Since this summary of the use of the loop colostomy seemed to fit well with the publication of the Classic Article on David Howard Patey, we have elected to juxtapose the two for the interest of the reader.

Securing the Loop—Historic Review of the Methods Used for Creating a Loop Colostomy

John M. Corman, B.A., Dan B. Odenheimer, M.D.

From Sansum Medical Clinic/Santa Barbara Medical Foundation Clinic, Santa Barbara, California, and Baylor College of Medicine, Houston, Texas

Loop transverse colostomy is a procedure that has been traditionally employed on a temporary basis for a number of indications, but, with improvement of intestinal suturing and stapling techniques, the applicability of this modality has become quite limited. This paper addresses the issue of securing the loop and traces the history of the development of this method to decompress the bowel, to divert the fecal stream, and to defunctionalize the distal colon. [Key words: Colostomy; History; Ostomy]

Corman JM, Odenheimer DB. Securing the loop—historic review of the methods used for creating a loop colostomy. Dis Colon Rectum 1991;34:1014–1021.

Ehud put forth his left hand, and took the sword from his right thigh, and thrust it into his belly. And the hilt also went in after the blade, for he drew not the sword out of his belly; and the dirt came out.

Judges 3:21–22

EVOLUTION

A colocutaneous fistula or inadvertent colostomy has been a consequence of penetrating trauma since antiquity. The injury may have been caused on the battlefield or from other sources of impalement. As might be expected, the likelihood of survival in those days after such an event was minimal. The first consideration for creating a deliberate colostomy is generally credited to Alexis Littré.[1] In 1710, he made the suggestion, at the time that he undertook a postmortem examination on an infant who had died with an imperforate anus, that "it would be necessary to bring the bowel to the surface of the body where it would never close, but perform the function of an anus." Thus was born the concept of the artificial anus. More than 80 years were to pass, however, before Duret[2] performed the first intentional, successful colostomy on a patient; the child survived until the age of 45. Among Duret's initial concepts was the importance of placing a suture through the mesocolon to support the bowel and to keep it from retracting. He observed, "Opening the little belly where the sigmoid colon was forming a little tumor apparent to the eye, I introduced my index finger... to pull out the sigmoid colon. In my fear that it would immediately fall back into the belly, I stitched it by threads passed through the mesocolon."[2] This recommendation of stomal support remains relevant today, especially when applied to loop colostomy. Duret's colostomy was made *via* an inguinal incision, but lumbar colostomy, as advocated by Amussat,[3] Curling,[4] and others, became the standard technique throughout the 19th century. Since the procedure did not result in breaching of the peritoneal cavity, it was felt to be safe, effective, and relatively simple to manage.[5,6] However, this perspective began to change as voluntary entrance into the abdominal cavity became more acceptable, with peritonitis becoming of lesser concern. In 1887, Allingham[7] performed six inguinal colostomies and concluded that the results of this operation were superior to those of the lumbar route. He stated that the peritoneum should no longer be held in awe as it had been "in former days."

Read in part at the meeting of The American Society of Colon and Rectal Surgeons, Anaheim, California, June 12 to 17, 1988.
Dr. Odenheimer is presently Staff Colon and Rectal Surgeon, Southern California Permanente Medical Group, Anaheim, California.
Address reprint requests to Mr. Corman: Cambridge Court, #71, 8055 Cambridge, Houston, Texas 77054.

APPLICATION

The first documented *transverse* colostomy was performed by Fine[8] in 1797 in Geneva. He successfully decompressed an obstruction from rectal cancer by drawing out a loop of bowel and securing the mesentery to the skin. He initially believed that he was bringing out a loop of ileum, but at autopsy three months later a transverse colon colostomy was demonstrated.

As transverse colostomy evolved, it began to be applied for a number of indications: decompression of dilated bowel, diversion of the fecal stream, and defunctioning of the distal colon. Specific conditions in which temporary loop colostomy plays a critical role include Hirschsprung's disease, rectal trauma, imperforate anus, distal bowel obstruction, and staged sphincter and fistula repair.

TECHNIQUES

With transverse colostomies, the simplicity of using an undivided loop of bowel has been well recognized, as is the issue of stomal support to minimize retraction and to facilitate spur formation and fecal diversion. In 1888, Maydl[9] was the first to suggest an external apparatus to accomplish these ends. Although Duret and Allingham before him had used mesocolic sutures, it was Maydl who suggested that placing an object through the mesentery and resting it on the skin of the abdominal wall could prevent the loop of bowel from retracting. He indicated that a rod made from India rubber or from a goose quill would serve adequately for this task. Numerous modifications have been developed during the past 100 years, but all are based on this fundamental concept (Fig. 1A).

