Long-term outcome of intestinal lengthening procedure for short-bowel syndrome: A case report

Yih-Huei Uen, MD, An-I Liang, MD, Hao-Hsien Lee, MD, *and* **Yun-Hsi Hsu, MD, FACS, FICS,** *Tainan, Taiwan, and New York, NY*

From the Division of General Surgery, Department of Surgery, Chi-Mei Foundational Hospital, Tainan, Taiwan, and the Department of Surgery at New York University Downtown Hospital, St Vincent Medical Center of Richmond and Carbrini Medical Center, New York, NY

CLINICAL APPLICATION OF THE PROCEDURE for intestinal lengthening as described by Bianchi[1] was first reported in a child by Boeckman and Traylor.[2] This procedure is probably the most frequently used adjunctive procedure for short-bowel syndrome in children.[3] However, to our knowledge, its use has been reported only in 2 adults.[3,4] We present a case of an adult who underwent this procedure including the results of long-term clinical and radiologic follow-up.

CASE REPORT

In March 1989, a 43-year-old obese woman underwent massive intestinal resection for acute mesenteric infarction. It was necessary to resect all of the small bowel from a point 25 cm beyond the ligament of Treitz to the mid transverse colon. Her postoperative course was complicated by abdominal pain, vomiting, and diarrhea (7 to 10 liquid stools per day); total parenteral nutrition (TPN) was instituted. Over the ensuing months, various oral feedings were attempted, none of which could be tolerated. She required long-term hospitalization for TPN and had recurrent episodes of catheter septicemia. An episode of acute acalculous cholecystitis required cholecystostomy.

Sixteen months after initial surgery, the patient's diarrhea was unchanged, and she was tolerating only 15% of her caloric requirement orally. Her body weight had dropped markedly from a preoperative level of 70 kg to 32 kg. She could not maintain body weight without supplemental intravenous nutrition for longer than 2 to 3 weeks. Contrast medium upper gastrointestinal (UGI) study revealed marked dilatation of the remaining small bowel with ineffective peristalsis (Fig l, *A*).

In an attempt to improve intestinal absorption function, the patient underwent operation in August 1990. At this time, the small bowel measured 7 cm in diameter and was 38 cm long, indicating a 13 cm spontaneous elongation during the 16-month postoperative period. The jejunocolic anastomosis was widely patent. The isoperistaltic intestinal lengthening procedure, as described by Bianchi,[l] was performed to longitudinally divide the dilated small bowel with tapering and lengthening of the bowel loops by 35 cm (Fig 2).

Three weeks later, the patient regained her appetite and began fluid intake. A low-fat diet was started at 4 weeks postoperatively. Gradually, regular enteral feeding was reinstituted over the next 3 months. The patient was then weaned from TPN over a 2-week period and discharged from the hospital at 4 months postoperatively. During the next 2 years, the patient had 4 short readmissions for supplemental parenteral nutrition. She continues to do well 7 years after the lengthening procedure, with no dietary problems and only 2 to 4 soft bowel movements per day. Her body weight is now a healthy 52 kg, and she performs her own housework without difficulty.

The functional changes in the UGI tract of our patient after this procedure are illustrated by a series of roentgenograms (Fig l, *B-D*). The small intestinal series made in the third postoperative month showed that the remnant jejunum was lengthened and had a normal diameter with effective peristalsis. Subsequent roentgenographic studies, performed 30 and 72 months later, showed slowly progressive dilatation of the lengthened loops with continuous presence of a radiologically verifiable peristalsis.

DISCUSSION

The intestinal tapering and lengthening procedure performed in our patient was first described experimentally in pigs by Bianchi in 1980.[1] The

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Reprint requests: Uen Yih-Huei, MD, No. 901, Chung-Hua Road, Chi-Mei Foundational Hospital, Yung-Kang City, Tainan 710, Taiwan.

