Surg Today (2004) 34:123–126
DOI 10.1007/s00595-003-2678-0

SURGERY TODAY

Stapled Versus Hand-Sewn Anastomoses in Emergency Intestinal Surgery: Results of a Prospective Randomized Study

FAUSTO CATENA, MICHELE LA DONNA, STEFANO GAGLIARDI, ANDREA AVANZOLINI, and MARIO TAFFURELLI

Department of Emergency Surgery, St. Orsola-Malpighi University Hospital, Via Massarenti 9, 40138 Bologna, Italy

Abstract

Purpose. Sutured and stapled intestinal anastomoses are perceived to be equally safe in elective intestinal surgery. However, our search of the literature failed to find any studies comparing hand-sewn and mechanical anastomoses in emergency intestinal surgery. Thus, we compared the short-term outcomes of patients with sutured as opposed to stapled anastomoses in emergency intestinal surgery.

Methods. Between 1995 and 2001, 201 patients underwent emergency intestinal operations at the Department of Emergency Surgery of Sant'Orsola-Malpighi University Hospital. The outcomes of patients with sutured and stapled anastomoses were compared in a prospective analysis. Patients were randomly divided into a stapled group (106 anastomoses) with anastomoses made using linear and circular staplers, and a hand-sewn group (95 anastomoses) with anastomoses made by double-layer suturing.

Results. There were no significant differences between the groups in operative indications or other parameters. The operation times in the stapled group were significantly shorter than those in the hand-sewn group ($P < 0.05$), but there were no significant differences in anastomotic leak rates, morbidity, or postoperative mortality between the two groups.

Conclusions. In emergency intestinal surgery comparable results can be achieved using mechanical and manual anastomoses.

Key words Prospective randomized comparative study · Stapled anastomosis · Hand-sewn anastomosis · Emergency intestinal surgery

Reprint requests to: F. Catena
Received: December 16, 2002 / Accepted: May 27, 2003

Introduction

Since Ravitch and Steichen[1] introduced a modified form of the Soviet-developed stapling instruments in the 1960s, various types of staplers and stapling techniques have been adopted worldwide. There are two main types of stapled intestinal anastomoses: anatomical end-to-end anastomoses, performed with circular staplers, and functional side-to-side anastomoses, performed with linear staplers. According to several studies, stapled anastomoses have rendered hand-sewn anastomoses obsolete.[2,3] It is known that less time is required for stapled intestinal anastomosis than for conventional hand-sewn anastomosis, and that the rate of anastomostic-related complications after stapling is acceptably low.[4–7] However, some articles have pointed out that stapled anastomoses are unfavorable in certain situations.[8,9] To our knowledge there are no papers in the literature comparing stapled and manual anastomosis in emergency traumatic or nontraumatic intestinal surgery.[10] Thus, we conducted a prospective randomized study to compare emergency intestinal surgical stapling with manual suturing.

Patients and Methods

The subjects of this study were 201 patients who underwent emergency intestinal surgery with anastomoses at our hospital between November 1995 and November 2001. The patients were randomly divided into a stapled group, consisting of 106 subjects with 106 anastomoses, and a hand-sewn group, consisting of 95 patients with 95 anastomoses. The preoperative assessment consisted of recording simple parameters such as weight, hematological results, and clinical data.

All stapled anastomoses were performed using GIA and EEA (Ethicon, Cincinnati, OH, USA). For manual intestinal anastomoses, we used a double-layer tech-

nique with 2/0 absorbable polyglycolic acid sutures. The anastomoses were performed with two layers of interrupted seromuscular sutures. The operating time was defined as the time from skin incision until the completion of skin suturing. All patients with a defunctioning stoma were excluded. A clinical leak was defined as an anastomotic dehiscence verified by reoperation, the development of an enterocutaneous fistula, or the evidence of bowel contents in the drainage fluid. Infective complications were also recorded. Wound infection was defined as a purulent secretion from the laparotomic incision. All data were collected prospectively. Any patient who was treated by a participating surgeon and who underwent emergency surgery resulting in intestinal anastomosis was enrolled. Antibiotic prophylaxis was based on a single intravenous dose of 1 g cefotaxime and 500 mg metronidazole. Postoperatively, the National Nosocomial Infection Surveillance System (NNISS) score was calculated and antibiotic therapy administered accordingly.[11] An abdominal drain was placed in all patients.

Statistical analysis was based on chi-squared and Student *t*-tests. This study was approved by the local ethics committee and written informed consent was obtained from all patients.

