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Use of balloon dilatation for management of postoperative intestinal strictures in children with short bowel syndrome

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ABSTRACT

Purpose: Children with short bowel syndrome (SBS) often require numerous operations to optimize intestinal function. Postoperative intestinal strictures are a complication that inhibits enteral feeding advancement and prolongs parenteral nutrition dependency, often requiring reoperation. Our objective was to review our experience with fluoroscopic balloon dilatation to treat intestinal strictures.
Methods: A retrospective cohort study of intestinal failure patients with SBS was completed. Patients who had radiologically diagnosed intestinal strictures and treated with fluoroscopic guided balloon dilatation were included [n = 6]. Data related to demographics, anatomy, surgical procedures, and dilatation procedures were collected. Descriptive summary statistics were employed.
Results: 98 intestinal failure patients were recruited between 2011 and 2015. Five of 98 patients (5.1%) [2 males; median age 4.4 months] underwent fluoroscopy guided balloon dilatation of 6 strictures. Balloon dilatation was successful in 4/6 (67%). The median number of dilatations was 2 per patient (range = 1–3). Median time to feed initiation postdilatation was 3 days. One patient developed an anastomotic leak after dilatation that required antibiotics, but no reoperation.
Conclusion: Four of six (67%) postoperative bowel strictures in 5 patients with SBS were successfully treated with fluoroscopically guided balloon dilatation. Balloon dilatation is less invasive than reoperation, preserves bowel length and reduces time to reinitiation of enteral feeding.
Level of evidence: 3.

Children with intestinal failure are at risk for numerous complications and comorbidities as a result of their chronic illness. Historically, the mortality rate in pediatric intestinal failure was estimated around 40% [1–3]. While there have been considerable advancements in the management of intestinal failure over the last 15 years, children with short bowel syndrome (SBS) often require numerous operations to optimize their intestinal function and absorptive capacity. Bowel preservation is a key component in the care of children with SBS. Repeated intestinal operations with resection can further impact their bowel length and adaptive potential, resulting in increased parenteral nutrition requirements. Postoperative anastomotic bowel strictures are a complication that results in reoperation and in delayed introduction/advancement of enteral nutrition, and leads to prolonged parenteral nutrition support and extended hospitalizations.

Fluoroscopically guided balloon dilatation has been used in the treatment of strictures in esophageal atresia [4–9] and Crohn's disease [10–14] resulting in resolution of strictures and minimized surgical intervention. To our knowledge, there are no reports of fluoroscopically guided balloon dilatation being used in the treatment of anastomotic strictures in pediatric SBS. Our objective was to review our experience with fluoroscopically guided balloon dilatation to treat intestinal strictures in pediatric patients with SBS.

1. Methods

We completed a retrospective cohort review of intestinal failure patients who had developed postoperative intestinal anastomotic strictures and underwent fluoroscopically guided balloon dilatation. All patients were managed by our intestinal rehabilitation program at The Hospital for Sick Children, had surgical procedures and subsequently had fluoroscopy guided balloon dilatation of a stricture between January 1, 2011 and December 31, 2015. Patients had a history of SBS and had radiologically confirmed anastomotic intestinal strictures.

After obtaining approval by our institutional Ethics Review Board [#1000050445], data were collected from the electronic patient chart. Data collection included demographics (gestational age, gender,

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etiology of IF), intestinal anatomy (residual small and large bowel absolute length, as well as, percentage of expected bowel length based on established norms [15]), surgical history, location of strictures, and fluoroscopically guided balloon dilatation (procedural success, number of dilatations per patient, clinical resolution, time to enteral feeds post dilatation, avoidance of further interventions and adverse events).

1.1. Technique

Informed consent for fluoroscopy guided balloon dilatation was obtained prior to the procedure from parents. Potential risks included bleeding, infection, peritonitis, sepsis, bowel damage or bowel perforation/rupture requiring emergent surgery. All procedures were performed under general anesthesia. Patients received prophylactic antibiotics prior to the procedure.

The bowel was accessed through the bowel opening closest to the stricture (stomach, stoma or rectum) and navigated with a directional catheter (Berestein or JB-1 catheters: COOK, Bloomington, IN, USA) and a 0.035″ soft guidewire (Bentson: COOK, Bloomington, IN, USA; or Terumo guidewire: TERUMO, Japan). The anastomotic stricture was crossed and the soft guidewire was exchanged for a 0.035″ stiff guidewire (Amplatz: COOK, Bloomington, IN, USA). The anastomotic stricture was dilated 2 to 3 times with a Mustang Balloon Dilatation catheter (Boston Scientific, USA) (5–20 mm) (Fig. 1). Blood was noted in the Balloon Dilatation catheter and it was used as a subjective measure of appropriate dilatation. A postdilatation pull-through contrast study was performed to assess for the presence of contrast staining (mucosal tear) or leakage/extravasation (bowel perforation). Patients were observed in hospital postprocedure.

