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Strictureplasty for Crohn's Disease: Techniques and Long-term Results

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Abstract. Strictureplasty for treatment of symptomatic intestinal strictures secondary to Crohn's disease is being performed with increasing frequency. To determine the overall clinical results after strictureplasty for Crohn's disease, all patients undergoing this procedure were prospectively studied. Between 6/1/89 and 2/1/97, 57 Crohn's disease patients underwent 60 operations utilizing strictureplasties. A total of 109 strictureplasties were performed (90 Heineke-Mikulicz, 6 Finney, and 13 side-to-side isoperistaltic). The 30-day perioperative morbidity was 12%, with complications being less common for patients undergoing elective versus unscheduled operations ($p < 0.002$). Recurrence of Crohn's disease requiring operation was seen in seven patients after a mean follow-up of 38 months. The estimated cumulative recurrence rate after 2 years was 15 ± 6% (± standard error) and 22 ± 10% at 5 years. A recurrence developed at the site of the previous strictureplasty in only five cases. Strictureplasty is a safe, effective means of providing long-term surgical palliation to selected patients with Crohn's disease. Perioperative complication rates are comparable to those seen with standard surgical treatment, and recurrences are not excessive.

Crohn's disease is a chronic inflammatory condition of unknown etiology that can affect any segment of the gastrointestinal tract. Although medical treatment is often effective in ameliorating symptoms, most patients with Crohn's disease ultimately require surgery as part of the treatment of their disease. Even though surgery typically results in long-term symptomatic relief, surgical treatment of Crohn's disease cannot be considered curative, as postsurgical recurrences are frequent and long-term reoperative rates for abdominal Crohn's disease have been reported to be as high as 30% to 60% [1–3]. Due to the recurrent nature of Crohn's disease, repeated resections have often been performed. With multiple resections, however, a considerable length of small bowel may be lost, giving rise to the potential for intestinal insufficiency and the short gut syndrome.

In an attempt to avoid the debilitating consequences of the short gut syndrome, intestinal strictureplasty for Crohn's disease strictures is being performed with greater frequency. Reports to date have been encouraging, although the safety and efficacy of this surgical approach to intestinal strictures secondary to Crohn's disease are still being established. Because strictureplasty does not remove the diseased segments, the potential for rapid symptomatic recurrence has been a concern. Additionally, the likelihood for perioperative complications related to the placement of suture lines in diseased tissue has been debated. To address these issues we prospectively analyzed all patients undergoing intestinal strictureplasty for Crohn's disease at the University of Chicago.

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Materials and Methods

Between 6/1/89 and 2/1/97 the authors performed 578 operations on 530 consecutive patients suffering from Crohn's disease. During this period 57 patients underwent 60 procedures (10% of total cases) that involved creation of at least one intestinal strictureplasty. Data pertaining to the surgical treatment of all patients were collected prospectively. Prior to operation the patients were interviewed by the attending surgeon and by a nurse-clinician specialized in the management of inflammatory bowel disease patients. Details of the patient's surgical history, preoperative physical findings, and current indications for operation were recorded. At the time of operation the length of resected small bowel and the length of residual small bowel were measured prior to closure of the abdominal wound. At the completion of the procedure the surgical findings and type of operation performed were recorded. Early surgical outcomes, including length of stay, and perioperative complications were recorded prospectively. Procedures were classified as urgent if the patient's condition required immediate operative intervention, deferable if the procedure could be delayed yet the patient's condition required hospitalization prior to surgery, and elective if the procedure was scheduled from the outpatient clinic. All patients were followed for a minimum of 30 days postoperatively. Patients were available for long-term follow-up in 58 (97%) of the 60 strictureplasty cases. Mean follow-up for the strictureplasty patients was 38 months (range 3–95 months).