Results

There were 201 patients enrolled in this study, comprising 95 with hand-sewn anastomoses and 106 with stapled anastomoses. The distribution of anastomosis in the different bowel segments and the patient characteristics were similar in the two groups (Tables 1 and 2, respectively). The operation time was 122 ± 30.2 min in the stapled group and 180 ± 27.4 min in the hand-sewn group. This was the only significant difference ($P < 0.05$). Blood loss was similar in the two groups. Among the 201 randomized cases, there were 16 anastomotic leaks, the leakage rate being 8.4% in the manually sutured group and 7.5% in the mechanically sutured group (*P* not significant). There were no differences in clinical leaks between colocolic/colorectal and small bowel anastomoses in the two groups. There were 12 deaths but only 4 (2 in each group) were directly caused by anastomotic dehiscence. The other 8 deaths were attributed to unrelated causes, principally cardiorespiratory insufficiency. The incidence of wound infection was 10.5% in the manually sutured group and 11.3% in the stapled group (*P* not significant).

The overall 30-day mortality rate was 5.9%, being 6.6% in the stapled group and 5.2% in the sutured group, without a significant difference ($P > 0.05$). The hospital stay was also comparable. The mean distance of the colorectal anastomosis from the anal verge and

Table 1. Site of anastomosis performed by hand suturing or stapling in emergency intestinal operations

Site	Stapled group (106 patients)	Hand-sewn group (95 patients)	*P*
Jejunal	7	8	n.s.
Ileal	38	40	n.s.
Colonic	52	39	n.s.
Colorectal	9	8	n.s.

n.s., not significant

Table 2. Clinical and laboratory parameters of patients who underwent emergency intestinal anastomosis

Data	Stapled group (106 patients)	Hand-sewn group (95 patients)	*P*
Mean age (years)	64.7 ± 20.2	68.7 ± 22.3	n.s.
Male/female	0.92	1.02	n.s.
Mean weight (kg)	58.4 ± 10.9	61 ± 11.3	n.s.
Mean hemoglobin (g/dl)	12.8 ± 2.4	12.2 ± 1.9	n.s.
Mean WBC count ($\times 10^3$ μl)	11.31 ± 2.4	11.47 ± 2.7	n.s.
Mean albumin (g/dl)	2.72 ± 1.1	2.98 ± 1.3	n.s.
Patients with malignant disease	59.4%	51.5%	n.s.
Mean operating time (min)	122 ± 30.2	180 ± 27.4	<0.05
Mean blood loss (g/dl)	1.58 ± 1.3	1.28 ± 1.1	n.s.
Leak rate	6.6%	5.2%	n.s.
Wound infection rate	11.3%	10.5%	n.s.
Other morbidity	6.6%	7.3%	n.s.
Mortality	6.6%	5.2%	n.s.
Length of hospital stay (days)	11.6 ± 2.1	12.8 ± 2.4	n.s.

WBC, white blood cell; n.s., not significant

the tumor stage were similar. There was one case of stapler malfunction, when a stapler did not fire properly. This anastomosis was subsequently done manually without any problems.

Discussion

Many randomized studies have been done to evaluate stapling methods in elective surgery; however, few reports have compared stapling and manual suturing in an emergency setting.[10] The advantages of staplers include a significantly faster anastomosis resulting in a shorter operating time,[12] while their main disadvantage is their expense. On the other hand, manual suturing affords significant advantages with respect to the wound infection rate and the hospital stay,[3] although the majority of studies do not show any difference in the incidence of anastomotic leaks.[1–9] To the best of our knowledge, there have been no trials specifically based on emergency surgery intestinal anastomosis.

Anastomoses in emergency surgery are usually performed in critically ill patients under difficult situations. Thus, because minimizing the operating time can be very important, faster anastomoses using the stapling technique may be fundamental. Moreover, patients treated in an emergency situation have not been prepared as in elective surgery, creating additional risk factors. Our study was carried out in a single institution by surgeons very experienced in suturing and stapling in emergency intestinal surgery, thereby minimizing the "surgeon risk factor." Other variables, such as antibiotic prophylaxis and anastomotic technique, can influence the integrity of anastomosis.[13] In our center, these variables were standardized because antibiotic prophylaxis was based on the NNISS protocol[11] and the same anastomotic technique was used by surgeons. Moreover, the overall incidence of anastomotic leakage was comparable with that of most reported series,[1–9] demonstrating the quality of our standards. There was no difference in the rate of anastomotic leakage between manual and stapled anastomoses, either of small bowel or colorectal anastomoses, despite a previous report that hand suturing resulted in a lower incidence of colorectal anastomosis leakage.[2]

Mechanical anastomosis is obviously less cost-effective.[14] Furthermore, patients with a stapled anastomosis did not have a shorter hospital stay than those with a sutured anastomosis, making stapled anastomosis definitely more expensive. This finding does not support the cost analysis reported by the West of Scotland Study.[2]

The difference in the mean operation time between the groups studied was about 60 min, which was greater than expected. This is mainly because manual double-layer interrupted suturing is time consuming.[15] However, there were no advantages related to shorter operating times as stated by other authors,[16] which is probably related to the sample size (population power).

