
Emergency Operations for Gastric and Duodenal Ulcers in High Risk Patients

HUNTER H. MCGUIRE, JR., M.D. J. SHELTON HORSLEY III, M.D.

With routine endoscopy, histamine antagonists, proximal gastric vagotomy (PGV) and declining prevalence of duodenal ulcers, morbidity and mortality of ulcer surgery should have declined. Two hundred thirty-four ulcer operations performed since 1976 were compared with 778 between 1961 and 1971. The hospital mortality rate has increased from 2.7 to 14.5%. Increased mortality was related to a doubling of the rate of emergency operations over age 50 and to a 94% decline in elective operations under 50. Mortality was increased by the need for emergency operations and more by concurrent diseases than by old age. Few operations could have been avoided by earlier elective surgery. Most perforations and hemorrhages occurred from previously unsuspected ulcers, many in patients being treated for other advanced or terminal diseases. Although most deaths occurred in this group, 42% survived. Such patients should be expeditiously offered the definitive operations most appropriate to the locations of their ulcers. Since 1976 among 200 survivors, 20 ulcers have recurred. Most recurred after PGV was tried for pyloric and prepyloric ulcers (8 of 16 recurred) and after previously untreated perforated ulcers were simply closed (4 of 11 recurred). The authors so far have one recurrence after 43 PGVs for duodenal ulcers. These recurrences confirm the need for vagotomy in perforated duodenal ulcer and for resection of ulcers proximal to the duodenum.

IN 20 YEARS, the prevalence of duodenal ulcers has declined. Their diagnosis has become more precise with endoscopy and their management improved by the introduction of histamine antagonists and proximal gastric vagotomy. These events should have improved results of operations for peptic ulcer. In our VA Medical Center, however, mortality and ulcer recurrence rates have increased. Between 1961 and 1971, Wolf, Bell, and Zimberg supervised and reported 778 operations with 2.7% mortality and 5% ulcer recurrence.¹ In 8 years since 1976, we performed 234 operations with 14.5% mortality and

From the Department of Surgery, Veterans Administration Medical Center, and the Medical College of Virginia, Virginia Commonwealth University, Richmond, Virginia

8.5% recurrence. Seeking remediable causes of mortality and recurrences, we compared patients and procedures for the two periods. We found a significant increase in the incidence of hemorrhage and perforation from previously unsuspected ulcers in high risk patients. This paper will describe their characteristics and discuss their management.

Methods

Annual rates of elective and emergency operations between 1961 and 1984 were derived from operating room logs of the McGuire Veterans Administration Medical Center. For 1961 to 1971, all other data are those published by Wolf, Bell, and Zimberg. During that period, they dictated policies and supervised residents in performing most operations. Between 1971 and 1976, endoscopy and proximal gastric vagotomy were inconsistently used; thus, data of that period were not used for comparison. Since 1976, policies, practices, and supervision have again been standardized. From the records of all patients operated on between October 1976 and November 1984 for gastric, pyloric, or duodenal ulcer, the following data were retrieved: age, methods of demonstrating ulcers, location and duration of ulcers, indications for surgery, concurrent diseases, operations performed, staff supervision, postoperative complications, days without food, days in hospital, duration of follow-up, weight change, and incidence of dumping, diarrhea, pain, satiety, endoscopic ulcer recurrence, and reoperation. All deaths in the hospital were attributed to ulcer surgery, except one from pneumonia in a quadriplegic patient 3 months after operation. Most operations and all convalescences were supervised by the authors. Superficial stress ulcers,

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Reprint requests: Hunter H. McGuire, Jr., M.D., Veterans Administration Medical Center (112), Richmond, VA 23249.

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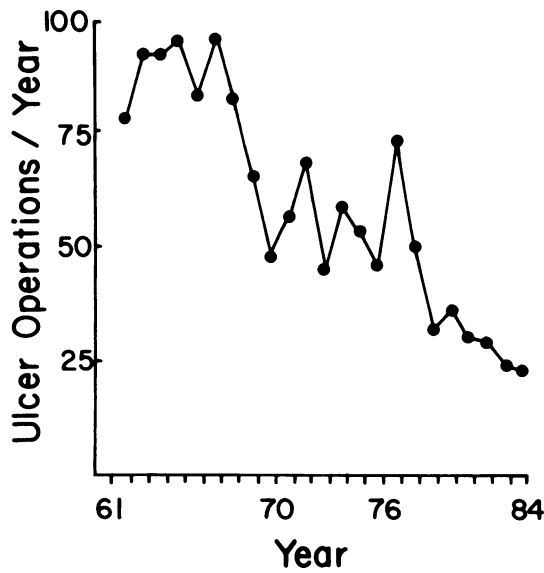


FIG. 1. Ulcer operations performed each year between 1961 and 1984 declined at approximately the same rate as admissions for duodenal ulcer in U.S. males.²

hemorrhagic gastritis and ulcers due to hypergastrinemia were excluded from this study.