The type of strictureplasty performed depended on the length of intestine effected by stenosis. For stenoses 7 cm or less in length the Heineke-Mikulicz technique was typically performed [4] (Fig. 1). For a stenosis between 7 and 15 cm a Finney strictureplasty was selected [5] (Fig. 2). In cases of longer strictures or where multiple strictures were closely grouped over a lengthy segment, a side-to-side isoperistaltic strictureplasty was performed [6] (Fig. 3). Strictureplasties were not performed in the presence of acutely inflamed phlegmonous intestinal segments, generalized intraabdominal sepsis, or for a long, tight stricture with a thick, unyielding intestinal wall.

All data were transcribed onto a relational database software program for subset query extraction and analysis (Paradox 7.0,

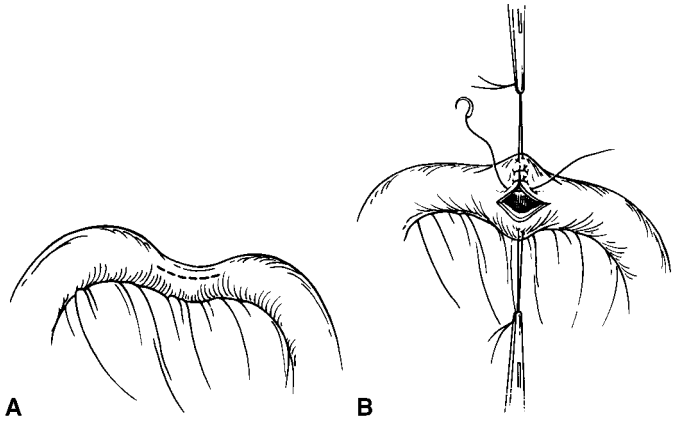

Fig. 1. Heineke-Mikulicz strictureplasty for short stenosis. Adapted from Fazio et al. [4] with permission of Lippincott-Raven.

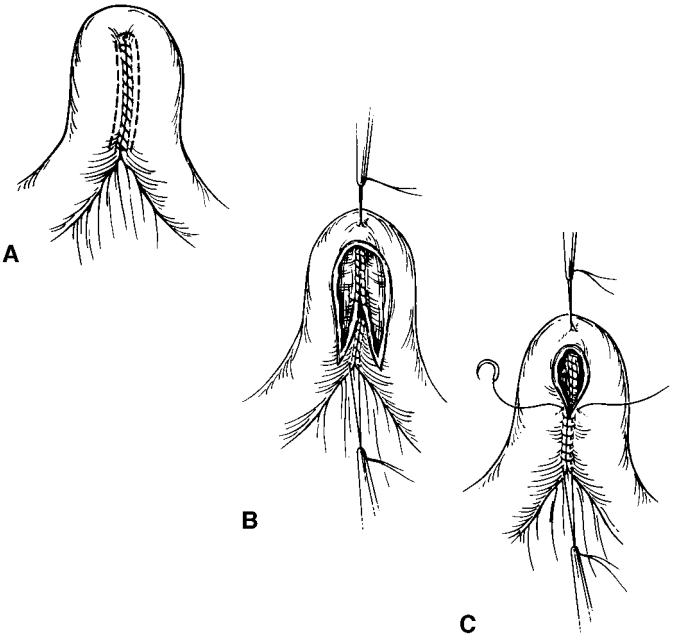

Fig. 2. Finney strictureplasty for stenosis longer than 7 to 8 cm.

Borland International, Scotts Valley, CA, USA). Where appropriate, nominal variables were compared using a single-tailed Fisher exact test. Statistical calculations were made with the aid of a statistical software package (SigmaStat 2.0 for Windows; Jandel, San Rafael, CA, USA). Life-table analysis was performed utilizing the technique of Kaplan-Meier. Mean values are expressed as mean ± SEM.

