO with TC</td>
<td>Rec. UTI, straining</td>
<td>2.3</td>
<td>Detethering of cord Gastrocystoplasty Mitrofanoff</td>
<td>73 months. Transient post-operative incontinence, spontaneously improved</td>
<td>Dry, hold urine for 1½ hrs. occasionally urge incontinence</td>
</tr>
<tr>
<td>DP</td>
<td>42 M/M</td>
<td>Lipo MMC</td>
<td>Rec. UTI, straining at micturi</td>
<td>2.1</td>
<td>Excision of lipoma,detethering Gastrocystoplasty, Mitrofanoff</td>
<td>38 months, catheterization drainage for 2 months for anastomosis leak. UTI once</td>
<td>Dry, H-D syndrome Hold urine for ½ -1 hr.</td>
</tr>
<tr>
<td>SRD</td>
<td>55 M/F</td>
<td>Caudal regression syndrome with TC</td>
<td>Urgency, incontinence walks with limp</td>
<td>1.8</td>
<td>Detethering Gastrocystoplasty Mitrofanoff</td>
<td>8 months, bladder sensibility + use CIC often</td>
<td>Weight gain + Bladder Sensibility + Dry, hold urine for 1-2 hr</td>
</tr>
</tbody>
</table>

Figure 1: A and B-MRI showing caudal regressing syndrome (Case no. 4).

MMC – myelomeningocele; TC – tethered cord; SBO – spina bifida occulta; CIC – clean intermittent catheterization; H-D syndrome - haematuria-uraemia syndrome
der with high post-void residual volume. The average bladder capacity was 50 ml (Fig. 2). Urodynamic studies performed at another center revealed small cystometric capacity, high detrusor pressure and high residual volume. The patients did not respond to anticholinergic ± α-adrenergic therapy and clean intermittent catheterization. All four patients were operated for correction of primary neurological problems followed by augmentation cystoplasty, ureteric re-implantation and Mitrofanoff’s procedure (Fig. 3 and 4 ABC). Bladder neck repair (Young-Dees technique) was done in 2 patients and bladder neck suspension in 1. All the patients had uneventful recovery except two; one of them had prolonged urinary leak from the suprapubic drain site, but the leak eventually closed without any surgery. The 2nd patient had incontinence after removal of the catheters, but achieved full continence in 6 months time. The neurological deficit of all the four patients improved after corrective surgery. Bladder sensation returned to 3 patients and all 4 patients could achieve total continence and could hold urine from 1 to 2½ hours (Table 1). Post-operative isotope renogram and/or excretory urography was done to assess upper tract function and was found to be stable in all of them. The patients could void using abdominal pressure and intermittent catheterization was needed only occasionally. Bladder capacity at follow-up was 150 ml, 210 ml, 230 ml and 300 ml respectively and post-void residues were less than 10 ml (Fig. 5). Stomach was used for

<table>
<thead>
<tr>
<th>Series [Ref]</th>
<th>Diagnosis</th>
<th>No. of patients</th>
<th>Mean follow up (years)</th>
<th>Early Complication (%)</th>
<th>Perforation (%)</th>
<th>Renal function</th>
<th>Recurrent UTI (%)</th>
<th>Bladder Stone (%)</th>
<th>Further Surgery (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surer et al. (2003) [14]</td>
<td>Exstr, PUV NB</td>
<td>33</td>
<td>3.4</td>
<td>3</td>
<td>-</td>
<td>3.3</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DeFoor et al. (2004) [15]</td>
<td>Exstr, PUV NB</td>
<td>48</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandi et al. (2007) [17]</td>
<td>Exstr, PUV NB</td>
<td>42</td>
<td>9.8</td>
<td>9.8</td>
<td>-</td>
<td>-</td>
<td>16.4</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>Metcalfe et al. (2006) [16]</td>
<td>Exstr, PUV NB</td>
<td>12</td>
<td>-</td>
<td>8.6</td>
<td>-</td>
<td>-</td>
<td>15</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Present series</td>
<td>NB</td>
<td>4</td>
<td>4.3</td>
<td>50</td>
<td>0</td>
<td>stable</td>
<td>25</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table II: Series showing results of gastrocystoplasty. NB - neurogenic bladder; PUV - posterior urethral valve; Exstr. - bladder extrophy

