

Gastrocystoplasty: A Novel Technique for Augmentation of Urinary Bladder- Advantages and Disadvantages

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Abstract: Gastrocystoplasty is necessary to augment bladder capacity in all exstrophy epispadias complex to prevent increase in bladder pressure and renal failure.

Aims:

- To study the outcome of gastrocystoplasty in pediatric patients of exstrophy-epispadias complex in terms of renal function, continence and quality of life
- To study possible complications associated with this procedure

Methods and Material: We conducted a retrospective study on 14 children who presented exstrophy-epispadias complex and underwent urinary reconstruction with gastrocystoplasty in the Dept of Pediatric Surgery, Nil Ratan Sircar Medical College and Hospital from January 2016 to January 2018. Preoperative and post operative examination included renal function test, electrolyte study, USG guided measurement of bladder capacity and cystomanometric evaluation.

Statistical analysis used:

Data collected from the study was entered and processed in SPSS version 20.0 program. Descriptive and analytical statistic was done. Summarization and presentations of qualitative data were done using proportions and percentage and quantitative data with mean, median and standard deviation. Chi square test (statistical test of significance) was used and p-value of < 0.05 was considered significant.

Results:

There were 14 patients of age group 5-7years with mean age 6.2years. Postoperative cystomanometric evaluation of the 14 patients with GCP enlargement showed a mean bladder capacity of 282 ml and mean maximum bladder pressure decreased from 57 to 13 cm water. Both were found to be statistically significant ($p < 0.05$).

Conclusions:

Our data show that gastrocystoplasty has significant advantages over intestinal augmentation, including decreased chloride reabsorption, mucous production and urinary infection, and an extremely low incidence of stones and perforation. The gastric patch is associated with metabolic alkalosis and the hematuria-dysuria syndrome, which may be avoided and medically treated with proper patient selection and close follow-up.

Key-words: Exstrophy-epispadias complex, Gastrocystoplasty, Cystomanometry, Metabolic alkalosis, hematuria-dysuria syndrome.

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I. Introduction

Gastrocystoplasty is a technique that uses a vascularised segment of the stomach to replace or augment the urinary bladder. In almost all exstrophy epispadias complex the renal parenchyma undergoes multiple insults and scarring leading to ESRD after complete repair. So bladder augmentation is necessary to increase its capacity so as to prevent increase in bladder pressure and renal failure. Augmentation cystoplasty has been described using ileum, cecum or sigmoid colon¹⁻³. But due to potential metabolic disturbances⁴ and nutritional consequences of using bowel segments⁵ the use of stomach segments for bladder augmentation has been suggested. The use of stomach in the bladder facilitates net excretion of chloride ions, which in turn supports a main buffer system of the urine (ammonium chloride). This permits secretion of acid without the use of titratable acids that potentially leads to the depletion of the buffer systems. Ammonia resorption does not occur either, as has been observed when large and small bowel are used in the urinary tract. In a partial renal failure model, gastrocystoplasty actually protected the dogs with chronic renal failure from the acidosis of chronic ammonium chloride loss.⁶ We report outcome of gastrocystoplasty in a group of 14 pediatric patients of exstrophy-epispadias complex in terms of renal function, continence, quality of life and complications associated with this procedure.

Subjects and Methods:

We conducted a retrospective study on 14 children who presented exstrophy epispadias complex and underwent urinary reconstruction with gastrocystoplasty in the Dept of Pediatric Surgery, Nil Ratan Sircar Medical College and Hospital. The study duration was from January 2016 to January 2018. Preoperative and post operative examination included renal function test, electrolyte study, USG guided measurement of bladder capacity and cystomanometric evaluation.

Operative technique:

Step 1: Midline laparotomy incision was given extending from xiphisternum to pubic symphysis.

Step 2: Identification of stomach and right and left gastroepiploic artery supplying greater curvature and its anastomosis were done.

Step 3: A pedicled flap is created based on right gastroepiploic artery from greater curvature of stomach.