Results

Among the 57 patients undergoing strictureplasties, there were 35 men and 22 women with a mean age of 39 ± 1 years (range 18–72 years). Fifty-five patients underwent one operation that utilized one or more strictureplasties; one patient had two operations where strictureplasties were utilized, and one patient underwent

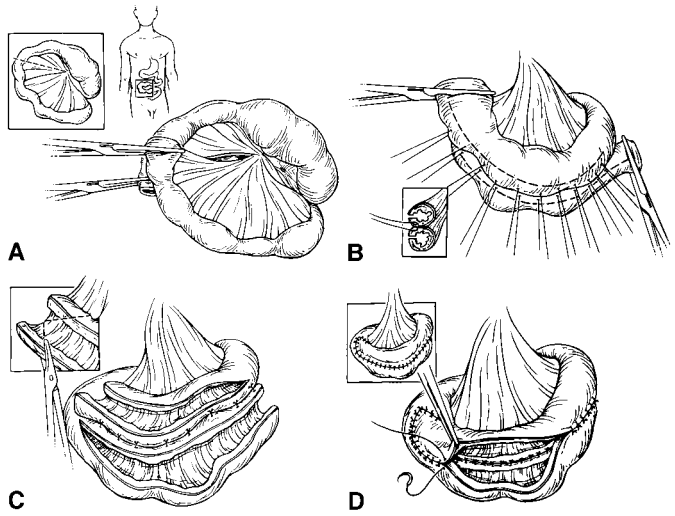

Fig. 3. Side-to-side isoperistaltic enteroenterostomy for stenosis and skip lesions of combined length of up to 30 cm. Adapted from Michelassi [6] with permission of Williams & Wilkins.

Table 1. Number of abdominal surgeries for Crohn's disease prior to strictureplasty.

No. of previous surgeries	No. of cases
0	15
1	19
2	15
3	4
4	4
5	1
6	1
7	1

three operations with strictureplasties for a total of 60 procedures. For these 60 procedures the primary indication for the operation was treatment of obstructive symptoms: chronic obstructive symptoms unresponsive to medical management (n = 49) or acute high-grade, partial or complete intestinal obstruction (n = 11). A total of 49 strictureplasties were performed on an elective basis, and 11 were classified as deferable. No strictureplasties were performed on an emergent basis. In 15 cases strictureplasty was performed at the patient's first abdominal surgery for Crohn's disease with 45 patients having undergone one or more previous abdominal procedures (Table 1). In total, 90 Heineke-Mikulicz type, 6 Finney, and 13 isoperistaltic side-to-side strictureplasties were performed for a total of 109 strictureplasties. This yielded a mean of 1.8 strictureplasties per procedure (range 1–7 strictureplasties per procedure).

Most of the strictureplasties was performed on small bowel stenoses, although nine stenotic ileocolic anastomoses and one isolated stricture of the ascending colon were also managed by strictureplasty (Table 2). In the 60 strictureplasty cases, simultaneous small bowel resections were performed in 40 (67%). The mean length of resected small bowel was 36 ± 5 cm (range 10–132 cm). For all 60 cases the mean length of residual small bowel measured at the completion of operation was 302 ± 15 cm (86–620 cm).

Strictureplasties were not performed on intestinal segments

Table 2. Location of disease treated with strictureplasty.

Intestinal segment	No. of cases
Ileum	33
Jejunum	9
Jejunum and ileum	8
Ascending colon	1
Ileocolic anastomosis	9

involved with fistulas or abscesses. However, the presence of these Crohn's-related complications was not considered a contraindication to strictureplasty of disease segments elsewhere in the gastrointestinal tract. Thus simultaneous enteroenteric fistulas were identified in 12 cases and intraabdominal or pelvic abscesses in five cases in which strictureplasty was performed. In all 60 cases patients experienced complete resolution of Crohn's-related symptoms and were tolerating a normal diet within 30 days after surgery.

A total of seven perioperative complications occurred with seven operations, yielding a 30-day perioperative morbidity rate of 12%. There were no deaths. The most common early postoperative complication was partial or complete small bowel obstruction, occurring in three cases. One of these patients required surgical adhesiolysis, and the other two were managed with nasogastric decompression. Two patients suffered from prolonged ileus (>5 days). Two patients suffered from complications directly attributable to the strictureplasty. Gastrointestinal hemorrhage, presumable from the strictureplasty site, occurred in one patient, requiring transfusion of 2 units of packed red blood cells. In one patient a Heineke-Mikulicz type strictureplasty dehisced, resulting in peritonitis. It required resection of the strictureplasty site and creation of a temporary ileostomy. The complication rate for deferable cases were significantly higher than for elective cases (45% vs. 4%, respectively; $p < 0.002$). None of the five patients with Crohn's-related intraabdominal or pelvic abscesses suffered from early postoperative complications. The complication rate for patients with enteroenteric fistulas was similar to that for patients without fistulas (17% vs. 10%, respectively; $p = 0.43$).

