

Vagotomy and Drainage Procedure for Duodenal Ulcer:

The Results of Ten Years' Experience

M. M. EISENBERG,* M.D., E. R. WOODWARD, M.D.,
T. J. CARSON, M.D., L. R. DRAGSTEDT, M.D.

*From the Department of Surgery, University of Florida College of Medicine,
Gainesville, Florida 32601*

THE choice of operative procedure in the surgical management of patients with duodenal ulcer has been a long-established dilemma; although currently there are available three satisfactory approaches—subtotal gastrectomy, vagotomy combined with limited gastric resection, and vagotomy combined with compensatory drainage procedure, it is only within the past half-decade that the characteristic effectiveness, safety, and freedom from morbidity associated with each of these operations has begun to emerge with clarity. It is now becoming apparent that all of these procedures have earned a permanent place in the armamentarium directed against primary and recurrent gastro-duodenal ulceration. With an improved understanding of ulcer pathophysiology and with data on the relative merits of each of these operations rapidly accumulating it should be, in the near future, possible for the thoughtful surgeon to tailor the avenue of attack to the specific problem at hand. The following data represent our accumulated experience over a 10-year period with 455 ulcer patients treated by one of the approaches, vagotomy and drainage, at the University of Florida teaching and affiliated hospitals.

Clinical Material

During the period which comprises this study, October 1958 through January 1968, a total of 455 patients with duodenal ulcer underwent vagotomy and drainage. The sources of clinical material are listed in Table 1. All 212 patients at the affiliated hospitals and approximately 90% of the patients at the University Hospital were operated upon by resident surgeons under supervision by attending surgeons. There were 415 male and 40 female patients, a male/female ratio in excess of 10:1. A large segment of the patient population was derived from the Veterans' Administration and State Prison hospitals accounting for the unusual male preponderance. Of 243 patients at the University Hospital, 39 or 16% were female, a sex proportion more consistent with that usually reported for duodenal ulcer. Three hundred eighty-two (84%) of the patients were white and 72 (16%) were black (Fig. 1). Random sampling of patients admitted to the source hospitals during the same period of time revealed the ratio of white (60%) to black (40%) to be significantly different. The inference drawn by others that duodenal ulcer occurs somewhat less commonly among blacks, is supported by these data.

Patient occupations are listed in Table 2. The relatively high incidence (61.6%) of skilled and unskilled workers as opposed to professional or executive personnel is a

Presented at the Annual Meeting of the American Surgical Association, April 30–May 3, 1969, Cincinnati, Ohio.

* Current address: Department of Surgery, University of Minnesota, Minneapolis, Minnesota 55455.

TABLE 1. *Vagotomy and Drainage for Duodenal Ulcer 1958-1968*

	No. Patients
University of Florida Clinics	243
Lake City V.A. Hospital	176
Raiford State Prison	30
Gainesville V.A. Hospital	6
Total	455

further reflection of the source of clinical material, and differs somewhat from the distribution sometimes reported in studies on duodenal ulcer disease.

The age range in the group was 8 to 83, with an average of 49 years; 44.7% of the patients were 50 years or older at the time of operation.

Symptomatology

Pain was present in 94.3% of the patients and 85.5% reported post-prandial epigastric discomfort; 55.8% also suffered nocturnal pain. Duration of symptoms at time of operation ranged from acute onset to more than 20 years (Table 3). The incidence of patients with ulcer symptoms of at least 1 year's duration was 87.1%; 63.8% had symptoms for more than 10 years; only 5.9% of the patients had acute onset of symptoms just prior to operation. Table 4 depicts the age of onset of symptoms.

Anxiety was an important symptom in this series. One hundred seventy-seven patients (39.0%) reported symptoms of significant, sustained anxiety; 30 (6.7%) reported previous psychiatric treatment.

Possible Contributory Habits

Smoking habits in 444 patients were recorded; 341 smoked (77%), 22 patients (5%) formerly smoked, and 80 (18%) were nonsmokers. Recent statistics reported by the American Cancer Society reveal that 68% of American males 18 years or older are smokers.

Of 446 patients for whom alcohol-drink-

ing habits were recorded, 203 (46%) imbibed regularly, 60 (13%) reported previous regular ethanol intake, and 183 (41%) were nondrinkers.