Figure 2: MCUG showing small contracted bladder with bilateral gross reflux

Figure 3: Stomach segment selected with attached greater omentum
augmentation in these patients because, according to some studies, stomach patch cause less post-operative metabolic derangements than colon or ileal patches. Follow up period ranged from 8 months to 84 months (median 50.6 months).

**Discussion**

Augmentation cystoplasty (AC) has traditionally been used in the treatment of low capacity, poorly compliant or refractory overactive bladder. Conservative treatment using clean intermittent catheterization and pharmacotherapy with anti-cholinergic ± α-adrenergic medication may alleviate symptoms and achieve continence in a variable number of patients [1]. Patients who do not respond to conservative treatment or develop renal insufficiency, breakthrough infection and incontinence are subjects for augmentation cystoplasty. Linder et al. [1] studied 18 children with neurogenic bladder dysfunction who underwent AC. Pre-operatively, the patients were divided into 3 groups: (1) those with extremely poor bladder wall compliance, (2) those with severe detrusor hyperreflexia and (3) those with a combined problem of poor bladder wall compliance and hyperreflexia. Ileocystoplasty and cecocystoplasty were performed in 3 and 15 patients respectively. Eighty two percent of his patients became asymptomatic in a follow up from 12 to 120 months.

Shekarriz et al. [2] analyzed post-operative results in 133 patients with neurogenic bladder (100 patients), bladder extrophy (12), cloacal extrophy (6), posterior urethral valve (3) and others (12). AC was done using ileum (63 patients) and sigmoid colon (68). Additional procedures like bladder neck repair or continent stoma was necessary in 56% and 23% of the patients respectively. Overall continence was achieved in 95% of the patients. Spontaneous bladder perforation was noted more among the neurogenic dysfunction group than other groups, but calculi formation was less in the neurogenic group. Sigmoid colon showed a trend of a lower rate of spina bifida occulta (SBO) with no difference in perforation or stone formation compared with ileum. Primary diagnoses of bladder or cloacal extrophy and continent stomas are risk factors for the development of calculi. Lockhart et al. [3] performed AC using ileum, cecum and sigmoid colon in 15 children with neurogenic bladder dysfunction and urinary incontinence. The small bowel stored larger amounts of urine at a lower maximal detrusor pressure at capacity than the large bowel. All ureterointestinal and ureterovesical reimplantations were successful. The 2 failures in the series were characterized by persistent urinary incontinence, included a male patient

![Figure 4: A, B - Opened native bladder and gastric patch anastomosed.](image1)