For all patients undergoing strictureplasty, the mean length of postoperative stay was 10 ± 1 days with a median of 8 days and a range of 4 to 40 days. Of the 58 cases available for long-term follow-up, there were seven recurrences of Crohn's disease requiring abdominal surgery. The mean time to surgical recurrence in these seven cases was 30 months (range 10–67 months). At 2 years the recurrence rate was calculated at 15% with a standard error of 6%. At 5 years the recurrence rate was 22% with a standard error of 10% (Fig. 4). Life-table analysis utilizing the Mantel-Haenszel comparison technique failed to demonstrate any effect of sex, urgency of operation, or the simultaneous performance of small bowel resection on the long-term recurrence rates after strictureplasty.

Five of the seven surgical recurrences occurred at the site of a previous strictureplasty, requiring resection of the strictureplasty in each instance. In the remaining two cases of surgical recurrence, the previous strictureplasty was not involved with active Crohn's disease at the time of reoperation.

For the 13 patients undergoing isoperistaltic side-to-side strictureplasty, there were no perioperative complications. After a mean follow-up of 27 months (range 3–63 months) one patient

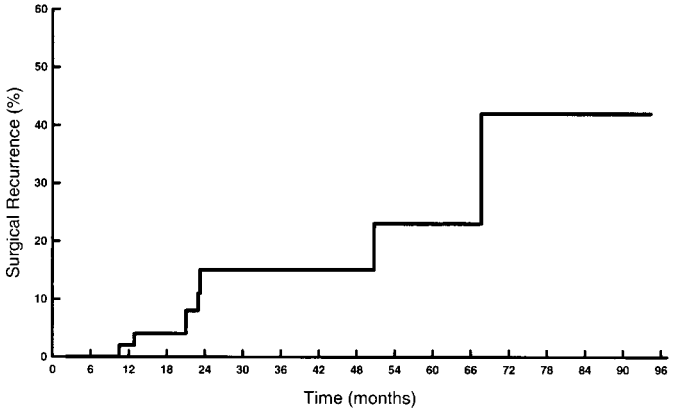

Fig. 4. Kaplan-Meier estimate of the rate of intraabdominal recurrence requiring operation after intestinal strictureplasty.

experienced a surgical recurrence of Crohn's disease after 21 months. This recurrence, however, did not involve the site of the old strictureplasty and was limited to the colon.

Among the nine patients undergoing strictureplasty of an ileocolonic anastomosis, one perioperative complication occurred: adhesive small bowel obstruction requiring surgical lysis of adhesion. Additionally, one of these patients suffered from a surgical recurrence of Crohn's disease 10 months after strictureplasty of an ileocolonic anastomosis, and this recurrence required resection of the old strictureplasty site.

Discussion

Intestinal strictureplasty was first reported by Katariya et al. as a means of treating ileal strictures secondary to intestinal tuberculosis [7]. Lee and Papaioannou were the first to report on the use of strictureplasty for the treatment of intestinal strictures resulting from Crohn's disease [8]. Since this initial report, intestinal strictureplasties have been gaining support as an alternative to resection, particularly for patients who may be at risk for developing the short gut syndrome.

When managing abdominal Crohn's disease the surgeon must consider the natural history of the disease. Long-term reoperative rates have been reported to be as high as 60%. Greenstein et al. have reported that patients undergoing resection of small bowel are at particularly high risk for recurrence [1]. With each subsequent resection the patient is placed at increased risk for vitamin B_{12} and folate deficiencies, anemia, diarrhea, chronic malnutrition, and in some cases the short bowel syndrome severe enough to require home hyperalimentation. Given the recurrent nature of Crohn's disease, the goal of the surgeon must be to alleviate the symptoms while striving to avoid postsurgical morbidity. The use of nonresectional options such as strictureplasty can be a valuable tool for meeting these goals.

