Alkaline Reflux Gastritis

Late Results on a Controlled Trial of Diagnosis and Treatment

WALLACE P. RITCHIE, JR., M.D., PH.D.

In 1977, a controlled, prospective trial was initiated to test the hypothesis that excessive enterogastric (EG) reflux was responsible for a unique postgastrectomy syndrome, "alkaline reflux gastritis." Late (42 ± 3 months) follow-up on all treated patients (N = 14; Rx = 45 cm Roux Y limb) is reported. The following parameters were assessed in symptomatic (N = 11 nonrefluxers, 15 refluxers) and asymptomatic postgastrectomy patients (N = 9): CCK-stimulated scintographically determined EG reflux (EGRI %), intragastric (IG) concentration of bile acids (BA, mM), net bile acid reflux/hr (μM), maximum acid output (mEq/hr), intragastric pH, gastric emptying of ^{99}Tc-labeled solids (T ½; minutes), gastritis score (GS = 0–15), and specific symptomotology. A significant linear relationship was noted between intragastric BA concentration and the severity of histologic gastritis in the residual gastric pouch. As a group, excessive refluxers demonstrated significantly greater IG BA concentration, net BA reflux/hour, and EGRI than did either nonrefluxers or controls. Gastritis score in this group was also greater, intragastric pH higher, and maximal acid output (MAO) lower. Gastric emptying was not different between groups. Following Roux (N = 14), reflux was eliminated early and late, pH fell, MAO increased, and gastritis improved. Early marked delays in emptying occurred but normalized late and were rarely a clinical problem. Early symptomatic results were pain eliminated in 14/14, nausea in 8/14, vomiting 11/14, bilious vomiting in 14/14. Complications were one marginal ulcer (no vagotomy), two severe delays in emptying (simultaneous Roux + vagotomy). Late symptomatic results were recurrent or persistent pain in 4/14, nausea in 7/14, vomiting in 5/14. Bilious vomiting remains eliminated.

WHETHER EXCESSIVE enterogastric reflux is responsible for a unique postgastrectomy syndrome, so-called alkaline reflux gastritis, remains controversial. Early clinical series suggested that the concomitant symptoms of continuous burning epigastric pain and vomiting associated with endoscopic evidence of gastritis and bile staining of the mucosa of the residual gastric pouch could be almost universally relieved by shunting upper intestinal content away from the residual stomach.[1,2] A more recent series, however, has challenged this view by emphasizing cogently the unpredictable, almost random, nature of the clinical outcome when operation is undertaken on the basis of these findings alone.[3] Furthermore, remedial operations themselves may produce untoward sequelae in substantial numbers of patients.[4,5]

In a recent communication, it was suggested that, for the syndrome to be scientifically acceptable (and, therefore, clinically useful), certain critical questions required resolution.[6] The most important of these was: is excessive enterogastric reflux the root cause of the symptoms supposedly specific to the syndrome? For this to be the case, it was felt that certain criteria needed to be fulfilled: the symptoms should always occur in the presence of excessive reflux; the symptoms should never occur in the absence of excessive reflux; and the symptoms should disappear once excessive reflux is eliminated. To address this issue, a prospective study was undertaken in 1977, the purpose of which was to quantitate reflux in symptomatic and asymptomatic postgastrectomy patients, to subject those identified as excessive refluxers to Roux-en-Y gastrojejunostomy, and to assess the long-term results of this procedure of both reflux and symptomatology. Early (14 ± 1 month) results have already been described.[7] We now report late (42 ± 3 months) follow-up on all operated patients.

Methods

Thirty-five patients were studied on a total of 42 occasions, each involving a 3-day hospitalization on the

From the Departments of Surgery, Temple University School of Medicine, Philadelphia, Pennsylvania, and the University of Virginia Health Sciences Center, Charlottesville, Virginia

Presented at the 97th Annual Meeting of the Southern Surgical Association, Hot Springs, Virginia, December 1–4, 1985.

Supported by USPHS RO1AM-17591, RR 00847, and RR 00349.