One variation was offered in 1900 by Henri Hartmann.[10] Hartmann is recognized as the individual who described an alternative operation for treatment of cancer of the mid-to-upper rectum, a procedure which is frequently applied today in the initial surgical management of complicated sigmoid diverticulitis. He advocated using iodoform gauze rolled longitudinally into a tampon and placed through a hole made in the mesentery (Fig. 1B). The ends of the gauze roll rested on additional exterior gauze packing. This prevented retraction of the stoma and assisted in the development of the spur while protecting the underlying skin. A second, more frequently applied modification of Maydl's idea was the use of a glass rod (Fig. 1C).[11–15] The bridge was held in place by a rubber loop which connected both ends of the rod (Fig. 1D).[14] Later, in an effort to decrease the bulkiness of the apparatus, the rubber loop was replaced by small rubber sleeves which were attached to the ends of the rod and sometimes sutured to the underlying skin (Fig. 1E).[11,12,16] In the late 1960s, rubber tubing was used as a safer alternative to the glass rod and was sewn to the abdominal skin (Fig. 1F).[16] Alternatively, the tube could be folded at each end and sutured to itself to act as a flange (Fig. 1G).[17] The primary advantage of a rubber tube instead of a glass rod is the ease of securing the appliance. An even less bulky device is a Penrose drain sutured to the skin.[18] However, the prob-

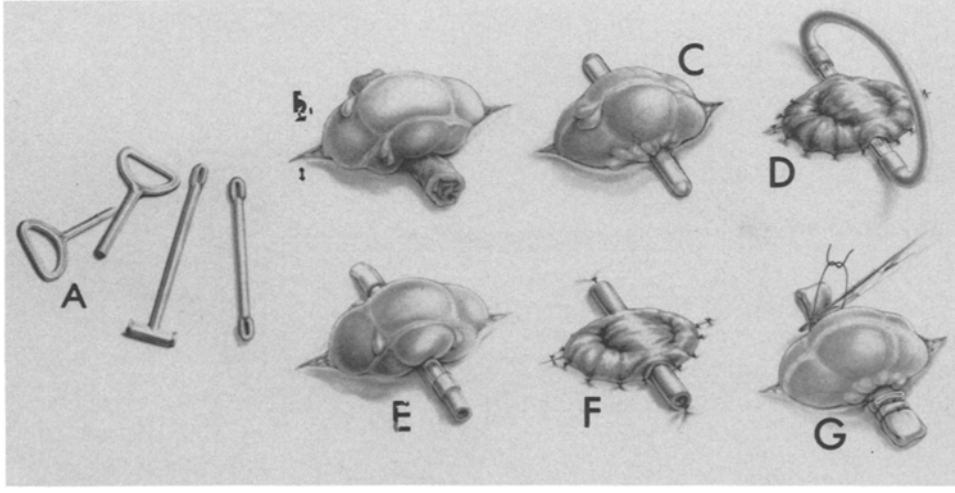

Figure 1. Alternatives for securing the loop of colon. A. Commercially available rods. B. Rolled gauze. C. Glass rod. D. Glass rod with rubber loop. E. Glass rod with rubber sleeves. F. Rubber tubing. G. Folded tubing or drain.