Fifty-seven (12.8%) of 446 patients reported "frequent" aspirin ingestion.

Previous Complications

Two hundred seventy-three (60%) of patients had at least 1 episode of hemorrhage prior to operation; 101 patients (22%) experienced only 1 episode, 144 (32%) experienced from two to four bleeding episodes, 26 (5.7%) from five to ten episodes, and two patients (0.3%) suffered more than ten episodes. Only 10% of the 455 patients, however, underwent emergency operation for hemorrhage.

Seventy-nine patients (17%) had a history of previous perforation; three of these had two previous perforations recorded.

Coexistent Disease

Approximately 40% of the 455 patients undergoing operation had significant coexistent systemic disease (Table 5), with almost 25% having major renal, cardiac, or pulmonary pathologic findings. The risks of major operation in this group, therefore, were not insignificant and may have been substantially higher than might be expected from random sampling of patients with duodenal ulcers; examination of

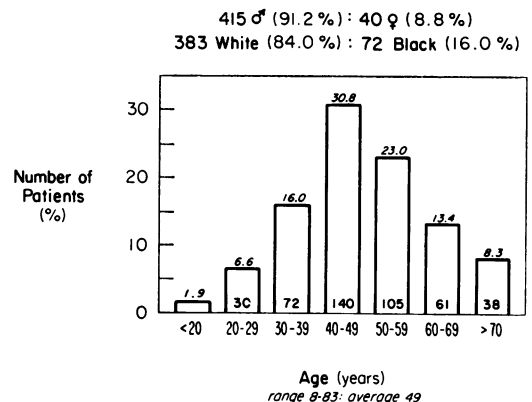


FIG. 1. Patient population.

TABLE 2. Patient Occupation

Occupation	% Patients
Unemployed	2.4
Executive	1.0
Professional	6.8
Management	7.0
Sales	5.5
Clerical	2.9
Skilled	38.7
Unskilled	22.9
Housewife	6.2
Other	6.6

the data on morbidity and mortality deserves to be interpreted in this light.

Acid Secretory Analysis

Three hundred eighty patients (83.5%) underwent fasting preoperative gastric secretory analysis (Fig. 2). Of these, 80.8% demonstrated free acid secretory rates in excess of 2 mEq./hr., levels which, although not here corrected for age and sex, we would consider to be in the hypersecretory range. Except for patients operated upon as emergency, virtually all patients who underwent surgery also underwent pre- and postoperative secretory studies. During the first 7 years of this study, a simple 2-hour basal secretory analysis was performed. In recent years a 1-hour fasting acid output measurement has been made, followed by a modification of Kay's augmented histamine test; maximal and peak acid outputs have been established and data are interpreted in the context of the patient's age and sex. These studies have been found to be helpful in: characterizing the severity and virulence of the disease; assessing the effectiveness of the operative procedure; occasionally—in the absence of radiologic confirmation—establishing the diagnosis; screening for endocrinopathic ulcer (Zollinger-Ellison); and, finally, accumulating data which, hopefully, will permit more accurate interpretation of the disease state.

Previous Medical or Surgical Therapy

Four hundred forty-one (89.9%) patients underwent previous medical therapy for ulcer disease. The untreated group (10.1%) comprised the majority of patients undergoing emergency therapy; 87 patients (18.0%) had previous non-medical treatment. The most common procedure was closure of perforation (Table 6).

Blood Type

Blood type was recorded in 320 patients; a comparison of blood types in this group and the blood type of unselected patients from a concurrent hospital population, is listed in Table 7. These data are consistent with those accumulated from Great Britain, Scandinavia, other parts of western Europe, and the United States, and demonstrate that there is a slight, but probably significant increase in blood type O among patients with duodenal ulcer disease.

