Stapled Anastomosis in Colorectal Surgery*

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Cutait DE, Cutait R, DaSilva JH, Manzione A, Kiss DR, Lourenção JL, Calache JE. Stapled anastomosis in colorectal surgery. Dis Colon Rectum 1981;24:155–160.

The authors review their experience with stapled anastomosis in colorectal and ileorectal resections for malignant and benign lesions of the large bowel. They describe the technique and results in a series of 49 patients (24 with cancer of the rectum and rectosigmoid junction; six with familial polyposis, associated with cancer in four; 12 with chagastic megacolon; three, Crohn's disease; two, ulcerative colitis; and one each, diverticular sigmoiditis and ischemic sigmoiditis). Anterior resection was performed in 38 patients and total colectomy with ileorectal anastomosis in 11. Main complications and mortality are presented. They conclude that stapled anastomosis is an efficient method for intestinal reconstruction after resection for malignant and benign lesions of the large bowel. [Key words: Anastomosis, stapled; Colorectum; Surgery, stapled anastomosis]

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ANASTOMOSIS BY STAPLING began to be performed about two decades ago, when Moscow's Institute for Research of Apparatus and Instruments introduced an automatic suturing device designed for vascular anastomoses and, later, for gastrointestinal sutures. Its complex design, difficulty in handling and sterilization, and the need for individual assemblage of the staples in the cartridge contributed, however, to its low acceptance. Great impetus resulted from recent improvement of the Russian apparatus and the introduction of the American model instrument, which enable more simplified management.

Using this new technique, we performed a series of 49 colorectal and ileorectal anastomoses, which we review in this paper.

Technique

Device: The American model (Auto-Suture E.E.A. Instrument) was used in all our patients. This instrument (Fig. 1) consists of a center rod, with the firing handle and a wing nut on one of its extremities, and a special device for fitting the loading unit on the other tip. The latter is made up of two pieces: a cartridge containing the staples for the anastomosis and the anvil acting as a resistance surface for the staples shot by the cartridge when the firing handle is squeezed all the way (Figs. 2 and 3).

The equipment is also supplied with a special clamp designed for facilitating the accomplishment of the purse-string suture of the colonic and rectal anastomotic stumps (Auto-Suture Purse String Instrument). This instrument has two notched branches, each of them with a filiform channel for the passage of the thread to be used for the purse-string suture (Fig. 4).

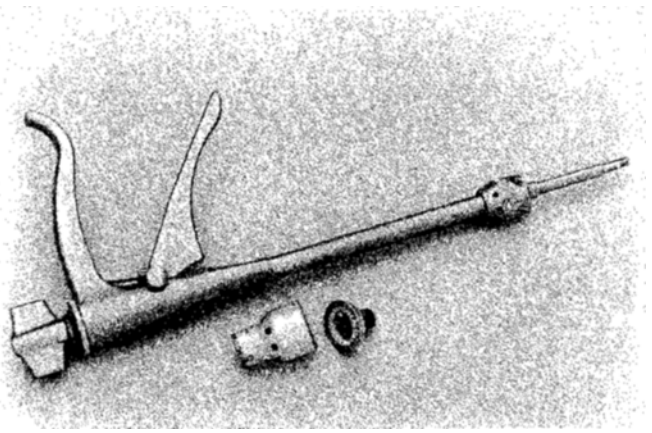

FIG. 1. Auto-Suture E.E.A. Instrument and loading unit.

* Received for publication May 19, 1980.

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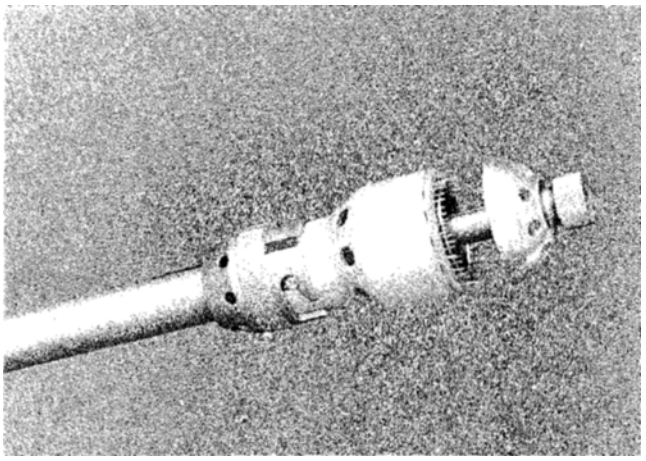

FIG. 2. Loading Unit. The cartridge is in a special arrangement to show the staples projected and circular knife.