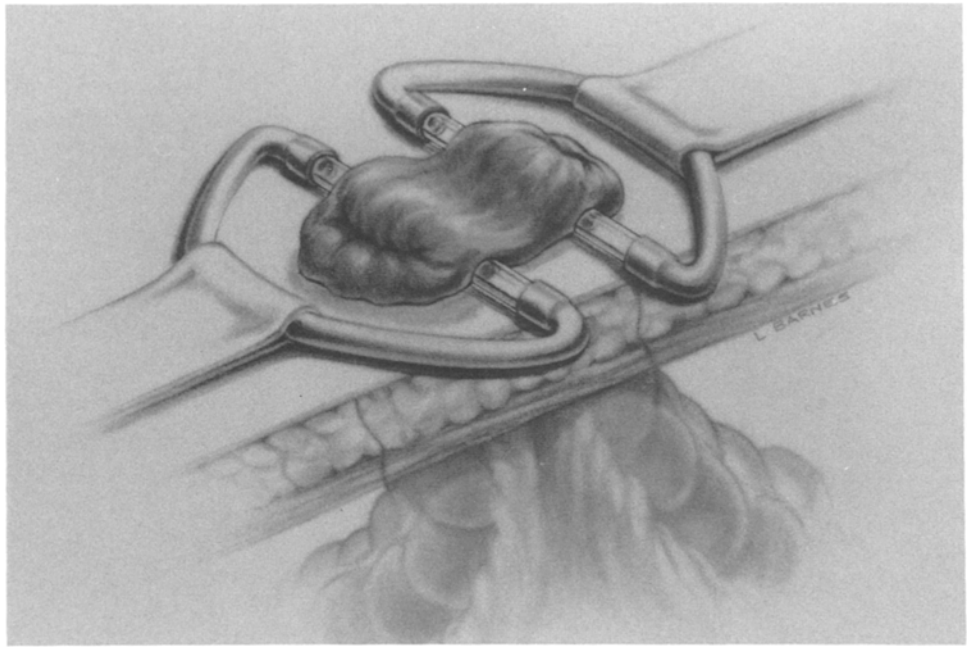

Figure 2. Wangensteen support mechanism utilizing two rods pulled apart by a belt. This technique served the dual purpose of preventing retraction and emphasizing the spur.

lem with all of these methods is that the fixation may interfere with changing and securing the appliance.

Another variation of Maydl's original technique was suggested by Wangensteen[19] in 1947. He utilized double glass rods with two rubber loops which were pulled in opposite directions by strapping or by a belt (Fig. 2). Wangensteen felt that by using this apparatus he was able to exteriorize a larger loop of bowel and to promote more effective fecal diversion by separating the proximal and distal ends. Later, others used two rods for transverse loop colostomy, not necessarily to ensure fecal diversion, but in the hope that it would prevent prolapse of the efferent limb.[20]

SYNCHRONOUS MATURATION

Many other methods for preventing loop retraction have been suggested during the years, a consequence possibly of dissatisfaction with conventional or established methods, but a more credible explanation can be attributed to a need to evince ingenuity. There was great fear of the risk of contaminating the incision if this maneuver were to be undertaken on the operating table with a freshly closed incision. Thus, it was not until the 1960s, and, in some centers, the 1970s, that opening the colostomy at the time of operation was even contemplated. The ritual of "unveiling the stoma" traditionally took place 48–72 hours after the procedure. The dressing was removed, and at the bedside the surgeon employed a cautery to open the colon. Of course, there was little opportunity to ascertain the viability of the bowel with the dressing in place, and, if obstruction had been the indication for surgery, no immediate decompression took place.

Patey[21] is generally credited with being the first individual to attempt maturation of the diverting loop colostomy at the initial operation when he reported his technique in 1951. Another method for addressing this concern was offered by Greene[22] in 1971. He advised the use of a bar, cut into the appropriate configuration from a thin, flexible piece of plastic. The "dumbbell" shape of the bar prevented it from slipping out (Fig. 3A). The author believed that this device improved fecal diversion and limited the likelihood of soiling. With it he felt that the colostomy could be safely opened at the initial procedure and an appliance immediately utilized. In 1973, Aries[23] devised a similar mechanism using a device shaped like the letter "I" (Fig. 3B). Both ends rotated 90 degrees, allowing the shaft to be inserted through the mesentery. Rotating the ends back to their original positions perpendicular to the shaft kept the device from moving out of place. As with the Greene