Indications for Surgery

There were 401 (88.1%) elective operations and 54 (11.9%) emergency procedures (Table 8). The chief indication for elective operation was intractable pain which occurred in 265 patients (66.1%). Intractability, an abstract and "philosophic" diagnosis, has been defined—for purposes of this study—as that point in the course of the patient's disease at which he, his family, and his physician have come to agree that the risks of surgery no longer outweigh the risks of discomfort—both social and physical—incurred by continuing

TABLE 3. Duration of Symptoms (Pain)

Time	% Patients
Acute onset	5.9
6 months-1 year	7.0
1-5 years	23.3
6-10 years	23.4
11-20 years	25.0
> 20 years	15.4

TABLE 4. *Age at Onset of Symptoms (Pain)*

Years	% Patients
8	0.2
11-20	10.2
21-30	26.8
31-40	29.4
41-50	17.6
51-60	9.3
61-70	5.6
71-80	0.9
80+	0.0

with the ulcer. Intractability implies failure, in most instances, of medical therapy.

The chief indication, by far, for emergency operation was hemorrhage (85.2%). The incidence of patients who were operated upon electively (more than 24 hours after admission) for pyloric obstruction was 11.5%. Inability to follow medical management was the indication for operation in 5.5%. These patients were predominantly from the State Prison group where less than optimal conditions exist for medical management.

Emergency Operations

Of 54 emergency procedures, 46 (85.2%) were performed for hemorrhage and only 8 (14.8%) for perforation. Of the 46 patients who underwent emergency operation for hemorrhage, 38 had acute massive bleeding—according to Stuart's definition, which is: Hemoglobin levels of 8 Gm. or less and hematocrit less than 25%; the requirement of 2,000 ml. or more of whole blood for restoration of circulatory status or replacement of approximately 40% circulating blood volume; shock; hypotension of at least 40 mm. Hg below normal.¹

Operative Findings

The findings at the time of operation are listed in Table 9; approximately 50% of the patients had active ulcers at the time of exploration. Location of the ulcers is tabulated in the same table, with the ma-

jority, as anticipated, found in the duodenal bulb.

Operative Procedures

Four hundred sixteen (91.4%) underwent vagotomy with pyloroplasty as the drainage procedure (Table 10). In 39 (8.6%) the drainage procedure was gastroenterostomy. In general, with the exception of the first 2 years comprising this study, single layer pyloroplasty of the Weinberg modification of the Heinecke-Mikulicz type was preferred. An occasional patient, because of specific anatomic reasons or difficulty in mobilizing and exposing a markedly scarred and distorted duodenum, underwent a gastroenterostomy or Finney-type pyloroplasty. Except under extraordinary circumstances, however, even the most deformed duodenum has been found to be safely (and effectively) amenable to the Weinberg technic.

Associated operative procedures are also listed in Table 10. Foley catheter gastrostomy has been the standard accompaniment of vagotomy and drainage in this series, and was performed in 94.0% of the cases. It has been found to be an exceptionally safe and efficient technic for decompressing the upper gastrointestinal tract. The drainage tube is placed on suction for the first 24 hours, and subsequently is left to straight gravity drainage. On the eve of the fourth postoperative day it is clamped and the residual gastric fluid accumulation is measured each morning and evening. If the residual is 150 cc. or less, the tube is re-clamped; it is removed on the evening of

TABLE 5. *Coexistent Disease*

	No. Patients	%
Cardiac	53	11.6
Pulmonary	44	9.7
Renal	15	3.3
Gastrointestinal (hiatal hernia)	49	10.8
Endocrine (diabetes mellitus)	18	4.0

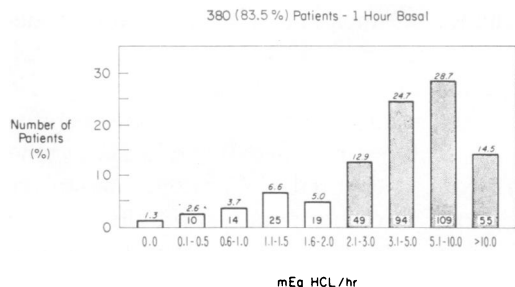


FIG. 2. Preoperative gastric secretory studies.

the ninth or morning of the tenth postoperative day. Oral intake is usually advanced from water and clear liquids to soft and full solids beginning with the fourth postoperative day. All carbonated drinks, juices, and coffee are withheld during the first 10 postoperative days. The "full liquid" stage is usually omitted because of its potential to precipitate early post-prandial dumping. Occasionally, in patients with transient emptying difficulties, the gastrotomy may be reopened and the pattern re-initiated.

