

Single-Layer Open Gastrointestinal Anastomosis

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"IN END-TO-END anastomosis of the intestine, only one row of sutures should be taken. . . . I should regard a second row as a factor of danger rather than security." Thus, Halsted summarized intestinal anastomosis.⁴ Despite this principle, two-layer anastomoses, either open or closed, have been used almost universally in the past.⁶ Emphasis has been on suture material and the technic of placement of sutures. Only a few stress the importance of a single layer of sutures as sufficient to complete a safe anastomosis.

An abundant experience has been gained during the past three years in the use of a single-layer closure in the gastrointestinal tract. This study of 327 patients is limited to patients who have had colon and gastrojejunanal anastomoses and includes 136 colon anastomoses, 95 single-layer and 41 multiple-layer, and 191 gastrojejunanal anastomoses, 89 single and 102 multiple. Two-layer anastomoses were all performed during the first three years, and the single-layer series during the second three-year period. No cases were excluded from the study. Single-layer anastomoses have been used successfully in small intestinal anastomoses, cholecystojejunostomy, duodenal stump closures and pyloroplasties, but these cases are not considered in this report. The incidence of complications, other than anastomotic leakage and survival rates, are not discussed.

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Current Practice among Surgeons

Six months ago a questionnaire was sent to members of the Southern Surgical Association to determine the type of anastomosis preferred. There was a 90 per cent response to 365 questionnaires. Of those responding, 60 stated that they did not do gastrointestinal operations routinely. Of those who do perform such operations, 12 preferred single-layer open anastomoses, 10 preferred one-layer closed anastomoses, and 243 preferred multiple-layer anastomoses in the colon. In the stomach, 10 preferred one-layer open anastomoses, three stated they did one-layer closed anastomoses and 248 stated a preference for multiple-layer gastrojejunanal anastomoses (Table 1). This survey shows that most gastrointestinal surgeons today prefer two-layer closures for both colonic and gastric operations.

Technic of Single-layer Open Gastrointestinal Anastomosis

Halsted, in his original article, emphasized that the mattress-type suture was superior to the Lembert suture in intestinal

TABLE 1. *Survey of Members of the Southern Surgical Association Showing Preference of Anastomosis*

Colon Anastomosis		Stomach Anastomosis	
Single layer		Single layer	
Open	12	Open	10
Closed	10	Closed	3
	22		13
Multiple layer	243	Multiple layer	248

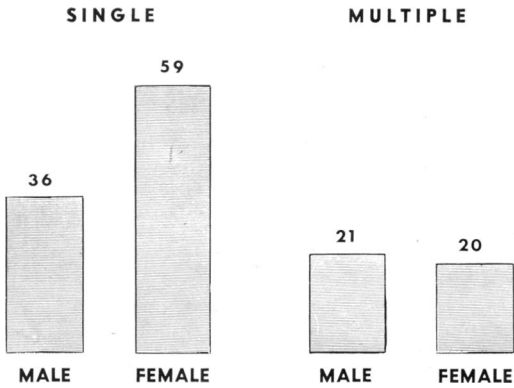


FIG. 1. Sex of patients with colon anastomoses.

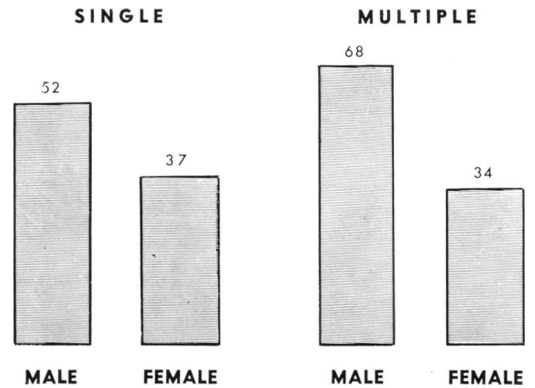


FIG. 2. Sex of patients with stomach anastomoses.

