

The Results of Strictureplasty in Pediatric Patients with Multifocal Crohn's Disease

L. Oliva, R. Wyllie, F. Alexander, M. Caulfield, R. Steffen, I. Lavery, and V. Fazio

The Cleveland Clinic Foundation, Cleveland, Ohio, U.S.A.

Summary: This study is a retrospective review of eight pediatric patients with multifocal intestinal Crohn's disease who underwent strictureplasty with or without concomitant bowel resection between January 1978 and April 1992. The patients ranged in age from 9.9 years to 18.5 years. Indications for surgery were partial intestinal obstruction ($n = 6$), failure of medical therapy or steroid dependence ($n = 4$), growth failure ($n = 2$), and enterocutaneous fistula ($n = 2$). Thirty-six strictureplasties were performed in the eight patients (median, 4.5 strictureplasties per patient; range, 1-12). Bowel resection was performed in six of the eight patients in areas where strictureplasty was not feasible. The mean length of resection was 40 cm (range, 15-82 cm). The only complication was intestinal hemorrhage, which was conservatively managed in two patients. The patients were followed for a mean of 19 months (range, 3-55 months). Five patients had a weight below the fifth percentile prior to

surgery. Postoperatively, there was a weight gain in seven patients, including all five patients who were originally below the fifth percentile. A statistically significant weight gain was found when a paired t test analysis was applied to the entire group ($p = 0.04$). Five of six patients who were on steroid medication at the time of surgery were successfully weaned within 1.5-3 months (mean, 2.3 months) from the time of surgery. Seven of eight patients had relief of their intestinal symptoms. Strictureplasty with small-bowel resection, or perhaps strictureplasty alone, in pediatric patients with multifocal intestinal Crohn's disease can improve gastrointestinal symptoms, promote weight gain, and allow discontinuation of steroid medications. Strictureplasty should be considered for patients who are refractory to medical therapy or dependent on chronic steroid medication for control of their symptoms. **Key Words:** Crohn's disease—Strictureplasty—Bowel resection—Small intestine—Steroids.

Multifocal intestinal Crohn's disease occurs in 12-35% of patients with Crohn's disease (1). In these patients, surgical resection has generally not been attempted because of the risk of producing short-bowel syndrome. Another concern has been the likelihood of a recurrence following surgery, necessitating the use of steroid medications or further operative intervention (2,3). Strictureplasty offers an alternative to surgical resection in pediatric patients with Crohn's disease that can resolve intestinal symptoms without causing loss of absorptive surface area.

In 1977, Katariya first reported the successful

performance of strictureplasty on tuberculous enteric strictures (4,5). This procedure was subsequently applied to the treatment of Crohn's disease in adults by Lee and Alexander-Williams (6). Many reports (1,2,4,6-13) have described the use of strictureplasty in adults with Crohn's disease, but to our knowledge it has not been reported heretofore in pediatric patients with Crohn's disease. Therefore, we decided to evaluate the effectiveness of strictureplasty in the management of young patients with Crohn's disease.

PATIENTS AND METHODS

We reviewed the charts of eight pediatric patients with Crohn's disease who underwent strictureplasty at the Cleveland Clinic Foundation from January 1987 to April 1992. Additional information was obtained by phone calls to the patients and their

Address correspondence and reprint requests to Dr. R. Wyllie, Section of Pediatric Gastroenterology, Cleveland Clinic Foundation, 9500 Euclid Avenue, Cleveland, OH 44195, U.S.A.

Received February 5, 1993; revisions received July 1, 1993, August 31, 1993; accepted September 1, 1993.

primary physicians. The mean duration of follow-up was 19 months (range, 3–55 months). Parameters reviewed include early and late surgical complications, length of hospital stay, weight, overall health, and ability to be weaned from steroid medications.

RESULTS

Demographics and indications for surgery are outlined in Table 1. The group included eight Crohn's patients who had undergone strictureplasties (six girls and two boys). Their mean age was 15.8 years (range, 9.9–18.5 years). Indications for surgery included partial small-bowel obstruction ($n = 6$), steroid dependency ($n = 4$), growth retardation not responsive to medical therapy including enteral nutrition ($n = 2$), and enterocutaneous fistula ($n = 2$).