Reprint requests: Wallace P. Ritchie, Jr., M.D., Ph.D., Department of Surgery, Temple University Health Sciences Center, 3401 North Broad Street, Philadelphia, PA 19140.

Submitted for publication: December 23, 1985.

TABLE 1. *Details of Index Operative Procedures in Control Subjects, Symptomatic Patients*

	Indication			Ulcer Location			Index Operation		Reconstruction			
	Bleed	Obstruction	Pain	Duo.	Gastric	PP*	STG†	TV + A‡	BI	BII	AC-IP§	AC-AP‖
Control (N = 9)	2	1	6	7	2	0	1	8	1	8	6	3
"Excessive" refluxers (N = 15)	5	2	8	11	3	1	3	12	1	14	12	2
"Normal" refluxers (N = 11)	6	0	5	9	1	1	4	7	1	10	9	2

* Pre-pyloric.
† Subtotal gastrectomy.
‡ Truncal Vagotomy, Antrectomy.
§ AC-IP = Antecolic, isoperistaltic.
‖ AC-AP = Antecolic antiperstaltic.

clinical research unit either at the University of Virginia Hospitals or at Temple University Hospital. The study protocol was approved by both institutional review boards and informed consent was obtained in each instance. All patients had undergone previous operative therapy for benign peptic ulcer disease. Nine subjects (mean age 55 ± 2 years, M:F = 1.5) were recruited as control subjects because of the absence of any postoperative complaints save for occasional episodes of early satiety in two patients. The remaining 26 patients were referred for study because they experienced one or more of the following symptoms: epigastric pain in 23, vomiting in 23 (which was bilious in 17), nausea in 26, and associated diarrhea in 13. Ten patients had experienced some degree of weight loss, five were moderately anemic, and six patients gave a history compatible with the early postprandial "dumping syndrome." All patients were without radiographic or endoscopic evidence of stomal obstruction, recurrent ulcer, significant reflux esophagitis, or cholelithiasis. Twelve patients had undergone previous cholecystectomy. The interval from index operation to study was 3.1 ± 0.2 years in the control patients, 4.3 ± 1.0 years in the study patients (Table 1).

Using methods that have been described in detail elsewhere, every patient was evaluated for each of the following parameters: specific symptomotology; histologic gastritis in both the stomal and nonstomal areas of the residual gastric pouch, with development of a "gastritis score" (G.S. = 0 to 15) using criteria developed experimentally; intragastric pH in recumbency and gastric acid output in the upright position both in basal state and following maximal stimulation with histamine; gastric emptying of solids using ^{99}Tc-labeled sulphur colloid mixed with oatmeal and milk or with eggs; and, as an index of reflux magnitude, intragastric bile acid (BA) concentration (mM/L) and net bile acid reflux (μM/hr) in recumbency, in the upright position, and following the ingestion of a liquid test meal. Bile acid studies were performed between 8:00 and 9:00 A.M. on every case. The reproducibility of the assays for reflux and of the gastritis scoring has been verified previously.[7]

An additional measure of the magnitude of enterogastric reflux was the development of an enterogastric reflux index (EGRI%) in every patient on each occasion. In brief, patients were transported to the scintography suite immediately after completing the reflux studies. With the patient positioned supine under the detector of a gamma camera, five millicuries of ^{99}Tc-HIDA (5 mg) were administered intravenously and count rates were recorded continuously for 45 minutes or until the ^{99}Tc activity was maximal in the gallbladder. The subjects were then given 0.04 μg/kg intravenously of purified CCK. At 15 minute intervals for the next 2 hours, ^{99}Tc activity was monitored over liver, gallbladder, biliary tree, small bowel, and residual stomach. The enterogastric reflux index at any given moment time, t, was then calculated as $EGRI_t = (S_t - S_o)/(HB_o - HB_t) \times 100$, where S_o = the ^{99}Tc activity in the stomach immediately prior to the giving of CCK; S_t = ^{99}Tc activity in the stomach at time t; HB_o = the ^{99}Tc activity in the hepatobiliary tree prior to the injection of CCK; and HB_t = the ^{99}Tc-M activity in the hepatobiliary tree at time t. The derivation and validation of this method is described elsewhere.[8]

