Multiple Spontaneous Small Bowel Anastomosis in Premature Infants With Multisegmental Necrotizing Enterocolitis

By Marc S. Lessin, David L. Schwartz, and Conrad W. Wesselhoeft, Jr
New Hyde Park, New York and Providence, Rhode Island

Background/Purpose: Fulminant necrotizing enterocolitis (NEC) may result in extensive bowel necrosis. Resection of involved segments may result in short bowel syndrome. Multiple stomas result in complications and further loss of intestinal length with closure.

Methods: Two patients with extensive multisegmental NEC were treated with an intraluminal stent without anastomosis. All necrotic intestine was resected and the remaining viable intestine was lined up over a feeding tube without anastomosis of the intestinal segments. One patient had a diverting jejunostomy and mucous fistula with the tube used to orient the defunctionalized intervening intestinal segments. The second patient had the bowel left in continuity with the tube brought into the jejunem proximal to the first area of resection and distally brought out through the tip of the appendix. Both tubes were brought through the abdominal wall and secured in a loop.

Results: Contrast study findings showed that the intestinal segments had auto-anastomosed. In the first case the tube was left in place and intestinal continuity was restored. The patient is now 4 years old and takes full enteral feeds. The latter patient had the enterostomy tube removed at the time of the contrast study, but only tolerated partial feedings and died at 1 year of total parenteral nutrition–related liver failure.

Conclusion: The technique eliminates nonviable bowel, maximizes length, avoids multiple stomas, and may help avoid reoperation.
J Pediatr Surg 35:170-172.

INDEX WORDS: Necrotizing enterocolitis, short bowel syndrome, intestinal intraluminal stenting.

FULMINANT necrotizing enterocolitis (NEC) may result in extensive bowel necrosis. Resection of involved segments with or without enterostomies may result in short bowel syndrome. Multiple stomas often result in complications and further loss of intestinal length with closure.[1] Optimal treatment consists of conservation of maximal intestinal length, removal of nonviable bowel while minimizing operating time, and early institution of enteral feedings.

A technique of intraluminal stenting was adapted from a previous report of its use in multiple intestinal atresias with an adaptation for NEC.[2] The technique was used in 2 patients with extensive NEC to preserve maximal bowel length while minimizing the time needed to perform multiple anastomosis.

From the Divisions of Pediatric Surgery, Long Island Jewish Medical Center, Schneider Children's Hospital, New Hyde Park, NY, and Brown University School of Medicine, Hasbro Children's Hospital, Providence, RI.

Presented at the 30th Annual Meeting of the American Pediatric Surgical Association, Rancho Mirage, California, May 16-19, 1999.

Address reprint requests to Marc S. Lessin, MD, Division of Pediatric Surgery, New England Medical Center, 750 Washington St, Box 281, Boston, MA 02111-1845.

0022-3468/00/3502-0004$03.00/0

CASE REPORTS

Case 1

A 26-week-gestational age, 815-g infant had NEC at 11 days of age after ligation of a patent ductus arteriosus. Several hours later, the baby presented with a large pneumoperitoneum, which was initially managed by placement of a peritoneal drain. After 2 weeks, the infant was fed and found to have a complete distal small bowel obstruction. Findings during exploration 26 days after placement of the peritoneal drain showed severe adhesions and extensive segmental necrosis of the small intestine including the terminal ileum and right colon. A right hemicolectomy, proximal end jejunostomy 10 cm beyond the ligament of Treitz, and transverse colon mucus fistula were performed. Multiple small bowel resections were undertaken leaving 25 cm of small bowel distal to the jejunostomy in 6 segments. Seven anastomoses would have been required to reestablish continuity. An 8F feeding catheter was passed through each segment of bowel, and their respective mesenteries were aligned. The ends of the catheter were brought out through separate abdominal wall puncture sites and secured in a continuous loop outside the abdominal wall (Fig 1).

A contrast study was obtained 2 weeks later through the feeding tube, which showed that the bowel had autoanastomosed. The tube was left in situ until the patient reached 3 months of age and weighed 1,900 g. The 6 segments were dissected in continuity using the intraluminal stent as a guide. The proximal and distal openings of the bowel were found to have adhered to the peritoneum at the entrance and exit sites of the alignment catheter. Intestinal continuity was reestablished with 2 anastomoses: 1 between the jejunostomy and the proximal aspect of the intervening small bowel, and the other between its distal end and the transverse colon mucus fistula. The patient was discharged at 5 months, weighing 3,170 g with supplemental total parenteral nutrition (TPN),

Fig 1. Intraluminal stent secured in continuous loop through abdominal wall. Jejunostomy seen in left lower abdomen.

which subsequently was stopped. She is now 4 years old, is on full enteral feedings, has a normal stooling pattern, and is neurologically normal.

