A Comparative Study of Vagotomy and Emptying Procedure Versus Subtotal Gastrectomy Used Alternately in the Treatment of Duodenal Ulcer *

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BECAUSE of the controversy among surgeons during the late forties as to whether subtotal gastrectomy or vagotomy with emptying procedure was the better operation for duodenal ulcer, it occurred to the senior author that a nonselective alternation of operations would provide a scientific comparison and would also be fair to the patients as they came up for surgery, since there was no conclusive way of predicting which modality would best suit the individual case.

Plan and Scope of Study

A system was set up of blind, consecutive alternation between vagotomy and an emptying procedure (hereafter to be referred to simply as "vagotomy") and subtotal gastrectomy for all elective operations for duodenal ulcer from January 1950 to January 1956. All but one of the patients were men and all were medical treatment failures. Two hundred eleven patients were thus treated and by this past summer of 1960, final evaluation was complete on 96 per cent of patients for a period of from four and one-quarter to ten and one-quarter years.

Gastric Secretory Studies. Dragstedt 12-hour secretion and Hollander Insulin tests were carried out pre- and postoperatively on most of the vagotomy candidates since April 1954. It was surprising to find that patients with very low values in both tests and seemingly, therefore, with very low vagal tone, obtained operative results as satisfactory as those showing strongly positive tests. Furthermore, in the follow up studies, there was poor correlation between the Dragstedt and Hollander tests and the clinical results. However, we believe there is definite confirmatory value when the tests and clinical evaluation coincide.

Operative Technic. The gastrectomies were nearly all Hofmeister-type with antecolic (occasional retrocolic) gastrojejunostomy. The vagotomies involved a careful search of the lower esophagus and its bed for the vagi and any secondary fibers, together with either a pyloroplasty or gastroenterostomy for emptying.

Eighty-seven per cent of gastrectomies and 96 per cent of vagotomies were performed by residents under senior staff supervision. Follow up was initiated by sending a detailed questionnaire to all patients. Just over half answered in a manner allowing satisfactory evaluation; the remainder were called in for personal examination, laboratory tests and barium studies.

Exclusions from the series were as fol-

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TABLE 1. Age, Duration of Disease and Incidence of Complications

Group	Ave. Age (yrs.)	Ave. Dur. of Disease (yrs.)	History of Bleed.	History of Perf.	Signif. Obstruct.
Vagotomy	42	11	49%	38%	38%
Gastrectomy	42	9	50%	23%	41%

lows: One of the gastrectomy group was dropped because co-existent pancreatitis was discovered. Three patients (two postvagotomy, one postgastrectomy) died subsequently with insufficient information for evaluation. Two patients (one of each group) were completely lost. Three patients (two postvagotomy, one postgastrectomy) claimed ulcer pain in their questionnaire but would not come in for examination. Although the majority of such patients prove not to have true ulcer pain, this must be excluded by personal study. Thirteen patients, in addition to the three mentioned above, died of causes other than their ulcer, 14 months to nine years, or an average of five years, postoperatively, but sufficient information was available for evaluation so they were included. Four of the gastrectomy group and five of the vagotomy group were lost from the series, leaving for analysis 102 of the former and 101 of the latter.

Findings

Patient age, duration of disease, and incidence of ulcer complications (Obstruction or history of perforation or bleeding) within the two groups is relatively similar (Table 1) except for history of perforations in 38 per cent of vagotomies as compared to 23 per cent of gastrectomies.

Technical Considerations. Among the gastrectomies the amount of stomach excised was recorded in 88 cases. In half it was 70 to 80 per cent, rarely more; in half it was 60 to 68 per cent, rarely under 60 per cent. The results were found entirely comparable either way.

The emptying procedure used with the vagotomies (Table 2) is of interest in the light of the experiments of Nyhus,[9] Heupel [5] and their co-workers. They found a high incidence of ulcer in dogs following gastroenterostomy and none after Finney pyloroplasty. As shown Table 2 the over-all therapeutic results following the few Finney pyloroplasties of this series do appear superior to those following gastroenterostomy; but they are even more strikingly superior to the Heineke-Mikulicz pyloroplasties which function on the same physiologic principle of preserving the duodenal channel. Perhaps part explanation, at least, is better emptying with the Finney than with the Heineke-Mikulicz closed with two layers.

Postoperative complications were comparable in the two groups as shown in the tabulation. There were 16 following vagotomy and 13 following gastrectomy. Five of the former and four of the latter group (including two duodenal fistulas) required reoperation. None was fatal.

