Proximal Gastric Vagotomy

Follow-up of 109 Patients for 6–13 Years

J. LYNWOOD HERRINGTON, JR., M.D.*  JESSE DAVIDSON III, M.D.†  SARA J. SHUMWAY, M.D.‡

From January 1973 through December 1979, 131 patients underwent proximal gastric vagotomy (PGV) for duodenal ulcer. There were 78 men and 53 women, whose age ranged from 19 to 73 years, with a mean age of 45 years. One hospital death occurred as a result of pulmonary embolism (0.7% mortality). There were 12 late deaths unrelated to ulcer disease, and each of the 12 patients was graded Visick I or II prior to death. Nine patients were lost to follow-up. This report is an analysis of the remaining 109 patients followed from 6 to 13 years. One hundred two patients (93.5%) underwent PGV for intractability. Seven patients (6.5%) who underwent PGV in selective circumstances for either acute perforation (3 patients), bleeding (1 patient), and moderate outlet obstruction (3 patients) are included. Follow-up results reveal that 52 patients (47%) are graded Visick I, 40 patients (36%) Visick II, five patients (5%) Visick III, and 12 patients (12%) Visick IV. Mild diarrhea occurred in 2.8% and mild dumping in 1.9%, and no reflux gastritis or esophagitis was noted. Recurrent ulceration took place in 10 patients, and seven subsequently required reoperation. Two additional patients had the antral pump mechanism denervated and later required antrectomy. PGV has yielded satisfactory results over a 6–13 year follow-up when operation was done for intractability. The low incidence of unpleasant long-term side effects is an appealing feature of the operation. A recurrent ulcer rate of 9.2% (10 patients) has, however, been of major concern. Those with a prime interest in gastric surgery are urged to continue the use of PGV in cases of intractability. Another 10 years of clinical investigative work will no doubt be necessary to determine the ultimate rate of recurrent ulceration.

THE MODERN CONCEPT of denervating the parietal cell area of the stomach for treatment of duodenal ulcer (DU) began with the experimental work of Griffith and Harkin in the 1950s. These investigators performed a parietal cell denervation on ten animals. They found that the procedure effectively eliminated the cephalic phase of gastric secretion, and gastric evacuation was relatively unchanged as the animals' stomachs emptied very much like the normal controls. They termed the operation parietal gastric vagotomy.

In 1957 Griffith applied the operation to three patients with DU but subsequently abandoned the procedure clinically since he and Harkin felt that more experimental studies and laboratory data were in order. A disturbing feature was that when the operation was done experimentally in accompaniment with a Heidenhain pouch, subsequent challenge with a protein meal resulted in an increase in both acid and volume from the isolated pouch. Such findings did not occur after experimental selective gastric vagotomy and pyloroplasty.

In 1967 Holle and Hart of Munich applied parietal cell denervation on a clinical basis but always added pyloroplasty since serum gastrin levels were observed to rise appreciably after the vagal denervation. Without pyloroplasty, they feared that the rate of recurrent ulceration might be high. Holle has subsequently had an extensive experience with the operation and continues to report highly satisfactory results. He terms the procedure selective proximal vagotomy (SPV).

In the late 1960s Johnston and Wilkinson reported their early clinical results and named the operation highly selective vagotomy (HSV). At about the same time the group in Copenhagen headed by Amstrup and Jensen began their experimental and clinical studies and used the term parietal cell vagotomy (PCV). The latter two groups have reported an extensive clinical experience and continue almost yearly to record their long-term results.
It is of interest that, according to the late Owen Wangensteen, Eugen Bircher of Aarhu, Switzerland, in 1920 reported denervating the lesser curvature of the stomach for ulcer disease, tabes dorsalis, and also for various functional gastrointestinal disturbances. When one studies Bircher’s article carefully he was probably performing total gastric vagotomy (selective gastric vagotomy), as described by Latarjet in the early 1900s and not a denervation of the parietal cell mass alone.