Case 2

A 26-week gestational age 620-g boy had abdominal distension, radiographic pneumatosis intestinalis, and low lung volumes requiring high-peak ventilatory pressures at 2 months of age. Exploratory laparotomy was performed because of clinical deterioration with inability to ventilate. Extensive NEC with multiple noncontiguous segments of infarcted jejunem and ileum were resected, and the ends of the bowel were closed. A ventral wall defect silo bag (Bentec Medical, Sacramento, CA) was placed to reduce abdominal compartment pressures. The patient was returned to the operating room for a planned second-look laparotomy with resection of additional necrotic segments of bowel leaving 30 cm of small bowel with an ileocecal valve. A Replogle suction catheter (Sherwood Medical, St Louis, MO) was brought through the abdominal wall in the left upper quadrant and then brought into the lateral wall of the jejunem 5 cm beyond the ligament of Treitz and 5 cm proximal to the first resection. The 3 intervening small intestinal segments were oriented over the tube by placing a single suture on the mesenteric and antimesenteric borders to orient the mesenteries (Fig 2). The tube was brought through the ileocecal valve, out the tip of the appendix, and through the abdominal wall in the right upper quadrant and secured in a continuous loop without a diverting stoma (Fig 3). A contrast study was obtained through the stent after 1 month, which showed that intestinal continuity had been reestablished (Fig 4). The intraluminal stent was removed after the contrast study and feedings were begun 3 days later. He was only able to tolerate partial enteric feedings because of short gut syndrome. He died at 1 year of liver failure related to TPN.

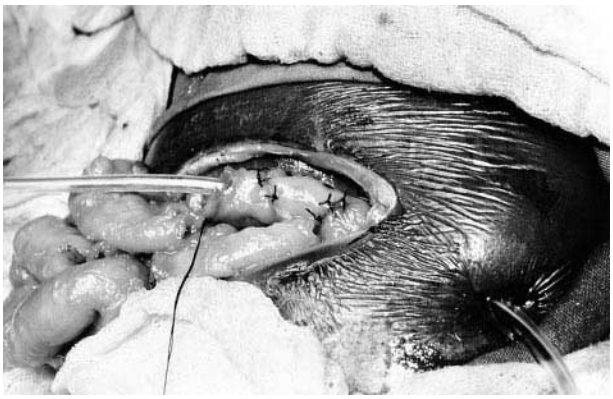

Fig 2. Intraluminal stent threaded through jejunem across line of resection. The sutures were used to orient the bowel.

Fig 3. Intraluminal stent brought out tip of appendix.

DISCUSSION

The optimal treatment for extensive NEC in the unstable neonate consists of preservation of maximal intestinal length while minimizing operating time. The classic treatment of the unstable patient with extensive NEC would consist of segmental resections and stomas

Fig 4. Contrast study through stent shows restoration of bowel continuity by autoanastomosis.

requiring multiple surgeries. The morbidity and mortality of extensive bowel resections is directly related to the amount of intestine remaining. Although there are reports of survivors with less than 10 cm of small intestine, most succumb to complications associated with long-term TPN such as sepsis and cholestatic jaundice leading to hepatic fibrosis.[3,4] Stomas have been associated with a 34% revision rate and as high as a 44% complication rate with their closure.[5] Their closure often results in further loss of valuable intestinal length. Multiple resections with stomas are complicated by fluid losses, electrolyte imbalances, and problems with protection of the peristomal skin. Techniques such as the ''clip and drop-back'' method with subsequent reexploration with delayed primary intestinal anastomosis have been proposed as alternatives to traditional treatments. This approach only has been applied, however, to infants over 1.2 kg with remaining bowel lengths of 46 to 175 cm.[6]

An 8F feeding catheter is an ideal tube for an intraluminal stent, serving both to align the intestinal segments and to serve as access to the bowel for a contrast study after 2 weeks to evaluate restoration of continuity. If the stent is in a defunctionalized segment of bowel, it can be left in place as a guide for dissection at the time of stoma closure and reestablishment of intestinal continuity. If no diverting stoma has been brought out at the initial surgery, the stent should be removed at the time of the contrast study.

Intraluminal stents have been useful for management of multiple intestinal atresias.[2,7] The current application of the intraluminal stent is a useful addition to the surgeon's armamentarium for a sick premature infant with NEC, in whom, after resection of necrotic bowel, less than 50 cm of small intestine remains or more than 2 anastomoses would be required to reestablish intestinal continuity. Additionally, it minimizes operating time allowing for the rapid return of an unstable patient to the intensive care unit for stabilization.

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Discussion

R. Sonnino (Kansas City, Kansas): Did you ever get a chance to look at the autoanastomosis at least in the second patient at the time of death? Did you see how the healing had occurred and if it was any different from what you would expect if you did a suture anastomosis?

M.S. Lessin (response): Unfortunately there was no autopsy done. The child who expired was never reoperated upon, and the family refused an autopsy. The first patient's bowel segment at the time of ostomy closure had excellent healing. There was no stricture or scarring at the anastomotic site.