Finally, it is important to note that there was one case of stapler malfunction when a stapler did not fire properly, but the anastomosis was subsequently carried out manually without any problems. Thus, we conclude that in emergency intestinal surgery, mechanical anastomoses can achieve results comparable to manual anastomoses, but the latter is definitely more cost-effective.

References

1. Ravitch MM, Steichen FM. Techniques of staple suturing in the gastrointestinal tract. Ann Surg 1972;175:815–37.
2. Docherty JG, McGregor JR, Akyol AM, Murray GD, Galloway DJ. Comparison of manually constructed and stapled anastomoses in colorectal surgery. West of Scotland and Highland Anastomosis Study Group. Ann Surg 1995;221:176–84.
3. Ceraldi CM, Rypins EB, Monahan M, Chang B, Sarfeh IJ. Comparison of continuous single layer polypropylene anastomosis with double layer and stapled anastomoses in elective colon resections. Am Surg 1993;59:168–71.
4. Scher KS, Scott-Conner C, Jones CW, Leach M. A comparison of stapled and sutured anastomoses in colonic operations. Surg Gynecol Obstet 1982;155:489–93.
5. Kusunoki M, Ikeuchi H, Yanagi H, Shoji Y, Yamamura T. A comparison of stapled and hand-sewn anastomoses in Crohn's disease. Dig Surg 1998;15:679–82.
6. Yamamoto T, Bain IM, Mylonakis E, Allan RN, Keighley MR. Stapled functional end-to-end anastomosis versus sutured end-to-end anastomosis after ileocolonic resection in Crohn disease. Scand J Gastroenterol 1999;34:708–13.
7. Yamamoto T, Keighley MR. Stapled functional end-to-end anastomosis in Crohn's disease. Surg Today 1999;29:679–81.
8. Dunn DH, Robbins P, Decanini C, Goldberg S, Delaney JP. A comparison of stapled and hand-sewn colonic anastomoses. Dis Colon Rectum 1978;21:636–9.
9. Luukkonen P, Jarvinen H. Stapled vs hand-sutured ileoanal anastomosis in restorative proctocolectomy. A prospective, randomized study. Arch Surg 1993;128:437–40.
10. Brundage SI, Jurkovich GJ, Hoyt DB, Patel NY, Ross SE, Marburger R, et al. Stapled versus sutured gastrointestinal anastomoses in the trauma patient: a multicenter trial. WTA Multi-institutional Study Group. Western Trauma Association. J Trauma 2001;51:1054–61.
11. Gaynes RP, Culver DH, Horan TC, Edwards JR, Richards C, Tolson JS. Surgical site infection (SSI) rates in the United States, 1992–1998: the National Nosocomial Infections Surveillance System basic SSI risk index. Clin Infect Dis 2001;33 Suppl 2:S69–77.
12. Fingerhut A, Elhadad A, Hay JM, Lacaine F, Flamant Y. Infraperitoneal colorectal anastomosis: hand-sewn versus circular staples. A controlled clinical trial. French Associations for Surgical Research. Surgery 1994;116:484–90.
13. Mann B, Kleinschmidt S, Stremmel W. Prospective study of hand-sutured anastomosis after colorectal resection. Br J Surg 1996;83:29–31.
14. Izbicki JR, Gawad KA, Quirrenbach S, Hosch SB, Breid V, Knoefel WT, et al. Is the stapled suture in visceral surgery still justified? A prospective controlled, randomized study of cost effectiveness of manual and stapler suture. Chirurg 1998;69:725–34.

15. Littke MP, Markgraf R. Continuous single-layer technique in turnable and nonturnable gastrointestinal anastomoses. A prospective observational study of emergency and elective operations. Zentralbl Chir 2002;127:992–6.

16. Anselmi A, Salvini P, Crozzoli L, Manenti F, Papotti R, Sallusti M, et al. Comparison of mechanical and manual anastomoses in emergency gastric resection. G Chir 1991;12:81–3.