Hedenstedt of Stockholm is given credit for emphasizing the importance of also denervating the distal 5–7 cm of the abdominal esophagus when performing PCV. Denervation of the parietal cell mass is currently widely used to treat the complications of DU throughout both Great Britain and Europe. It has been employed less extensively in America, where it is generally referred to as proximal gastric vagotomy (PGV).

Clinical Study

During a 6-year period from January 1973 through December 1979, 131 private patients with complications of DU underwent PGV by the senior author (J.L.H., Jr.) or else by members of the senior housestaff under his operative supervision. Among the patients, there were 78 men and 53 women whose ages ranged from 19 to 73 years (mean age: 45 years). One hospital death took place as a result of a massive pulmonary embolism occurring on the fifth postoperative day (mortality 0.7%). During the long-range follow-up, 12 additional deaths have occurred (9%). All deaths were unrelated to ulcer disease, and each of the 12 patients prior to death obtained either an excellent or good result. Nine patients (7%) have been lost to follow-up. This report is an analysis of the remaining 109 patients (84%) followed from 6 to 13 years (1973 through 1985).

Indications

One hundred two patients (93.5%) underwent PGV for intractable pain. A conservative course of therapy had been used for each patient, ranging from 6 months to several years before operation was recommended. Three patients (2.7%) had an acute ulcer perforation. Each posed minimal risk factors and, in addition to patch closure, underwent PGV. Three patients (2.7%) had moderate gastric outlet obstruction and were treated by intraoperative dilatation of the gastroduodenal outflow tract followed by PGV. One patient (1%) with a massively bleeding DU underwent duodenotomy with undersewing of the bleeding vessel, followed by PGV.

Operative Technique

The technical aspects of PGV have been thoroughly described elsewhere. We do not attempt to isolate and tape with a vessel loop the main right and left vagal nerve trunks at the esophageal hiatus. The initial dissection is begun at the “Crow’s foot” and usually the most proximal branch of the Crow’s foot is incorporated in the dissection, leaving the distal two branches intact to the distal antrum. The neurovascular bundles to the lesser gastric curvature are divided and tied with fine silk, care being taken to avoid injury to the anterior and posterior nerves of Latarjet. The dissection bares the lesser gastric curvature from the Crow’s foot to the esophagogastric junction. We then proceed to skeletonize the entire abdominal esophagus (5–7 cm) of all neurovascular structures. Circumcision of the longitudinal musculature of the esophageal wall is no longer routinely done; division of the right gastroepiploic nerve along the greater gastric curvature also perhaps does not add to the procedure. The lesser gastric curvature is reperitonized with fine silk sutures. On completion of the procedure, the hepatic plexus of nerves, the main right vagal trunk, which enters the celiac ganglion, and the anterior and posterior nerves of Latarjet innervating the distal antrum are intact.

Associated Operations

Twenty-seven patients (25%) underwent associated operations at the time of PGV. Eleven patients had cholecystectomy for biliary calculi, and 11 patients underwent a Nissen fundoplication for documented symptomatic reflux esophagitis. Splenectomy proved necessary in two patients with severe iatrogenic injuries. One patient underwent bilateral inguinal hernia repairs, one had a sigmoid polypectomy, and one was subjected to choledochothotomy.

Postoperative Complications

Four patients (3.7%) developed postoperative wound infections, and in two the infections were significant, requiring incision and drainage. In both cases, hospitalization was prolonged to 14 and 16 days, respectively. No significant intra-abdominal complications occurred among the 109 patients. Postoperative dysphagia was not encountered, and no patient developed symptoms of gastroesophageal reflux. Complaints of epigastric fullness and early satiety, however, were encountered frequently, since this is a common occurrence following PGV. After 2–3 weeks, symptoms almost always disappear completely. The postoperative hospital stay among the entire group averaged 8 days.

