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## Subtotal Gastric Resection

### An Appraisal of a Means of Treatment of Benign Peptic Ulceration of the Stomach and Duodenum

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THE MOST COMMONLY EMPLOYED surgical procedure for benign peptic ulceration of the stomach and duodenum is subtotal gastric resection. Since the results of this procedure are often not completely satisfactory, vagotomy with an emptying procedure, or combined with hemigastrectomy, is now being used more frequently. The ideal operation is one which would result in low mortality and recurrence rates and a minimum of sequelae. An analysis of a series of 400 patients operated upon by the senior author from 1946 to 1958 has been made in order to appraise the results of subtotal gastric resection.

The location of the ulcers is shown in Table 1. All the gastric ulcers were benign and the gastrojejunal ulcers were treated by subtotal gastric resection only. Thirty per cent of the patients were women. Indications for operative treatment were long-established symptoms, such as chronic pain, hemorrhage (uncontrolled or recurrent), obstruction, repeated perforations, and, in the case of gastric ulcers, possible malignant change. In many instances the indications for operation were combined. The duration of symptoms in most instances was 10 to 20 years except in patients with gastric ulcerations. In general the best results occurred in patients

• In a series of 400 cases of subtotal gastric resection for the treatment of benign ulceration of the stomach and duodenum, the mortality, morbidity and recurrence rate was acceptably low. Fifty-six per cent of the patients had a perfect result, 38 per cent satisfactory, and 6 per cent unsatisfactory. However, the postoperative nutritional status was sufficiently interfered with in a number of patients whose preoperative weight was subnormal that the routine adoption of 75 per cent gastric resection must be questioned. Vagotomy with either pyloroplasty or partial resection may prove to be the most valuable procedure for patients of this type. In properly selected patients, however, gastric resection is a rewarding procedure for both patient and surgeon.

TABLE 1.—Data on 400 Cases of Subtotal Gastrectomy for Benign Ulceration of the Stomach and Duodenum

	No. of Patients	Per Cent
Location of ulcer:		
Duodenal .....	289	75.25
Gastric .....	89	22.25
Gastric and duodenal.....	7	1.75
Gastrojejunal .....	15	3.75
Sex:		
Male .....	280	70
Female .....	120	30

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**TABLE 2.—Operative Procedure Employed in 400 Cases of Benign Ulceration of the Stomach and Duodenum**

	No. of Patients	Per Cent
Subtotal Gastric Resection with:		
Anterior gastrojejunostomy .....	262	65.5
Posterior gastrojejunostomy .....	56	14
Gastroduodenostomy .....	82	20.5
Cholecystectomy .....	10	2.5
Antral exclusion .....	9	2.25

with a long history of symptoms. Only 15 patients (3.7 per cent) were operated upon for emergency treatment of bleeding. No resection was done at the time of operation for a perforated ulcer.

The type of operative procedure is shown in Table 2. More recently we have preferred anterior gastroenterostomy to posterior gastroenterostomy. A gastroduodenostomy was done when feasible but no attempt was made to compromise on the amount of stomach removed. A Billroth I procedure was used in 72 patients, 31 of whom had gastric ulcers. Early in the series a 60 per cent resection was done while in the past five years a 70 to 75 per cent resection was done. Antral exclusion, done in nine early cases due to the hazardous operative condition of the duodenum, is no longer employed. Concomitant cholecystectomy was done in ten cases (2.5 per cent). Multiple procedures were discouraged but were employed occasionally in ideal circumstances.

Antibiotics were used prophylactically early in the series, but only therapeutically in the past five years. The complications apparently were not influenced by the use of antibiotics prophylactically. The number of postoperative hospital days is shown in Table 3 (79.5 per cent of the patients were in hospital ten days or less). Patients without complications were usually ready for discharge on the seventh postoperative day.

Four patients died postoperatively. Two of these deaths were due to anesthesia, one of them occurring after spinal anesthesia, hypotension and anoxia, and the other after the use of Anectine (succinylcholine chloride) and resultant irreversible respiratory paralysis. Of the other two deaths one was owing to postoperative hemorrhage, wound dehiscence and cardiac failure and one to peritonitis resulting from an unrecognized leak of the duodenal stump.

