



# Serial transverse enteroplasty is associated with successful short-term outcomes in infants with short bowel syndrome

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STEP;  
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D-Xylose

## Abstract

**Background:** The serial transverse enteroplasty (STEP) has been shown to improve nutritional indices in an animal model of short bowel syndrome. The aim of this study was to review short-term surgical and nutritional outcomes in the first cohort of infants to undergo the STEP procedure at our institution.

**Methods:** All patients who underwent the STEP procedure during a 26-month period from February 2002 to March 2004 were reviewed. Paired *t* tests were used for comparisons between values pre-STEP and post-STEP ( $P < .05$  deemed significant). Data are expressed as mean and range.

**Results:** The STEP was performed on 5 patients, including 1 newborn. The STEP was used as a primary lengthening operation in 4 patients. Intestinal length was significantly increased in all patients with 18 (10–26) stapler applications. There were no perioperative complications and no evidence of intestinal leak or obstruction on routine postoperative contrast study. Nutritional follow-up was available on 3 subjects at 17 (11–26) months post-STEP. Percentage of enteral nutrition was significantly increased in these subjects ( $P < .05$ ). One subject was fully weaned from total parenteral nutrition 6 weeks after the STEP, and bilirubin in another patient with profound cholestasis who had been listed for liver–small bowel transplant normalized after the STEP. An additional patient, with established cirrhosis before operation, underwent successful liver–small bowel transplantation 8 months after intestinal lengthening.

**Conclusion:** The STEP procedure is a simple bowel-lengthening procedure with promising early surgical and nutritional outcomes. Further data from a multicenter registry are needed to demonstrate its long-term efficacy.

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The management of short bowel syndrome remains a challenge for the pediatric surgeon. Recently, the serial transverse enteroplasty (STEP) was introduced as a novel

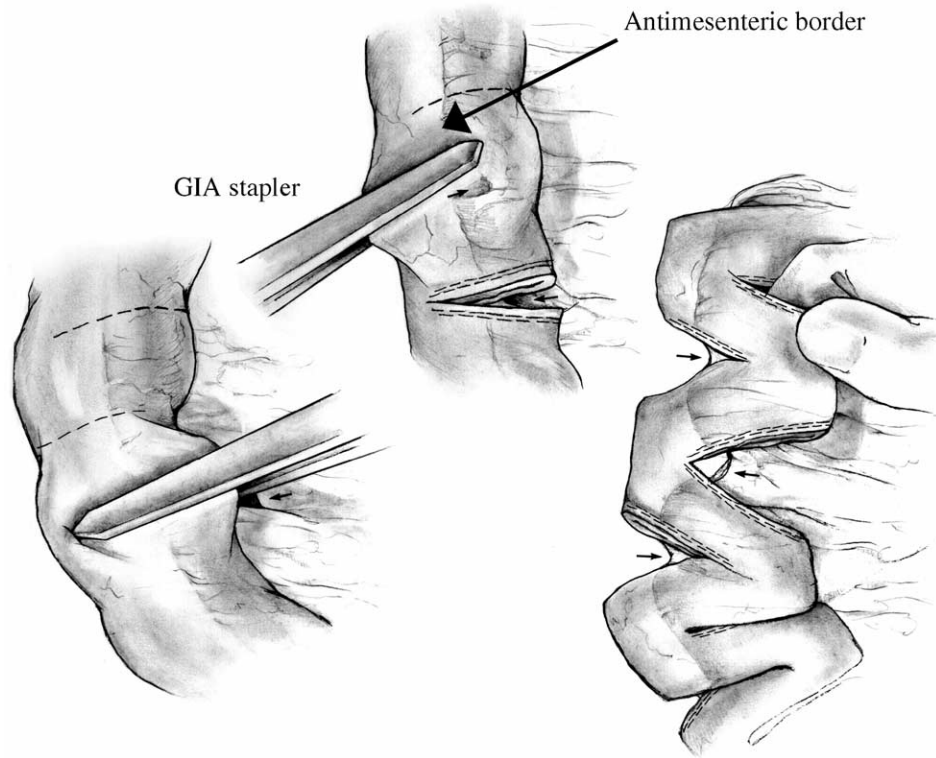
option for operative bowel lengthening in short bowel syndrome. The STEP procedure involves the sequential linear stapling of the dilated small bowel from alternating directions perpendicular to the long axis of the intestine (Fig. 1). In this way, all stapler applications are placed parallel to the direction of mesenteric blood flow so that the intestinal blood supply is not put at risk.

Since its introduction, the STEP has been shown to be an effective bowel-lengthening technique in an animal model

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**Fig. 1** The basic concepts of the STEP procedure. Serial applications of the linear stapler are used to create a zigzag-shaped channel of lengthened small bowel. The stapler is placed perpendicular to the long axis of the bowel, so that all stapler applications are parallel to the mesenteric blood supply.

of short bowel syndrome [1] and in select human case reports [2,3]. Recently, data have also demonstrated that the STEP may provide a nutritional benefit to animals with short bowel syndrome [4]. As experience with the STEP procedure continues to evolve, the operation is now being performed at multiple institutions worldwide. However, to date, an aggregate analysis of outcomes in patients who undergo the STEP procedure has not been performed. Therefore, the aim of this study was to measure and review the short-term surgical and nutritional outcomes of the first cohort of patients to undergo the STEP procedure for short bowel syndrome at our institution.

## 1. Methods

After approval from the Children's Hospital Boston Committee on Clinical Investigation (#M04-03-071), a retrospective chart review was performed on all patients who have undergone the STEP procedure at our institution. The period for data review was a 25-month period beginning in February 2002 (when the first STEP procedure was performed) and ending in March 2004. In addition to the patients' hospital medical records, data were collected from the Children's Hospital Boston Short Bowel Syndrome Clinic and from radiological imaging studies.

Data recorded by investigators included patient characteristics and medical history, intestinal length pre-STEP and

post-STEP, perioperative complications, and results of postoperative radiological imaging. Intraoperative intestinal length was measured along the antimesenteric border of the bowel. Weight parameters for each subject were assessed preoperatively and then at each postoperative clinic visit. For each subject, the degree of enteral intake was calculated as the percentage of total caloric intake derived from enteral administration, as measured by a study nutritionist. Serological liver function tests and levels of D-xylose were measured in the chemistry laboratory at Children's Hospital Boston both pre-STEP and at subsequent clinic visits postprocedure.

Paired *t* tests were used for statistical comparison of values pre-STEP and post-STEP.  $P < .05$  was deemed statistically significant. Unless otherwise indicated, all data are expressed as mean and range.

## 2. Results

Table 1 presents a summary of patient baseline data and results of operative bowel lengthening. In total, 5 patients underwent the STEP procedure during the 26-month study period. Mean age at time of STEP was 12 (range 0-23) months. The STEP was performed on 1 newborn infant with gastroschisis associated with intestinal atresia. The STEP was used as a primary bowel-lengthening operation in 4 of the 5 subjects in this cohort; the remaining patient

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