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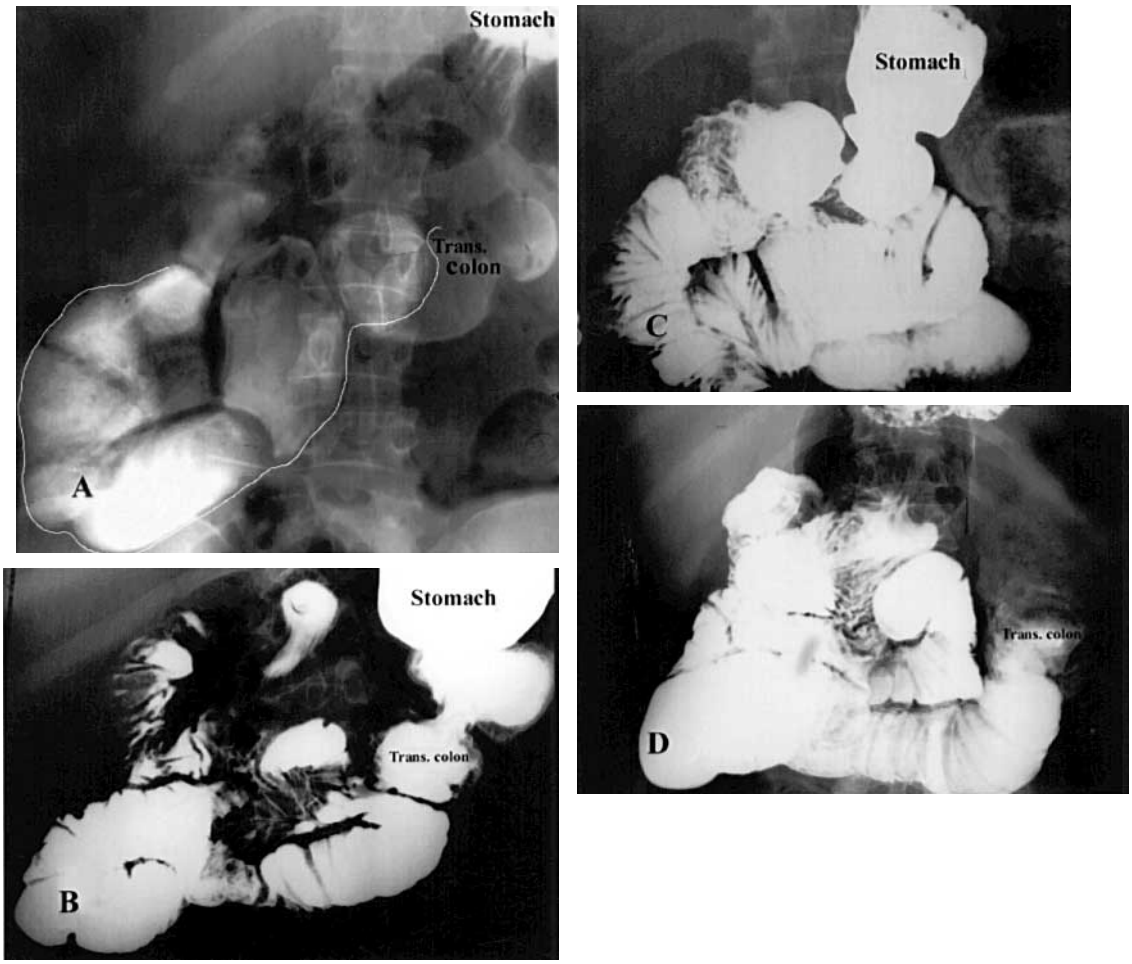

Fig 1. Preoperative **(A)** and postoperative UGI series. **B,** 3 months, **(C)** 30 months, and **(D)** 72 months after the operation. Intestinal transit time increased from less than 5 minutes **(B)** to 20 minutes **(C)** and only 10 minutes **(D)**.

technique can be performed because of the anatomic division of the intestinal vasculature within 2 leaves of mesentery. By longitudinally dividing the intestine between the 2 mesentery leaves, it can be separated into 2 parallel lumens with their own vascularity. Because this procedure preserves all mucosa by doubling the intestinal length and corrects the ineffective peristalsis by tapering the dilated intestine, it may be indicated in cases of short-bowel syndrome where the intestine is not only shortened but also dilated as part of the adaptation process.