A total of 36 strictureplasties were performed. The mean number per patient was 4.5 (range, 1–12) (Table 2). The mean cumulative length of the strictureplasties was 35 cm (range, 7–80 cm) per patient. Bowel resection was performed in six patients in areas where strictureplasty was not technically feasible. The mean length of resected bowel was 40 cm (range, 10–82 cm). The indication for resection included indurated, fibrous bowel at the stricture site

TABLE 1. Demographics and indications for surgery

Patient	Sex	Age at surgery (yr)	Duration of disease prior to surgery (mo)	Indication for surgery
1	f	17.8	78	Obstruction, steroid dependency
2	f	14.8	90	Growth failure, steroid dependency
3	f	15.7	48	Obstruction, enterocutaneous fistula
4	f	18.5	22	Obstruction, steroid dependency
5	m	18.3	108	Obstruction, enterocutaneous fistula
6	m	15.6	67	Growth failure
7	f	9.9	16	Obstruction
8	f	15.7	58	Obstruction, steroid dependency

TABLE 2. Surgical procedures

Patient	Number of strictureplasties	Indication for resection	Length of small-bowel resection (cm)	Length of strictureplasties (cm)
1	12	A	18	60
2	6	—	0	80
3	6	B, C	65	30
4	3	D	10	26
5	1	A, B, C, D, E	82	8
6	4	A, B	15	24
7	1	—	0	7
8	3	D	36	48
Total	36		226	283

Reason for resection: (A) ileocecal region, (B) phlegmonous inflammation, (C) fistula, (D) indurated bowel, (E) multiple strictures in a short segment.

($n = 3$), strictures located in the ileocecal area ($n = 3$), acute phlegmonous inflammation at the stricture site ($n = 2$), fistulae ($n = 2$), or multiple strictures in a short segment of bowel. Patients were discharged within 4–12 days of surgery (mean, 8.75 days).

Z scores were used to evaluate the nutritional status of each patient postoperatively; they were calculated from the weights obtained at each follow-up visit. The Z score, which denotes the units of standard deviation from the mean, is defined as $Z = (x - X)/SD$, where x is the patient's weight, X is the mean weight for age, and SD represents the standard deviation of X (14). A Z score of zero is equal to the mean for age. The paired t test was performed to evaluate the statistical significance of the change in Z scores (Table 3).

As a group, the patients demonstrated a statistically significant weight gain following surgery ($p = 0.04$). Figure 1 illustrates the changes in Z scores over time for each of the eight patients. All but one

TABLE 3. Analysis of Z scores

Patient	Preoperative Z score	Last postoperative Z score	Differences in Z scores
1	-1.29323	-1.07813	0.21510
2	-1.77679	-1.04464	0.73215
3	-1.81897	-1.16406	0.65491
4	-0.84375	-0.71094	0.13281
5	-2.08209	-0.70896	1.37313
6	-2.32143	-1.42623	0.89520
7	-0.89333	-1.29762	-0.40429
8	-0.72414	-0.44828	0.27586
Mean	-1.46922	-0.98486	0.48436 ^a

^a p value = 0.040.