Results

The number of ulcer operations we performed each year from 1961 to 1984 declined at approximately the same rate as hospital admissions for duodenal ulcer in the United States (Fig. 1). Our elective operations declined from averages of 70 per year in the earlier decade to 12

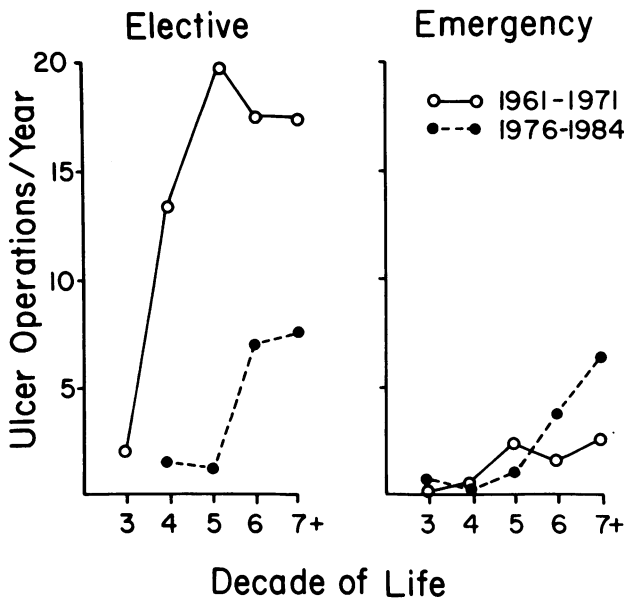


FIG. 2. Elective operations before age 50 declined from an average of 35 per year to less than three per year. Emergency operations on patients over age 50 increased from averages of 4.2 to 10.2 per year.

per year in the last 8 years. Our rate of emergency operations increased from averages of 7.6 to 12 per year.

Age

The average number of elective operations performed each year on patients under age 50 declined by 93%, while emergency operations over 50 increased by 94% (Fig. 2). These changes were out of proportion to the aging of all veterans admitted to our surgical service. Rates of all admissions to our service were constant; all admissions under age 50 declined by only 50% and those over age 50 increased by only 50%.

Location

Before 1970, prepyloric and pyloric ulcers were not distinguished from duodenal ulcers. Instead, all 660 ulcers associated with hypersecretion were reported as a single group treated by truncal vagotomy and antrectomy or drainage. These were distinguished from 57 gastric ulcers without hypersecretion and 61 anastomotic ulcers. In the past 8 years, we have operated on 111 duodenal, 58 pyloric and prepyloric, 55 gastric (over 4 cm proximal to the pylorus), and 11 anastomotic ulcers. These changes constitute a 77% decline in annual rate of operations for anastomotic ulcers, 68% decline in duodenal, pyloric, and prepyloric ulcers, and a 21% increase in rate of operations for gastric ulcer.

Indication

In the earlier decade, 447 operations were performed to relieve intractable pain, 179 for recurrent but controlled bleeding and 76 for obstruction. In the past 8 years, these indications declined by 83%, 64%, and 61%, respectively (Fig. 3). The average number of emergency operations per year for active hemorrhage and for perforation increased by 61% and 53%.

Duration

Since 1976, the average duration of ulcer disease operated electively for intractable pain was 6.9 years, for recurrent but controlled bleeding 7.6 years, and for obstruction 12.3 years. All but three elective cases had been treated unsuccessfully with cimetidine or ranitidine before admission. Of 57 patients operated emergently for incessant hemorrhage, only nine were known to have had ulcers before admission. Of 39 treated for perforation, only 17 had antecedent ulcer symptoms. Ulcers were thus known to have been present before admission in only 27% of patients who required emergency operations.

