Use of Intraluminal Stents in Multiple Intestinal Atresia

By Frederick Alexander, Dadvand Babak, and Marilyn Goske
Cleveland, Ohio

Multiple intestinal atresia presents a difficult technical problem because of extreme loss of intestinal length, disparity of residual bowel wall size, and discontinuity of multiple short intestinal segments. The authors report on a 3,000-g infant with gastroschisis complicated by intrauterine volvulus and multiple intestinal atresias who was treated successfully with intraluminal stenting and sutureless anastomoses. A total of 25 cm of small bowel was salvaged including 13 segments each measuring 1 to 8 cm in length. Subsequent radiographic studies showed spontaneous anastomosis with a compartmental configuration of the residual bowel and decreased transit time. Five months postoperatively, the patient was weaned off total parenteral nutrition completely and one year later is growing and gaining weight with 4 to 6 bowel movements per day.

INDEX WORDS: Intestinal atresia, short gut syndrome, intraluminal intestinal stents.

THE OUTCOME of intestinal atresia has steadily improved owing to advances in surgical technique, nutritional support, and neonatal intensive care.[1] Today, the major cause of morbidity and mortality is short gut syndrome, which typically occurs in patients with multiple atresias. The surgical repair of multiple atresias is technically difficult because of disparity of bowel wall size and discontinuity of multiple short intestinal segments. We have found that intraluminal stenting with sutureless anastomosis performed in 2 stages is safe and allows recovery of the maximal length of functional small bowel. Further, this technique may improve short gut syndrome as the result of compartmentalization, decreased motility, and increased absorption of small bowel contents.

CASE REPORT

A 3,000-g 36-week-gestational boy was delivered with gastroschisis and intrauterine volvulus. He underwent primary closure and placement of a gastrostomy tube and duodenostomy tube an outside hospital. He was placed on total parenteral nutrition and transferred to our facility whereupon he underwent reexploration at 6 weeks of age. At surgery, he was found to have a proximal atresia 15 cm distal to the pylorus with an extremely dilated duodenum and proximal jejunum. Distally, there were 13 patent small bowel segments separated by adjacent type I, II, and III-A atretic segments. The entire colon was absent from the ileocecal valve to the midsigmoid. Each patent segment of small bowel was opened proximally and distally, and the adjacent segments of atretic bowel were resected. A 10F SILASTIC® (Dow Corning, Midland, MI) catheter was passed through each of the small bowel segments sequentially and all type I membranes were excised (Fig 1). A total of 13 segments of patent small bowel were placed side by side over the catheter, ranging in length from 1 cm to 8 cm. The total length of small bowel placed on the catheter was 25 cm. The most distal of segments was anastomosed to the sigmoid colon, and the catheter was brought out through the antimesenteric aspect of the sigmoid colon as well as the most proximal end of the small bowel. The proximal and distal ends of the catheter were brought out through the anterior abdominal wall, and the most proximal end of the small bowel as well as the sigmoid colon were affixed to the anterior abdominal wall. No other anastomoses were performed; however, a few tacking sutures were applied to align the segments of small bowel encompassed by the catheter. Two weeks after this surgery, a distal contrast enema showed no extravasation or obstruction to the proximal small bowel (Fig 2). Four weeks after the initial surgery, the patient underwent a preemptive tapering enteroplasty of the dilated proximal duodenum and jejunum with enterotomy closure and removal of the duodenostomy tube and the SILASTIC® stent. Postoperatively, the patient regained bowel function in 5 days whereupon continuous feedings using Portagen were begun through the gastrostomy tube and gradually advanced over the next 3 weeks to 10 MLec/hr. Initial postoperative upper gastrointestinal series showed delayed intestinal transit with a transit time of 10½ hours (Fig 3). The patient was discharged from the hospital 4 weeks postoperatively at which time approximately one half of his total daily caloric requirement was being met with enteral gastrostomy feedings, and he was having approximately 4 to 6 bowel movements per day. Enteral feedings were advanced gradually at home by both oral and gastrostomy routes, and he was completely weaned from his total parenteral nutrition by 5 months of age at which time he weighed 5.6 kg. He subsequently had new onset of feeding intolerance with weight loss, abdominal distension, and decreased bowel movements to less than 2 per day. He returned to our facility whereupon he was found to have radiographic evidence of small bowel obstruction (Fig 4). He underwent reexploration at 6 months of age at which time he was found to have multiple dilated segments of small bowel extending from his proximal jejunum to his sigmoid colon. A proximal enterotomy was made, and a 16F Foley catheter was pushed distally, whereupon 3 of the 14 sutureless anastomoses were found to be stenotic, and 3 separate stricturoplasties were performed. Postoperatively, bowel function returned in 4 days, and the patient was advanced to full enteral feedings including diet-for-age by mouth and continuous gastrostomy tube