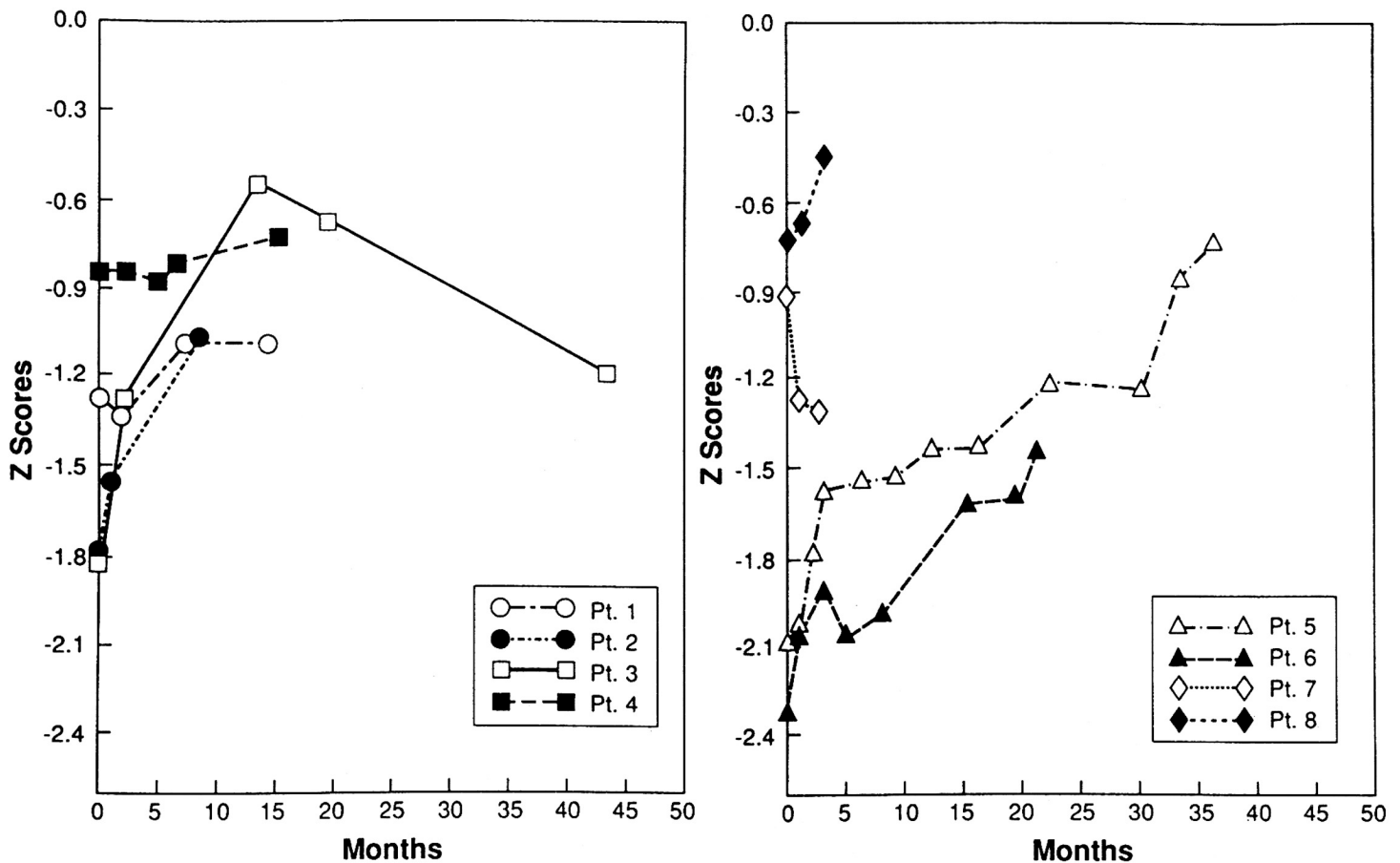


FIG. 1. Postoperative changes in Z scores.

patient reported an improvement in symptoms, including reduced abdominal pain, diarrhea, and increased appetite. Of the six patients who were on steroid medication at the time of surgery, five were completely weaned within a mean period of 2.3 months (range, 1.5–3 months) postoperatively.

DISCUSSION

Surgical intervention is indicated in patients with Crohn's disease whose course has been complicated by fistulas, intraabdominal abscess, bowel obstruction, or who are refractory to medical therapy. In addition, patients who are dependent on high-dose steroid medication or who develop complications such as bone disease, cataracts, or growth failure should be assessed for possible surgical intervention (15,16).

The most commonly performed stricturoplasties include the Heineke-Mikulicz stricturoplasty, used for strictures <10 cm in length, and the Finney stricturoplasty, used for strictures >10 cm and ≤30 cm in length (1,2,4,7,8,11). Other types of stricturoplasties include the Judd stricturoplasty, used in patients with ileal fistulas, and the Walske-Neumayer

stricturoplasty, used for strictures that are 6–25 cm in length (Fig. 2).

The relative contraindications to stricturoplasties include presence of phlegmonous inflammation, perforation, intestinal abscess, multiple strictures in a short segment of bowel, stricture close to an area that is being resected, thickening and rigidity of the bowel that makes side-to-side anastomosis hazardous, and internal or external fistulas arising from a site of Crohn's disease (1,2,6). Stricturoplasty is not recommended for colonic strictures; therefore, strictures located in the ileocecal region are usually resected (6). Ultimately, the decision to resect a segment of bowel or perform a stricturoplasty is made by the surgeon intraoperatively.

The incidence of complications following stricturoplasty is comparable to that following resection (4,7). Postoperatively, two of our patients had evidence of gastrointestinal bleeding. Patient 4 had a drop in hemoglobin of 2.3 gm/dl over a 6-day period. No other signs or symptoms were noted, and no intervention was undertaken. Patient 8 had abdominal pain on the 5th postoperative day accompanied by melanic stools and dizziness. She had a drop in hemoglobin of 2.5 gm/dl and was transfused

