

Experiences with the Surgical Management of the Afferent Loop Syndrome

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DURING the past decade the afferent loop syndrome has gained increasing recognition as a cause of high intestinal obstruction in patients who have previously undergone gastric resection of the Billroth II type or when gastro-enterostomy has been part of an operative procedure.^{3, 6, 7} This syndrome was poorly understood until recently, and was erroneously classified as a component of the dumping syndrome. It is now recognized that postgastrectomy symptoms may result from several causes, and a thorough understanding of each category of symptoms is essential to correct diagnosis and treatment.

Interest in the afferent loop syndrome has been predominantly expressed by British investigators,^{1, 4, 11, 13, 14, 28, 33, 43} and only in recent years reports have appeared in the American literature concerning the complication.^{5, 21, 23, 37, 40, 41, 42, 48, 49} The syndrome has also been referred to as afferent loop obstruction or as bilious vomiting. It may occur following a Billroth II type gastric resection or gastro-enterostomy when the gastro-intestinal anastomosis is retrocolic. However, it is more prone to follow antecolic anastomosis. Particularly is this true if a long afferent loop of jejunum has been employed following high resection of the stomach.

Symptoms vary in intensity and may begin during the early postoperative period, but may occur weeks, months, or years following operation. Symptoms consist of

vomiting, 10 minutes to an hour after meals, of voluminous quantities of bile stained fluid unmixed with food particles. The vomiting is purely mechanical from obstruction along the course of the afferent loop or at its junction with the gastric stoma. A twist, kink, or volvulus of the jejunal loop may account for the obstruction. Internal hernia, or intussusception may also produce this complication. Symptoms may be acute, requiring early operation, or may be chronically recurring in various gradations of severity.

Acute Obstruction of the Afferent Loop

Acute afferent loop obstruction may occur shortly postoperative or months or years later. The longer the afferent loop, the greater is the risk of acute obstruction. An internal hernia in which the efferent jejunal loop and its mesentery passes anterior and behind the afferent loop may compress the afferent loop. The long afferent loop when attached to the lesser curve of the gastric pouch may herniate beneath the efferent loop producing the same compression. On occasions an acute twist, kink, volvulus, or jejunogastric intussusception may account for the complication.

In acute obstruction, there is usually total or near total occlusion of the afferent loop. During the early postoperative period, disruption of the closed duodenal stump is likely to follow. Otherwise, as bile, pancreatic juice, and jejunal secretions accumulate in the closed circuit, a rise in

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pressure in the loop soon exceeds venous pressure. As stasis and intra-luminal pressure further increase, secretory pressures in the pancreatic duct and common duct are exceeded, there may be a rise in serum amylase with or without pancreatitis. The patient complains of increasing epigastric and right upper abdominal pain with nausea and vomiting. If the obstruction is complete, the vomitus is free of bile. Fever, tachycardia, leukocytosis, and an abdominal mass may be present. Plain x-ray film of the abdomen may outline the tubular gas shadow of the occluded jejunal loop. Elevated serum amylase in these circumstances is not a valid reason to withhold operation. If operation is delayed, necrosis and perforation of the jejunal segment may occur. Also, hepatocellular degeneration has occurred in some reported cases. Treatment is prompt surgical intervention with release of the obstruction and measures to prevent recurrence which will be discussed below. Should there be necrosis of the jejunal loop, partial resection of the loop with Roux-Y anastomosis may be indicated. In case of gangrene of the excluded duodenum and entire afferent loop, complete excision with reimplantation of the common and pancreatic ducts will be necessary.

With retrocolic gastrojejunostomy, the afferent loop syndrome is less likely, due primarily to the short length of the afferent loop. Nevertheless, acute internal herniation and kinking at the gastro-enterostomy stoma have occurred with retrocolic anastomoses. Herniation of the afferent loop into the lesser peritoneal sac due to the disruption of sutures used to anchor the gastric pouch to the transverse mesocolon has also caused acute obstruction following a retrocolic anastomosis.

Chronic Afferent Loop Obstruction

Symptoms of chronic afferent loop obstruction may appear weeks, months, or years following operation. Usually from a

few minutes to an hour following meals, the patient first complains of upper abdominal fullness. This fullness increases in severity, and pain may be present. Nausea usually follows and then vomiting of from 500 to 1,000 cc. of clear bile-like material unmingled with food. Vomiting gives sudden and complete relief of symptoms. The cause is again mechanical with partial and intermittent obstruction along the afferent loop or at the gastro-enteric stoma. The responsible factor may be either partial volvulus, kink, twist, weight of the omentum and transverse colon, retrograde intussusception or internal herniation. With the ingestion of food, bile, pancreatic juice, and jejunal secretions accumulate in the partially obstructed loop. With distention the patient becomes aware of epigastric and generalized upper abdominal fullness. Increased motor activity in the partially obstructed loop then forcefully ejects contents of the loop into the stomach. Symptoms may vary in intensity and frequency, and may be mild and transient. On occasion, the symptoms are severe and associated with weight loss and weakness. Gastritis and esophagitis may result. When symptoms are moderate and frequent, or produce severe distress, operative intervention is indicated.