anastomosis.⁴ He was emphatic in stressing that the needle should pass through submucosa, but should not penetrate mucosa. In this study, the technic has been Dacron sutures through the serosa, muscularis and submucosa of the intestine with emphasis on avoiding penetration of the mucosa. An attempt was made to catch submucosa approximately 5 mm. inferior to the cut surface of the mucosa. Suturing intestine in this manner permits accurate approximation of all layers of the intestinal wall. The sutures are placed approximately 5 mm. apart to avoid an inverted intestinal cuff.⁷ Consideration of the blood supply of the intestine shows that the deep blood vessels lie in the submucosa. Therefore, sutures which include the submucosa afford both hemostasis and approximation. In two-layer anastomoses the posterior row of su-

tures were all placed before they were tied; the anterior row were tied as they were placed. In gastrojejunal anastomoses, the blood vessels were ligated prior to placement of the submucosal sutures. This is necessary because submucosal blood vessels in the stomach bleed vigorously and require immediate ligation.

Results

The age, sex and hemoglobin levels on admission are summarized for comparative purposes in Figures 1 to 5. The patient population was similar in the open and closed series of both colonic and gastrojejunal groups.

Colonic Anastomoses

The distribution of patients with respect to the disease which necessitated the op-

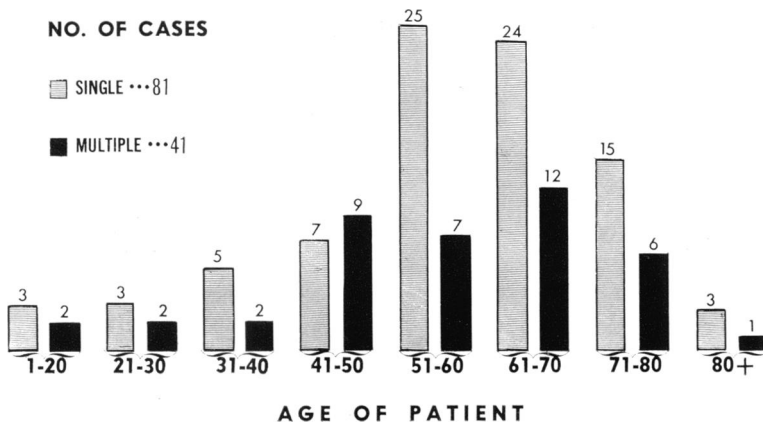
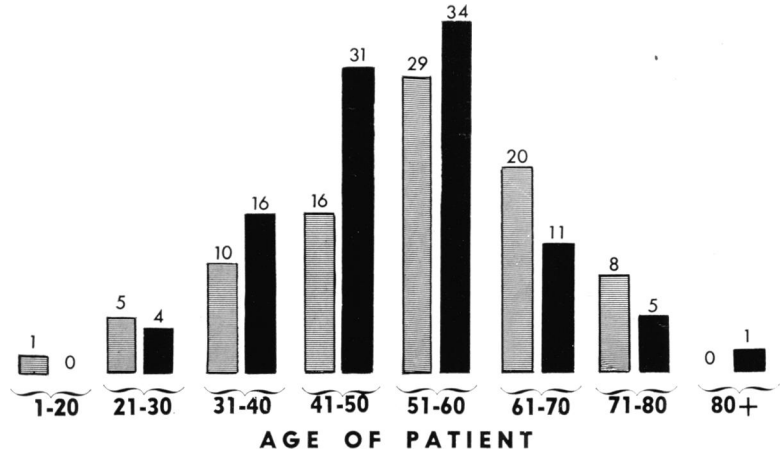


FIG. 3. Distribution of age of patients in colon series.

FIG. 4. Distribution of age of patients in stomach series.



eration is shown in Figure 6. Both series of patients were prepared for operation with antimicrobial agents consisting of neomycin and Sulfathalidine for 36 hours prior to operation. In addition, uniform doses of castor oil were given.

Sutures for single-layer anastomoses were interrupted 3-0 braided Dacron. For multiple-layer closures, an inner row of continuous 2-0 chromic catgut sutures and an outer layer of interrupted 3-0 braided Dacron sutures were used.