Approximately 1/4 of the patients underwent associated operative procedures other than gastrotomy; hiatal herniorrhaphy was the most common. It is of more than passing interest that there is excellent correlation in many reported series between the presence of duodenal ulcer, acid hypersecretory states, and symptoms referable to acid reflux and hiatal hernia.

Duration of Postoperative Stay

The average length of postoperative hospital stay is depicted in Table 11, and again reflects the source of the clinical material. The typical postoperative stay at the University Hospital approximates 10 days and, in recent years, a patient without postoperative complications has been discharged on the sixth or seventh day, to return to the clinic on the tenth day for removal of the gastrotomy tube.

Follow-up

There were five operative deaths and seven additional patients were lost to follow-up; 443 (98.3%) of the original 455 patients remain for long-term postoperative analysis. Follow-up methods include clinic visits, written response to mailed questionnaires, telephone conversations, or letters from the referring physician; in the majority of the patients follow-up has been achieved by all four technics (Fig. 3). All patients included in this series were studied for a minimum of six months. Average follow-up period was 39 months with 69.5% studied for at least 24 months and 53.9%, for 36 or more months.

Although ulcer recurrence tends to increase with longevity of follow-up irrespective of the operative procedure under evaluation, the majority are usually apparent within the first 36 postoperative months. In this regard, this series has sufficiently matured to lend added weight to the postoperative data (*Vide infra*). Naturally, follow-up study on the remaining patients continues. It is anticipated that the results will be tabulated and re-evaluated in a subsequent publication.

Operative Mortality

Five deaths (1.1%) related to the operation were recorded (Table 12). Twenty-two additional deaths have occurred in subsequent follow-up periods with only one related to duodenal ulcer disease; this was at the time of subsequent gastric resection for recurrent ulceration. Of 401 operations performed on an elective basis, four deaths comprise a mortality rate of slightly under 1%; of 54 emergency operations 1 death

TABLE 6. Previous Non-Medical Treatment for Duodenal Ulcer

Closure of perforation	15.8%
Irradiation of stomach	1.3%
Gastric freezing	0.7%
Gastric cooling	0.2%

TABLE 7. *Blood Type of Duodenal Ulcer and Unselected Patients in Same Hospital Complex*

Unselected % Patients	Duodenal Ulcer % Patients	Blood Type
48.5	52.7	O
36.0	35.3	A
13.0	9.0	B
2.5	3.0	AB

resulted in a mortality rate of 1.85%. Two of the five operative deaths (40%) occurred in women; only 8.8% of the total patient population was female. Although the number of deaths was too small to credibly analyze in terms of sex distribution, in view of the preponderance of males to females in this series the operative risk in females appears inordinately high.

Summary of Elective Operative Deaths

1. A 64-year-old Negro woman underwent operation for pyloric obstruction. A penetrating duodenal lesion with localized peripancreatic abscess was found. Postoperatively the patient developed septicemia and died on the 6th day. No autopsy was performed; suspected cause of death was intra-abdominal abscess.

2. A 70-year-old Caucasian man underwent operation for pyloric obstruction. Active gastric and duodenal ulcers were

found. Coincident cholecystectomy was performed for cholelithiasis. Immediately postoperative the patient became oliguric; death occurred on the 5th postoperative day. Autopsy revealed severe chronic renal disease, intestinal infarction, mesenteric venous thrombosis and peritonitis.

3. An extremely obese, 46-year-old Caucasian man underwent operation for intractable ulcer symptoms. A rent (unrecognized) was made in the esophagus during performance of the vagotomy. Mediastinitis with septicemia developed in the postoperative period; the patient died on the 5th postoperative day.

4. A 44-year-old Caucasian man with previous myocardial infarction, underwent operation for intractable ulcer pain. Postoperatively, generalized peritonitis developed and the patient died on the 5th day. Autopsy revealed malpositioning of the gastrostomy; excessive tension on the pyloroplasty suture line culminated in its disruption with subsequent major leakage.