Step 4: The long pedicled flap is mobilised and brought down to reach the bladder though retro colic route.

Step 5: The gap in the donor site (greater curvature of stomach) is closed with vicryl 3-0 suture.

Step 6: Bladder is opened in saggital plane and sutured to the pedicled flap with vicryl 3-0 without tension after confirming its viability.

Step 7: Two ureteric stents in two ureters and per urethral catheter are brought out and fixed to the skin for bladder decompression.

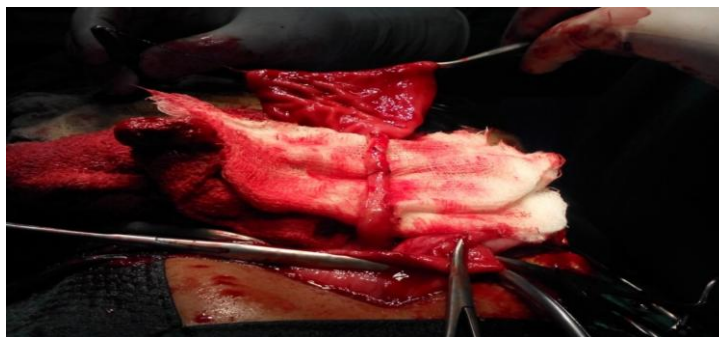


Fig (i): Operative Procedure



Fig (ii): Operative Technique



Fig (iii): Postoperative



Fig (iv): Post operative

II. Results

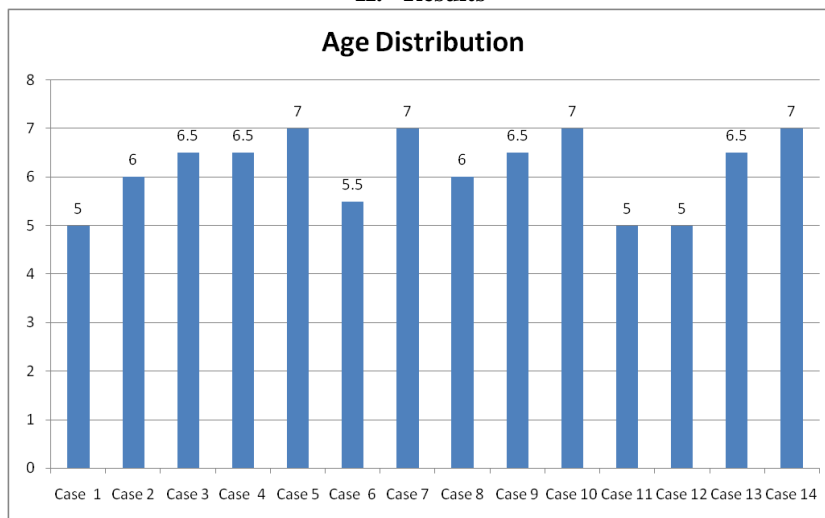


Fig 1: Age Distribution

There were 14 patients of age group 5-7years in this study with mean age 6.2years

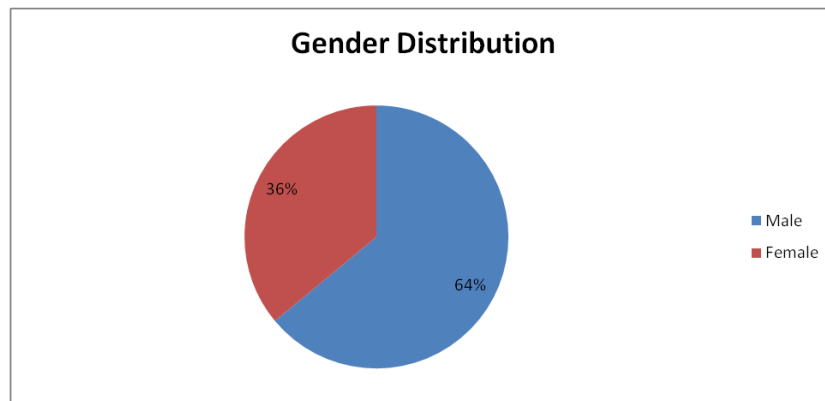


Fig 2: Gender Distribution

There were 9 male (64%) and 5 female (36%)