From the Department of Pediatric Surgery, The Cleveland Clinic Foundation, Cleveland, OH.

Address reprint requests to Frederick Alexander, MD, Department of Pediatric Surgery, The Cleveland Clinic Foundation, 9500 Euclid Ave, M14, Cleveland, OH 44195.

1531-5037/02/3711-0031$35.00/0
doi:10.1053/jpsu.2002.36206

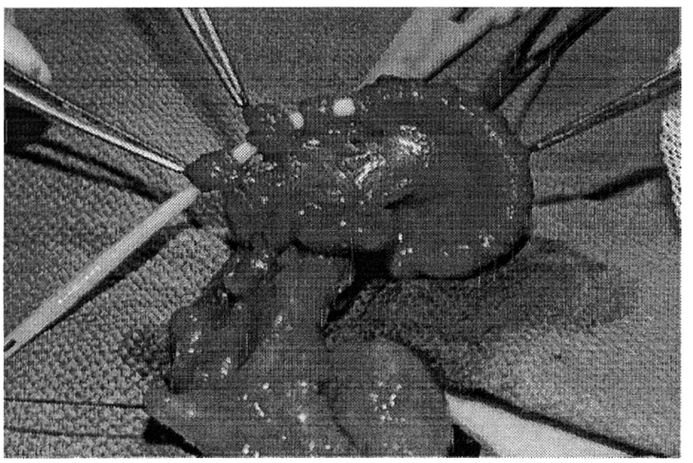

Fig 1. Sutureless anastomosis using intraluminal stents may salvage intestinal segments as short as 1 cm.

feedings at night. A postoperative UGIS showed a transit time of 148 minutes. At discharge (6 months of age), the patient weighed 5.1 kg and was tolerating enteral feedings (Portagen) totalling 100 Kcals/kg/d. At 12 months of age, the patient continues on the same diet plus table food with approximately 4 to 6 bowel movements per day and now weighs 7.1 kg.

DISCUSSION

Jejunoileal atresia occurs in 1 of 2,500 live births owing to an intestinal vascular insult in utero. Multiple intestinal atresias occur less frequently, affecting only one fifth of all infants with intestinal atresia. Traditional surgical treatment has included tapering enteroplasty, resection, and primary anastomosis. These techniques along with total parenteral nutrition have greatly improved the overall survival rate of infants with intestinal atresia from 69% in 1969[2] to 90% in 1993.[3]