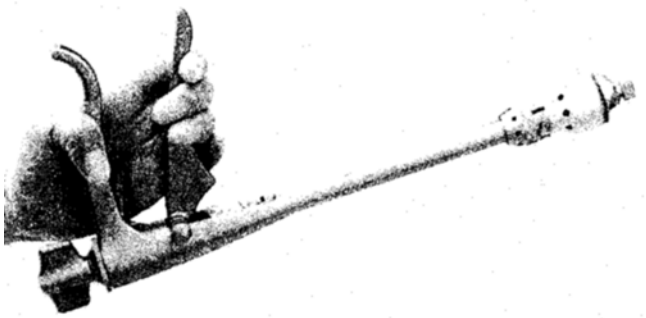

FIG. 3. Loading unit fitted to the instrument.

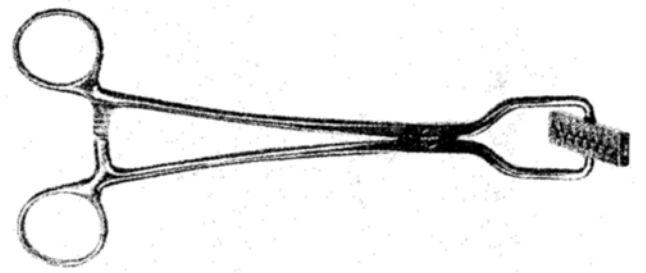

FIG. 4. Auto-Suture Purse String Instrument.

Procedure: After dissection and mobilization of the colon and rectum, the Auto-Suture Purse String Instrument is applied to the colon, and the appropriate anastomotic level. A long and straight needle with chromic catgut 00 is introduced in the filiform channel of one of the clamp's branches, and is then pulled with a Kelly forceps. The needle is next introduced in inverse direction into the other channel of the clamp and pulled again. A Rochester forceps is placed distally, and the colon is divided with a scaple between the two clamps (Figs. 5 and 6). The special instrument is removed leaving the purse-string suture just prepared in the colon.

The same instrument is then placed in the rectum at the proposed level of section, following the same procedure for performance of the purse-string suture. A crushing clamp is then placed proximally and the rectum is divided flush with the purse-string instrument. After removal of the surgical specimen, dilation of the anus and cleansing of the rectum, the mechanical suturing instrument, bearing the staple cartridge and the anvil, is introduced in the rectal lumen.

The purse-string instrument is removed from the rectum and the anvil and cartridge are then separated by turning the instrument wing nut counterclockwise. After the anvil has gone beyond the cut edge of the rectum, the thread applied to the rectal stump is pulled and firmly tied, thus completing the purse-string suture, leaving the staple cartridge in the rectal lumen (Fig. 7).

The colonic stump is next slipped over the anvil, and the corresponding suture thread is also pulled and tied, thus completing the purse-string suture of the colon (Fig. 8). The threads are cut and approximation of proximal and distal stumps is made by closing the space between cartridge and anvil by turning the wing nut clockwise until secure (Fig. 9), aligning the black marks on the instrument (Fig. 10). Safety is released from the locked position and the instrument is fired so that a double staggered row of stainless steel staples, shot by the cartridge, is inserted, joining both stumps by means of an automatic two-layer suture. Simultaneously, the knife of the instrument cuts the tissues of the colonic and rectal stumps. The fired staples take the shape of a "B," allowing adequate irrigation of the anastomotic edges.

The instrument is then withdrawn and the colonic and rectal rings, corresponding to the excised excess bowel tissues are removed from inside the cartridge. When the anastomosis is adequately accomplished, these rings are intact.