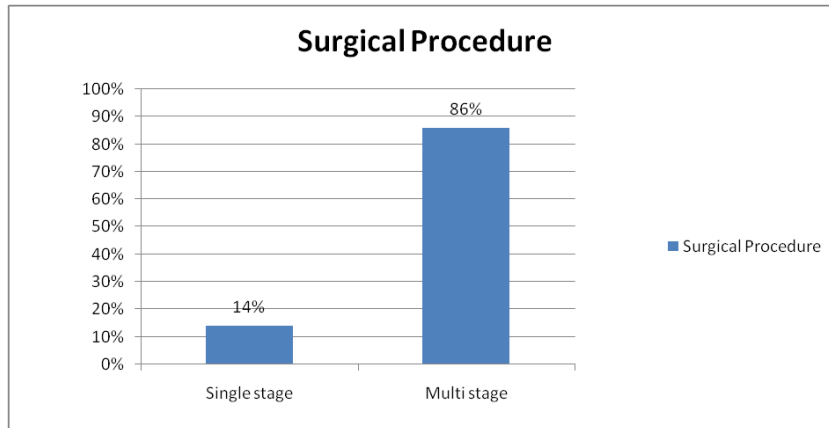


Fig 3: Surgical Procedure performed

Out of 14 patients 2(14%) underwent single stage operation and 12 patients (86%) underwent staged repair following primary bladder closure.

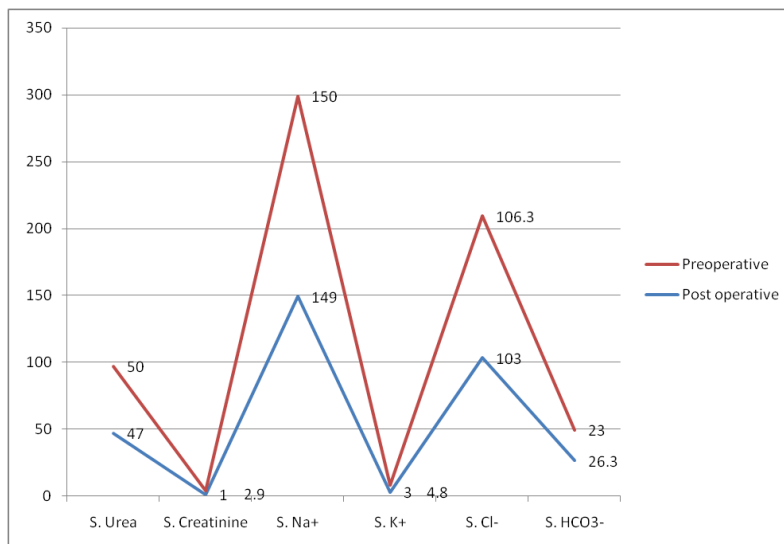


Fig 4: Pre and post operative serum electrolyte level

Pre and post operative electrolyte results did not show any notable alteration in the mean values of sodium, potassium, chloride, bicarbonate, creatinine, and urea.

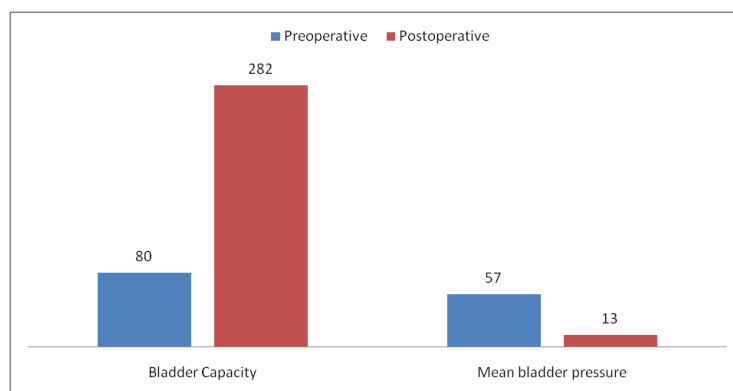


Fig 5: Pre and post operative bladder capacity and mean bladder pressure

Postoperative cystomanometric evaluation of the 14 patients with GCP enlargement showed a mean bladder capacity of 282 ml and mean maximum bladder pressure decreased from 57 to 13 cm water. Both were found to be statistically significant ($p < 0.05$).