Using data obtained in asymptomatic postgastrectomy subjects (Table 2), symptomatic patients were identified as being "excessive" enterogastric refluxers if they demonstrated reflux values more than two standard deviations beyond the mean of the control values in two of the three tests that directly or indirectly quantitated reflux. Fifteen of the 26 symptomatic patients (mean age 44 ± 3 years, M:F 2:0) fulfilled this criterion. Eleven (mean age 44 ± 3 years, M:F 1:3) did not and were classified as nonrefluxers. Fourteen of the 15 patients with excessive reflux consented to undergo operative diversion of upper intestinal content away from the residual gastric pouch using 45 cm Roux-en-Y limb. In each, the stoma appeared patent both gastroscopically and radiographically and was not revised at operation. In 12 patients, all of whom had had a truncal vagotomy performed as part of their index operative procedure, a preoperative sham-feeding "Hollander" test was negative and the esophageal hiatus was not approached. In one patient, vagotomy had not been previously per-

formed and was therefore accomplished at the time of Roux construction. The final patient underwent reconstruction as a Roux without concomitant vagotomy. All were then restudied on two subsequent occasions: early (14 ± 1 months) and late (42 ± 3 months) after operation.

Statistical analysis of the results was accomplished using Student's t-test for paired and unpaired variables and chi square analysis, as appropriate. Correlation coefficients were determined from linear regression analysis using the least squares method. The level of statistical significance was taken to be the 95% confidence limit.

Results

Consistent with previous findings, a significant linear relationship was found to exist within the entire group between bile acid concentration in the recumbent position and the severity of histologic gastritis in the residual gastric pouch in areas distant from the stoma ($y = 0.55x + 0.35$, $r = 0.90$, $p < 0.05$). A similar relationship held for net bile acid reflux per hour in recumbency and for both bile acid concentration and net reflux per hour postprandially. No such relationship was apparent in the upright position.

Thirteen of 26 symptomatic patients demonstrated excessive reflux on all three tests designed to assess this parameter. An additional two patients demonstrated abnormalities in two of the three. Of the remaining 11 patients, only two demonstrated abnormalities in any one test and then only marginally. The values obtained in the rest all fell within two standard deviations of the mean of control patients. As indicated in Table 3, the refluxing symptomatic patients clearly distinguished themselves as a group from nonrefluxing symptomatic patients and from controls with respect to intragastric bile acid concentration, net bile acid reflux per hour, and enterogastric reflux index. They also demonstrated more severe histologic gastritis in the residual gastric pouch associated with a decreased capacity to secrete acid in response to histamine and an increase in fasting recumbent intragastric pH. Gastric emptying of a solid meal was rapid in every patient, with no significant differences noted between groups.

On clinical grounds, it was difficult to separate symptomatic patients with excessive reflux from those with normal reflux. As indicated in Table 1, there were no significant differences observed in the type of index operation performed, the method of reconstruction employed, or the indication for initial surgery. The frequency of symptoms was also similar. In the excessive reflux group, epigastric pain was present in 14 of 15 patients, vomiting in 15 of 15, and nausea in 15 of 15. In the nonreflux group, pain was present in nine of 11, vomiting in eight of 11, and nausea in 11 of 11. Bilious vomiting was the only symptom encountered significantly more frequently in the excessive reflux group than in the nonreflux group (14 of 15 *vs.* 3 of 11, $p < 0.05$). There were also no differences between groups with respect to hematocrit, amount of weight lost, or gastrin outputs.

TABLE 2. *Reflux Values Obtained in Asymptomatic Postgastrectomy Patients*

	$IG[BA]_{Rec}$	Net BA/Hr	EGRI
Mean	0.8	20	20
+2 SD	2.2	72	42

As indicated in Table 4, following conversion to a 45 cm Roux-en-Y limb gastrojejunostomy, reflux was eliminated in all 14 patients both early and late, irrespective of the test used to evaluate this parameter. Concomitantly, mucosal histology in the nonstomal area of the gastric mucosa improved, intragastric pH fell, and the residual stomach regained some capacity to secrete acid in response to histamine.