The diagnosis is usually apparent, especially if an antecolic anastomosis had been performed. Gastro-intestinal x-rays may show partial or complete lack of filling of the afferent jejunal loop. If the obstruction has been temporarily relieved at the time the x-rays are taken, however, the afferent loop may fill. Jordan devised a diagnostic test in which a mercury-weighted Levin tube is passed into the efferent jejunal loop and its position confirmed by x-rays. A fasting specimen is aspirated, and the patient is then fed a liquid meal of milk and glucose solution. Samples of jejunal contents are aspirated at intervals until good mixing of bile with the ingested meal is seen. If there is afferent loop ob-

struction, there should be no bile in the aspirate during symptoms, and symptoms should be relieved when bile passes the obstructed point. Dahlgren¹⁵ mentions a more effective test for diagnosis. The patient with suspected partially obstructed afferent loop is given an injection of secretin to stimulate pancreatic and biliary secretions. Cecekin, a strong duodenal motor stimulant, is then administered, and bilious vomiting should follow if there is partial obstruction in the loop. This test has been used by Woodward⁵⁰ with excellent confirmatory results.

Operative Methods for Correction of Symptoms

Most patients with this syndrome who require operation have chronic recurring symptoms, and operation can be carried out as an elective procedure. In a few instances, emergency operation will be necessary for sudden acute total loop occlusion by an internal hernia, retrograde intussusception, or a kink.

Operations used to alleviate afferent loop obstruction vary from simple procedures to major resections. Capper and Butler¹² advocate suspending the afferent jejunal loop to the gastrohepatic omentum and posterior peritoneum to promote drainage into the efferent loop. Simple reduction of minor kinks and angulations of the loop with suture fixation has also been reported. Removal of a large fatty omentum has been described for this condition. Buttressing the afferent loop to the lesser curvature of the gastric pouch so that it will assume a higher position than the efferent loop has been advocated. Entero-anastomosis between the afferent and efferent loops has resulted in alleviation of bilious vomiting, but the procedure shunts neutralizing bile and pancreatic juices away from the gastroenteric stoma. Nonetheless, supporters of this procedure claim that the incidence of marginal ulcer is small. Steinberg⁴² constructed a jejunoplasty, or a pantaloons

anastomosis, between the afferent and efferent jejunal loops just below the gastric pouch. Theoretically, this appears to be superior to entero-enterostomy which excludes alkaline secretions. Division of the afferent loop at the gastro-enterostomy site, closure of the end nearest the stomach, and implantation of the proximal divided end into the efferent loop after the method of Roux³⁶ has been used. Again, this procedure diverts alkaline secretions away from the stomach, and probably should not be employed unless combined with an adequate gastric resection or with vagotomy. One of the most widely used and most effective procedures to correct the afferent loop syndrome has been conversion of a Billroth II anastomosis to a Billroth I. When the afferent loop syndrome follows vagotomy and gastro-enterostomy, symptoms may be corrected by dismantling the gastro-enterostomy and performing pyloroplasty.

In recent years, some surgeons have converted a Billroth II type resection by transfer of a jejunal segment which is interpolated between the gastric pouch and duodenum. In this procedure, the original gastrojejunostomy is left intact, and either the afferent or efferent jejunal segment for a short distance near the gastro-enterostomy is transposed to the duodenum. The afferent (antiperistaltic) loop may be divided 15 cm. proximal to the gastro-enterostomy, and the distal divided end anastomosed to the opened duodenal stump. The efferent jejunal loop is next divided at the gastro-enterostomy junction, the proximal end closed, and the proximal end of the afferent jejunal loop is anastomosed to the distal efferent loop to restore continuity. If the efferent (isoperistaltic) jejunal segment is used for transformation, this segment is divided 15 cm. below the gastro-enterostomy site and anastomosed to the opened duodenal stump. The afferent jejunal loop is divided at the gastro-enterostomy, the distal end closed, and the proximal end of

TABLE 1. *Operations Designed to Alleviate Afferent Loop Obstruction*

1. Suspension of afferent loop	5. Entero-enterostomy
2. Reduction of twists or kinks by suture fixation	6. Jejunoplasty
3. Excision of greater omentum	7. Roux-en-Y anastomosis
4. Buttressing afferent loop to gastric pouch	8. Conversion Billroth II to Billroth I
	9. Conversion gastroenterostomy to pyloroplasty
	10. Jejunal transfer procedures

the afferent loop anastomosed to the distal efferent loop to restore continuity. When an isoperistaltic segment of jejunum is placed between the gastric pouch and duodenum, vagotomy is necessary to prevent ulceration in the transposed segment (Table 1).

Case Reports

Case 1. E. E. A., a 50-year-old physician, was admitted to the hospital in May 1960 after 8 hours of severe epigastric pain. Nine years prior, he had undergone truncal vagotomy, antrectomy and retrocolic Billroth II reconstruction for duodenal ulcer. He was well except for one short episode of epigastric discomfort a year before.