Lack of integrity means either incomplete or faulty resection, requiring reinforcement with seromuscular stitches. When uncertainty arises about the anastomo-

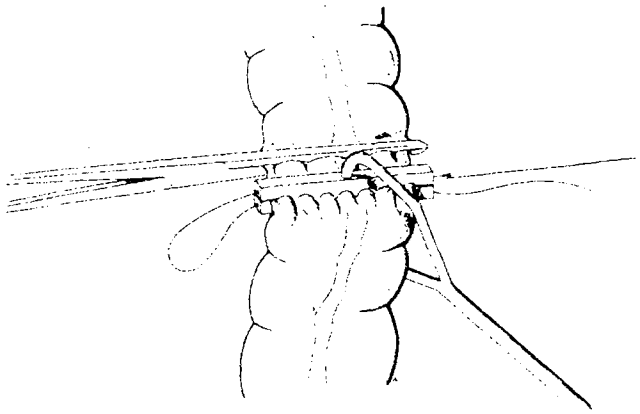

FIG. 5. Needle with thread introduced in the filiform channel of the Auto-Suture Purse String Instrument.

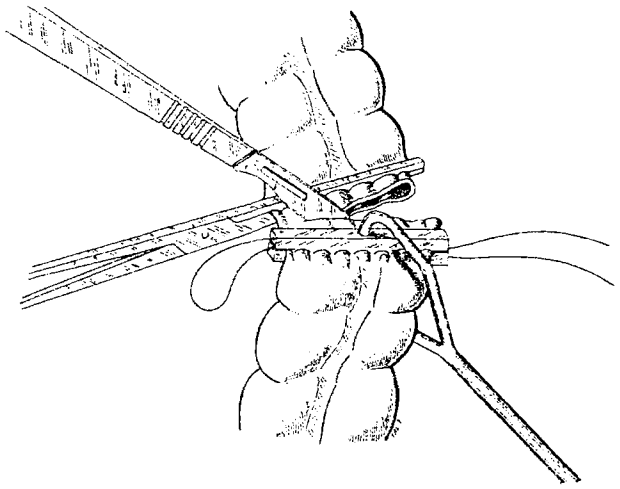

FIG. 6. Division of the colon.

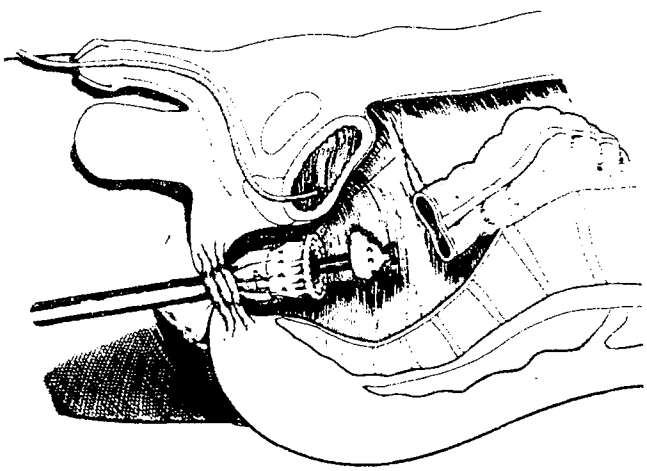

FIG. 7. Placing the stapling device within the purse-string suture of the rectum. Note the suture of the colon.

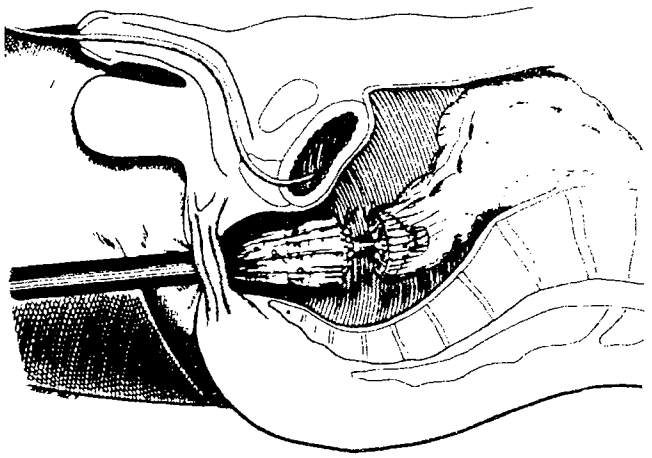

FIG. 8. Colonic and rectal stumps after completion of purse-string sutures.