The observation made in our original communication that creation of a Roux-Y limb resulted in marked delays of gastric emptying in those patients who had undergone vagotomy as part of their index operation is also confirmed. At 14 ± 1 months after operation, the half-time for emptying of a solid meal in these 12 patients was 146 ± 34 minutes, compared to 41 ± 12 minutes before operation ($p < 0.05$). In every patient, the gastroenteric anastomosis was widely patent both before and after operation; in no patient was revision of the gastrojejunostomy required. With the exception of two patients in whom vagotomy was performed coincident with the creation of the Roux (discussed below), the observed delay appeared to be of no clinical consequence whatsoever. Of interest, when all patients were restudied at 41 ± 3 months after operation, the rate of gastric emptying of solids had returned to pre-Roux levels (39 ± 13 minutes).

Two significant complications occurred during the course of the study. The first developed in a 72-year-old male who, 17 years previously, had undergone a subtotal gastrectomy with Billroth II reconstruction without con-

TABLE 3. *Preoperative Assessment of Reflux, Gastritis, Gastric Acid Production, Gastric Emptying*

	IG[BA]	Net BA/HR	EGRI	G.S.	MAO	IGpH	T ½
Control (N = 9)	0.8 ± 0.2	20 ± 9	20 ± 5	1.8 ± 0.6	1.0 ± 0.3	5.0 ± 0.9	38 ± 8
Nonrefluxers (N = 11)	0.5 ± 0.2	15 ± 6	16 ± 9	1.4 ± 0.4	1.9 ± 0.4	5.3 ± 0.6	47 ± 9
Refluxers (N = 15)	4.6 ± 0.6*	163 ± 37*	81 ± 15*	6.7 ± 0.9*	0.5 ± 0.2*	7.0 ± 0.2*	46 ± 12

* $p < 0.05$ *vs.* nonrefluxers, controls.

TABLE 4. *Effect of Roux Conversion (N = 14) on Reflux, Gastritis, Gastric Acid Production*

	IB[BA]	Net BA/HR	EGRI	G.S.	MAO	IGpH
Preoperative	4.4 ± 0.6	170 ± 57	78 ± 13	6.5 ± 0.9	0.4 ± 0.2	7.0 ± 0.1
Early (14 ± 1 mo) Postoperative	0*	0*	0*	1.5 ± 0.6*	1.0 ± 0.9	3.6 ± 0.6*
Late (42 ± 3 mo Postoperative	0*	0*	0*	1.3 ± 0.2*	1.4 ± 0.8*	2.8 ± 0.9*

* $p < 0.05$ *vs.* preoperative value.

comitant vagotomy. At operation, his gastrojejunostomy was patent and was converted to a Roux-en-Y but without revision of the anastomosis. A truncal vagotomy was also performed. After operation, the patient developed severe gastric stasis, requiring prolonged nasogastric intubation and treatment with urecholine. The patient recovered and has had no untoward sequelae. The second complication developed in a 38-year-old woman who, 5 years previously, had also undergone a subtotal gastrectomy with Billroth II reconstruction without concomitant vagotomy. She was converted to a Roux-en-Y limb, again without revision of the anastomosis. However, in this instance, a truncal vagotomy was not performed. She was placed on prophylactic cimetidine and restudied 9 months later. At that time, gastric emptying of solids was normal, and there was no evidence of stomal ulceration on endoscopy. However, 1 year later, despite alleged compliance with her cimetidine regimen, she developed recurrent epigastric pain that proved to be the consequence of a giant marginal ulcer. At this time, a truncal vagotomy was performed in association with resection of the gastrojejunal anastomosis and reconstruction as a Roux-en-Y limb. After operation, she also developed severe and prolonged gastric stasis requiring Urecholine® for control. She ultimately recovered and has been asymptomatic since.