According to the review of Shanbhogue and Molenaar,[3] at least 38 children have been treated with this procedure, and nutritional status improved in 71% of these patients. Remarkably, only 2 adult cases have been reported in the literature,[3,4] and one of them had a 17 cm remnant small bowel after ligation of the superior mesenteric artery. Her jejunum was lengthened by 33 cm during the procedure, and her enteral intake increased from 0% to 60% of caloric requirements.[3]

Follow-up with UGI barium meal studies was sufficiently long in our patient to ensure that effective isoperistalsis will continue in these lengthened intestinal segments. This long-term effect is due primarily to the slow progressive dilatation of the luminal diameter and the absence of recurrent dilatation to the initial level that was observed throughout the 72-month follow-up period. Long after provision for increased bowel length, there was still insufficient hypertrophy of the intestinal villi to prove the mechanism of "enhanced adaptation response" as supposed by Bianchi.[1] Although a similar trend of prolonging intestinal transit time by doubling the intestinal length was noted by Pokorny and Fowler,[5] its effect in our patient was limited and inconstant.

The technique involved in this procedure is demanding and may be associated with procedure-

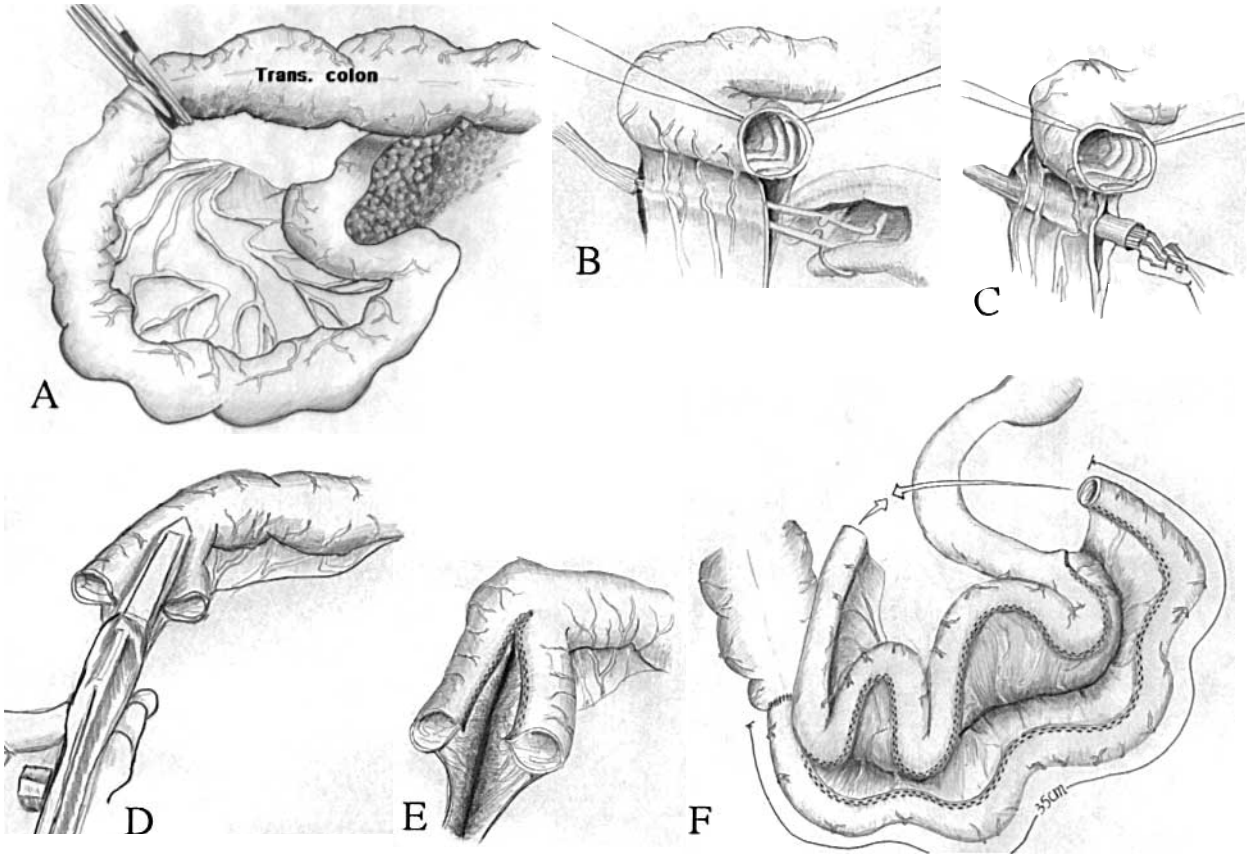

Fig 2. Description and illustration of procedure of intestinal tapering and lengthening. **A,** Bowel is transected at previous anastomotic site of jejunocolostomy. **B,** Leaves of mesentery are separated, directing alternate vessels to either side of bowel wall, and relatively avascular plane is developed. **C,** Lower anvil of 5 cm GIA stapler is advanced into mesenteric space with aid of a Penrose drain. **D, E,** Intestine is transected longitudinally with stapler. **F,** Transection of bowel is repeated in retrograde fashion for 35 cm, and resulting parallel segments undergo isoperistaltic intestinal anastomosis in end-to-end fashion.

related complications such as ischemic necrosis of intestinal loops, anastomotic leakage, fistula formation, and intestinal obstruction. No such complications were observed in this case.