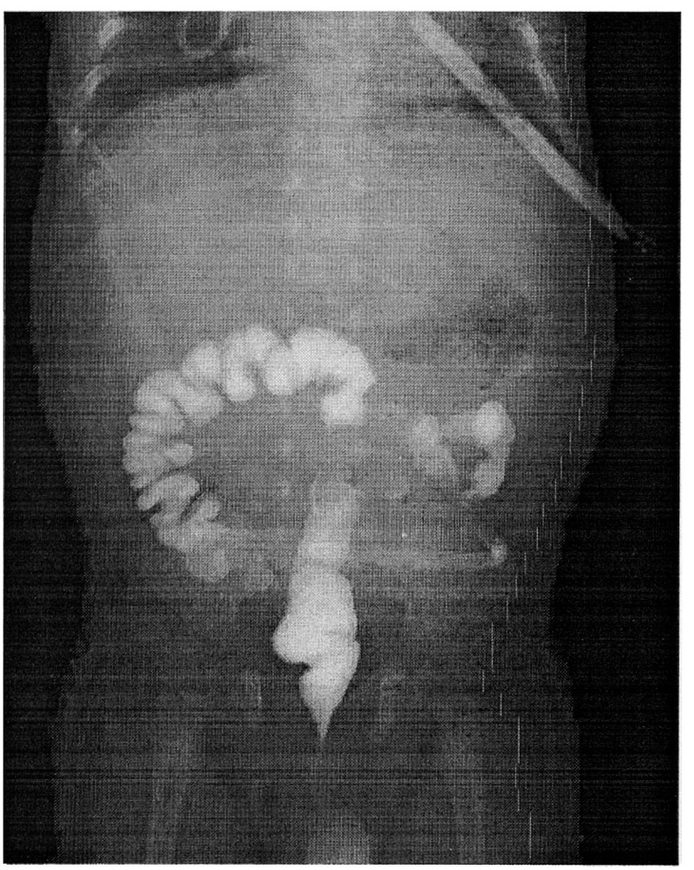

Fig 2. Distal contrast study shows no leaks 2 weeks after sutureless anastomosis (stent still in place).

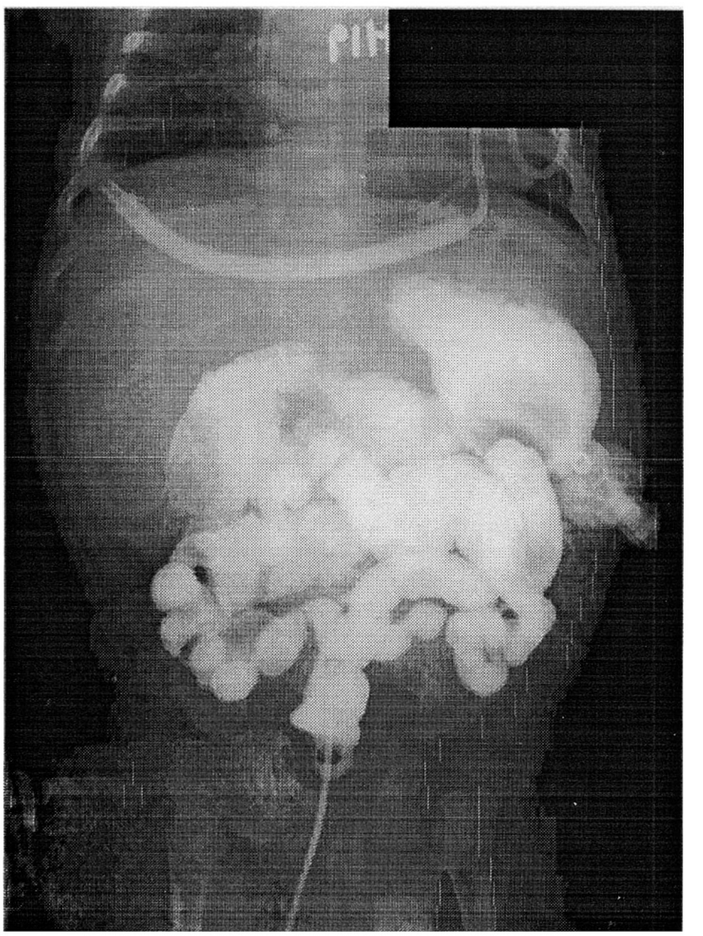

Fig 3. Upper gastrointestinal series shows compartmentalization of intestinal segments after enterostomy closure.