Postoperative abdominal and extra-abdominal complications are shown in Table 4. The most serious intra-abdominal complication was leakage of the duodenal stump. Even if this condition is recognized, the mortality is high. The use of a duodenal catheter in substitution for duodenal closure has been advocated, but we have not used this procedure. When a pronounced inflammatory process is found involving the duodenum and head of the

**TABLE 3.—Length of Stay in Hospital for Patients Operated Upon for Benign Gastric or Duodenal Ulceration**

	No. of Patients	Per Cent
7 days or less.....	152	38
8 days or less.....	262	65.5
10 days or less.....	318	79.5

**TABLE 4.—Complications in 400 Cases in Which Operation Was Done for Gastric or Duodenal Ulceration**

	Cases
Abdominal pain—26 cases (6.3 per cent) :	
Duodenal stump leakage.....	2
Postoperative bleeding .....	9
Wound dehiscence .....	6
Partial stomal obstruction.....	3
Wound infection .....	2
Partial loop obstruction.....	1
Small bowel obstruction.....	1
Common duct injury.....	1
Pancreatic fistula .....	1
Extra-abdominal—44 (11 per cent) :	
Atelectasis .....	27
Cystitis .....	7
Pulmonary embolus .....	2
Cardiac decompensation .....	2
Cerebral vascular accident.....	1
Fever of undetermined origin.....	5

pancreas, the surgeon cannot help feeling (except in uncontrolled bleeding) that his choice of procedure or of time for the operation was at fault. Intensive nonsurgical treatment at the peak of the patient's symptoms often will bring about subsidence of this inflammatory process. Furthermore, an alternate procedure such as vagotomy with pyloroplasty or gastroenterostomy may best be employed when the inflammatory process of the duodenum makes resection hazardous.

Other complications such as stomal leaks and obstruction were not a problem in this group of patients. It was not our experience that postoperative hemorrhage was more likely in patients who bled preoperatively. Other complications were infrequent. Wound dehiscence can occasionally be predicted in obese, muscular patients or in patients with preoperative chronic pulmonary problems. We have discontinued the use of nasogastric suction and have noted a distinct decrease in pulmonary complications without any untoward intra-abdominal complications. Application of proper surgical principles at the time of operation and close postoperative surveillance have reduced the complications in "good risk" patients to an acceptable minimum.

The recurrence of an ulcer may be difficult to ascertain and clinical impressions must be resorted to. Roentgenographic visualization of a recurrent ulcer has not been very successful. Patients may bleed asymptotically on one or two occasions only. Symptoms suggesting ulcer frequently subside after problems of emotional stress are treated. Some

**TABLE 5.—Results as Observed in 292 of 400 Patients Who Had Subtotal Gastric Resection for Benign Ulceration of the Stomach or Duodenum**

	No. of Patients	Per Cent
Perfect .....	164	56
Satisfactory .....	113	39
Unsatisfactory .....	15	5
Proved recurrence .....	9	
Other .....	6	

digestive complaints may be eliminated by the discovery and treatment of an unrelated disease. There were nine patients (3.1 per cent) with proved recurrent ulcers and three with asymptomatic bleeding (Table 5). Four of the recurrences were apparent within 12 months of the resection. There have been no recurrences in this series after three years although we are aware that they may occur at any time. Two of the recurrences were in patients who had an antral exclusion. Nine such operations were done. One patient who had bled postoperatively asymptotically had a Billroth I procedure. The remaining recurrences were following a Billroth II procedure. There has not been any recurrence to date in those who had a 75 per cent resection.

Just as the recurrence rate may be difficult to ascertain, the long term results may likewise be difficult to evaluate. As time passes, the results of the operation will improve, probably because the patient learns to adjust to the idiosyncrasies of his disease. It has been our experience that if patients are carefully questioned, most of them will at some time shortly after operation mention some symptoms of the "dumping syndrome." Most of these patients soon learn that they are unable to take sweets, and a few that they cannot eat dairy products. Only one patient in this series was incapacitated because of the dumping syndrome. This patient did fairly well for two years after operation, but following a coronary occlusion and severe emotional stress he was unable to work because of nutritional changes secondary to the dumping syndrome. He did not have anemia and the volume of blood was normal. This patient had a Billroth I anastomosis. The incidence of dumping was essentially the same for the patients in the Billroth I and II groups. No attempt has been made to narrow the stoma in any of these cases.