When all patients were evaluated for symptomatology 14 ± 1 months after operation, all 14 were free of epigastric pain and bilious vomiting. Vomiting had been eliminated in 11 patients and nausea in eight. On late (42 ± 3 months) follow-up, however, pain had recurred in four of 14 patients, vomiting had recurred in two additional patients, and one additional patient experienced recurrent nausea. Bilious vomiting remained absent in all patients.

Discussion

The accrual of 14 additional study subjects and the additional follow-up of all operated subjects to 42 ± 3 months confirms and extends observations originally made in 1980.[7] Assessment of intragastric bile acid concentration and net reflux per hour continue to be satisfactory markers of the magnitude of enterogastric reflux. The use of gamma scintography to develop an enterogastric reflux index has the added virtue of being a noninvasive and, perhaps, a more physiologic assessment of the same parameter. In combination, the capacity of these tests to discriminate between refluxers and nonrefluxers was quite satisfactory. In addition, agreement between the three methods of assessing reflux magnitude was close. Studies on nine asymptomatic control subjects permitted the identification of normal values for enterogastric reflux postgastrectomy. On the basis of these data, it was elected to define excessive refluxers as discussed above. This definition is admittedly arbitrary. It should be noted, however, that inclusion of the two excessive reflux patients with ⅔ abnormal tests in the nonreflux category or, conversely, inclusion of the two nonreflux patients with ⅓ abnormal tests in the excessive refluxer category did not significantly alter the objective results obtained in either group.

As before, when histologic gastritis was scored using the criteria described previously, a significant linear relationship was found to exist between intragastric bile acid concentration, especially in recumbency, and the severity of histologic gastritis at sites distant from the stoma of the residual gastric pouch. Furthermore, the excessive reflux group demonstrated a mean gastritis score before operation that was significantly greater than the remaining symptomatic patients or controls. Such a relationship might be expected based on animal experimentation.[9] Several groups have reported similar findings[10,11]; others, however, using different histologic criteria, have not.[12] The fact that patients with excessive reflux also demonstrated a higher fasting intragastric pH and a lower maximal acid output (MAO) compared to other study subjects might be evidence of a decreased parietal cell mass. Conversely, neutralization of secreted H^+ by reflux might also be responsible. The clinical lesson is clear: in view of the disparate results obtained concerning histology, the subjective nature of histologic gastritis scoring, and the great potential for sampling error, it would seem unwise to rely heavily on morphologic criteria to identify patients with excessive enterogastric reflux.

As noted previously, the symptomatic patients appeared quite homogeneous by other objective criteria. Most importantly, symptomatic nonrefluxers did not clearly distinguish themselves on clinical grounds from symptomatic excessive refluxers, with the single exception that bilious vomiting was present significantly more frequently in the latter group than in the former. Once again, the clinical lesson is clear: the routine assessment of the presence or absence of symptoms "appropriate" to the syndrome, with

the possible exception of bilious vomiting, is insufficient to establish the presence or absence of abnormal enterogastric reflux.

Conversion to a 45 cm Roux-en-Y limb gastrojejunostomy resulted in complete and permanent elimination of reflux, irrespective of the methodology employed to assess this parameter. Others have made qualitatively similar observations.[12] Concomitantly, using the same histiologic criteria as those employed before operation, gastritis scores improved markedly, an observation also made by some but not by others using different histologic criteria or shorter intervals of observation.[12,13] Simultaneously, intragastric pH fell and H^+ output in response to histamine increased significantly, a finding that might reflect an increased parietal cell mass. The clinical significance of this observation is that patients converted to a Roux, especially in the absence of vagotomy, are susceptible to recurrent ulceration on at least two grounds: absence of alkaline upper intestinal content at the anastomosis and recovery of the capacity of the residual gastric pouch to secrete acid.