Operative Death, Emergency

An 83-year-old Caucasian woman with pre-existing severe cardiac and pulmonary disease, underwent operation for massive acute hemorrhage. Vagotomy, pyloroplasty, gastrostomy and suture ligation of the bleeding vessel with postoperative tracheostomy were performed. The patient died on the second postoperative day in cardiac

TABLE 8. *Indication for Operation*

	Elective 401/455 (88.1%) Pts.		Emergency 54/455 (11.9%) Pts.		
	Number of Patients	Per Cent	Number of Patients	Per Cent	
I. Intractability	265/401	66.1	I. Hemorrhage	46/54	85.2
II. Inability to adhere to medical Rx	22/401	5.5	II. Perforation	8/54	14.8
III. Recurrent hemorrhage prev. perf. Sx HH	68/401	16.9			
IV. Obstruction	46/401	11.5			

arrhythmia. There was no evidence of recurrent hemorrhage; no autopsy was permitted.

Nonfatal Complications

Nonfatal operative complications recognized during the postoperative period are listed in Table 13. The high incidence of associated intra-abdominal procedures in approximately 1/4 of the patients undergoing operation for duodenal ulcer, contributed to the complication rate. The tabulation includes four instances of stomal "obstruction" which required re-exploration. In two of these the pyloroplasty was widely patent; gastric atonia was the underlying pathophysiologic basis for the emptying problem. In our usual experience, time and an occasional assist by Urecholine (2-5 mg. P.O. with meals) will alleviate this type of motility dysfunction.

Recurrent Ulceration

A standard definition of recurrent ulcer has been utilized (Weinberg).² Recurrence has been defined as persistence of ulceration following operation; ulceration in a new site; recurrence after an interval of apparent complete healing; any suspected recurrence of ulceration unless proven *not* to exist.

TABLE 9. Operative Findings

Findings	Patients	
	No.	%
Duodenal ulcer (active)	224	49.2
Duodenal scar	174	38.3
Healing duodenal ulcer	39	8.6
Duodenal scar, active gastric ulcer	3	0.7
Active duodenal and gastric ulcer	6	1.3
Other	9	1.9

Location	% Patients
Duodenal bulb	77.5
Pyloric channel	13.0
Post-bulbar	3.4
Multiple duodenal	2.9
Duodenal and gastric	1.6
Other	1.6

Of 443 patients utilized for analysis, there are 13 proved and 3 suspected recurrent ulcers—an overall rate of 3.6% (Table 14). Only 1 of the 16 proved or suspected recurrences occurred in a female patient. Two of the recurrences occurred in the 39 patients who underwent vagotomy and gastroenterostomy. Eleven of 416 patients who underwent vagotomy and pyloroplasty had recurrence. The number of recurrences appears to be too small to determine the significance of the distribution according to type of drainage procedure. Moreover, follow-up study of

TABLE 10. Operative Procedure

	Primary		Incidental (120 or 26.3% pts.)		
	Number of Patients	Per Cent	Number of Patients	Per Cent	
Vagotomy and pyloroplasty	416/455	91.4	Hiatal herniorrhaphy	48	10.6
I. Weinberg	407/416		Cholecystectomy	21	4.5
II. Finney	9/416		Appendectomy	16	3.5
Vagotomy and gastroenterostomy	39	8.6	Splenectomy	6	1.3
			Other	29	6.4
Total	455	100.0			
Gastrostomy	428	94.0			

TABLE 11. *Postoperative Hospital Stay*

Days	All Patients (% Patients)	University Hospital Only (% Patients)
Up to 5 days	2.9	2.9
6-7	2.9	3.7
8-9	12.5	21.4
10-11	34.7	31.3
12-13	20.0	15.6
14-15	9.2	6.6
16-20	8.4	8.6
21-30	5.7	7.4
>30	3.7	2.5

patients drained by gastroenterostomy has been somewhat longer than that for those who underwent pyloroplasty. Eighty per cent of the patients with vagotomy and gastroenterostomy have been studied for 3 years or longer, and 51% have been studied for 5 years or longer; this compares with the overall series follow-up of 54% of patients studied 3 years or longer and 33% who were studied for 5 years or longer.

Time Interval and Treatment of Recurrence

The time interval which transpired between operation and proven or suspected recurrence is found in Table 15. Ten patients with recurrent ulcers have required surgical management and six have been satisfactorily controlled on medical therapy alone. Six of the ten patients undergoing reoperation were treated by gastric resection and Billroth II anastomosis, one by gastric resection with Billroth I anastomosis, two with transthoracic vagotomy combined with Billroth II gastric resection and one was treated by transthoracic vagotomy and gastroenterostomy. One of the patients retreated by gastric resection died postoperatively.