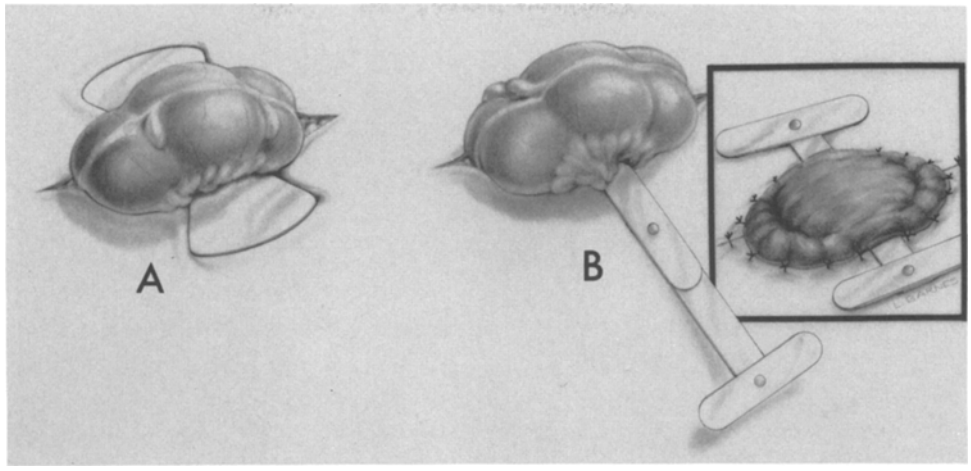

Figure 3. A. Greene's plastic bar. B. Aries' rotating device. These apparatus addressed the same concerns as those of Wangensteen but with much less cumbersome appliances.

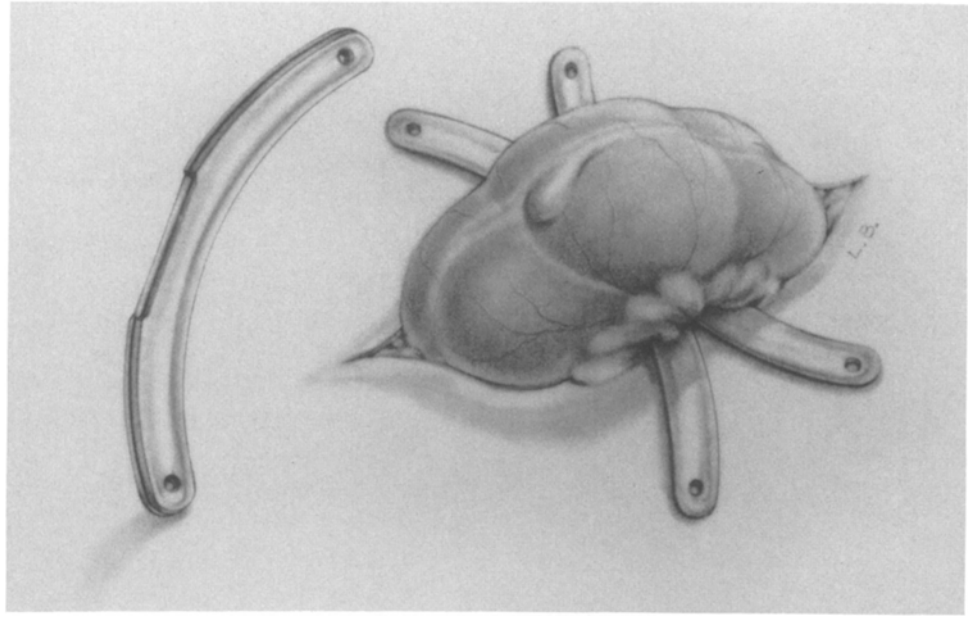

Figure 4. Hollister® (Hollister, Inc., Libertyville, IL) loop ostomy appliance. Compressible, butterfly-shaped flange passed through the leaves of the mesentery. The flange is then secured beneath a gasket with skin barrier (not shown).

appliance, the stoma could be opened and matured primarily.

In the 1970s, a number of commercially made devices became available, one of the most frequently employed being the Hollister® (Hollister, Inc., Libertyville, IL) loop ostomy appliance.[24–26] The bridge is flat and butterfly-shaped (Fig. 4). For application the wings of the bridge are compressed and fed through the mesentery of the loop of bowel. Once in place, the wings are opened; the bridge may be secured by sutures to the skin. An appropriate appliance with gasket and skin protector is then utilized. Another such commerically available product is the so-called ConvaTec Gentle Touch™ (ConvaTec, E.R., Squibb & Sons, Princeton, NJ) loop ostomy system.

All of the devices described thus far employ a rod, bridge, or tube resting on the abdominal skin and supporting the loop of bowel. However, a major potential limitation is the tendency to interfere with placement of the colostomy appliance itself.

