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Wing-Shaped End-to-End Anastomosis for the Treatment of High Jejunal Atresia

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Kato, T., Hebiguchi, T., Yoshino, H., Mizuno, M. and Yamada, M. *Wing-Shaped Endo-to-End Anastomosis for the Treatment of High Jejunal Atresia.* Tohoku J. Exp. Med., 2000, **192** (2), 119-126 —— Six infants with jejunal atresia, one infant with ileal atresia, and one infant with colonic atresia were managed by a newly developed wing-shaped end-to-end anastomosis. The technique was accomplished by anastomosing the tip of the dilated proximal bowel to the diminutive distal bowel, which had been divided into two parts, including the mesentery. The completed anastomosis resembled extended wings, and this technique was therefore named wing-shaped anastomosis. This technique for anastomosis is effective in preventing functional obstruction because no axial deviation between the proximal and distal anastomotic bowels exists, and the mucosal absorptive surface is completely preserved. ———— high jejunal atresia; end-to-end anastomosis

Both functional anastomosis and preservation of the mucosal absorptive surface are essential for the successful treatment of intestinal atresia. In patients with ileal atresia, resection of the dilated segment of intestinal atresia followed by end-to-end anastomosis is possible, and, at the same time, an adequate length of small intestine is preserved. In cases of high jejunal atresia, however, the dilated segment of the intestine may involve the entire jejunum to the ligament of Treitz as well as the duodenum. Under these circumstances, resection of the proximally dilated intestine may either be impossible or may severely compromise the amount of absorptive surface of the remaining small intestine. Examination of anastomotic methods have resulted in a variety of techniques for the management of such conditions. Jejunoplasty (Thomas 1969) for the correction of jejunal atresia is one of the techniques that was developed for this purpose. We describe here a new technique for end-to-end anastomosis between a dilated proximal and diminutive distal bowels.

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Methods

Operative procedures

Dissection was performed in the space between the vessels in the mesentery from the diminutive distal atretic bowel to the anal side, a length of about 2 cm. By blunt dissection to the mesenteric border of the bowel, the peritoneal leaves of the mesentery were dissected apart, allowing access to the vascular plane (Fig. 1). The mesenteric vessels were allocated on an alternative basis to ensure an adequate blood supply to either side of the bowel.

The mesenteric border of the bowel was carefully dissected so that an avascular space was created between the points of entry of the supplying vessels. The distal diminutive bowel was cut into two parts, each 2 cm in length, through the dissected mesenteric border of the bowel (Fig. 2).

Then an incision of 2 cm in length was made at the blind tip of the dilated proximal bowel in the right angle direction to the mesentery (Fig. 2). End-to-end anastomosis was accomplished using one-layer interrupted Albert's suture of 5-0 polyglycolate (Figs. 3A and 3B). The form of the distal bowel in the completed anastomosis resembled extended wings and was named wing-shaped anastomosis. The mesenteric defect was closed, and tube jejunostomy proximal to the anastomosis was made using an 10 Fr. silicon rubber tube to decompress the anastomosis. No transanastomotic feeding tube was indwelled.

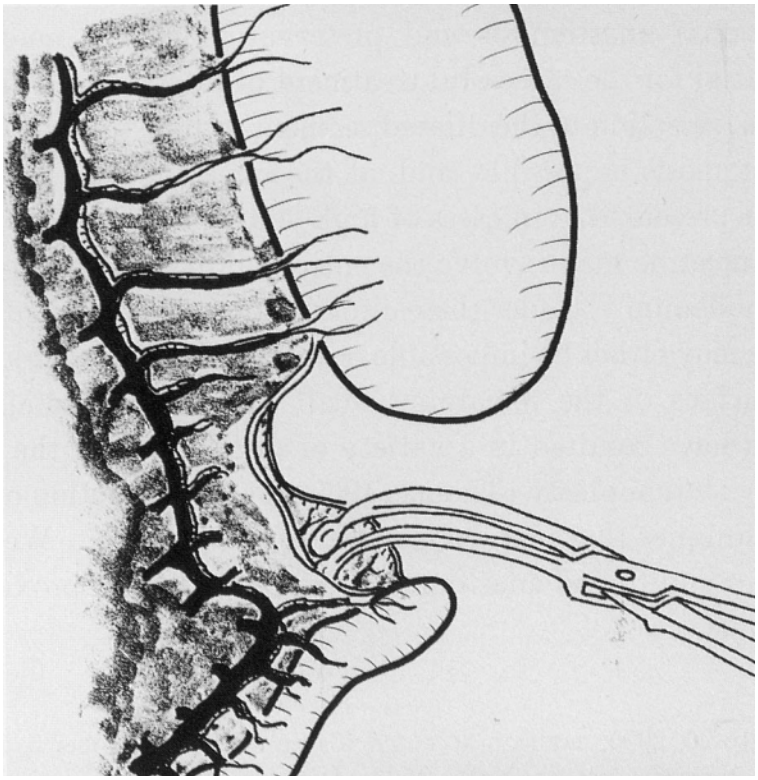

Fig. 1. The peritoneal leaves of the mesentery close to the border of the distal atretic bowel are dissected apart, allowing access to the vascular plane.