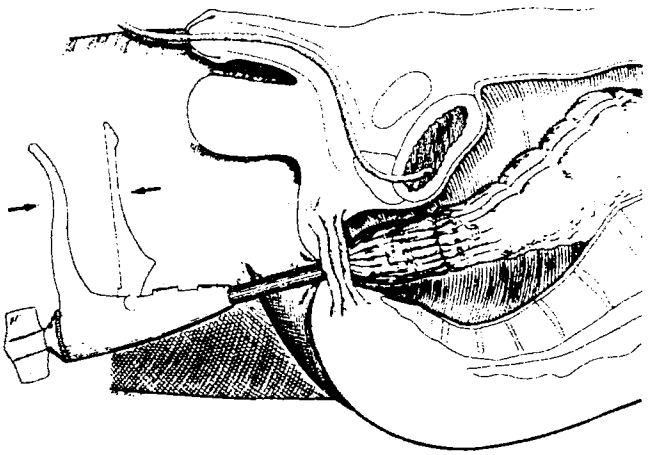

FIG. 9. Approximation of colonic and rectal stumps completed preparatory to squeezing the handle.

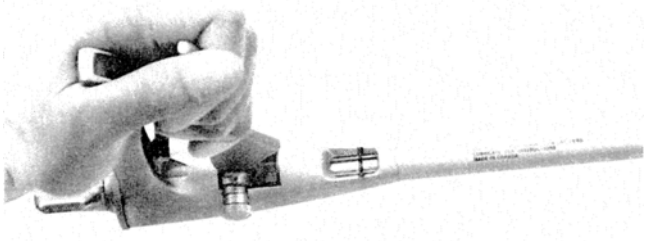

FIG. 10. Aligning the black marks on the stapling device to complete closure of space between anvil and cartridge.

TABLE 1. *Diagnoses of 49 Patients Treated by Resection and Anastomosis*

	Number of Patients	Per Cent
Cancer of the rectum or rectosigmoid junction	24	49.0
Multiple familial polyposis	6	12.2
Chagasic megacolon	12	24.4
Crohn's granulomatous colitis	3	6.1
Ulcerative colitis	2	4.1
Diverticular sigmoiditis	1	2.1
Ischemic sigmoiditis	1	2.1
TOTAL	49	100.0

tic integrity, it is most convenient to establish a proximal covering intestinal derivation. The mesocolic gap is closed, a soft rubber drain is placed in the pelvic space and brought out in the right iliac fossa through a stab wound.

When restoring intestinal continuity after total colectomy, the anvil is obviously inserted in the ileal stump; anastomosis is performed as already described.

Material and Methods

From November 1978 to April 1980 mechanical anastomosis was carried out in 49 patients. The conditions treated by resection are summarized in Table 1.

The operations are summarized in Table 2. Anterior resection was performed in 38 patients: 24 with cancer; 12 megacolon; one, diverticular sigmoiditis with colovesical fistula; and one, ischemic sigmoiditis with colonic necrosis. Colorectal anastomosis was considered "high" (at or above 6 cm from the anal verge) in seven patients, and "low" in 31. In four patients submitted to anterior resection, one for cancer and three for megacolon, a proximal transversostomy was performed due to insecurity concerning safety of the anastomosis. All of them had an uneventful recovery, allowing closure of the ostomy. Concerning ischemic sigmoiditis, Hartmann's sigmoidectomy was carried out as a first-stage emergency procedure due to necrosis of the affected segment of bowel. Restoration of intestinal continuity was performed as a second-stage procedure, by means of the automatic colorectal anastomosis, which lay at 4 cm from the anal verge requiring thus a covering transverse colostomy. The patient is waiting for the right occasion to have it closed.