An alternative to resting a supporting rod or bar on the skin's surface is to partially bury the device

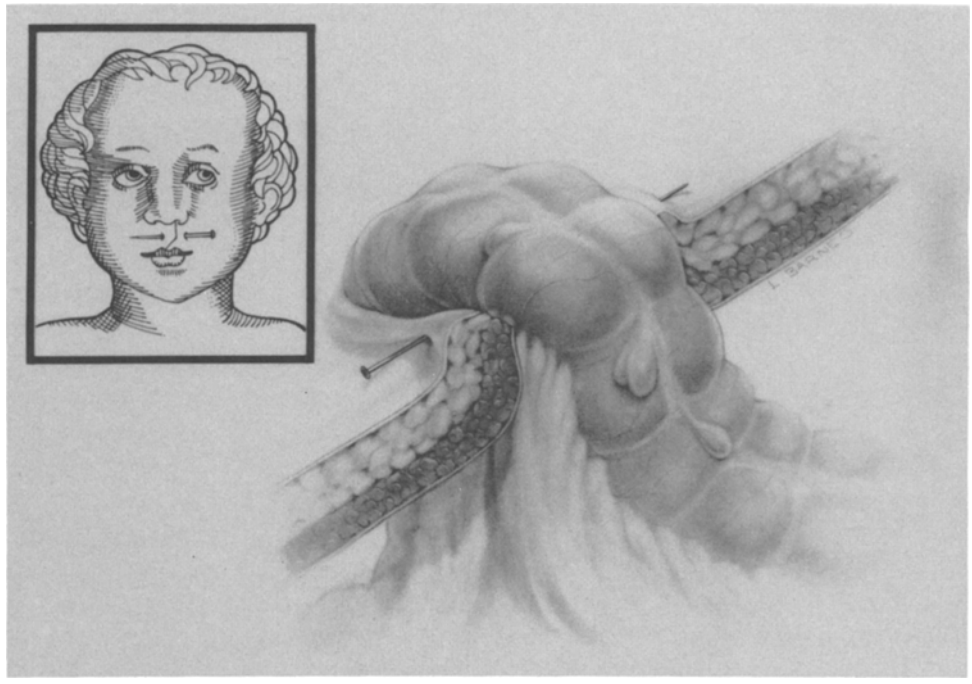

Figure 5. Buried supporting device. Kelsey's use of a "harelip" pin. This was the initial such effort.

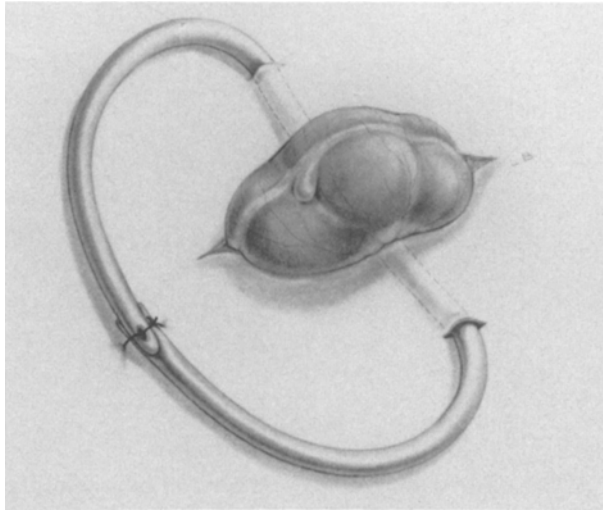

Figure 6. Buried supporting device using conventional rubber tubing.

subcutaneously. This concept was advocated initially by Kelsey[27] in 1889 with the use of a "harelip" pin (Fig. 5). The pin was passed through the skin and abdominal wall on one side of the incision and then through the mesentery of the loop of bowel, and it finally pierced the abdominal layers on the opposite side of the wound. A similar concept was employed by Abeyatunge[28] and others[29] when they passed a rubber catheter through a stab incision on the skin, through the mesentery, and out through a second stab wound (Fig. 6). For additional support of the stoma and to prevent small bowel inclusion, Abeyatunge approximated the tenia coli of the proximal and distal ends of the loop colostomy.

A related method of stomal support was suggested by Ward.[30] In 1914, he advocated creating a loop of suture through both skin edges of the wound and through an avascular area of the mesentery. Two small rubber tubes were tied to the ends of the loop to prevent the thread from cutting into the skin. Browning and Parks'[31] variation on this theme was to thread a rubber tube onto the loop of suture. Others adapted subcutaneous rods and tubes that pierced the skin on both sides of the wound, 6–10 cm from the stoma, passing it through the mesentery of the exteriorized loop (Fig. 7A).[32,33] In addition, a colostomy supporting device has been modified so that it can be inserted through only one skin opening and then placed through the mesentery (Fig. 7B).[34]