Also confirmed is the intriguing observation originally made by us that a significant delay in gastric emptying of solids developed early after conversion to a Roux. This circumstance was encountered in all patients reconstructed in this way who also had, on preoperative testing, concomitant evidence of a complete vagotomy (12 of 14 subjects). In this group, the original gastroenteric anastomosis was not revised at reoperation nor were the vagus nerves touched. After operation, all stomata were widely patent both endoscopically and on barium study. In our original communication, we suggested that division of the afferent limb might affect the peristaltic pattern of the efferent (Roux) limb, resulting in delayed gastric emptying. Although the experimental evidence to suggest that this is, indeed, the case, is inconclusive, a recent clinical communication indicates that both the fasting and fed motility patterns of the Roux limb are markedly abnormal, indicating that it may act as an area of functional obstruction.[5,14,15] This, in turn, might be a consequence of isolating the limb from the pacemaker of the small bowel located in the duodenal bulb.

The contribution of extragastric vagotomy to either gastric or Roux limb stasis is unclear. It may be of significance that delayed emptying appeared to be of no clinical consequence in the 12 operated patients who had undergone a complete truncal vagotomy as part of their initial procedure. Conversely, in two patients, truncal vagotomy was accomplished simultaneously with conversion to the Roux; severe delays in gastric emptying were encountered in both. This anecdotal experience suggests, at least, that simultaneous extragastric vagotomy may compound the motility defect induced by small bowel transection *per se*. Although the magnitude of the clinical problem is uncertain, it is important to note that, in one recent experience, 10% of patients undergoing concomitant truncal vagotomy, antrectomy, and primary reconstruction as a Roux developed clinically significant symptoms suggestive of gastric stasis.[4] Under any circumstance, however, long-term (42 ± 3 months) follow-up of all operated patients in the present series indicates that the delayed emptying noted initially normalizes at this time. The reasons for this circumstance are unclear but may relate to reconstitution of a pacesetter in the proximal portion of the Roux limb with restoration of normal motility.

The early symptomatic results observed in all operated patients were quite gratifying, a circumstance also noted by others[12]: continuous burning midepigastric pain and bilious vomiting were eliminated in all patients, nausea and vomiting were relieved in most. On late follow-up, however, despite the complete absence of reflux, symptomatic deterioration was noted in the group as a whole. Epigastric pain had recurred in four patients, an additional patient experienced recurrent nausea, and two patients noted renewed episodes of vomiting. Bilious vomiting remained eliminated, as others have also noted.[12] Despite extensive evaluation, including assessment of the hepatobiliary tree and pancreas, barium studies of the lower gastrointestinal tract, and computed tomography of the upper abdomen, no objective abnormalities were identified in these patients. It has been reported that symptomatic patients with excessive enterogastric reflux demonstrate significantly greater Minnesota Multiphasic Personality Inventory (MMPI) profiles for hypochondriasis than do controls.[12] This may account, in part, for a less than completely satisfactory outcome in these patients on a long-term basis. In any case, our data also suggest that, in the majority of patients with excessive enterogastric reflux, conversion to a long-limb Roux-en-Y results in sustained symptomatic benefit for at least 3 years. Whether this circumstance will persist for longer periods of time remains to be determined.

On a more theoretical level, it is apparent that the present study has not achieved the central purpose for which it was undertaken, *i.e.*, to prove or disprove the hypothesis that excessive enterogastric reflux results in a unique postgastrectomy syndrome. This is so because the specific criteria outlined above to accomplish this end have not been fulfilled; the only clinical symptom encountered significantly more often in symptomatic postgastrectomy patients with excessive enterogastric reflux is bilious vomiting; despite complete elimination of enterogastric reflux, total elimination of symptoms is not achieved, especially in the long term. Although the outcomes observed in this and other series are sufficiently salutary that the existence of the syndrome should not be rejected out of hand, the prudent surgeon will undertake remedial operative ther-

apy with considerable circumspection and only after excessive enterogastric reflux has been convincingly documented and all other causes of postgastrectomy "dyspepsia" have been thoroughly excluded.

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Discussion

DR. J. LYNWOOD HERRINGTON, JR. (Nashville, Tennessee): Dr. Ritchie certainly is to be congratulated on the superb experimental and clinical studies that he has done over the years with alkaline reflux gastritis. The main drawback that has occurred with this clinical problem has been the general lack of objective data to define which particular patient with reflux will benefit from a Roux-en-Y diversion.