1.2. Statistical analysis

Baseline and outcome data were described using summary statistics. Continuous variables were presented as medians and categorical variables were presented as frequencies and proportions.

2. Results

98 patients were referred to the intestinal rehabilitation program at the Hospital for Sick Children between 2011 and 2015. Of those 98 patients, 5 (5.1%) had six episodes of radiologically diagnosed postoperative intestinal anastomotic strictures that were treated with balloon dilatation under fluoroscopically guided therapy by an experienced interventional radiologist.

Table 1 displays the patient characteristics. The cohort was comprised of 2 males (40%) with a median gestational age of 32.6 weeks (range: 24–40 weeks). All patients were diagnosed with intestinal failure from a variety of etiologies (gastroschisis, midgut volvulus, dysmotility, jejunal atresia and necrotizing enterocolitis).

Table 2 summarizes the surgical and fluoroscopy guided balloon dilatation information. Median age at time of surgical intervention preceding development of intestinal stricture was 4.4 months (range: 1.25–46 months) with a median of 3 previous surgical interventions (range: 1–5). Two strictures were in the small intestine while 4 strictures were accessible from the colon. The median number of dilatations per patient was 2 (range: 1–3) with the first dilatation occurring between 23 and 69 days postoperatively (median 37.5 days). In patients who had multiple dilatations, the median days between procedures were 8.5 (range: 9–14). In total 12 balloon dilatations were completed and 10 were technically successful. In one patient initial dilatation was

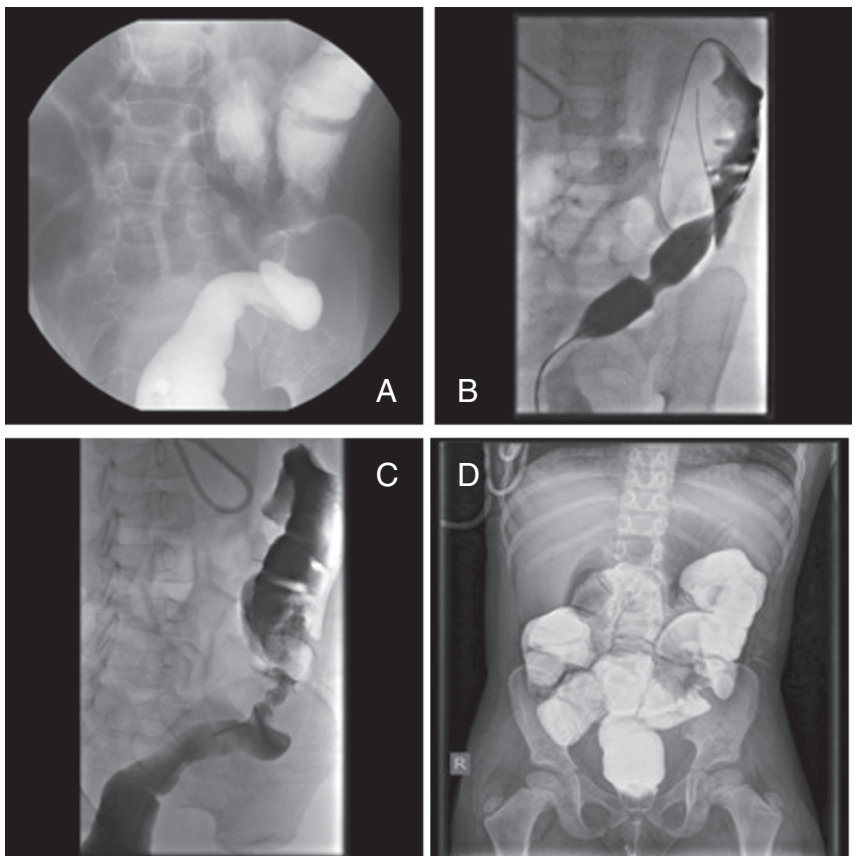

Fig. 1. Example of procedure of fluoroscopically guided balloon dilatation. A: Radiologically diagnosed colonic stricture. B: Fluoroscopically guided balloon dilatation. C: Fluoroscopic evaluation post dilatation. D: Radiological evaluation post procedure.