In 9 patients the recurrences were duodenal in location, in 2 jejunal (gastroen-

terostomy site), and in 2, combined gastric and duodenal locations. In 3 additional patients with *suspected* recurrences only, no definitive sites were determined.

Postoperative Secretory Studies in Patients with Recurrent Ulcer

Eleven of 16 patients with proven or suspected recurrence have undergone postoperative basal gastric secretory analysis. In 9 of the 11 patients basal gastric free acid secretory rates in excess of 2 mEq./hr. were demonstrated; in no patient was basal achlorhydria found (Table 16).

Incomplete vagotomy has been proven in 5 of 7 patients, based on positivity of the Hollander insulin test. Four additional patients are strongly suspected of having had incomplete vagotomy on the basis of postoperative basal secretory studies. In four other recurrences, clinical and x-ray evidence of marked gastric retention, probably secondary to inadequate gastric emptying, has been confirmed. Two of the suspected recurrences occurred in chronic alcoholic patients.

Dumping

Symptoms suggestive of the dumping syndrome were present in 65 (14%) of the

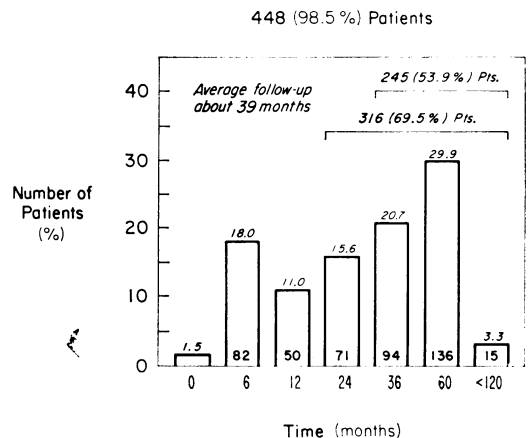


FIG. 3. Postoperative follow-up.

TABLE 12. *Operative Mortality*

	No. Patients	%
Elective surgery	4/401	1.0
Emergency surgery	1/54	1.8
Overall mortality	5/455	1.1 (average)

patients (Table 17). Sixty have had symptoms characteristic of early post-prandial type dumping syndrome, and five of the late post-prandial type. Extremely liberal criteria for the diagnosis of dumping have been utilized in this evaluation (mild post-prandial weakness, palpitations, diaphoresis, etc.), and only one patient, by these standards, had sufficiently severe symptomatology to require reoperation (at another institution); only moderate relief of symptoms has been obtained.

Diarrhea

Diarrhea has been defined as three or more loose stools daily. This symptom was present initially in 21 or 4.7% of the patients. In none has this been a severe or incapacitating complaint and the problem, generally, has decreased with time; in some instances, adherence to a strict, non-irritating diet with limited fat or carbohydrate intake has helped to ameliorate symptomatology.

Weight

Three hundred eighty patients have accurate pre- and postoperative weight records. As an important indication of the degree to which the surgery has been tolerated, in terms of nutritional absorption and gastrointestinal function, in 79.0% of the patients postoperative weight either remained *unchanged* or *increased* from 5% to 15% as compared with the preoperative state. In only 8.6% was a weight loss in excess of 5% recorded. If correction is made for the presence of a preoperative

overweight condition, this latter figure is substantially reduced.

Objective-Subjective Evaluation of Results

All 443 patients available for postoperative follow-up analysis have been graded as to quality of clinical results, both objectively (by the attending physician) and subjectively (by the patient) (Table 18). Self-evaluation by the patient was governed by the following four categories: highly pleased, satisfied, dissatisfied, and highly dissatisfied. The physician rating system included the following criteria: 1) excellent—patient free of all gastrointestinal symptomatology; 2) good—persistence of intermittent, mild gastrointestinal symptoms of dumping or diarrhea; 3) fair—presence of moderate gastrointestinal symptoms, but condition clearly improved as compared with the preoperative state. No recurrence proved or suspected; 5) failure—proved or suspected recurrence, operative death, symptoms sufficiently severe to require reoperation (Table 19). Correlation between objective and subjective evaluation was remarkably close; 94.5% of the patients (physician rating) and 95.6% of the patients (subjective evaluation) have, by the outlined criteria, attained satisfactory or superior results. Objective and subjective