TABLE 2. *Operations Performed*

	Number of Patients	Per Cent
Anterior resection		
"High"* anastomosis	7	14.3
"Low" anastomosis	31	63.3
Total colectomy with ileorectal anastomosis	11	22.4
TOTAL	49	100.0

* At or above 6 cm from the anal verge

Total colectomy with ileorectal anastomosis was performed in 11 patients, six for multiple familial polyposis, three for Crohn's granulomatous colitis, and two for ulcerative colitis. In nine patients anastomosis was performed at the middle or upper third of the rectum, in two at a very low level, 5 or 6 cm from the anus. In two patients, both with multiple polyposis, a temporary covering loop ileostomy was simultaneously carried out, in order to protect the suture. Ileostomy was also established in another case of polyposis due to partial leakage of the suture line, as will be shown later on. Ileostomy was closed in one patient, without complication; the other two patients are awaiting closure.

Results

Postoperative recovery in anterior resection was satisfactory in the majority of patients. Six to eight daily motions were initially observed with semisolid or liquid feces, decreasing after a few weeks to two or three daily motions, with feces of normal consistency.

Two patients submitted to low anastomosis complained of slight incontinence for flatus. The patients submitted to total colectomy with ileorectal anastomosis had numerous liquid stools in the immediate postoperative period. However, in a few weeks, the feces acquired a firmer consistency, and the number of bowel motions decreased to one or two daily. Figures 11 and 12 record aspects of two cases of our series.

The main complication was rupture of the anastomosis, which occurred in four cases of anterior resection and in one of total colectomy with ileorectal anastomosis. In three of the former it was small and healed spontaneously, and in the other, leakage was followed by fecal peritonitis which necessitated emergency laparotomy. The anastomosis was dismantled and the colon brought out through the left iliac fossa. The patient died a few days later in severe toxemia. In the case of total colectomy, the patient was re-operated; cleaning of the cavity, drainage of the

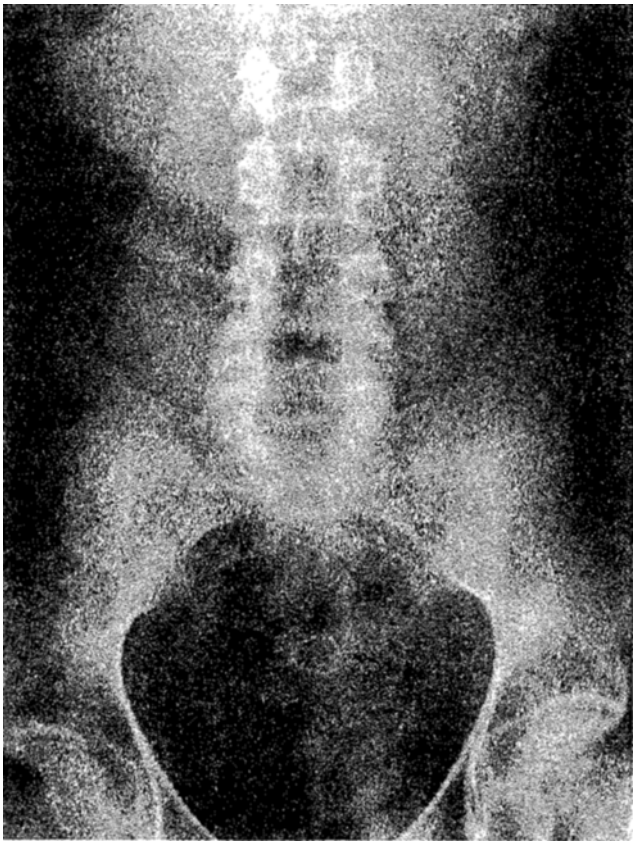

FIG. 11. Plain x-ray of the abdomen. Note the stapled ring anastomosis.

FIG. 12. Barium enema showing the stapled ring anastomosis.

pelvis and proximal loop ileostomy were performed, followed by satisfactory recovery. Infection of the presacral space occurred in one patient, subsiding promptly with treatment with antibiotics. In three patients slight stenosis was detected by rectal palpation; two had no trouble with intestinal transit. The other, however, needed postoperative dilations, which provided excellent results.

There was one death (2.1 per cent), which was related to dehiscence of the anastomosis, as described above.