Procedures

Operations employed in the two periods are listed in Table 1. Since 1976, residents have been assisted by staff

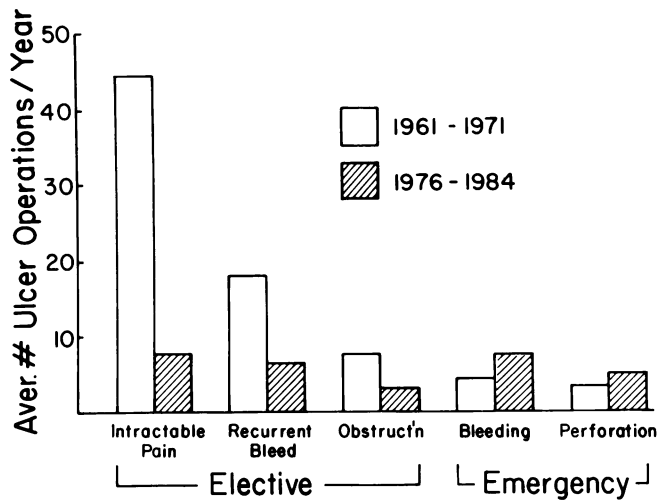


FIG. 3. Intractable pain as an indication for elective surgery declined from an average of 45 cases per year to eight per year. There were significant but less marked declines in elective operations for recurrent bleeding and obstruction while emergency operations increased.

surgeons in all elective and all but 19 emergency cases. Complication and recurrence rates were no greater when staff surgeons were not scrubbed. All proximal gastric vagotomies (PGV) were carefully supervised and performed in precisely the same manner. Deaths following procedures used are shown in Table 2. Comparing emergency and elective procedures for the two series of patients, there are no differences in mortality that are statistically significant. Complication rates of operations since 1976 are compared in Table 3. The only significant difference is that emergency PGV was followed by fewer complications than any other emergency procedure. This may be because the fittest patients with perforations were selected for PGV.

Complications

Since 1961-1971, controllable, technical problems such as wound infection declined but were replaced by cardiovascular complications (Table 4). After emergency operations, wound infections were more than replaced by renal failure, bleeding, anastomotic leaks, and intra-abdominal abscesses (Table 5). Mortality was not caused by inordinate delay or excessive transfusion before emergency operations. Before operation, only four cases received more than 10 units of blood, and their complications were attributable to coagulopathy, pneumonia, or cancer.

Deaths

Morbidity and mortality were related to the necessity for emergency operation, advancing age, and concurrent diseases. In the earlier decade, mortality rates were 0.8% after elective surgery and 19.7% after emergency operations. From 1976 to 1984, rates were insignificantly higher, 2.2% and 32.2%. In the later period, 62 patients had severe

TABLE 1. Procedures Employed

Procedure	1961-1971		1976-1984	
	Number	%	Number	%
Antrectomy	57	7.3	58	24.8
Vagotomy and antrectomy	548	70.4	77	32.9
Proximal gastric vagotomy	0		60	25.6
Vagotomy and pyloroplasty	75	9.6	12	5.1
Vagotomy and gastroenterostomy	25	3.2	0	
Perforation closure	5	0.6	20	8.6
Wedge resection or ligation	6	0.8	0	
Vagotomy for marginal ulcer	21	2.7	6	2.6
Resection for marginal ulcer	18	2.3	1	0.4
Other	22	2.8	0	
Total	778	100	234	100

concurrent diseases such as disseminated cancer, pulmonary or renal failure requiring ventilation or dialysis, liver failure with ascites, recent infarction of heart, lung, brain, or extremity, or recent major operation. Data in Table 6 show how these conditions affected mortality rates. In the absence of severe concurrent disease, elective operations were safe at any age. In the presence of severe diseases, most emergency operations were fatal regardless of age, but 21 such patients (42%) were discharged and 10 have been followed from 1 to 5 years.