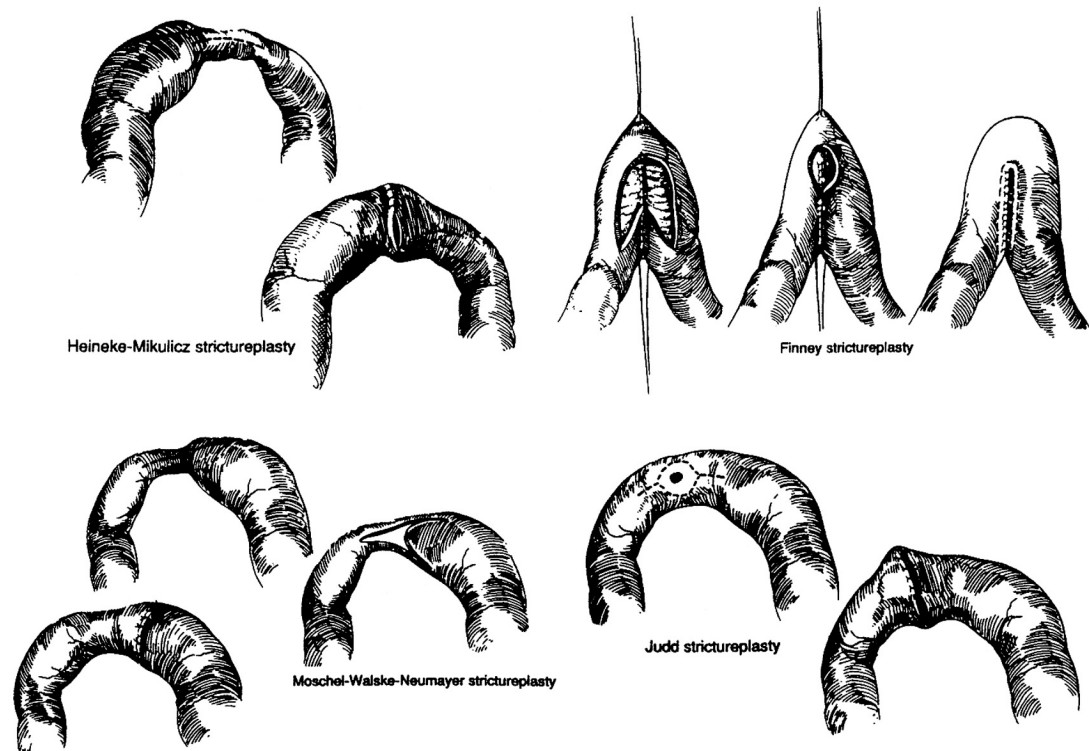


FIG. 2. Types of strictureplasties.

with three units of packed red blood cells. There was no further evidence of hemorrhage, and no additional therapy was required.

It appears that the overall frequency of recurrent disease or stricture at the site of the previous strictureplasty is no different from that encountered with resection. Sayfan et al. compared 173 resection sites to 129 strictureplasty sites over 60 months and found no significant difference in the prevalence of re-stricture (17). Crohn's exacerbation occurred in patients 3 and 6 at 8 and 7 months after surgery, respectively. Remission was obtained in both patients after a short course of steroids (<30 days). Anecdotal reports have described complete healing without evidence of active Crohn's disease in areas of the bowel that had undergone previous strictureplasty (1,7). These cases included strictureplasties performed on bowel that was inflamed at the time of surgery. Preservation of diseased bowel has not been associated with early recrudescence at the strictureplasty site (17).

Growth retardation is common in children with Crohn's disease. It has been reported in 15–40% of this population (15). The etiology of growth failure in Crohn's is multifactorial, but it is related in part to poor nutritional intake. Many reports have demonstrated that such growth failure can be reversed by supplementary enteral or parenteral feeding (18–22). Although the procedure is controversial, resection of affected bowel may lead to "catch-up

growth" in the growth-retarded pediatric patient with Crohn's disease (23–27). Although serial height measurements were not obtained for our patients, strictureplasty in conjunction with resection was associated with weight gain in seven of eight patients. Of the two patients who had strictureplasty alone, one demonstrated a significant weight gain. In addition, an overall improvement in symptoms was reported by seven of the eight patients.

Strictureplasty is a bowel-sparing alternative to multiple resections in patients with diffuse or multifocal intestinal Crohn's disease that is unresponsive to medical therapy. It may also be considered for patients whose disease is controlled with medications but who suffer significant side effects. Most patients demonstrated weight gain and relief of symptoms, and most were able to discontinue steroid medications. Further prospective studies are warranted to assess the long-term effectiveness of strictureplasty in children with Crohn's disease.