TABLE 2. *Emptying Procedure Used with Vagotomy Related to Final Evaluation*

Empt. Procedure	Final Evaluation			
	Excellent	Good	Fair	Failure
Finney pyloroplasty (8)	62.5%	25%	12.5%	0%
Heineke Mikulicz pyloroplasty (50)	28%	16%	26%	30%
Gastroenterostomy (42)	36%	33%	21%	10%

Postvagotomy Complications (16)

Pulmonary	3
Wound Infection or hematoma	2
Fecal fistula and pneumonitis	1
Wound dehiscence	2
Paralytic ileus with negative reexploration	1
Thrombophlebitis	1
Lower nephron syndrome	1
Gastro-intestinal hemorrhage, cause unexplained	1
Stomal obstruction requiring lysis of adhesions	1
Emotional upset requiring four months psychiatric care	1
Cardiospasm requiring four months dilatation and phrenic crush	1
Gastric retention	1

Postgastrectomy Complications (13)

Pulmonary alone	2
Wound infection	1
Duodenal fistulae, one associated with evisceration	2
Splenectomy for torn pedicle	1
Homologous serum jaundice	1
Postoperative vomiting unexplained by G-I Series	1
Partial intestinal obstruction	1
Cystitis from catheterization in prostatism	1
Mild dumping syndrome	1
Hemorrhage from suture requiring reexploration	1
Thrombophlebitis	1

Postoperative Deaths. There was one postvagotomy death from perforation of the esophagus during vagotomy. Despite immediate closure of the perforation, the repair broke down and the patient died of peritonitis the seventh postoperative day. Three patients died following gastrectomy. One death resulted from acute hemorrhagic pancreatitis but without demonstrable injury to either common or pancreatic duct. A 1-cm. common channel was present. The second death was from hepatic failure in a patient with previously unrecognized chronic hepatitis and early cirrhosis whose operation had been prolonged to five and three-quarters hours by difficult dissection around the duodenum. The third death resulted from accidental transfixion of the common duct by a suture in a difficult duodenal closure. The mortality rate then was 0.94 per cent for vagotomy and 2.9 per cent for gastrectomy.

Disagreeable side effects were about equally distributed in both groups (Table 3) though diarrhea appears slightly more often after vagotomy and vomiting and dumping more often after gastrectomy.

Postoperative Weight Change. Although vagotomy is generally regarded as conserving the patients' weight, in this series there is very little difference between the two operations (Table 4). No adequate explanation for this could be found, nor was any correlation detectible between this weight change and the emptying procedure used. This failure to gain weight after vagotomy among Veteran patients was also observed by Edwards and co-workers.[3]

Rehabilitation is relatively difficult for patients of the prevailingly low economic strata of this study. Incentive to recover may be limited especially if they are capable only of hard or drudgery type of labor. Both Tanner [11] and Edwards [3] point out that the desire to get well is the chief ingredient of a good result. It will be seen (Table 5) that there is no significant difference in rehabilitation between the two groups.

TABLE 3. *Side Effects Following Vagotomy and Gastrectomy*

Procedure	Abdom. Pain Fullness, etc. (%)			Diarrhea (%)			Vomiting (%)			Dumping (%)		
	Mild	Mod.	Sev.	Mild	Mod.	Sev.	Mild.	Mod.	Sev.	Mild	Mod.	Sev.
Vagotomy	35	10	1	18	6	4	7	15	3	8	8	1
Gastrectomy	42	7	0	9	11	2	15	9	5	12	11	2

The patient's appraisal of his own health and the success of his operation is shown in Table 6. Although, in self-estimate of postoperative health, the two therapeutic groups are nearly identical, 11 more post-gastrectomy patients than postvagotomy patients felt their operation had been perfect. This was in keeping with our impression from numerous follow up interviews, that there was somewhat more tendency to mild nagging complaints following vagotomy than following gastrectomy.

Effect of Disability Compensation. Contrary to the opinion of Jordan and co-workers [7] who believed "pensionitis" played no part in success or failure of ulcer operations on Veteran patients, the findings in this study indicate quite otherwise, and Edwards [3] also remarked upon the poorer outcome of operations on the Veteran patient. Table 7 shows a striking contrast between the good results of the noncompensated and the poor results of the compensated patient. Thus the Veteran, whose ulcer is "service connected," and is operated upon, is entitled to increasing compensation beginning with such mild symptoms that all of our postoperative patients with this privilege were on compensation. If, however, his ulcer is non-service connected, before receiving any pension, he must demonstrate 50 to 60 per cent permanent incapacity—a thing he can seldom do.

The over-all evaluation of results of the two therapeutic groups is based upon the grading pattern shown below. This conforms closely to that used by several writers of experience [1,2,6] and is as follows:

Excellent: Free of all ulcer type symptoms or objective evidence of ulcer while on unrestricted diet and without medications. Side effects absent or very mild. Usual occupation.

Good: Free of ulcer symptoms or objective evidence of ulcer, but moderate persistent side effects of some type, which are not seriously disturbing. Works practically full time.

Fair: Still partly incapacitated (side effects, weakness, nervousness, etc.) but no persistent ulcer pain and no objective evidence of recurrent ulcer. Patient himself feels he is definitely improved.

Failure: Definite persistent ulcer type pain, or proven recurrent ulcer. Incapacitating side effects. Reoperation necessitated to revise the original therapeutic procedure.