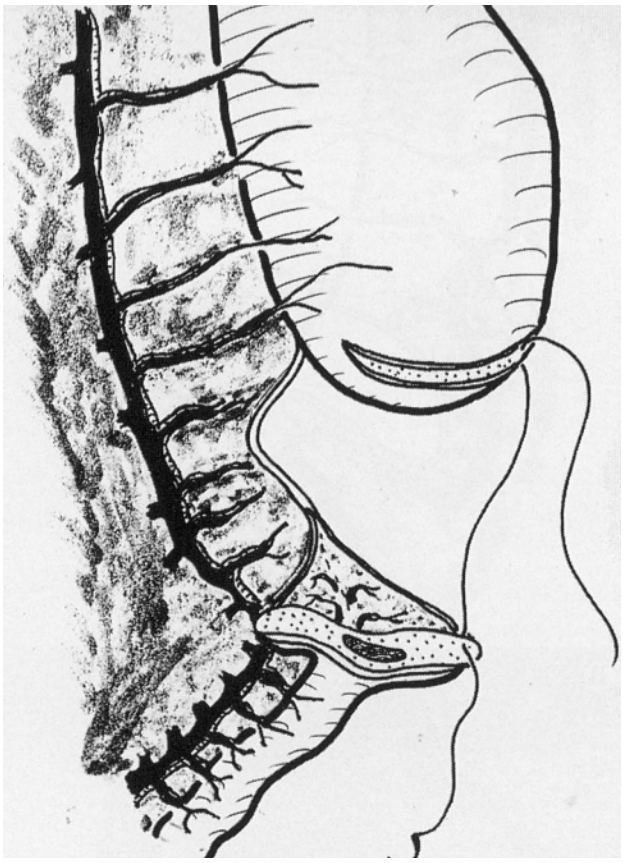

Fig. 2. The distal diminutive blind bowel is cut into two parts through the dissected mesenteric border of the bowel. An incision is then made at the blind tip of the proximal bowel in the right angle direction to the mesentery.

Results

Data on the infants who underwent wing-shaped anastomosis between 1986 and 1999 are summarized in Table 1. The sites of atresia were the high jejunum within 10 cm from the ligament of Treitz in six cases, the ileum in one case, and the colon in one case. The caliber ratio between proximal and distal atretic bowels ranged from 3.8 to 6.0 (mean: 5.1). Upper gastrointestinal contrast studies performed in case 1 showed considerable relief of anastomotic stenosis on postoperative day 20 compared with that on day 7 (Figs. 4A and 4B). Oral feeding in cases of high jejunal atresia was initiated between the 8th and 23th postoperative days (mean: 14.1 days), and intravenous hyperalimentation (IVH) was gradually weaned. IVH was stopped between the 15th and 30th postoperative days (mean: 20.2 days). The postoperative follow-up period was between 3 and 14 years (mean: 7.5 years) and all patients alive and well during the follow-up period. One infant (case 2) was re-explored on the 4th postoperative day because of minor anastomotic leakage. Since no blood flow disturbance in the anastomosis was recognized, the deficient region was resutured, and tube jejunostomy was made in the proximal dilated segment for decompression. Tube enterostomy proximal to the anastomosis was routinely added to the procedure of