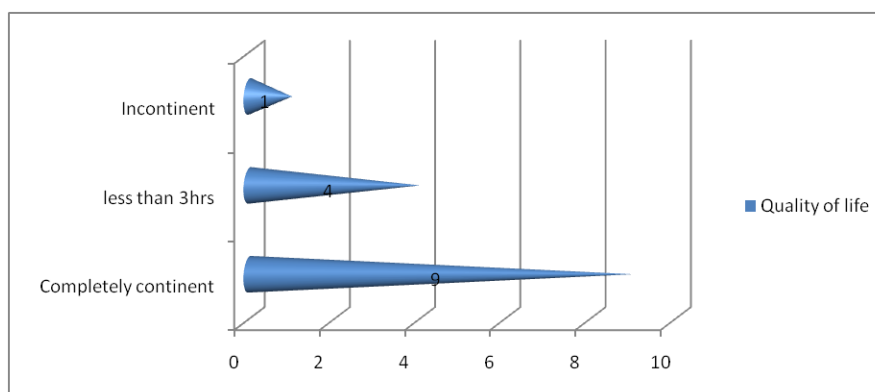


Fig 6: Quality of life in terms of urinary continence

9 out of 14 (64.38%) patients were completely continent with intermittent catheterization. 4 patients were continent for less than 3 hour (28.57%) and one patient was incontinent.

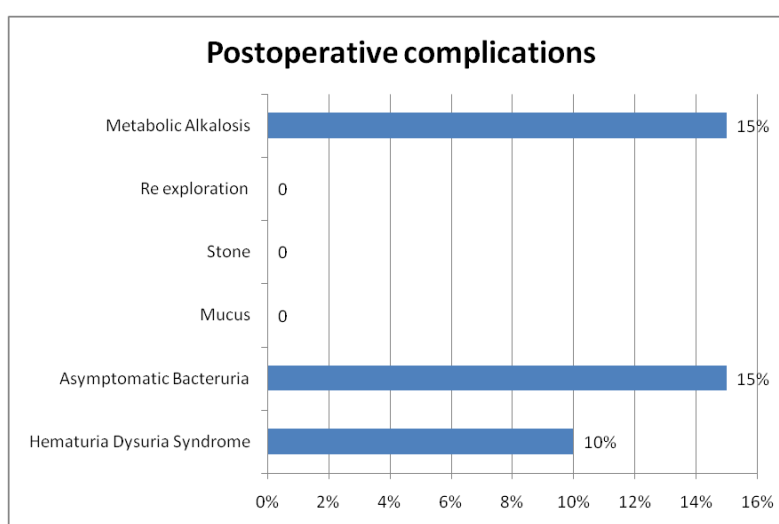


Fig 7: Post operative complications

Symptoms consistent with the hematuria-dysuria syndrome were present in 10% of the patients. 15% patients had metabolic alkalosis. No patients had bothersome mucus or required routine bladder irrigation. No patient required reoperation for complications related to gastrocystoplasty. No patient had perforation. Asymptomatic bacteriuria was present in 15%.

III. Discussion

Augmentation gastrocystoplasty (AGC), described by Adams et al⁷ in 1988 in children, involves augmentation of the mobile part of the native bladder by insertion of a gastric patch, which is pedicled on the right gastroepiploic artery. The advantages of a gastric patch compared to an ileal or sigmoid segments are: (i) the absence of hyperchloraemic acidosis by reabsorption, which risks disrupting phosphocalcium metabolism in a growing child^{7, 8} (ii) the absence of production of lithogenic mucus; and (iii) a reduction of the infection risk by chronic acidification of urine^{9, 10}. In the past decade, many augmentation gastrocystoplasties were offered to paediatric patients with congenital bladder dysfunction to deal with a small or poorly compliant bladder⁷. In our retrospective study of 14 cases, gastrocystoplasty was an effective way to preserve renal function while achieving continence.