Discussion

Mechanical stapled suture is an important advance in gastrointestinal surgery. The advantages are evident, mainly for colorectal or ileorectal anastomosis, especially for the "low" procedure, which, when performed by conventional hand suture, is difficult in the majority of cases. The stapling device may partially compensate for difficulties experienced by the individual surgeons in performing anastomosis manually.

The anastomosis should be carried out only in normal tissues, without evidence of thickening. In our country, this fact must be carefully considered when "low" abdominal rectosigmoidectomy is done for megacolon; the disease frequently causes conspicuous thickening of the rectal wall. In this case, the staples which are only 4 mm long, are insufficient to adequately enclose both colic and rectal wall. For this reason, we had to give up previously planned stapled anastomosis in several megacolon patients; at completion of rectal dissection, great thickening of the bowel wall was disclosed. In all these cases a delayed perineal colorectal anastomosis was performed, with excellent results, according to the technique we proposed[1] in 1960 for the treatment of megacolon.

Although the medical literature has shown considerable experience with mechanical suture of the digestive tract, the number of patients submitted to colorectal resections with restoration of intestinal continuity by means of mechanical anastomosis is still relatively small.

Chassin *et al.*,[2] in a series of 402 cases of mechanical anastomosis in several gastrointestinal operations, reported only six colorectal anastomoses, a very small number, impeding any critical appraisal.

Only recently did colorectal anastomosis begin to arouse the attention of world literature. Goligher *et*

al.,[3] using the Russian model 249 instrument, performed this type of anastomosis in 62 patients; in 38 it was considered to be "high" and in 24 to be "low," the latter lying below 5 cm from the anal verge. Postoperative gastrointestinal enema studies showed all the "high" anastomoses to be intact, whereas six of the 24 "low" anastomoses revealed dehiscence (25 per cent). Hemorrhage occurred in three patients, two of whom required blood transfusion. Stricture developed in two patients, one of which needed dilation; in the other the stricture disappeared six months after closure of the covering transverse colostomy, which had been performed in both patients.

Held[4] performed 40 mechanical colorectal anastomoses, 14 being "low." In some patients, the anastomosis lay at 3 cm from the anus, making it possible to avoid abdominoperineal excision with definitive colostomy.

Rothenberger *et al.*,[5] in 30 cases of colorectal anastomosis, reported three dehiscences, one partial stenosis, and one fecal incontinence.

Polglasse *et al.*[6] had two dehiscences and one hemorrhage in 57 operated cases.

Ravitch and Steichen[7,8] fully described the technique of colorectal anastomosis in a research work utilizing 12 dogs, without mortality. Leakage was observed in some cases but without abscess or inflammation. They stated that the American model instrument enabled the performance of a two-layer inverting anastomosis with interrupted stainless steel staples.

Smith[9] reported several complications, mainly anastomotic dehiscence, in 26 cases of colorectal anastomosis. The author claims that they were due to lack of staples in the cartridge in two patients, and failure of the instrument knife in two others.

As may be inferred, stapled anastomosis yields good results, but is not free from complications, dehiscence being the most frequent, mainly following "low" anastomosis.

This complication was reported by Goligher *et al.*[3] in 25 per cent of their "low" anastomosis patients, by Rothenberger *et al.*[5] in 10 per cent, by Polglasse *et al.*[6] in 4 per cent, and by Ravitch and Steichen[7,8] and Smith[9] in indeterminate number.

In our series, dehiscence occurred in about 12.2 per cent of the cases, incidence much higher than the 2.8 per cent observed in our several hundred cases of delayed colorectal anastomosis.

Proximal covering colostomy must be done whenever uncertainty arises concerning the integrity of the mechanical suture.

Other complications have been reported in the literature: slight anastomotic stenosis and hemorrhage from the suture line. Stricture was observed in three of our patients, but without disturbing intestinal transit. As for hemorrhage, it did not occur in our series.

Concluding, mechanical stapled anastomosis is a valuable method for restoring intestinal transit, and must be within the scope of all surgeons. We believe that colorectal or ileorectal anastomosis is the main field of application for this type of anastomosis.

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