TABLE 13. *Nonfatal Operative Complications*

Complication	No. Patients	% Patients
Pneumonitis	30	6.6
Wound infection	26	5.7
Urological tract infection	11	2.4
Thrombophlebitis	5	1.1
Splenic injury	5	1.1
Stomal obstruction	4	0.9
Wound dehiscence	3	0.7
Hemorrhage (intraluminal)	3	0.7
Hemorrhage (intraperitoneal)	2	0.4
Cardiac complications	2	0.4
Esophageal disruption	2	0.4
Peritonitis	2	0.4
Pneumothorax	1	0.2

TABLE 14. *Recurrent Ulcer*

Overall	No. of Patients	%
Proved	13/443	2.9
Suspected	3/443	0.7
Total	16/443	3.6

results of evaluation, categorized according to original indication for operative therapy, is found in Table 20.

Comment

At the time this series was conceived as a prospective and continuing study of the value of vagotomy and drainage in the surgical management of duodenal ulcer, effort was made to insure accurate and complete collection of data, meaningful follow-up including pre- and postoperative assessment of gastric secretory status, and, insofar as is possible with data of this type, just and reasonable interpretation of the accumulated facts. In this regard, this report represents the distillation of efforts of the attending surgical staffs at four hos-

TABLE 15. *Time Interval Between Surgery and Recurrence*

Time Interval Postoperative	No. Recurrences
Less than 6 months	3
6 months to 1 year	4
1 to 2 years	2
2 to 3 years	2
3 to 4 years	4
4 to 5 years	0
5 to 10 years	1

Operation for Recurrence	No. Patients
Gastric resection (Billroth II)	6
Gastric resection (Billroth I)	1
Transthoracic vagotomy with subsequent gastric resection (Billroth II)	2
Transthoracic vagotomy and gastroenterostomy	1

TABLE 16. *Postoperative Basal free Acid Secretion in Patients with Proved or Suspected Ulcer Recurrence*

Milliequivalents per Hour	No. Patients
0 to 0.6	0
0.6 to 1.0	1
1.0 to 2.0	1
2.1 to 3.0	1
3.1 to 5.0	2
5.1 to 10.0	5
More than 10.0	1

pitals, multiple generations of medical students and residents, and the exceptional cooperation of the patient population itself. Still, the data are relatively "raw" and not nearly so refined as we would pretend or hope for; continued effort and further studies are required before the safety, effectiveness, and tolerance to operations of this nature can be fully assessed.

A few observations on the reported data deserve emphasis. It is generally acknowledged that a partial or incomplete vagotomy is unlikely to be of any therapeutic value. It is also becoming widely recognized that patients who undergo vagotomy and who subsequently develop ulcer re-

TABLE 17. *Morbidity*

	Number of Patients	Per Cent
Dumping		
I. Early P.P.	60/443	13.4
II. Late P.P.	5/443	1.1
	65	14.5
Diarrhea		
>2 Loose stools/day	21/443	4.7
Weight Status		
Unchanged	202/380	53.2
> 5%	54	14.2
>10%	27	7.1
>15%	17	4.5
		79.0% } Unchanged or ↗
> 5%	47	12.4
>10%	23	6.0
>15%	10	2.6

TABLE 18. *Subjective-Objective Evaluation*

	I Excellent (highly satisfied %)	II Good (satisfied %)	III Fair (dissatisfied %)	IV Failure (highly dissatisfied %)
Patient	76.6	19.0	3.2	1.2
	95.6		4.4	
	92.0		8.0	
Physician	76.0	16.0	2.5	5.5

currence in a duodenal location almost invariably can be shown to have persistent parasympathetic gastric innervation; a rare few have the Zollinger-Ellison syndrome. While it is not always possible to objectively prove vagal capability in this group when the Hollander (insulin) test is used as the sole criterion, if basal or augmented histamine gastric acid analyses are performed, abnormal secretory patterns are

usually demonstrable. Insulin, it must be remembered, is primarily an *inhibitor* of gastric secretion³; it acts as a stimulant only by virtue of the effect of hypoglycemia on the vagal nerve centers. Under certain circumstances a negative Hollander test may merely reflect this "conflict" of action when, in fact, persistent vagal innervation is present. Basal and histamine-stimulated secretory rates may therefore,