For comparison four factors in the two

series of patients were analyzed: 1) mortality; 2) anastomotic leakage; 3) first day patient tolerated food; and 4) first day patient passed stool and flatus. In patients with single-layer anastomoses, five per cent tolerated food on the second postoperative day while none of the patients with the two-layer anastomoses could tolerate food at this time (Fig. 7). Forty-two per cent of patients with single-layer anastomoses tolerated food on the third day as compared to only ten per cent of those with two-layer anastomoses. It required approxi-

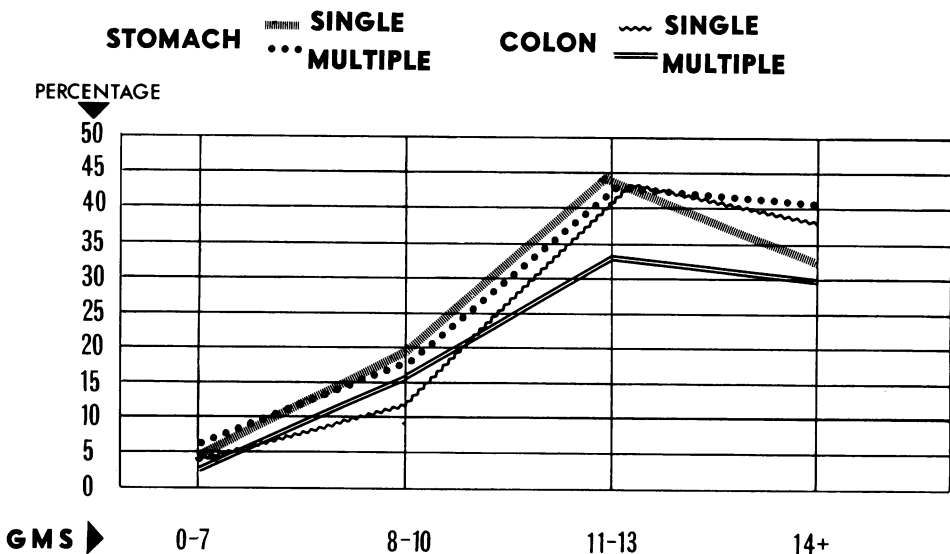


FIG. 5. Hemoglobin determination at the time of admission to hospital of both series.

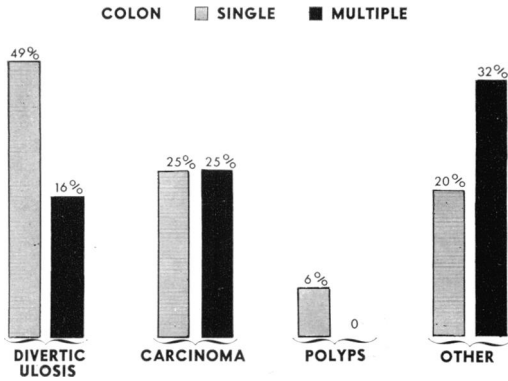


FIG. 6. Diagnosis in colon series.

mately one day longer for patients with two-layer anastomoses to tolerate food than for those with single-layer.

The first day of passage of stool and flatus is shown in Figure 8. In the single-layer series, 29 per cent of patients passed stool and flatus on the third day and only seven per cent of those in the two-layer series did so. By the fourth day, 72 per cent in the single-layer series passed stool and flatus as compared to only 35 per cent in the multiple-layer series.

Gastrojejunal Anastomoses

The distribution of patients, according to the disease for which operation was performed is shown in Figure 9. Duodenal ulcer was the most frequent disease and the number of patients was essentially the

TABLE 2. Distribution of 327 Patients with Gastrointestinal Anastomoses

	Single	Multiple
Colon	95	41
Stomach	89	102
Total	184	143

same in both series. Gastric ulcer and carcinoma were the next most frequent and the distribution of patients was approximately equal in both series.