The third type of apparatus for supporting the loop stoma includes the modifications which are entirely subcutaneous. Galofre and Ponsetti[35] suggested the placement of a glass or plastic rod through the mesentery, resting it on the rectus sheath (Fig. 7C). After an appropriate interval, the rod is removed through a small incision at one end. A similar approach is the use of a fibrin (Biethium)

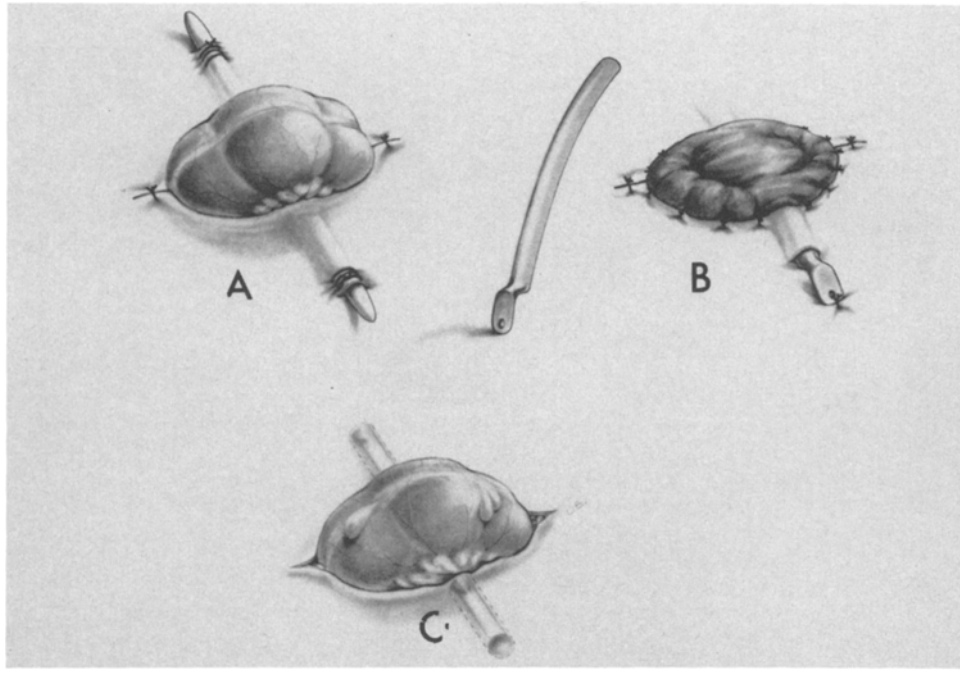

Figure 7. Buried supporting rods. A. Piercing skin in two places. B. Piercing skin in only one place. C. Completely buried rod.

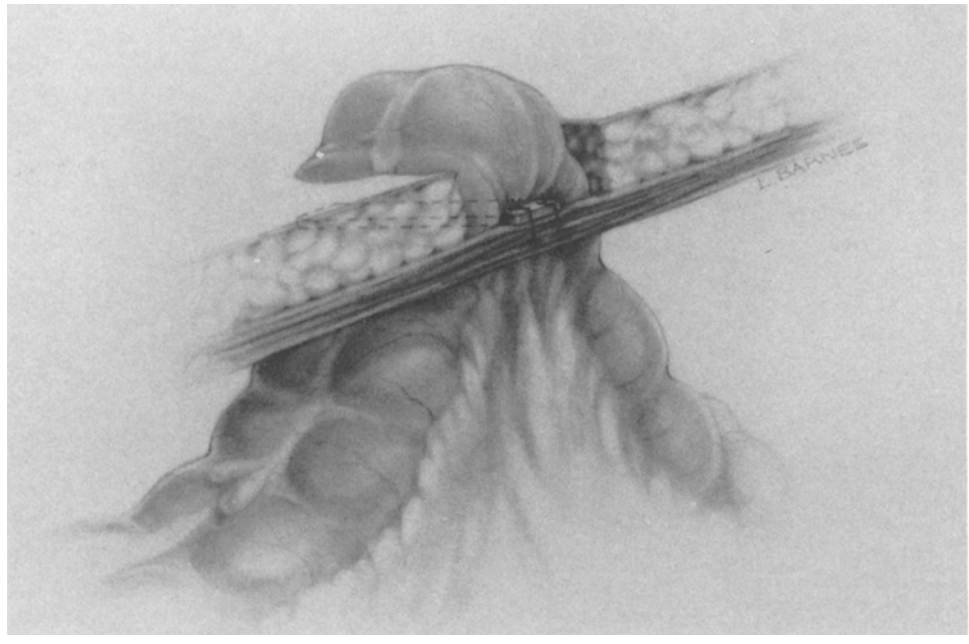

Figure 8. Dissolvable, fibrin (Biethium) bridge.