Follow-up

In both periods, about 15% of patients were followed less than 1 year or lost to follow-up. Comparisons between the two periods are further faulted by different techniques of study. In the earlier period, almost all patients had postoperative Hollander tests, but few had flexible endoscopy. In the late period, all postoperative ulcer symp-

TABLE 2. Mortality of Procedures Employed (Deaths/Total Operations)

Procedure	Elective		Emergency	
	1961-1971	1976-1984	1961-1971	1976-1984
Antrectomy	1/50	1/34	4/7	11/24
Vagotomy and antrectomy	4/506	0/49	2/42	6/28*
Proximal gastric vagotomy	0	1/48	0	0/12
Vagotomy and pyloroplasty	0/61	0/1	4/14	5/11
Vagotomy and gastroenterostomy	1/25	0	0	0
Perforation closure	0	0	3/5	9/20
Wedge resection or ligation	0	0	2/6	0
Vagotomy for marginal ulcer	0/21	1/6	0	0
Resection of marginal ulcer	0/18		0	0/1
Other	0/22	0	0	0
Total	6/702	3/138	15/76	31/96
Per cent mortality	0.8%	2.2%	19.7%	32.3%

* Even between emergency vagotomy and antrectomy in the two periods, the difference in mortality rate is not statistically significant ($\chi^2 = 3.11$).

TABLE 3. *Complication Rates of Procedures Employed, 1976-1984*

Procedure	Elective	Emergency
	Complicated/ Performed	Complicated/ Performed
Antrectomy	5/34	14/24
Vagotomy and antrectomy	16/49	18/28
Proximal gastric vagotomy	12/48	1/12*
Vagotomy and pyloroplasty	1/1	9/11
Perforation closure		16/20
Vagotomy for marginal ulcer	3/6	
Resection of marginal ulcer		1/1
Total	37/138	59/96
Per cent complicated	26.8%	61.5%

* Emergency PGV had significantly fewer complications ($p = < 0.01$) than any other emergency procedure. Differences between elective procedures are not significant.

toms were investigated by endoscopy, but few had secretory studies. The extent of follow-up since 1976 is shown in Table 7. Despite these shortcomings, certain observations summarized in Table 8 are clearly significant.

After PGV dumping and diarrhea were absent, weight loss was rare, and postprandial pain occurred only in patients with persistent or recurrent ulcers. The rate of reoperation for ulcer was significantly higher after PGV than after antrectomy with or without vagotomy, but no reoperation was required after PGV for duodenal ulcer. After 43 PGVs for duodenal ulcer, there has been one endoscopic recurrence in 1-9 year follow-up (mean: 3.9 years). After another PGV for multiple duodenal ulcers, endoscopy showed "duodenitis," and pain was unaffected by subsequent antrectomy.

Sixteen duodenal, two gastric, and two marginal ulcer perforations were treated by simple closure, nine because

TABLE 5. *Complications of Emergency Operations*

Complication	1961-1971		1976-1984	
	Num- ber	%	Num- ber	%
Wound infection	11	14.5	1	1.0
Pneumonia	14	18.4	12	12.5
Delayed gastric emptying	0		3	3.1
Postoperative bleeding	2	2.6	6	6.3
Anastomotic leak	1	1.3	6	6.3
Intraabdominal abscess	2	2.6	4	4.2
Dehiscence	2	2.6	4	4.2
Renal failure	1	1.3	5	5.2
Myocardial infarct, arrhythmia	5	6.6	9	9.4
Stroke	2	2.6	4	4.2
Other	2	2.6	1	1.0
All cases with complications	40	53%	61	64%

we felt they were too ill for definitive procedures and 11 because they had no antecedent ulcer history. Nine died in hospital and three died within 2 years of other diseases. Of eight followed 1-8 years, four have required reoperation for recurrent complications of duodenal ulcers.

Discussion

Our elective operations since 1976 have been as safe and effective as the same procedures were before 1970. Our emergency mortality rates of 20% and 32% are not significantly different ($\chi^2 = 2.48$) or higher than reported by others.⁴ Except for introducing PGV, we employed the same techniques in elective and emergency operations during both periods of study. That vagotomies with antrectomy in the two periods were equally effective (Table 9) is evidence that our techniques did not change. Our overall increase in mortality must therefore have been caused by a change in some factor other than surgical technique.

Between 1961 and 1984, we experienced a 93% decline in the rate of elective operations for ulcers under age 50. This decline was parallel to the decline in hospital admissions for duodenal ulcer in the United States and in western Europe. Sonnenberg and Muller attribute this phenomenon to the disappearance of a population cohort born about 1880 to 1890 that was predisposed to ulcers by some yet unidentified environmental factor or factors.³

At the same time, we experienced a doubling in need for emergency operation over age 50. This was not attributable to doubling of veterans over 50, because elective ulcer surgery over 50 declined by 50%. Some factor other than, or in addition to, age seemed to have increased our emergency operations. Hemorrhage or perforation required emergency surgery 42 times in the first decade studied, 81 times in the later 8-year period. Our increased overall mortality rate was thus caused as much by dou-