Follow-up Results

Each patient has been carefully evaluated at frequent office visits, and endoscopy studies have been carried out only in symptomatic patients. Weight loss, anemia and nutritional disorders have not posed a problem among the group.
Strict criteria have been adhered to in evaluating the long-term results. Patients have been graded according to the method introduced by Visick. An excellent result (Visick I) is recorded for patients who have no symptoms whatsoever referable to the gastrointestinal tract. A Visick II grade, or good result, is rendered those who experience mild and infrequent epigastric fullness but are otherwise free of gastrointestinal symptoms. A Visick III grade, or a fair result, is given those patients who experience either abdominal fullness, flatulence, or mild intermittent diarrhea or dumping symptoms. These patients are generally improved, however, as compared to their preoperative status. They nevertheless experience significant long-term ill effects. A Visick IV grading, or poor result, consists of those who develop a recurrent ulcer and those who receive no benefit or else are made worse by the operation.

Using these criteria, 52 patients (47%) are listed Visick I and 40 patients (36%) Visick II. Thus, highly satisfactory results have been obtained in 83% of patients. Five patients (5%) are Visick III, and 12 patients (12%) are graded Visick IV (Fig. 1). In the latter group, ten of the 12 developed a recurrent ulcer during follow-up (9.2% incidence of recurrence). Two patients graded Visick IV had persistent gastric emptying problems, probably resulting from excessive denervation of the antrum pump mechanism. Mild intermittent diarrhea has been experienced by three patients (2.8%), and mild dumping has occurred in two patients (1.9%). No subjective symptoms of reflux gastritis or esophagitis were noted among the group.

In comparing the overall clinical results between the 63 men and 46 women comprising the group of 109 patients, there appeared to be no significant difference (Fig. 2).

**Analysis of Failures**

Among the ten patients (9.2% of the group) who developed a recurrent ulcer, there were five men and five women. The time interval between the original PGV and the development of recurrent ulcer symptoms varied from 1 to 8 years, for an average of 2.9 years. Recurrent ulceration appeared in the duodenal bulb in seven instances and midway along the lesser gastric curvature in one patient, and in two patients the recurrence was both duodenal and gastric. It is of interest that in all cases the recurrent ulcers were small and shallow and were diagnosed by endoscopic examination. Barium with air contrast studies was of little value in providing a diagnosis. Among the three patients who originally presented with DU and gastric outlet obstruction, two developed a recurrent ulcer within 12 months following PGV and intraoperative pyloroduodenal channel dilatation. The third patient who presented with gastric outlet obstruction continues to do well. Three recurrent ulcers became manifest during the first 3 years of the study (1973–1975). Seven recurrent ulcers took place among patients operated on during the latter 3 years of the study (1977–1979) (Fig. 3).

Treatment of seven of the ten recurrences with medical therapy proved unsuccessful, and each patient subsequently underwent either antrectomy alone (4 patients) or antrectomy with truncal vagotomy (3 patients). The remaining three patients have done well on intermittent treatment with H2 receptor blockers.

In regard to the two patients who developed persistent delayed gastric emptying, symptoms of epigastric fullness increased in severity during follow-up, and both barium food meal studies and nuclide labeling demonstrated significant gastric retention. Endoscopy showed healing of the ulcer in both patients with no evidence of pyloroduodenal narrowing, but diffuse superficial antral gastritis was present in both patients. Treatment with smooth muscle stimulants was unsuccessful, and later antral resection with a Billroth I reconstruction was carried out. Both patients now experience an excellent result. In those cases it is reasonable to assume that the lesser curvature denervation was carried too far distally on the antral Crow’s foot.
PROXIMAL GASTRIC VAGOTOMY

Discussion

During the past 15 years PGV has enjoyed increasing popularity throughout Europe and Great Britain, but it has been used to a lesser extent in America. Its primary indication has been to treat patients with ulcer intractability. The operation has also been employed in selected cases for good risk patients with an acute ulcer perforation.\textsuperscript{18,19} Few reports cite its use in management of the patient with hemorrhage,\textsuperscript{20} and enthusiasm for PGV plus intraoperative pyloric dilatation in cases of gastric outlet obstruction has waned considerably.\textsuperscript{18,21-23} Recently, however, Hooks\textsuperscript{24} and Bowden reported good results in 18 of 20 cases.