With the introduction of strictureplasty questions regarding the early postoperative morbidity have been raised. Unlike resections where diseased tissue is removed to grossly normal margins and anastomotic suture lines are placed in healthy tissue, strictureplasties are typically placed within scarred and diseased tissue. Despite this, however, perioperative morbidity with strictureplasty is low. The overall early complication rate of 12% for the 60

procedures utilizing strictureplasty in this study is lower than that in several reported series for all patients undergoing abdominal surgery for Crohn's disease [9–13]. Among the seven complications that occurred, only two could be directly attributed to the strictureplasty. One patient suffered from gastrointestinal hemorrhage presumably from the site of strictureplasty and one patient suffered from dehiscence of the strictureplasty. In a large series Ozuner and Fazio likewise found strictureplasty-related complications to be low, with postoperative gastrointestinal hemorrhage occurring in 9.3% of cases [14]. In most instances this hemorrhage can be managed conservatively, as was possible in the one patient in our study. The single strictureplasty dehiscence from the total 60 cases yielded a leak rate of 1.7%, which compares favorably with other published studies where septic complications such as strictureplasty dehiscence, intraabdominal abscess, and fistula have been reported to occur in 3% to 9% of cases [4, 15].

Because diseased tissue is retained after strictureplasty, the possibility of rapid, frequent symptomatic recurrence has been raised. Current available data, however, suggest that surgical recurrence after strictureplasty is not excessively rapid or frequent [16–20]. The 2-year recurrence rate of 15% and 5-year recurrence rate of 22% reported in this study are similar to figures from other reported series of strictureplasty [16] and similar to reoperation rates reported for all patients with abdominal Crohn's disease [1, 2, 21].

Although recurrence is often part of the natural history of Crohn's disease, it has also been noted that when disease recurs it often involves a length of intestine similar to that affected by Crohn's disease prior to the resection [22]. Therefore it seems logical that patients with long-segment disease or multifocal disease are at highest risk for short gut syndrome not only from the initial resection but from any likely recurrence of disease. It is this group of patients who would seem most likely to benefit from nonresectional strategies such as strictureplasty. To manage such patients, innovative strategies must be employed. Multiple Heineke-Mikulicz strictureplasties can often be effective. However, when multiple strictureplasties are located in close proximity to each other, only short segments of normal intestine may separate one strictureplasty from another, with the consequent formation of a bulky and relatively unyielding intestinal segment, which can lead to considerable tension on each suture line. Longer strictures can often be managed with a Finney-type intestinal strictureplasty, and even when feasible the Finney strictureplasty may simply result in a functional intestinal bypass with a sizable lateral diverticulum that could be at risk for bacterial overgrowth. The side-to-side isoperistaltic strictureplasty is a means of managing long-strictured segments or segments with multiple short strictures without the technical and functional consequences of multiple Heineke-Mikulicz or Finney strictureplasties [6]. For the 13 side-to-side isoperistaltic strictureplasties reported in this study, there were no perioperative complications; and after a mean follow-up of 27 months, no reoperations have been required for recurrence at the site of the strictureplasty. Further follow-up is necessary, but the side-to-side isoperistaltic strictureplasty appears to be a promising technique for management of the most difficult long-segment or multiple-segment stricturing disease.

Although strictureplasty is an excellent option for many cases of abdominal Crohn's disease, intestinal resections are still required in most cases [23]. Even among the 60 procedures in this study for which strictureplasty was performed, two-thirds of the cases required simultaneous intestinal resection for the disease not amenable to strictureplasty. Diseased segments involving fistulas, deep sinus formation, or abscesses are best managed with resection. Additionally, long high-grade strictures with a thick, unyielding intestinal wall are often not amenable to strictureplasty and therefore require resection.

Strictureplasty can be safely performed in patients who develop recurrence of Crohn's disease with stricturing at an anastomotic site, as indicated by the nine cases reported in this study. Additionally, Tjandra and Fazio reported on the use of strictureplasty for management of anastomotic strictures, with similar good results [24].