REFERENCES

1. Fazio VW, Galandiuk S, Jagelman DG, Lavery IC. Strictureplasty in Crohn's disease. *Ann Surg* 1989;210:621–5.
2. Dehn TC, Kettlewell MG, Mortensen NJ, Lee EC, Jewell DP. Ten-year experience of strictureplasty for obstructive Crohn's disease. *Br J Surg* 1989;76:339–41.
3. Greenstein AJ, Sachar DB, Pasternack BS, Janowitz HD. Reoperation and recurrence in Crohn's colitis and ileocolitis. *N Engl J Med* 1975;293:685–90.
4. Alexander-Williams J, Haynes IG. Conservative operations

- for Crohn's disease of the small bowel. *World J Surg* 1985; 9:945-51.
5. Katariya RN, Sood S, Rao PG, Rao PL. Stricture-plasty for tubercular strictures of the gastro-intestinal tract. *Br J Surg* 1977;64:496-8.
 6. Fazio VW. Conservative surgery for Crohn's disease of the small bowel: the Role of Strictureplasty. *Med Clin North Am* 1990;74:169-81.
 7. Alexander-Williams J, Haynes IG. Up to date management of small bowel Crohn's disease. *Adv Surg* 1987;20:245-64.
 8. Silverman RE, McLeod RS, Cohen Z. Strictureplasty in Crohn's disease. *Can J Surg* 1989;32:19-22.
 9. Gaetini A, DeSimone M, Resegotti A. Our experience with strictureplasty in the surgical treatment of Crohn's disease. *Hepato-gastroenterology* 1989;36:511-5.
 10. Kendall GP, Hawley PR, Nicholls JR, Lennard-Jones JE. Strictureplasty. A good operation for small bowel Crohn's disease? *Dis Colon Rectum* 1989;29:312-6.
 11. Whelan PJ, Saibil FG, Harrison AW. New options in the surgical management of Crohn's disease. *Can J Surg* 1987; 30:133-6.
 12. Lee EC, Papaioannou N. Minimal surgery for chronic obstruction in patients with extensive or universal Crohn's disease. *Ann R Coll Surg Engl* 1982;64:229-33.
 13. Andrews HA, Keighley MR, Alexander-Williams J, Allan RN. Strategy for management of distal ileal Crohn's disease. *Br J Surg* 1991;78:679-82.
 14. Frisancho AR. Anthropometric standards. In: Frisancho AR, ed. *Anthropometric standards for the assessment of growth and nutritional status*. Ann Arbor: Univ. of Michigan, 1993;37-118.
 15. Michener WM, Wyllie R. Management of children and adolescents with inflammatory bowel disease. *Med Clin North Am* 1991;74:103-17.
 16. O'Donoghue DP, Dawson AM. Crohn's disease in childhood. *Arch Dis Child* 1977;52:627-32.
 17. Sayfan J, Wilson DA, Allan A, Andrews H, Alexander-Williams J. Recurrence after strictureplasty or resection for Crohn's disease. *Br J Surg* 1989;76:335-8.
 18. Morin CL, Roulet M, Roy CC, Weber A, Lapointe N. Continuous elemental enteral alimentation in children with Crohn's disease and growth failure. *Gastroenterology* 80;3:194-9.
 19. Belli DC, Seidman AM, Bouthillier L, et al. Chronic intermittent elemental diet improves growth failure in children with Crohn's disease. *Gastroenterology* 1988;94:603-10.
 20. O'Morain C, Segal AM, Levi AJ, Valman HB. Elemental diet in acute Crohn's disease. *Arch Dis Child* 1983;58:44-7.
 21. Rault RM, Scribner BH. Treatment of Crohn's disease with home parenteral nutrition. *Gastroenterology* 1977;72:1249-52.
 22. Strobel CT, Byrne WJ, Ament ME. Home parenteral nutrition in children with Crohn's disease: an effective management alternative. *Gastroenterology* 1979;77:272-9.
 23. McLain BI, Davidson PM, Stokes KB, Beasley SW. Growth after gut resection for Crohn's disease. *Arch Dis Child* 1991; 65:760-2.
 24. Lipson AB, Savage MO, Davies PS, Bassett K, Shand WS, Walker-Smith JA. Acceleration of linear growth following intestinal resection for Crohn's disease. *Eur J Pediatr Surg* 1991; 149:687-90.
 25. Guttman FM. Granulomatous enterocolitis in childhood and adolescence. *J Pediatr Surg* 1974;9:115-21.
 26. Wesson DE, Shandling B. Results of bowel resection for Crohn's disease in the young. *J Pediatr Surg* 1981;16:449-52.
 27. Frey CF, Weaver DK. Colectomy in children with ulcerative and granulomatous colitis. *Arch Surg* 1972;104:416-23.