

Reversed Intestinal Segment Revisited

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ABSTRACT

Background. Reversed segments (RS) designed to slow intestinal transit and improve absorption in patients with short bowel syndrome (SBS) are performed infrequently, and patient selection remains controversial. Our aim was to evaluate patient selection and outcome for RS in SBS patients.

Methods. Sixteen adult patients underwent RS among 520 SBS patients. All patients had remnant length >80 cm and rapid intestinal transit. Ten patients had a colon remnant and 12 had an ostomy. SBS was present for 8 to 150 months prior to RS.

Results. RS was performed either alone ($n = 9$) or concurrently with ostomy closure ($n = 5$) or creation ($n = 2$). There were 3 postoperative complications and no deaths. Three patients had bacterial overgrowth. One required repair of an ileocolonic stricture. Two reversed segments were taken down 12 months and 96 months later. Two patients subsequently underwent serial transverse enteroplasty (STEP) procedures, and 1 had isolated intestinal transplant. Fourteen (88%) required parenteral nutrition (PN) preoperatively and 2 (12%) had intractable diarrhea. Nine (56%) patients improved and 7 (44%) remained on PN or had persistent intractable diarrhea. Patients with a successful outcome were similar to those without improvement with respect to ostomy takedown, duration of SBS, Crohn's disease, intestinal length, a colon remnant, anatomy, and transit time.

Conclusions. Reversed segments significantly benefit one half of selected SBS patients who have rapid transit but adequate remnant length. Outcome in individual patients remains difficult to predict. Subsequent operation is frequently required. This procedure is applicable to a small proportion of SBS patients.

REVERSED intestinal segments (RS) designed to slow intestinal transit and improve absorption in patients with short bowel syndrome (SBS) are performed infrequently, and patient selection remains controversial [1–3]. Our aim was to evaluate factors predicting outcome for reversed intestinal segments in SBS patients.

METHODS

This was a retrospective study of 16 adult patients with SBS undergoing reversed intestinal segments to slow intestinal transit. Short-term follow-up of 9 of these patients has been reported previously [4]. There were 13 women and 3 men ranging from 19 to 61 years of age. All patients had small intestine remnant length >80 cm and rapid intestinal transit (<30 minutes). Reversed segments 10 to 15 cm in length were created in the distal intestinal remnant. Type of intestinal anatomy was as described by

Messing [5]: type 1 end-jejunostomy, type 2 jejunocolic anastomosis, and type 3 jejunocolic-ileocolonic anastomosis. Follow-up ranged from 8 to 192 months, with a mean of 65 months. Outcome was considered successful if PN was discontinued or diarrhea decreased by 50%. Statistical analysis was performed using analysis of variance and the χ^2 test as appropriate.

RESULTS

All patients had benign intestinal disease including postoperative SBS ($n = 11$), Crohn's disease ($n = 3$), intestinal ischemia ($n = 1$), and traumatic injury ($n = 1$) (Table 1).

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Table 1. Pre-operative Patient Characteristics

Patient	Age	Sex	Diagnosis	Duration SBS (mo)	Parenteral Nutrition	Transit Time (min)	Small Intestine Remnant	Colon Remnant	Ostomy Present	Intestinal Anatomy
1	43	F	Crohn's disease	12	+	15	100	Left	+	1
2	40	F	Post-operative	84	+	30	150	Total	-	3
3	59	M	Trauma	8	+	-	90	Left	+	1
4	46	F	Post-operative	24	+	15	90	-	+	1
5	53	F	Post-operative	10	+	30	110	-	+	1
6	46	M	Post-operative	9	+	10	120	Left	+	1
7	43	F	Post-operative	84	-	-	105	Rectum	+	1
8	61	F	Post-operative	16	+	10	110	Left	+	1
9	55	F	Post-operative	15	+	15	80	Left	-	2
10	37	F	Crohn's disease	60	+	-	120	-	+	1
11	42	F	Post-operative	10	-	15	180	Total	-	3
12	57	F	Crohn's disease	120	+	15	180	Rectum	+	1
13	55	F	Post-operative	150	+	10	90	Left	-	2
14	19	F	Post-operative	15	+	40	90	-	+	1
15	41	M	Ischemia	48	+	15	100	-	+	1
16	60	F	Post-operative	24	+	15	120	Left	+	1

The pre-operative duration of SBS was 8 to 150 months. Only 4 (25%) patients underwent RS within 1 year of development of SBS. Fourteen (88%) patients required parental nutrition (PN) pre-operatively. In 2 patients, rapid transit with severe diarrhea was the indication for operation. Small intestinal remnant length ranged from 80 to 180 cm. Intestinal remnant anatomy was predominately type 1 (n = 12), compared with type 2 (n = 2) and type 3 (n = 2). Twelve patients had an ostomy. Pre-operative transit time by contrast study ranged from 10 to 30 minutes, with 10 patients having transit time ≤ 15 minutes.

The 16 patients underwent reversed segment performed either alone (n = 9) or concurrently with ostomy closure (n = 5) or creation (n = 2) (Table 2). There were 3 post-operative complications (urinary infection, catheter infection, left upper-quadrant abscess) and no deaths. Three patients later had bacterial overgrowth; 1 had a 12-cm

reversed segment and 2 a 15-cm reversed segment. One patient required repair of an ileocolonic stricture. Two reversed segments were taken down 12 and 96 months later for persistent nausea and vomiting, but symptoms persisted after reversal of 1 procedure. The 3 patients with Crohn's disease have not had recurrent disease at follow-up (12, 48, and 50 months). Two patients subsequently underwent serial transverse enteroplasty (STEP) procedures, 1 for bacterial overgrowth and 1 to improve absorption. One had isolated intestinal transplant for recurrent line sepsis and difficult access.

Nine (56%) patients had clinical improvement (Table 3). Seven (44%) remained on PN or had persistent intractable diarrhea and were considered to have unsuccessful outcomes. Transit time was similar pre-operatively in both groups (mean, 14 minutes; range, 10 to 30 minutes). Two patients in each group had prolonged transit demonstrated

Table 2. Operation and Outcome

Patient	Reversed Segment	Other Procedure	Outcome	Follow-Up (mo)
1	10 cm	Ostomy takedown	Off PN @ 2 mo; transit 80 min, no Crohn's	120
2	12 cm	-	Off PN @ 3 mo; bacterial overgrowth, STEP, reversed procedure @ 10 years	192
3	15 cm	Ostomy takedown	Off PN @ 2 mo; bacterial overgrowth	25
4	10 cm	-	Off PN @ 4 mo; transit 40 min	12
5	10 cm	Parastomal hernia	Off PN @ 5 mo; high ostomy output	26
6	12 cm	Ostomy takedown	Off PN @ 5 mo	78
7	10 cm	-	Ostomy output decreased 50%	36
8	10 cm	Ostomy takedown	Off PN @ 3 mo; stricture repaired	8
9	12 cm	Ostomy	Off PN @ 8 mo	42
10	10 cm	-	PN, reversed procedure, no Crohn's	18
11	10 cm	-	No change diarrhea	80
12	10 cm	-	PN, transit time 50 min, no Crohn's, died	123
13	15 cm	-	PN, transit time 60 min, bacterial overgrowth	96
14	10 cm	-	PN, SBTX @ 13 mo; died	40
15	12 cm	-	PN 5 \rightarrow 3 nights/wk	122
16	12 cm	Ostomy takedown	PN, STEP @ 6 mo	15

Abbreviations: PN, parenteral nutrition; STEP, serial transverse enteroplasty; SBTX, small-bowel transplant.

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