TABLE 19. *Physician Rating*

Operative Indication	Satisfactory	Unsatisfactory
Perforation	100%	0%
Intractable pain	95.2%	4.8%
Recurrent hemorrhage, previous perforation, suspected carcinoma, or ulcer with symptomatic hiatal hernia	94.1%	5.9%
Obstruction	91.1%	8.9%
Unable to follow medical management	90.5%	9.5%
Emergency hemorrhage	88.8%	11.2%

Patient Rating

Operative Indication	Satisfactory	Unsatisfactory
Perforation	100%	0%
Intractable pain	93%	7%
Recurrent hemorrhage, previous perforation, suspected carcinoma, or ulcer with symptomatic hiatal hernia	91.6%	8.4%
Obstruction	90.7%	9.3%
Unable to follow medical management	90.5%	9.5%
Emergency hemorrhage	88.4%	11.6%

in the long run, prove to be more reliable indices of residual background vagal tone.

The type and quality of the drainage procedure accompanying parasympathetic denervation may be just as important a factor in recurrence as incompleteness of vagotomy. The recurrence of ulcer in a *gastric* location is, almost certainly, the result of inadequate drainage rather than incomplete denervation. Successful surgical management of the ulcer will depend, therefore, on tandem complete bilateral vagotomy *and* an adequate and properly functioning drainage procedure.

The operation of vagotomy and drainage, while not technically simple, can be satisfactorily performed by trained personnel or, as in this series, by relatively untrained personnel under careful supervision. Virtually all patients who were treated at affiliated hospitals in this report, and over 90% who were treated at the University Hospital, were operated upon by resident surgeons (first through fourth years) under attending surgeon control.

Special emphasis should be placed on the low rate of mortality encountered in patients who underwent emergency operations for massive upper gastrointestinal hemorrhage. Most studies on operative procedures designed to control massive bleeding under these circumstances have usually reported a mortality rate in the 10-25% range. That only 1 of 54 such patients in this study succumbed postoperatively is a reflection of the safety and overall effectiveness of suture ligation, vagotomy, and drainage.

Finally, only seven patients have been "lost" to follow-up, evaluation of the remainder has been careful, and the recurrence rate (3.6%) during the time for which this group has been followed is rewardingly low. Continued and prolonged evaluation, however, will in the ensuing years likely uncover additional recurrences;

this has been the experience in most studies on *any* operation for duodenal ulcer. Still, one would expect that the peak incidence in a series matured to the degree that this one has is passed and that as new patients are entered and others omitted (deaths), the *rate* will have roughly stabilized. Substantially longer follow-up study will be required to test this hypothesis.

Summary

Data accumulated on 455 patients with proven duodenal ulcers treated by vagotomy and drainage procedures at the University of Florida Medical Center have been analyzed; 70% of the patients have been studied for a minimum of 24 months, and more than half have been studied for from 3 to 10 years. The elective mortality rate has been 4/401 patients or less than 1.0%; one out of 54 patients operated upon under emergency conditions died, a mortality rate of 1.85%. The overall recurrence rate, including proved and suspected lesions, is 3.6% for the period in which these patients have been studied, and morbidity has been low with only rare development of serious dumping or diarrhea; the postoperative weight status of the patients attests to this fact with almost 80% either maintaining or increasing preoperative levels. These data demonstrate that vagotomy and drainage is an effective, safe, and extremely well-tolerated operation, useful in the management of patients with duodenal ulcer.

References

1. Stuart, J. D.: Blood Replacement and Gastric Resection for Massively Bleeding Peptic Ulcer. *Ann. Surg.*, 136:742, 1952.
2. Weinberg, J. A.: Recurrent Ulceration in Current Problems in Surgery. *Yr. Bk. Med. Pub.*, Chicago, Apr. 1964.
3. Woodward, E. R., Eisenberg, M. M., Quintana, R. and Dragstedt, L. R.: Insulin Inhibition of Gastric Secretion. *Surg. Research*, 111:479, 1963.