TABLE 4. *Complications of Elective Operations*

Complication	1961-1971		1976-1984	
	Num- ber	%	Num- ber	%
Wound infection	87	12.4	2	1.5
Pneumonia	40	5.7	10	7.2
Delayed gastric emptying	25	3.6	3	2.2
Splenic injury	9	1.3	0	
Esophageal injury	3	0.4	2	1.4
Postoperative bleeding	4	0.6	0	
Anastomotic leak	4	0.6	0	
Intraabdominal abscess	3	0.4	2	1.4
Dehiscence, hernia	0		3	2.2
Myocardial infarct, arrhythmia	3	0.4	3	2.2
Stroke	3	0.4	3	2.2
Pulmonary embolus	2	0.3	2	1.4
Other	12	1.7	2	1.4
All cases with complications	197	28%	37	27%

TABLE 6. *Mortality Related to Urgency of Operation, Age, and Concurrent Disease*

Urgency and Age	Concurrent Disease	
	None or Mild	Severe
Elective <60	0/74	0/5
Elective >60	1/52	2/7
Emergency <60	0/26	10/20 (50%)
Emergency >60	2/20	19/30 (63%)

bling of high risk patients as by disappearance of safe elective cases.

Increased need for emergency operations was not caused by physicians or patients having deferred earlier elective operations. Only 27% of our emergency cases had evidence of ulcers before complications required emergency surgery. In most cases, hemorrhage or perforation was unpredictably added to some other disabling disease. Whether a patient survived seemed more related to his concurrent disease than to his age. This suggests that the increase in emergency operations might be attributable to a growing cohort of people whose survival of severe or terminal disease is being prolonged by chemotherapy, radiation, transplantation, renal dialysis, or ventilatory support.

What we have observed is not unique to a Veterans Administration hospital. University and community hospitals have also experienced increased incidences of hemorrhage and perforation from previously unsuspected ulcers in older patients being treated for other conditions.⁵

The greatest challenge in peptic ulcer surgery is to find safe, effective, and compassionate treatment for a high risk patient with an incessantly bleeding or perforated ulcer. Therapy must be individualized. Patients suffering from intolerable, irreversible disability and discomfort before an ulcer complication occurs should rarely, if ever, be operated on. When there is chance of improvement, however, the high risk patient should be offered surgery even more expeditiously than one who is otherwise healthy.

Our gastroenterologists are evaluating endoscopic coagulation of spurting arteries and seem occasionally to have converted unsafe emergencies to safer elective operations, but, as yet, we have no strong evidence that endoscopic coagulation improves survival. Donovan et al. advocated nonoperative treatment of perforated acute ulcers and of perforated chronic ulcers in high risk patients when they appeared to be sealed by contrast x-rays.⁶ Such conditions, however, pertained in only eight of Donovan's 60 perforations and are too rare in very high risk patients to warrant delay for x-ray examinations.

The least likely beneficiaries of emergency ulcer surgery might seem to be patients with disseminated cancers, but

TABLE 7. *Follow-up 1976-1984*

Hospital deaths	34
Unrelated deaths within 1 year	10
Reoperation for ulcer within 1 year	11
Disappeared within 1 year (15.4%)	36
Followed 1-9 years (mean: 3.9)	143

Condon reported 16 emergency operations in patients on chemotherapy, with 11 surviving 2 to 21 months.⁷ Among our 11 patients with cancers, eight died in the hospital, but a patient with lung cancer lived at home for 6 months, one with leukemia for 18 months, and one who had seminoma in both lungs when he bled 12 units from a duodenal ulcer lived 5 years after emergency vagotomy and antrectomy.

In almost every case where any operation is indicated, the procedure of choice will be the one most effective for an ulcer in the location encountered. Duodenal ulcers need some form of vagotomy. In our earlier decade, 27 perforated duodenal ulcers were treated by truncal vagotomy and antrectomy with no deaths and no recurrences. For 8 years after 1976, we simply closed 16 duodenal perforations because of severe concurrent disease, severe peritonitis, or because ulcers were previously unsuspected and need for an operation that might have irreversible side effects was unproved. Of these 16 closures, five died in hospital, four required reoperation, and only four are known to be free of ulcer for over 2 years. During the same time, we performed 12 emergency PGVs for duodenal perforations with no deaths and no recurrences. We also have no death and only one recurrence after elective PGV for duodenal ulcers. With more cases and longer follow-up, our recurrence rate should remain low, as we have precisely imitated the technique of Heffernan whose recurrence rate is 4% at 5 years.⁸ We therefore agree with Sawyers and Herrington⁹ and Jordan¹⁰ that patients with duodenal perforations who can tolerate 2 to 3 hours of anesthesia should be treated with emergency PGV.