Proximal gastric vagotomy has also been used by some groups to treat a benign gastric ulcer. Gastric ulcers have been classified into three types by H. Daintree Johnson.\textsuperscript{25} For benign ulcers located along the lesser gastric curvature near the incisura angularis (type I ulcer), satisfactory results have been recorded.\textsuperscript{26} For the type II ulceration, which consists of both a duodenal ulcer and a benign gastric ulcer located at the antral corporal border, proximal gastric vagotomy has given unsatisfactory results. For the type III Johnson ulcer, a prepyloric ulcer that may extend into the duodenum, PGV has likewise given poor results with an astounding high rate of recurrent ulceration.\textsuperscript{27-30}

The attractive features of PGV have been the negligible mortality and diminished intraoperative and early postoperative complications. Also, long-term side effects, such as diarrhea, dumping, reflux, and nutritional problems, have been practically nonexistent. Early reports suggested a low recurrent ulcer rate, but with longer follow-up studies the recurrent ulcer rate has risen appreciably. Nevertheless, many observers feel that the advantages gained by the procedure more than offset the high recurrent ulcer rate. Also, some of the recurrences may be managed quite satisfactorily utilizing medical treatment. Should operation for recurrence become necessary, the morbidity and mortality rates are considerably lower than those following reoperation for recurrences that occur after other standard operations for ulcer disease.

In a prospective randomized study, Stoddard and Du-thie\textsuperscript{31} noted an 8.8% recurrent ulcer rate in patients followed up to 8 years, but overall results were superior to those after vagotomy and drainage, and the recurrent ulcer rate in this latter group was 9.4%. Hoffman,\textsuperscript{32} in a controlled study comparing TV-D, SGV-D, and PGV, found a higher incidence of recurrent ulcers in the latter group, but after treatment for recurrence the PGV patients achieved a more gratifying result than did the other two groups. The one factor contributing to the higher recurrence rate after PGV in their study was the large number of surgical trainees operating in the trials. This latter observation is in accord with that of Johnston,\textsuperscript{33} who feels that in his hands PGV is associated with a low recurrent ulcer rate of 3%, but when done by surgeons in his department with less experience it is much higher. Eric Am-drup\textsuperscript{34} is of the same opinion.

Gleysteen\textsuperscript{35} prefers PGV, when correctly performed, to vagotomy/antrectomy for the elective treatment of DU. Jensen\textsuperscript{36} noted in a large group of 333 patients followed 2-12 years an ulcer recurrence rate of 13%. Gorey\textsuperscript{37} reported a recurrent ulcer rate of 7% among 509 patients followed 1-2 years. In the first 4 years of the study, the recurrence rate was 10% but fell to 4% during the latter years. Donahue\textsuperscript{37} observed a decline in recurrence to 12% when he included an extensive periesophageal denervation, whereas a 33% recurrence took place when he terminated the dissection at the gastroesophageal junction. Lunde\textsuperscript{38} had an 11.4% incidence of recurrence among 420 patients followed in excess of 5 years. Saik and Pes-kin\textsuperscript{39} recorded a 10% recurrence rate, but greater satisfaction was obtained by these patients when compared to those who had undergone TV-P.

The Mayo Clinic group\textsuperscript{40,41} continues to utilize PGV as its elective surgical procedure of choice, and, in approximately 475 patients followed from 1 to 12 years, the recurrent ulcer rate has been approximately 7%. Paul Jor-dan\textsuperscript{42} has carried out PGV among 100 patients with intractable ulcer pain with a follow-up from 7 to 12 years. The recurrent ulcer rate has been 9%, and approximately one half of the 100 patients have been followed 10 years. Kennedy\textsuperscript{43,44} performed PGV on 304 patients between 1969 and 1977, and there was one operative death (0.3%). Two hundred forty-two patients (80%) were followed 5-13 years, and the recurrent ulcer rate was 12.4%. Among approximately 450 patients, Amdrup\textsuperscript{45} has accumulated a recurrent ulcer rate of 14%, the minimum follow-up

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\caption{PGV—recurrences (109 patients). Three recurrent ulcers occurred in patients operated on during the early part of the clinical study. Seven recurrent ulcers took place in those operated on during the latter years of the study.}
\end{figure}
has been 6 years, and some patients have been followed up to 15 years.