Infants with jejunoileal atresia do not exhibit the congenital anomalies associated with the VACTERL syndrome. In these infants, the most important cause of mortality is short gut syndrome, which occurs most often in infants similar to our patient with multiple intestinal atresia. Standard surgical therapy may not allow maximal preservation of residual small bowel in these infants because of the trimming process required for a safe and secure anastomosis. In addition, multiple anastomoses may require excessive operating time, jeopardizing the infant's clinical status.

The technique described in this report requires only the presence of a lumen, with minimal to no trimming. It may be used to salvage segments down to 1 cm in length and is relatively quick and easy to perform. The sutureless anastomoses thus achieved do not leak, but, in some instances, these anastomoses may develop stenosis. The resultant configuration of bowel wall resembles a series

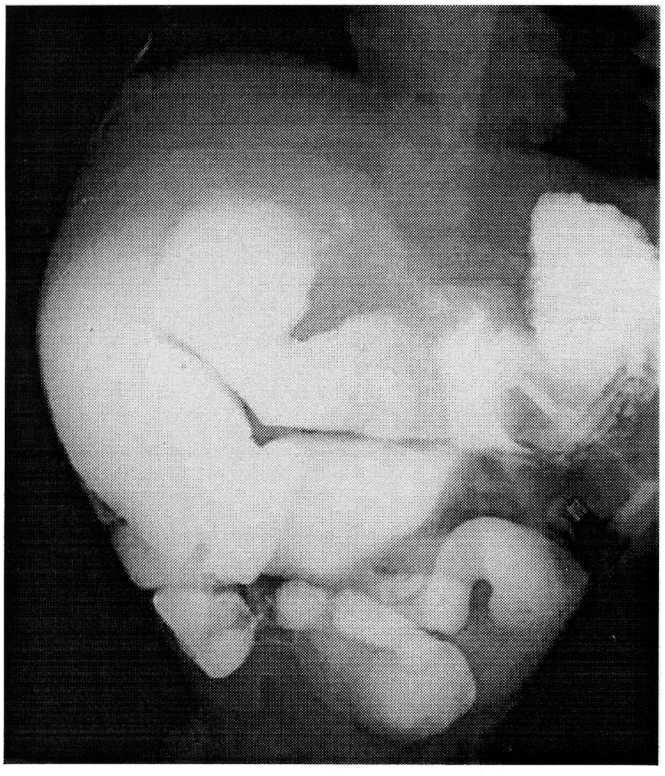

Fig 4. Upper gastrointestinal series shows partial small obstruction at 6 months of age.

of dilated, interconnected intestinal chambers. After proximal enteroplasty, enterostomy closure, and removal of the duodenostomy tube in our patient, this configuration of small bowel appeared to correlate with clinical and radiographic evidence of decreased small bowel motility. This may have benefited the infant by allowing for more efficient gastrointestinal absorption. Eventually, the infant did have feeding intolerance caused by partial small bowel obstruction. At reexploration, the patient was found to have multiple dilated segments of small bowel with stenosis involving 3 of the 14 spontaneous anastomoses, which were treated by stricturoplasty with excellent result.

The concept of intraluminal intestinal stents is not new. Hatch and Schaller[4] described a "shish-kebab" technique in 1986, to perforate multiple membranous obstructions as an alternative to multiple resections in infants with multiple intestinal atresia. Chaet et al[5] reported the use of intraluminal SILASTIC® stents to support multiple hand-sewn anastomoses in infants with multiple jejunoileal atresia. A more recent report by Lessin et al[6] showed that multiple spontaneous small bowel anastomoses could be achieved using stents in micropremature infants with necrotizing enterocolitis. This report provided the conceptual basis for the technique used in our patient.

Intraluminal intestinal stents may be used safely to promote spontaneous anastomosis with maximal preservation of small bowel length and shortened operating time. An unexpected benefit of this procedure is decreased intestinal motility associated with compartmentalization of the small bowel, which appears to allow for more efficient gastrointestinal absorption and faster-than-expected weaning of total parenteral nutrition.

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