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Rapid construction of sigmoid bladder augmentation using absorbable staples: Long-term results and comparison to standard colocystoplasty in children with neurogenic bladder

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Abstract *Objective:* Absorbable staples facilitate detubularization and reconfiguration of the bowel when performing augmentation colocystoplasty. We compared the outcomes of stapled sigmoid augmentation with standard sutured colocystoplasty.
Materials and methods: Between 2003 and 2011, 108 children underwent bladder augmentation at our institution. Colocystoplasty was used in 30 patients (27.8%). Medical charts of children who underwent stapled ($n = 8$) or sutured ($n = 22$) sigmoid augmentation were compared with regard to patient demographics and surgical complications, including anastomotic leak and urolithiasis.
Results: Eight children with underwent stapled sigmoid colocystoplasty. Average age at surgery was 8 years (range 4—17 years). Time to detubularize and refashion the bowel segment prior to augmentation was consistently under 5 min. Average length of follow-up was 44 months (range 12—80 months). One patient experienced anastomotic leak. Two of eight children (25%) in the stapled anastomosis cohort developed bladder stones. Twenty-two patients underwent standard sigmoid augmentation during the same time period (average age 8.2 years; range 4—16 years). One of 22 (4.5%) experienced anastomotic leak. Seven of 22 (31.8%) developed cystolithiasis.
Conclusions: Complications from stapled sigmoid anastomosis are similar to those from standard colocystoplasty. Use of absorbable staples decreases operating time by avoiding bowel spatulation and suturing, and should be considered in pediatric patients undergoing colocystoplasty.

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Introduction

Management of the pediatric neurogenic bladder includes achieving urinary continence while preserving upper tract function. Bladder augmentation is a mainstay in achieving these goals in a substantial number of patients who have failed non-surgical management, but its utility can be tempered by both short- and long-term morbidity [1—3]. Bladder augmentation requires detubularization of the bowel segment to decrease peristaltic pressure and increase capacity. Detubularization and reconfiguration of the bowel segment is a time-consuming step in an operation often coupled with Mitrofanoff, Malone antegrade continence enema (MACE) creation and bladder neck procedures in the pediatric population. Absorbable staples facilitate detubularization and reconfiguration of the bowel, thereby decreasing operative time. Despite the benefit of reduced operative time, concern has been raised regarding stone formation and other complications directly attributable to the use of absorbable staples. We evaluated urolithiasis and anastomotic leak rates of children who underwent stapled sigmoid augmentation compared with standard sutured colocystoplasty at our institution.

Methods

After Institutional Review Board approval, the medical charts of 108 children who underwent bladder augmentation at our institution between January 2003 and January 2011 were reviewed. Colocystoplasty was performed in 30 patients (27.8%). Those children who underwent stapled sigmoid augmentation cystoplasty ($n = 8$) were compared with those who underwent a sutured sigmoid augmentation ($n = 22$) with regard to patient demographics and surgical complications unique to the use of absorbable staples, including anastomotic leak and urolithiasis.

The surgical technique involved isolation of a 25-cm segment of large intestine in the standard fashion. The isolated segment was folded in a "U" configuration. The PolyGIA stapler (Covidien, Mansfield, MA, USA) was utilized in all children in the stapled cystocoloplasty cohort to detubularize and refashion the isolated sigmoid segment into a U-shaped patch for anastomosis to the native bladder (Fig. 1). As previously reported, four rows of polylactic acid and polyglycolic acid blend polymer (absorbable) staples are delivered, which divide the bowel between the second and third rows. Each staple line of the sigmoid pouch therefore has a double staggered staple line. The redundant staples can be trimmed if necessary to facilitate anastomosis to the bivalved bladder. The staples are absorbed within 4—6 weeks [4,5].

Results

Demographic and operative data for the stapled colocystoplasty patients are shown in Table 1. Between 2003 and 2011, five males and three females with neurogenic bladder underwent a stapled sigmoid augmentation cystoplasty by a single surgeon (A.J.K.) at our institution. The etiology of neurogenic bladder was spinal dysraphism in six patients and VATER syndrome in one patient; the remaining child had neurogenic bladder and bowel of unknown etiology. Mean age at surgery was 8 years (range 4—17 years). These children were compared with a cohort of 22 patients who underwent a standard sutured sigmoid bladder augmentation during the same time interval. The etiology of neurogenic bladder was spinal dysraphism in all patients in the sutured augmentation group. Mean age at the time of surgery for the sutured cohort was 8.2 years (range 4—16 years).

Mean length of follow-up was 44 months (range 12—80 months) in the stapled colocystoplasty cohort. A single patient experienced persistent fevers postoperatively, and was found to have an anastomotic leak on the anterior suture line of the native bladder, which required drain placement. There was no evidence of stapled pouch breakdown in this patient on postoperative imaging. Two of eight children (25%) in the stapled anastomosis cohort developed bladder stones, detected on routine surveillance ultrasound imaging. One child underwent endoscopic stone removal and the other required open cystolithotomy.

Mean follow-up in the sutured cohort was 46 months, similar to that of the stapled colocystoplasty children. One of 22 patients (4.5%) experienced an anastomotic leak in the postoperative period, which required exploration of the bladder and open placement of a suprapubic catheter. Seven of 22 children (31.8%) subsequently developed cystolithiasis. Five children underwent endoscopic stone extraction while the remaining two patients required open cystolithotomy to render them stone-free. All children in both cohorts were placed on a twice daily bladder irrigation protocol, with parents taught to perform irrigations prior to discharge.

Time to detubularize and refashion the bowel segment prior to augmentation using an absorbable stapler device was consistently less than 5 min. All children in the stapled colocystoplasty underwent at least one concomitant surgical procedure, with the average number of additional interventions being 3.25 (range 1—5). The most common concomitant procedures were bladder neck sling, Mitrofanoff, and MACE, with 87.5% of patients undergoing these interventions at the time of bladder augmentation.

Discussion

Medical management remains the treatment foundation for pediatric neurogenic bladder [3,6]. Objectives include preservation of renal function, achieving social continence, and eventual independence with respect to bladder management. When non-invasive measures fail, surgical management of lower urinary tract dysfunction must be considered and is dependent upon both storage capacity and sphincter function. Surgical intervention should be tailored to the individual child's urodynamic findings, medical history, age, and manual dexterity. Spinal dysraphism is the most common etiology of neurogenic bladder in the pediatric population. Despite aggressive non-surgical management of neurogenic bladder dysfunction, a recent review reported that 5.4% of children with spina bifida still undergo enterocystoplasty [7].

While bladder augmentation remains an invaluable tool in the management of pediatric neurogenic bladder, at