In the current study a recurrent ulcer rate of 9.2% over a 6- to 13-year follow-up is in accord with the reports of others. Most of our recurrences have taken place within 2-3 years following PGV, with the longest interval between operation and symptoms of recurrence being 8 years. Fifty-five patients who underwent PGV during the latter 3 years of the study (1977 through 1979) have now been followed 6 through 8 years, and seven recurrent ulcers have taken place (12.7% recurrence rate). During the first 4 years (1973 through 1976), 54 patients underwent PGV with a follow-up now extending from 9 to 13 years, with an ulcer recurrence rate of 5.5%. This is in contrast to most authors, who have experienced a larger number of recurrences taking place during the first 2 years after initiating the operation.

Excluding recurrences, patient satisfaction has been extremely rewarding, as evidenced by a Visick grading of I and II (83%). Very few patients (5%) appeared in the Visick III grading, and this is in sharp contrast to the rather high percentage of Visick III grading noted among patients who undergo operations for ulcer that either remove, alter, or bypass the pyloric sphincter mechanism.

The two patients termed failures as a result of marked gastric retention no doubt underwent excessive denervation of the distal antrum, and this occurred during the early part of our clinical study. It is also of interest that, of the three patients operated on for obstruction, two were failures. This has also been the experience of others, and no doubt considerable thought should be given to performing PGV in the presence of any degree of pyloric obstruction. Postpyloric stenosis, however, may respond well to duodenoplasty when PGV is performed.

Of the seven patients who underwent reoperation for recurrence, three had antrectomy with a Billroth I reconstruction performed elsewhere, and four had truncal vagotomy/antrectomy on our service. The addition of truncal vagotomy provides added assurance against future recurrence. The cause for recurrence after what is felt to be a properly performed PGV remains unclear, but perhaps in the future preoperative evaluation for the presence of possible G-cell hyperfunction or G-cell hyperplasia should be considered in DU patients. Neither PGV nor TV will suppress hyperacidity resulting from G-cell hyperplasia. We have had no experience redoing the PGV by first defining the remaining innervated area of the parietal cell mass using intraoperative Congo Red staining.

Our experience may perhaps be unique in that it represents the work of one surgeon along with the resident staff operating in a single institution. Also, surgical techniques remained standardized throughout the study, and practically all patients represented a homogeneous group in that intractable pain constituted the primary indication for PGV.

Before embarking on the study, we had the good fortune on two separate occasions of enjoying visits to our institution from members of the Copenhagen surgical group. These splendid surgeons operated with us and participated in teaching rounds with the primary focus directed to PGV. Following these visits, we elected not to begin performing PGV immediately on a clinical basis. To gain further confidence in our ability to carry out the operation correctly, we decided over the following several months to operate on a series of 15 good risk patients with intractable DU, first performing a PGV and on its completion converting the PGV to a truncal vagotomy/antrectomy. At the end of this time, we felt comfortable in doing the procedure and were then ready to carry it out on a clinical basis.

From our experience to date with PGV, we feel that highly satisfactory results have been obtained over a 6-13 year follow-up when the operation is done for intractability. The low incidence of undesirable side effects has been an appealing feature of the operation. A recurrent ulcer rate of 9.2% has been of major concern, but three of the recurrences have been managed quite satisfactorily medically. Also, reoperation using antrectomy with or without vagotomy has achieved very satisfactory results with a low morbidity and no mortality. We urge those interested in PGV to continue its use, particularly in cases of ulcer intractability. It should be emphasized, however, that patients should be carefully followed, and another 10 years of clinical investigation no doubt will be necessary to determine the ultimate rate of recurrent ulceration.

References


34. Amdrup E. Personal communication, 1986.
40. VanHeerdan JA. Personal communication, 1986.
42. Jordan P. Personal communication, 1986.
43. Kennedy T. Personal communication, 1986.
45. Amdrup E. Personal communication, 1986.