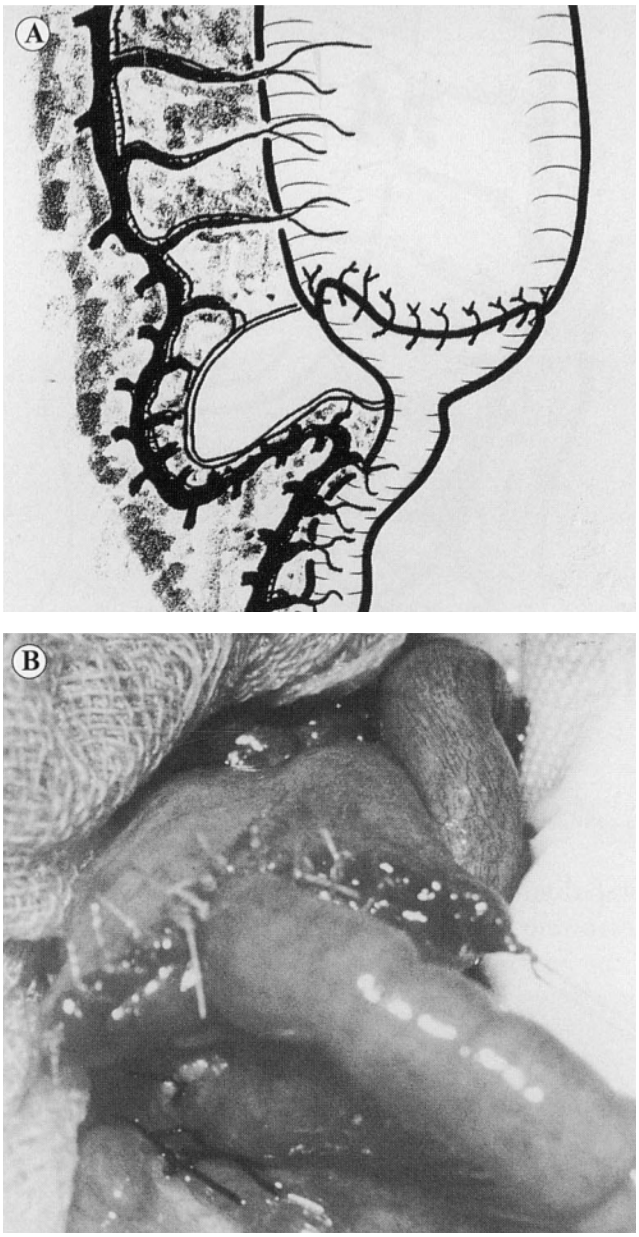

Fig. 3. A: End-to-end anastomosis between the proximal dilated and distal diminutive bowels is accomplished. The form of the distal bowel resembles extended wings. The mesenteric defect is not yet closed. B: Wing-shaped anastomosis in Case 1.

wing-shaped anastomosis, resulting in no subsequent anastomotic leakage.

Discussion

Many operative procedures have been devised for anastomosis between intestines with large caliber difference. The procedures can be fundamentally classified into two types: 1) widening of the caliber of the diminutive distal bowel and 2) reducing the caliber of the large proximal bowel. End-to-back, end-to-side and wing-shaped anastomoses presented this time belong to the first type, and tapering enteroplasty (Thomas 1969) followed by end-to-end anas-

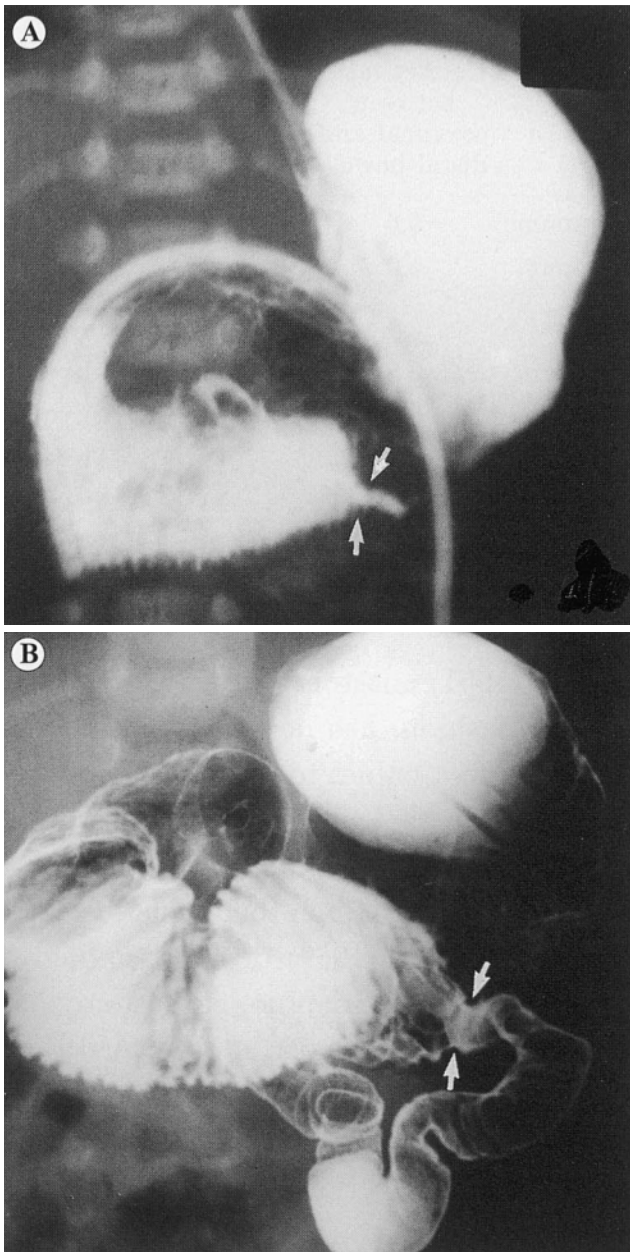

Fig. 4. A: Upper gastrointestinal contrast in case 1 shows marked anastomotic stenosis (arrows) still present on postoperative day 7. B: The anastomotic stenosis (arrows) has been considerably improved on postoperative day 20.

tomosis is the second type. A reducing procedure may involve both Gambee (1951) and Halsted (1887) methods.