bridge (Fig. 8).[36,37] It is made of molded, stabilized bovine fibrin using glycerol as a plasticizer and pretreated with formaldehyde.[37] The device is also fixed to the rectus sheath, but unlike the above method, the bridge dissolves within 4–6 weeks, and a second operation is not required. However, retraction of the stoma has been a concern in some patients.

A novel alternative for loop colostomy support is the utilization of skin flaps.[38,39] This can be accomplished by simple apposition following undermining of the skin, pulling one edge through

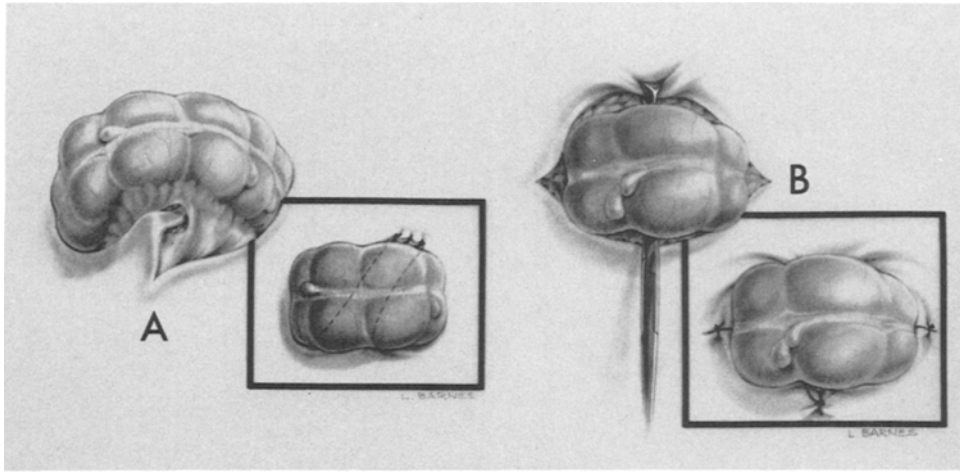

Figure 9. Using the skin itself as a bridge. A. Primary skin closure. B. Full-thickness skin flap.

the mesentery and suturing it to the opposite side (Fig. 9A). Another option is to mobilize a full-thickness flap and advance it to achieve the same ends (Fig. 9B).

CONCLUSIONS

Loop colostomy has not yet been relegated to mere historical curiosity, but the indications for its application and the frequency of its relevance have been considerably diminished in recent years. With the development of highly sophisticated and reliable anastomotic alternatives as well as the tendency to reestablish intestinal continuity without diversion, it is likely that surgeons will turn their creative efforts to other endeavors rather than to developing alternatives for maintaining loop colostomy stomal support.

ACKNOWLEDGMENT

The authors wish to express their sincerest appreciation to Ms. Lois Barnes, who prepared the beautiful art for this article.