In performing this procedure, many technical points deserve special attention. First, it is necessary to perform meticulous manipulation during longitudinal division of the mesenteric border with preservation of the vasculature in the intestinal loops. The use of a Penrose drain facilitates the advancement of the anvil of the gastrointestinal anastomosis stapler between the mesentery, without injury to the vessels.[2] Second, if the vessel space is adequate, use of a stapler in division and anastomosis will minimize the blood loss and the possibility of leakage of the long suture line. Third, to avoid tension on the afferent vessels and make anastomosis easier, these parallel lengthened segments should be properly positioned in a spiral or helical pattern.[6]

This procedure should be delayed until the adaptation process has been completed to increase the likelihood of satisfactory results.[5] The duration of adaptation after massive bowel resection usually lasts for more than 1 year. After this period of adaptation, the remnant intestine may undergo luminal dilatation. To use a stapler to perform the longitudinal intestinal division, the diameter must be at least 4 cm[5] to avoid compromising luminal patency.

We believe that this procedure has favorably modified the clinical course of this adult and that it may be useful in selected adult patients with short-bowel syndrome.

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CORRECTION

In the article "Usefulness of metyrapone treatment to suppress cancer metastasis facilitated by surgical stress" (Deguchi M, Isobe Y, Matsukawa S, Yamaguchi A, Nakagawara G. Surgery 1998;123:440-9) the illustration for Fig 2 on page 442 has poor resolution. The figure is reprinted below.

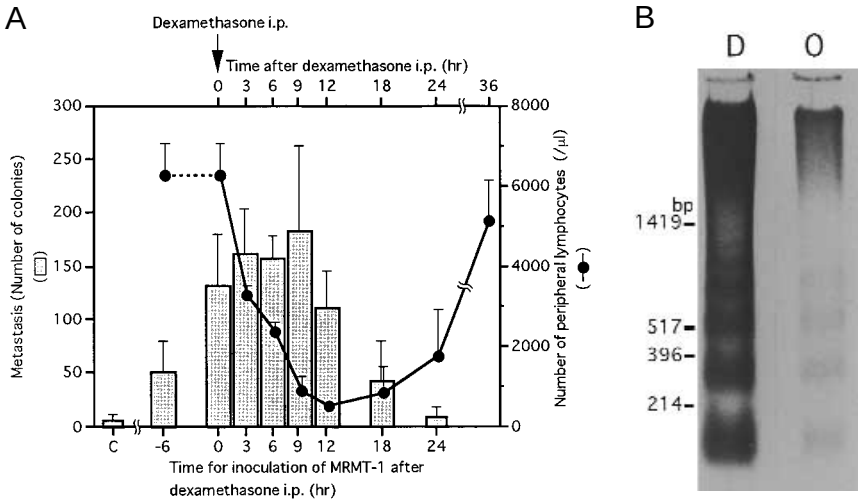

Fig 2. A, The relationship between changes in number of PBLs and metastasized nodules of MRMT-1 cells on lung as a function of time after inoculation of the parent cells after intraperitoneal administration of dexamethasone. C is the result of metastasized nodules of control rats. Results are expressed as the means ± SD (n = 4). **B,** DNA fragmentation of rat thymocytes induced by dexamethasone treatment and surgical operation. *Lanes D and O* indicate the DNA fragment patterns on a 1.2% agarose gel of thymocytes from dexamethasone-treated rats and rats surgically operated on, respectively. As a DNA size marker, *Hinf*I digested pUC19 DNA was used.