It has been suggested that the active disease left in situ with strictureplasty may have a long-term deleterious effect by placing the patient at risk for development of an adenocarcinoma [25]. Epidemiologic studies have shown an increased risk for small bowel adenocarcinoma in Crohn's disease patients [26]; yet it is unknown if strictureplasty affects this risk. It has been argued that continued presence of active inflammation after strictureplasty may increase the risk of this rare tumor [25]. Alternatively, there is some indication that relief of the obstruction by strictureplasty may lessen the activity of disease within the affected segment [27]. Again, how such a phenomenon would affect the risk of cancer is a matter of speculation. To date there has been only one reported case of an adenocarcinoma developing at a site of previous small bowel strictureplasty [28]. The long-term risk of malignancy after strictureplasty remains an open issue.

Conclusions

Strictureplasty is a safe, effective means for providing long-term surgical palliation to selected patients in whom resection of stricturing disease would result in the loss of large segments of functioning absorptive intestinal epithelium. Perioperative complication rates are comparable to those seen with standard surgical treatment, and recurrences do not appear to be excessive.

Résumé

On réalise de plus en plus de stricturoplasties pour traiter les sténoses intestinales symptomatiques secondaires à la maladie de Crohn. Pour évaluer les résultats cliniques globaux après la stricturoplastie pour maladie de Crohn, on a étudié prospectivement l'évolution de 57 patients ayant eu 60 interventions comportant au moins une stricturoplastie, opérés entre Juin 1989 et Février 1997. Au total, on a réalisé 109 stricturoplasties (90 - Heineke-Mikulicz, 6 - Finney, et 13 - latérolatérale isopéristaltiques). La morbidité périopératoire à trente jours était de 12%. Les complications étaient moins fréquentes pour les patients ayant eu une intervention élective comparés à ceux opérés en urgence ($p < 0.002$). Après un suivi moyen de 38 mois, sept patients ont eu une récidive de leur maladie de Crohn nécessitant une réintervention. Le taux de récidive cumulé à deux ans a été de $15 \pm 6\%$ ($\pm$ ET) et $22 \pm 10\%$ ($\pm$ ET) à cinq ans. On a observé une récidive de la maladie au site de la stricturoplastie dans seulement cinq cas. La stricturoplastie procure une palliation à long terme sûre et efficace à certains malades ayant une maladie de Crohn. Le taux de complications est comparable au taux

observé lors du traitement standard et les récidives ne sont pas excessivement fréquentes.

Resumen

El procedimiento de corrección de una estrechez ("strictureplasty") en el tratamientoo de las estenosis intestinales sintomáticas secundarias a enfermedad de Crohn está siendo practicada en forma cada día más frecuente. Se realizó un estudio prospectivo sobre la totalidad de los pacientes sometidos a plastía de la estrechez en el período entre el 1 de junio de 1989 y el 1 de febrero de 1997. Su propósito fue determinar los resultados clínicos globales luego de la "estenoplastia" en enfermedad de Crohn. El grupo quedó constituido por 57 pacientes en quienes se practicaron 60 operaciones utilizando estenoplastia. Se practicó un total de 109 estenoplastias (90-Heineke Miculicz, 6-Finney y 13 latero-laterales isoperistálticas). La tasa de mortalidad perioperatoria a 30 días fue 12%, siendo las complicaciones menos frecuentes en los casos de cirugía electiva que en los de urgencia ($p < 0.002$). En siete casos se registró recurrencia de la enfermedad de Crohn que requirió operación, luego de un seguimiento medio de 39 meses. La tasa estimada de recurrencia acumulativa después de dos años fue 15.5% (error estándar???) y de 22.10% (error estándar???) después de cinco años. Sólo se produjo la recurrencia en el sitio de la estenoplastia previa. La estenoplastia es un procedimiento seguro y efectivo para una paliación a largo plazo en pacientes seleccionados. Las tasas de complicaciones perioperatorias son comparables con las del tratamiento estándar quirúrgico y el número de recurrencias no aparece excesivo.

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