TABLE 4. *Weight Change After Vagotomy and After Gastrectomy*

Weight	Post Vagotomy %	Post Gastrectomy %
Rise or no change	29	28
Loss up to 10 lbs.	24	21
Loss 11–20 lbs.	29	31
Loss 21–30 lbs.	11	11
Loss over 30 lbs.	6	9

TABLE 5. *Rehabilitation Following Operation*

Degree of Restoration	Vagotomy (94 Pts.) %	Gastrectomy (98 Pts.) %
Partial or complete unempl. other reasons*	24.5	36.7
Full time	47.9	44.9
3/4 time	9.6	3.0
1/2 time	11.7	2.0
Less than 1/2	2.1	1.0
Compl. disab.	4.2	3.0

* This might be for lack of a job or from disability other than ulcer.

TABLE 6. *Patient's Evaluation of His Postoperative Health and of His Operation*

Health	Vagotomy Group %	Gastrectomy Group %
Completely well	35	32
Fairly well	54	56
Not well	11	12
Operation		
Perfect	32	43
Good	40	33
Fair	24	17
Failure	4	7

TABLE 7. *Service-Connected Compensation as Related to Operative Results (Both Groups)*

Service-Connected Compensation	Percentage			
	Excellent	Good	Fair	Failure
Compensated (77)	13	34	26	27
Not compens. (104)	60.6	22	8	9.6

According to the above pattern, the relative equality in therapeutic effectiveness of vagotomy and gastrectomy (Table 8) in this Center is apparent.

Analysis of Failures. There were 20 failures among the 106 vagotomies and 19 among the 105 gastrectomies. Of the 20 vagotomy failures, one was the postoperative death due to perforated esophagus; 12 were due to recurrent or probably recurrent ulcer; three were "technical failures" to be described presently; three had persistent ulcer pain but with negative gastro-intestinal series in all three and with negative acid studies in two. The last had incapacitating side effects. In three of the 12 ulcer recurrences, the vagotomy was found to be grossly incomplete and a satisfactory result followed the completed procedure. If these were excluded, the post-vagotomy recurrent ulcers would be reduced from 12 to nine. As to the "technical failures" one required reoperation for narrowed pyloroplasty outlet. The second patient, having developed a pseudodiverticulum at the site of his pyloroplasty, underwent gastrectomy and diverticulectomy. However, his severe dumping and weight loss are precisely as before. The third technical failure was the development of a moderate sized, symptomatic hiatus hernia. Since repair the patient's results would still only be graded "fair."

TABLE 8. *Over All Evaluation of Vagotomy and of Gastrectomy*

Eval. of Op.	Vagotomy %	Gastrectomy %
Excellent	34	36.3
Good	25	27.6
Fair	22	17.6
Failure	20	18.6

Of the 19 gastrectomy failures there were the three postoperative deaths already described; eight definite or probable recurrent ulcers; four cases of incapacitating side effects; two with persistent ulcer pain, weakness, etc.; one case of disabling postgastrectomy anemia, and one technical failure in which reoperation was required to correct a kinked overly long obstructed afferent loop.

Do Vagotomy Results Deteriorate with Time? To study this question, the first 53 vagotomies and 52 gastrectomies of this series, originally presented in an interval report by us in 1954[4] are herewith re-evaluated (Table 9). The vagotomies show an increase of "fair" results at the expense of the "excellent" and "good," whereas the gastrectomies remain remarkably stable. Not shown in the table are two vagotomy grades going from "good" to "failure" because of recurrent ulcer. One of these, however, was apparently a terminal ulcer found at autopsy in a patient dying in hepatic coma from cirrhosis of the liver. Two vagotomies moved out of "failure." None of the postgastrectomy patients developed recurrent ulcer but five moved into "failure" and five moved out. Whether this represents "escapement" from vagotomy effect is a matter of conjecture. If this were so, one might expect more patients to show some regression, whereas actually the majority has remained unchanged for six years.

TABLE 9. *Early Members of Present Series Re-evaluated after Six-year Interval*

Grade	Vagotomy (53 Pts.)		Gastrectomy (52 Pts.)	
	1954	1960	1954	1960
Excellent	25	20	25	24
Good	14	11	14	14
Fair	4	12	6	7
Failure	10	10	7	7

Summary and Conclusions

1. A blind alternation of elective operations for duodenal ulcer in Veteran patients between vagotomy and an emptying procedure and gastrectomy has been conducted from 1950 to 1956. The follow up of the 211 patients is 96 per cent complete over a period of four and one-quarter to ten and one-quarter years in duration.

2. The alternating treatment method herein described has, we think, given as accurate a comparison as possible between vagotomy and gastrectomy and has pointed up, among other things, two crucial factors.

a. The over-all evaluation of the two methods taking into account complications, uncomfortable side effects, freedom from ulcer symptoms and patient rehabilitation has been surprisingly comparable.

b. The actual or probable ulcer recurrence rate was 12 per cent for vagotomy and 8 per cent for gastrectomy, but the mortality was 1.0 per cent for vagotomy and 3.0 per cent for gastrectomy. In other words, if vagotomy were selected over gastrectomy as the operation of choice, among every 1,000 patients operated upon, although there will be up to 40 more postoperative recurrences (than after gastrectomy) there will be 20 more living patients.

3. We believe vagotomy should be employed for all poor-risk patients, or whenever the duodenum presents any trouble. In other cases we have come to prefer vagotomy and antrectomy to subtotal gastrectomy.

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