End-to-back anastomosis (Benson et al. 1960; Nixon and Tawes 1971) shows neither technical problems nor postoperative anastomotic functional obstruction if the caliber ratio between the proximal and distal atretic bowels is not large. However, as the caliber ratio increases, longitudinal axial deviation between the proximal and distal bowels gradually becomes close to 90 degrees, resembling end-to-side anastomosis, which easily results in functional obstruction. It seems to be very difficult to perform functional end-to-back anastomosis in cases in which the caliber ratio is over 4 values.

TABLE 1. *Details of wing-shaped end-to-end anastomosis and subsequent assessment*

Case (No.)	Birth weight (kg)	Site of atresia	Caliber ratio between proximal and distal bowels	Fed postoperative day (days)	Result	Follow-up (years)
1	2.2	High jejunum	5.6	12	Alive and well	14
2	2.6	High jejunum	5.0	12	Suture insufficiency, resutured P.O. 4 days, alive and well	13
3	3.2	High jejunum	3.8	8	Alive and well	13
4	2.1	High jejunum	6.0	23	Alive and well	6
5	2.5	High jejunum	4.5	15	Alive and well	4
6	3.5	Colon	5.0	15	Alive and well	4
7	1.7	High jejunum	5.0	15	Alive and well	3
8	1.5	Ileum	6.0	6	Alive and well	3

Gambee's single-layer (1951) anastomosis, which was originally performed in an end-to-end anastomotic fashion, has no anastomotic axial deviation, but the caliber ratio must be limited to 4 values to perform this procedure safely (Kimura et al. 1980b). Halsted's aseptic anastomosis (1887) also results in no anastomotic axial deviation and is reported to be possible in cases with a caliber ratio of up to 5 values (Kimura et al. 1980a), although there must be a limit for its indication.

Tapering jejunoplasty (Thomas 1969) of the proximal dilated segment followed by construction of an end-to-end jejuno-jejunostomy has been reported to be useful (Howard and Othersen 1973; Thomas and Carter 1974; Grosfeld et al. 1979; Rescorla and Grosfeld 1985) for lesions with large caliber difference. However, this technique has possible disadvantages associated with anastomotic bowel motility caused by considerable resection of the proximal antimesenteric intestinal wall and consequent axial deviation, even if the completed anastomosis resembles end-to-end anastomosis. The intestinal plication method (deLorimier and Harrison 1983), devised as a modification of tapering jejunoplasty, is considered to be advantageous in terms of both minimal risk of leakage and preservation of the mucosal surface. However, a plicated intestine may cause intestinal immotility, and anastomotic axial deviation may remain as it does in orginal tapering jejunoplasty.

Wing-shaped anastomosis necessitates no bowel resection and is completed as exact end-to-end anastomosis, resulting in early initiation of oral feeding. The technical characteristics of this anastomosis include both distal bowel dissection of the mesentery (Bianchi 1980) and division of the bowel. Dissection of the mesentery is performed easily and safely. The number of vessels and their arcades in the jejunum and colon is small compared with that in the ileum, necessitating meticulous manipulations to preserve smaller vessels as carefully as possible. One-layer suture facilitates wide anastomosis and avoids injury to the

vessels penetrating the bowel wall on the mesenteric side. The tips of both wings of the distal bowel end seem prone to blood flow disturbance, but anastomotic leakage, which was seen in only one case (case 2), was caused not by necrosis but by elevation in intra-luminal pressure proximal to the anastomosis, suggesting that sufficient blood flow was maintained in the region. To prevent anastomotic leakage, decompression of the proximal dilated segment is indispensable, and this is achieved by tube enterostomy in which a sufficiently thick tube is available and dislodgement of the tube is avoidable.

Nixon's experimental and clinical studies (1960, 1971) favored elective resection of the proximal dilated segment on the basis of increased diameter relative to dilatation and muscular hypertrophy resulting in ineffective perstalsis. However preservation of the dilated segment in the presented anastomosis technique did not preclude early functional recovery of the anastomosis, suggesting that resection of the dilated segment is not always necessary. There was no delayed anastomotic function in any of the babies with ileal and colonic atresia on whom this technique was performed.

Wing-shaped anastomosis developed for anastomosis of the bowels with large caliber difference results in no axial deviation between anastomosed bowels and needs no bowel resection, contributing to early functional recovery of the anastomosis and preserving the mucosal absorptive surface.

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