While our PGVs were highly effective for duodenal ulcers, they failed to control eight of 16 pyloric and pre-

TABLE 8. *Follow-up, 1976-1984*

Operations	Survivors	Diarrhea, Dumping	Weight Loss	Recurrence	Reoperation
V&A	71	11.3%	12.6%	4.2%	1.4%
V&P	7	14.2%	14.2%	14.2%	14.2%
PGV	59	0%*	6.8%	15.3%	11.9%*
Antrectomy	45	10.9%	15.2%	6.5%	2.1%
Closure	11	0%	?	36.4%	36.4%*

* The only differences that are statistically significant ($p < 0.05$) are the high recurrence rate after simple closure compared to all other operations, the absence of side effects of PGV, and the high reoperation rate after PGV compared to antrectomy or to vagotomy and antrectomy.

TABLE 9. Results of Vagotomies with Antrectomy

	1961-1971	1976-1984
Number performed	500	71
Dumping or diarrhea	8%	11.3%
Involuntary weight loss >4.5 K	25%	12.6%
Ulcer recurrence	2.2%	4.2%
Reoperation	0.6%	1.4%

pyloric ulcers. In much larger numbers of PGVs reported by Anderson¹¹ and Muhe,¹² pyloric and prepyloric ulcers recurred twice as often as duodenal ulcers. Pyloric channel ulcers recur after antrectomy alone at an unacceptable rate.¹³ Pyloric and prepyloric ulcers should be treated by truncal vagotomy and antrectomy.

Actively bleeding duodenal ulcers can sometimes be sutured through a duodenotomy that spares the pylorus and then cured by emergency PGV, but reliability of this procedure has not been proved. The safest emergency operation for bleeding is still the most effective, *i.e.*, truncal vagotomy and antrectomy. Substitution of pyloroplasty for antrectomy increases ulcer recurrence rate and does not reduce mortality¹⁴ but should be done selectively when ulcer or scar would make division of the duodenum unreparable.

Much of the increased mortality of ulcer surgery is related to incessant bleeding from discrete "chronic" gastric ulcers over 4 cm proximal to the pylorus, usually on or near the lesser curvature. When the duodenum is normal, antrectomy is the easiest, safest, and most effective operation for these ulcers. Vagotomy is unnecessary. Vagotomy and wedge resection of ulcer¹⁵ is not as dependable as removing the vulnerable antrum, which prevents recurrence in about 99% of cases.^{13,16} Our only recurrence of this type of ulcer treated by antrectomy (1 of 34) occurred in a patient on large doses of steroids for Crohn's disease.

In conclusion, we have found an increased need for emergency operations in patients whose peptic ulcers were unknown until hemorrhage or perforation was superimposed on other disabling diseases. Mortality rates are inevitably high but individual outcomes are not predictable. Except when bleeding can be controlled endoscopically, each patient should be promptly offered the operation

most effective for the location of his ulcer. Gastric ulcers need antrectomy, perforated duodenal ulcers need PGV, and most prepyloric, pyloric, and bleeding duodenal ulcers should have truncal vagotomy and antrectomy.

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DISCUSSION

DR. JOHN L. SAWYERS (Nashville, Tennessee): It is indeed a pleasure to discuss Dr. McGuire's presentation. He was kind enough to send me his manuscript 2 weeks prior to the meeting.

Several years ago Dr. Scott, Dr. Herrington, and I presented to you the results of 3500 patients with duodenal ulcer who had undergone elective truncal vagotomy and antrectomy. More than half of those patients were operated on because of the failure of medical therapy. We

seldom see such a patient now-a-days. Instead, it is the type of patient whom Dr. McGuire has described to us, a patient in the older age group or with concomitant disease who presents as an emergency because of perforation or hemorrhage.

Ten years ago we reviewed a series of patients who had perforated duodenal ulcer and advocated a definitive operative procedure to control the ulcer diathesis in those patients who had a prior history of ulcer disease, those who were in generally good condition prior to operation,