In a typical case after partial gastrectomy, submucosal blood vessels were ligated and a Hofmeister anticollic anastomosis was accomplished. The lesser curvature of the stomach was approximated with a single layer of interrupted 3-0 Dacron suture. The gastrojejunal anastomosis was completed with a single layer of interrupted Dacron sutures placed in a similar manner. In a multiple-layer gastrojejunal anastomosis an inner layer of 2-0 continuous chromic catgut suture and an outer layer of interrupted 3-0 Dacron were used.

In all patients, a nasogastric tube was placed in the stomach prior to operation. The two series were analyzed as to the first day the nasogastric tube could be removed and the patient could tolerate oral intake. Figure 10 shows that 39 per cent of patients with single-layer closure could be fed by the third day while only 11 per cent of

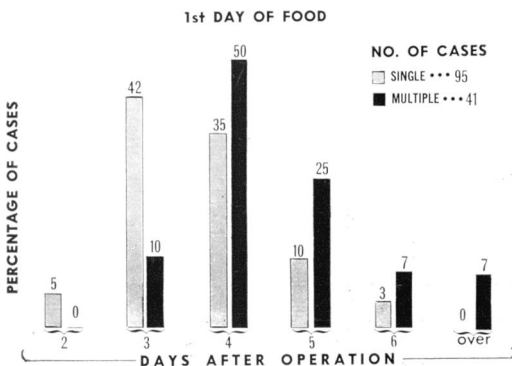


FIG. 7. Distribution of patients in colon series showing first day of oral intake.

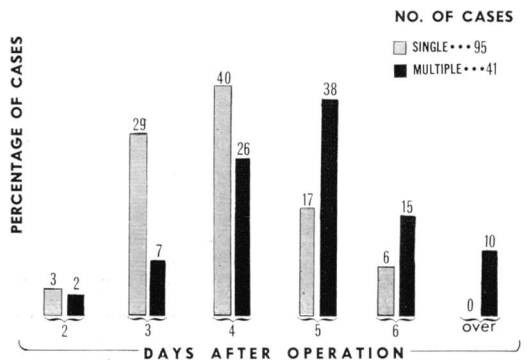
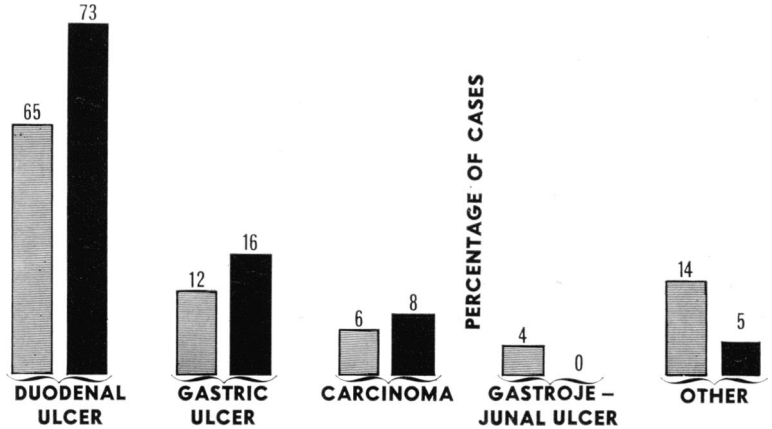


FIG. 8. Distribution of patients in colon series showing first day of passing stool and flatus.

FIG. 9. Diagnosis of patients with gastric resection.



those with multiple-layer closure could be fed at that time.

This indicates that there is less edema in single-layer closures of the stomach than in multiple-layer anastomoses.

Complications

Complications in both groups are summarized in Table 3. In the single-layer anastomoses of the colon, there was no leakage and there were no deaths in 95 consecutive cases. In three patients who had multiple-layer closures the anastomoses leaked and one patient with disseminated carcinoma in whom the anastomosis leaked died.

There was no leakage in either series of gastrojejunal anastomoses. There were two deaths with multiple-layer closures, but these deaths were not attributed to the

technic since the cause of death was pulmonary embolus which was proved at autopsy in each instance. In the total series of 184 patients with single-layer anastomoses of both colon and stomach, no patient leaked at the site of the anastomosis.