![Figure 4: C - Appendix mobilized for Mitrofanoff's procedure](image2)
who refused intermittent catheterization and a girl with persistent hypersecretion of mucus and recurrent urinary tract infections. Advantages of gastrocystoplasty are sparing of intestine and thereby preventing short bowel syndrome, decreased occurrence of hyperchloremic metabolic acidosis, decreased mucus production and lower rate of urine infection and stone formation [4]. So, patients with chronic renal insufficiency and renal acidosis are benefited from gastrocystoplasty [5]. However, fluid and electrolyte abnormalities may occasionally develop resulting in hypochloremic, hypokalaemic metabolic alkalosis [6]. Another serious complication of gastrocystoplasty is haematuria-uraemia syndrome, characterized by dysuria, genital skin irritation/excoriation, bladder spasm, suprapubic &/or urethral pain and gross haematuria. Treatment of this condition consists of increased fluid intake, anti-acid therapy and correction of electrolyte abnormality, rarely gastrectomy is indicated in refractory cases [7]. One of our patient had an episode of haematuria-uraemia syndrome, who responded to treatment. All the patients were put on long term anti-acid therapy to prevent dysuria. When small and large bowel segments are used for augmentation, fluid and electrolytes reabsorption can be significant and in presence of renal impairment, metabolic derangement can be profound. Colocystoplasty is associated with hyperchloremic metabolic acidosis, high mucus production leading to increased infection and stone formation. Sigmoid colocystoplasty is also associated with high incidence of bladder rupture [8]. It has been observed that over time, absorptive capacity of the augmented intestinal segment decreases [9]. By doing gastrocystoplasty, other complications of enterocystoplasty, such as vitamin deficiency, rickets and osteomalacia can be avoided. Although these deficiency states following enterocystoplasty are often subtle and may go unnoticed for years, correction of acid base abnormalities must be taken care of before correction of these anomalies [10]. There have been conflicting data regarding growth retardation following bladder augmentation, and most studies suggest that linear growth is not affected [11]. There have been reports of malignant transformation in the bladder, all following ileo and colocystoplasties [12]. Pinter et al. [13] did a prospective study on 20 colocystoplasty and 15 gastrocystoplasties with periodic clinical, biochemical and cystoscopic evaluation. The complications following colocystoplasties were: 50% developed stones, 95% had positive urine cultures and 70% had pathological changes in the bladder. However, no malignancy were detected. Of the gastrocystoplasty group, no cases developed stones or malignancy, and 13% had a positive urine culture and 60% had pathological changes in the bladder. The authors concluded that long term periodic cystoscopy is necessary to rule out premalignant or malignant lesions. Surer et al. [14] performed AC in 91 patients, 45 had ileocystoplasty, 33 had gastrocystoplasty and 22 had other bowel segments (Table 2). Early complications were noted in 3% of the patients, another 3.3% had UTI, and 26% developed bladder stones in a mean follow up of 6 years. DeFoor et al. [15] had a series of 105 patients who needed AC from which gastrocystoplasty was done in 48 patients. The only complications noted in their study was bladder stones recorded in 11% of the patients. Bandi et al. [16] had gastrocystoplasty in 42 of their 61 patients. Early complications were noted in 9.8% of the patients, bladder stones in 16.4%, perforation of the augmented bladder noted in 9.8% and 11.5% of the patients needed further surgery for correction of complications. Metcalfe et al. [17] had the largest series of children undergoing AC with a follow up of 13.3 years. Sixty patients had ileal segment for augmentation and gastric patch was used in only 12 patients. The overall complications were perforation of augmented bladder in 8.6%, bladder stones in 15% and 9% of their patients needed a second surgery. In the present series, early complications were noted in 2 patients, one patient developed haematuria-uraemia syndrome and another had recurrent UTI. However, no other complications were noted in a follow up of 4.3 years. The other series cited here included patients who had exstrophy bladder, cloacal exstrophy and posterior urethral valves apart from neurogenic bladder. Our series is small in number as we included patients with neurogenic bladder dysfunction only. To achieve
socially acceptable continence in children with neurogenic bladder, enhancement of bladder outlet resistance often becomes necessary. Various options available for this are bladder neck reconstruction, injection of bulking agents around the bladder neck, bladder neck suspension, artificial urinary sphincters and facial sling procedures [18]. Although these procedures are effective in achieving continence, some of these procedures have complications rate ranging from 20% to 50% [19]. One study reports 88% continence rate with fascial sling operation with a follow up of 4.16 years [20]. We used Young-Dees bladder neck reconstruction in 2 patients and bladder suspension operation in one with good outcome. The fourth patient did well with AC and pharmacotherapy.

Conclusion
Gastrocystoplasty is an excellent method of treatment in selected cases for children with neurogenic bladder dysfunction with renal insufficiency. Bladder neck strengthening may

REFERENCES