The many parameters that Dr. Ritchie has outlined this morning are certainly of immense value in selecting the proper patients for operation.

During the past 12 years Drs. John Sawyers and William Scott and myself have carried out a Roux-en-Y diversion in approximately 120 patients. The great majority have been to correct enterogastric reflux. A smaller number have been done for selected cases of gastric, duodenal, and stomal ulceration.

Like Dr. Ritchie, we feel that close to three-fourths of these patients have received benefit from the Roux-en-Y.

Two marginal ulcers have occurred in the group, and, of course, these two were my brother-in-law's patients (Laughter) and were due to an incomplete vagotomy. As you know, the Roux-en-Y principle is not ulcerogenic if it is coupled with a complete vagotomy and a good antral resection.

We have found that the Roux-en-Y gastroenterostomy shows varying differences in emptying. Some of the Roux's will empty normally, some of them will empty a little rapidly, but, as Dr. Ritchie mentioned, the great majority will show a delay in gastric emptying that will usually correct itself over a period of time. I want to focus attention just a moment on the problem that a small percentage of the patients that you see with alkaline reflux gastritis following a vagotomy with a resection, either B-1 or B-2, may also present the additional problem of significant delayed gastric emptying. The reason for this is somewhat unclear. Perhaps it is due to the vagotomy effect, and I would like Dr. Ritchie to elaborate upon that on closing.

This emptying problem may be missed completely unless you really look for it, and this additional problem must be corrected at the time of eliminating the enterogastric reflux with the Roux.

In our evaluations, we have found that after documenting enterogastric reflux with endoscopy, with biopsy, and with other appropriate studies, some of which Dr. Ritchie has outlined, that a routine barium study of the stomach is of little value in detecting coexisting delayed gastric emptying. Also, the technetium sulfa colloid study in our experience may give false-negative results. This may be related to the small volume of the isotope and the short time that it is held tagged to the chicken liver or to the egg. I would also like Dr. Ritchie to comment on that.

In my judgment, the most dependable study has been a barium food meal and checking radiographically gastric emptying over a period of several hours.

Now, the patient with a vagotomy and a modest resection, say an antrectomy, who experiences both alkaline gastric reflux and delayed gastric emptying will be cured of his reflux by the Roux-en-Y, but the delayed gastric emptying will persist. This represents only a small percentage of patients, and in such a patient we carry out a high gastric resection leaving only about 5% of the gastric remnant and then doing the Roux-en-Y.

We have seen around a dozen patients over the years who have presented with this combined problem. Some of these patients have undergone four or five operations before they came to Dr. Sawyers or myself. They have had the Roux-en-Y revised even though there was no obstruction. They have had mini-re-resections, and, certainly, I think that when one sees such a problem and it does not respond to intensive medical treatment, then one must do a very high re-resection and leave only a small nubbing of the stomach, again setting up a Roux-en-Y anastomosis.

(Slide) This is a routine GI series with barium alone in a patient who has had a truncal vagotomy and antrectomy and a Billroth I reconstruction.

This patient over a period of time after the operation developed significant enterogastric reflux that was documented by appropriate studies, but also the patient clinically had fullness and was uncomfortable. He could not eat a normal meal, but you see here that the routine GI series shows the stomach remnant to empty normally. A technetium sulfa colloid study was done and here again the stomach emptied solids a little bit more rapidly than did the normal controls.

The patient was then given a barium food meal, and this film was taken after the initial swallowing of the barium food meal. This film is about 30 minutes later and here you see some retention in the gastric remnant.

After 1 hour, there is considerable retention. After 3 hours and 15 minutes, still significant retention, and at this point the patient vomited a huge quantity of the barium and the eggs, and, as I say, this patient had been treated with intense medical treatment and was still not doing well.

So we went back in on this patient and did a high re-resection of the remaining remnant, leaving him about 5% of the stomach, hooking him up with a Roux-en-Y again. He now has no delay in emptying. You see the small stomach pouch connected in an end-to-side manner to the jejunum, and this patient has been relieved of his symptoms.