The postoperative nutritional status of the patient may be disturbing, particularly in women. Some 12 per cent of the patients in this series were unable to regain or maintain their weight at a satisfactory level. An attempt to assess the merit of a procedure based on the ability of a patient to regain ideal weight seems illogical, since many normal people may never reach their ideal weight. As the surgeon surveys the preoperative weight and dietary habits of these patients,

he can usually predict those who will have a nutritional problem postoperatively. Since these patients have experienced a reduction in caloric intake and have a relatively inefficient gastrointestinal tract, the surgeon should not be surprised to find that they fail to gain weight. Patients who eat well and have difficulty with excessive weight do not, as a rule, have any nutritional problems postoperatively. Those who are underweight despite a high caloric "ulcer diet" can hardly expect to regain their ideal weight postoperatively. Our experience has been that a patient's eating habits and bodily build have more influence in determining the postoperative nutritional status than the amount of stomach resected. Some patients who were overweight assumed a desirable weight postoperatively. Many whose weight is below the ideal accept this level although women are less likely to accept a weight loss below the preoperative level. Although a high gastric resection reduces the incidence of recurrence its routine use in underweight patients seems undesirable.

Based on a follow-up of 73 per cent of the patients in this series, 164 (56 per cent) were able to eat everything, a normal amount, and their weight was ideal or above (Table 5). One hundred twelve (38 per cent) were satisfied with the operation but had some food idiosyncrasies or their weight was below their desired level, and in six instances the patients stated that they wished they had not been operated upon. Among these six were one with uncontrolled dumping, two in whom the pathologic change was minimal and hence the operation ill advised, and three with emotional problems which would preclude a satisfactory result with any operative procedure. One patient who did well for four years was then subjected to great emotional stress and developed an incapacitating postpyramidal hypoglycemia. Improvement followed dietary management. As previously mentioned, there were nine proved recurrences and three unproved. It was our experience that any follow-up other than direct questioning proved to be misleading. Many patients who claimed to be in perfect health could not eat sweets and had other minor complaints. On the other hand a patient who said he had a poor result might be an alcoholic or perhaps be suffering from an unrelated illness. We found it difficult to appraise the entire series satisfactorily since the individual response was so variable. Patients who had bleeding as the chief indication for operation and in whom pain was not the predominant factor, were not as enthusiastic about the results of surgical treatment as were those with severe pain or obstruction. Patients with minimal pathologic change observed at operation, despite the array of symptoms, were likely to have more complaints postoperatively. We did not do extensive resection on patients of this type.

## DISCUSSION

An appraisal of the treatment of peptic ulcer of the stomach and duodenum by subtotal gastric resection shows that the mortality and morbidity was acceptably low. The recurrence rate can be lowered further by a high 75 per cent resection and the result would be more satisfactory. Although the over-all late results have been satisfactory, nutritional disturbances occurred often enough that the advisability of a routine 75 per cent resection is doubtful. The use of vagotomy with an emptying procedure may eventually prove to be the better procedure. To date, vagotomy and gastrojejunostomy has not proved to be superior to subtotal gastrectomy. Vagotomy with pyloroplasty is a simple procedure and the results to date are encouraging. Partial gastrectomy with vagotomy is the most appealing procedure, but the mortality and morbidity associated with it may tend to limit its advantages.

We believe that each procedure should be selected individually to treat a specific patient. In patients whose weight has never been a problem (except in abundance) a high subtotal gastric resection will

usually give an acceptable result. For patients who are underweight, vagotomy with pyloroplasty may be the most promising procedure. In cases in which the local condition of the duodenum precludes satisfactory pyloroplasty or the stomach is large and atonic and does not empty properly, partial resection with vagotomy would seem indicated. Patients who are emotionally unstable probably will not do well regardless of procedure; in fact a high gastric resection makes them susceptible to many postoperative complaints. Vagotomy with an emptying procedure or resection should not be done unless the surgeon is absolutely confident of the completeness of the vagotomy, a challenge which he will occasionally encounter. We are unable to determine preoperatively which patients are most likely to have a recurrence. In patients whose nutrition was poor (in the absence of obstruction) before operation, extensive resection cured the ulcer, but subsequent nutrition was poor, a phenomenon which has led us to adopt a more conservative attitude. In such circumstances we are inclined to do a vagotomy with pyloroplasty.

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