Discussion

It appears from this study that patients with single-layer anastomoses of the colon tolerated food and passed flatus and stool on the average of 24 hours earlier than those patients with multiple-layer closures. The incidence of leakage at the site of anastomosis was less in single-layer closures.

Patients who had single-layer gastrojejunal anastomoses tolerated food one day earlier than those with multiple-layer closures, and there was no evidence of leakage in this group. It is concluded that a single-

FIG. 10. First day of oral intake following gastric resection.

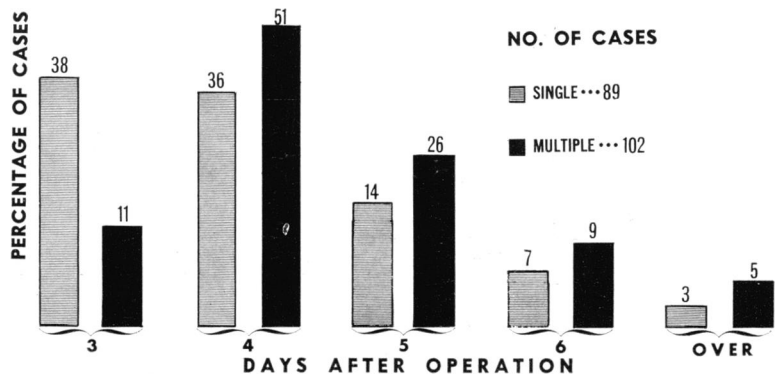


TABLE 3. *Summary of Gastrointestinal Anastomoses*

	Colon		Stomach	
	Single	Multiple	Single	Multiple
Leakage	0	3	0	0
Deaths	0	1*	0	2**
No complications	95	37	89	100
Total	95	41	89	102

* Leakage-peritonitis—ca.

** Pulmonary embolus.

layer anastomosis of the colon and between the stomach and jejunum is safe. Probably less edema at the one-layer suture line accounts for the ability to tolerate food and pass flatus one day earlier than with multiple-layer closures.

Gambée in 1951² and in 1956,³ reported an 8.5 per cent incidence of leakage of single-layer anastomoses. Beling in 1956¹ reported a series of 60 consecutive one-layer anastomoses without mortality. Heifetz in 1966⁵ described the technic of single-layer anastomoses in the colon and compared 50 cases of single-layer versus two-layer closures. Patients on whom he used one-layer technic, passed stool and flatus on an average of one day earlier and mortality and morbidity were the same for both groups. No reports of an appreciable series of single-layer gastrojejunal anastomoses were found.

Summary

In a survey of more than 300 American surgeons, it was found that most prefer

two-layer closure for gastrointestinal anastomoses. A study of 327 patients compared single-layer with multiple-layer closures in two groups of patients; 136 with colon anastomoses and 191 with gastrojejunal anastomoses.

In anastomoses at both sites patients with single-layer closures tolerated food and passed flatus and stool 24 hours earlier than those with multiple-layer closures. There were no anastomotic leaks and no deaths in the single-layer series.

In the multiple-layer anastomoses of the colon, three patients had leaks at the anastomotic site and one died. None of the multiple-layer closures of the gastrojejunal region leaked.

Single-layer anastomoses can be accomplished with less morbidity and with comparable mortality to multiple-layer closures.

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DISCUSSION

DR. GEORGE B. SANDERS (Louisville): Dr. Noer, Dr. Yeager and gentlemen. I want to compliment Drs. Hamiltan and Bronwell for two excellent papers. I really don't think I need to compliment them, the applause certainly did that.

It seems to me that these papers, like so many other good papers on intestinal anastomosis, bring out the fact that technics of anastomosis which

assure that each stitch engages the submucosa are reliable and those that do not are unreliable.

If a surgeon meticulously chooses a suture technic which is reliable, it seems obvious that more than one layer is unnecessary and may even be harmful, as was brought out in both of these papers.

Now, since it is true that only the stitch that engages the submucosa adequately is reliable, and