REFERENCES

1. Littré A. Quoted in Dinnick T. The origins and evolution of colostomy. Br J Surg 1934;22:142–54.
2. Duret C. Quoted in Dinnick T. The origins and evolution of colostomy. Br J Surg 1934;22:142–54.
3. Amussat J-Z. Mémoire sur la possibilité d'établir un anus artificiel dans la région lombaire sans pénétrer dans le péritoine. Paris: Germer-Baillière, 1839 (translated in Dis Colon Rectum 1983;26:483–7).
4. Curling TB. Observations on the treatment of painful cancer of the rectum, without obstruction, by establishing an anus in the left loin. With cases. Lancet 1865;1:3–5.
5. Deaver JB. Lumbar vs iliac colostomy. J Phila County Med Soc 1891;12:97–106.
6. Bryant T. The Bradshaw Lecture on colostomy, lumbar and iliac, with special reference to the choice of operation. Lancet 1889;2:1211–6.
7. Allingham HW. Inguinal colotomy: its advantages over the lumbar operation, with special reference to a method for preventing feces passing below the artificial anus. Br Med J 1887;2;874–8.
8. Fine. Quoted in Dinnick T. The origins and evolution of colostomy. Br J Surg 1934;22;142–54.
9. Maydl K. Zur technik der kolotomie. Centralblatt Chirg 1888;15:433–40.
10. Hartmann H. Technique de la colostomie dans le traitement de certaines tumeurs inopérables du rectum. Rev Chir 1900;22:613–20.
11. Gabriel WB, Lloyd-Davies OV. Colostomy. Br J Surg 1934–5;22:520–38.
12. Wiley HM, Sugarbaker ED. Colostomy, indications, technique, and management. Surg Gynecol Obstet 1950;91:435–44.
13. Rombeau JL, Wilk PJ, Turnbull RB Jr, Fazio VW. Total fecal diversion by the temporary skin-level loop transverse colostomy. Dis Colon Rectum 1978;21:223–6.
14. Philippart AI, Eraklis AJ. Transverse colostomy in the infant. Surg Gynecol Obstet 1972;134:101–2.
15. Wheatley AE. Skin level loop colostomy. Proc R Soc Med 1960;53:654–5.
16. Lee Y-TN. A simple technic for fixing loop colostomy. Am J Surg 1968;116:138–9.
17. Goldstein S, Sohn N, Weinstein MA, Robbins RD. Simplified loop ostomy fixation using rubber tubing. Surg Gynecol Obstet 1984;158:375–6.
18. Lafreniere R, Ketcham AS. The Penrose drain: a safe, atraumatic colostomy bridge. Am J Surg 1985;149: 288–91.

19. Wangensteen OH. Complete fecal diversion achieved by a simple loop colostomy. Surg Gynecol Obstet 1947;84:409–14.
20. Case TC. Simple technic for transverse colostomy. J Am Geriatr Soc 1973;21:333–4.
21. Patey DH. Primary epithelial apposition in colostomy. Proc R Soc Med 1951;44:423–4.
22. Greene HG. Loop colostomy—bar versus rod. Dis Colon Rectum 1971;14:308–9.
23. Aries L. Colostomy and ileostomy retainer. Int Surg 1973;58:490.
24. Hansen JB, Hoier-Madsen K, Lindenberg J. Loop transverse colostomy: a new method. Acta Chir Scand 1974;140:658–9.
25. Poticha SM. A new technic for loop colostomy with use of a plastic bridge. Am J Surg 1974;127:620–1.
26. Corman ML, Veidenheimer MC, Coller JA. An appliance for management of the diverting loop colostomy. Arch Surg 1974;108:742–3.
27. Kelsey CB. An improvement in the technique of inguinal colotomy. Med Rec 1889;36:398.
28. Abeyatunge LR. A modified technique of colostomy. Br J Surg 1972;59:99–100.
29. Fitzgibbons RJ Jr, Schmitz GD, Bailey RT Jr. A simple technique for constructing a loop enterostomy which allows immediate placement of an ostomy appliance. Surg Gynecol Obstet 1987;164:78–81.
30. Ward. Quoted in Moynihan B. Abdominal operations. 3rd ed. Vol. 1. Philadelphia: WB Saunders, 1914:417–32.
31. Browning GG, Parks AG. A method and the results of loop colostomy. Dis Colon Rectum 1983;26: 223–6.
32. Schuler JG, Aliapoulios MA. The Cambridge loop colostomy. Surg Gynecol Obstet 1973;137:281–2.
33. Vogel SL, Maher JW. An improved method for construction of loop colostomy. Surg Gynecol Obstet 1986;162:377–8.
34. Rickett JWS. Subcutaneous colostomy rod. Br Med J 1969;3:466.
35. Galofre M, Ponsetti JM. A simplified method of transverse loop colostomy. Surg Gynecol Obstet 1983; 156:798–9.
36. Simkin EP, Shields R. Human tissue response to oxfibrin (Biethium) with special reference to use as absorbable colostomy rods. Br J Surg 1980;67:376.
37. Jenkinson LR, Houghton PWJ, Steele KV, Donaldson LA, Crumplin MKH. The Biethium bridge—an advance in stoma care. Ann R Coll Surg Engl 1984; 66:420–2.
38. Jarpa S. Transverse or sigmoid loop colostomy fixed by skin flaps. Surg Gynecol Obstet 1986;163:372–4.
39. Conklin WT, Grove GP. A simple technique for securing a loop colostomy. Am Surg 1984;50:502.