Studies reported pre- and postoperative urodynamics showed average increase in bladder volume of greater than 200 cm³ (150%)¹¹. Mean end fill pressures were decreased to less than 30 cm H₂O. In our study postoperative cystomanometric evaluation of the 14 patients with GCP enlargement showed a mean bladder capacity of 282 ml and mean maximum bladder pressure decreased from 57 to 13 cm water. Both were found to be statistically significant ($p < 0.05$).

Augmentation of the bladder with intestine carries a significant risk for hyperchloraemic, hypokalemic, metabolic acidosis, especially in children with impaired renal function^{12, 13}. Mitchell and Piser² reviewed 129 cases of intestinocystoplasty and found significant changes in chloride in all patients. The renal failure patients' mean postoperative serum chloride and bicarbonate values were 113 and 16 mEq/l, respectively¹³. Mild chronic acidosis and consequent calcium loss from intestinal diversion has been related to osteomalacia, rickets, decreased growth, and increased orthopedic morbidity. Loss of distal ileum may also result in fat malabsorption and decreased bile-salt absorption and absorption of fat-soluble vitamins¹².

In contrast to the intestine, the stomach mucosa acts as a barrier to chloride and ammonium absorption and actually excretes chloride¹⁰. Although the aciduria and chloride loss of the gastric mucosa is advantageous in most patients, some are at risk for a syndrome of hypochloremic, hypokalemic, metabolic alkalosis. Our review of the series that cited this problem found that 15% patients developed this syndrome. Plawker et al¹⁴ presented two patients who developed severe metabolic alkalosis without laboratory evidence of dehydration. One patient had a history of renal insufficiency and both had evidence of hypergastrinemia. Gosalbez et al¹⁵ described the first two patients with normal renal function (based on serum creatinine values) to develop metabolic alkalosis preceded by gastrointestinal fluid loss.

The hematuria dysuria syndrome (HDS) is characterized by red or coffee-brown urine, suprapubic pain, skin irritation, and/or burning upon urination. Incidence of mild to moderate symptoms is found to be 17% and that of severe symptoms to be 3%¹¹. The largest study on this syndrome was reported by Nguyen et al¹⁶, who followed 57 patients for a mean of 23 months. In all, 27 (36%) had symptoms consistent with HDS. In our study symptoms consistent with the hematuria-dysuria syndrome were present in 10% of the patients which was managed successfully with conservative treatment.

Animal models of gastrocystoplasty^{17, 18} and multiple clinical series^{19, 20, 21} have noted lower mucus production following gastric as compared with intestinal augmentation. The decreased mucus production minimizes problems of bladder emptying by spontaneous voiding or catheterization. Less residual urine, decreased mucus, and the acidic urine have been proposed as mechanisms to explain the lower incidence of bacteriuria and symptomatic infections in gastric versus intestinal augmentation^{19, 20, 21}. In our study, no patients had bothersome mucus or required routine bladder irrigation. Asymptomatic bacteriuria was present in 15%. Three studies reported the rate of infection in 9 of 61 patients (15%) with asymptomatic bacteriuria^{21, 22}.

Short-term follow-up has not shown an increase in carcinogenesis following gastrocystoplasty as compared with intestinal augmentation, but similarly close surveillance is required in both cases.

Gastrocystoplasty has significant advantages over intestinal augmentation, including decreased [chloride](#) reabsorption, mucous production and urinary infection, and an extremely low incidence of stones and perforation. But it is associated with metabolic alkalosis and the hematuria-dysuria syndrome, which may be avoided and medically treated with proper patient selection and close follow-up.

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