The patient was acutely ill, and a tender mass was palpable in the epigastrium. Gastro-intestinal x-rays showed obstruction to outflow of barium from the gastric pouch, and a coil of jejunum was seen protruding through the gastro-enteric stoma into the gastric pouch. In the opinion of the radiologist this was jejuno-gastric intussusception (Fig. 1).

At operation the afferent jejunal loop had herniated into the gastric pouch and was readily reduced by pressure on the pouch. The jejunum was edematous, but viable. The gastro-enteric stoma was large and admitted three fingers. The afferent and efferent loops were fixed to the posterior parietal peritoneum with interrupted silk sutures

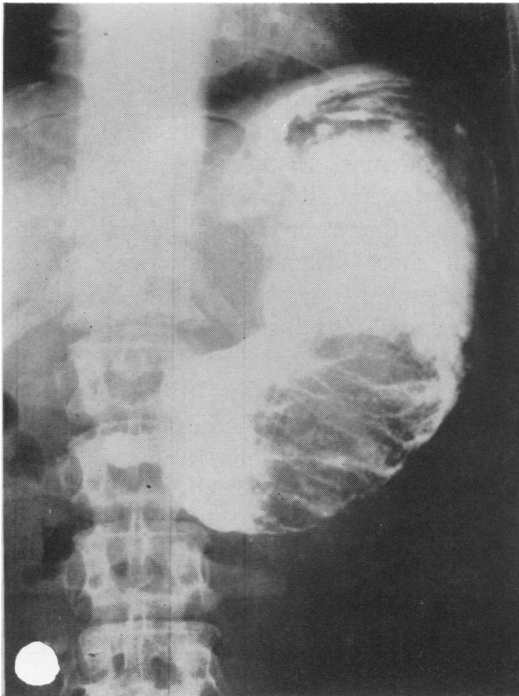


FIG. 1. (Case 1): X-ray showing jejuno-gastric intussusception caused by afferent loop herniation.

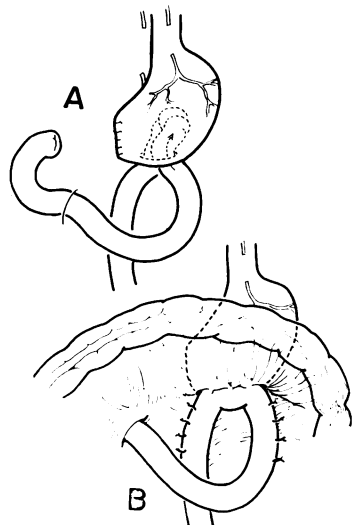


FIG. 2. (Case 1) (A): Sketch depicting the afferent loop herniation through the gastro-enteric stoma. (B) The intussusception has been reduced and the afferent and efferent loops have been anchored to the posterior parietal peritoneum with interrupted silk.

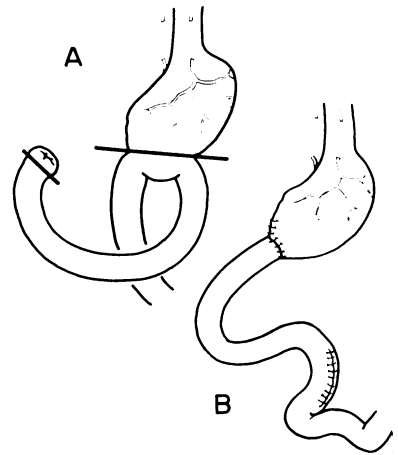
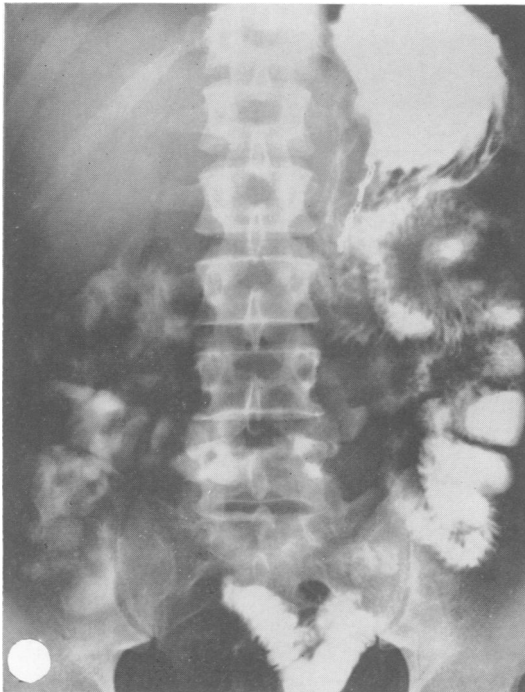


FIG. 3. (Case 2): Gastro-intestinal barium study demonstrating poor filling of the afferent loop.

FIG. 4. (Case 2) (A): The gastro-enterostomy is dismantled by dividing the gastro-enteric stoma in transverse fashion. (B): The previous Billroth II anastomosis is converted to a Billroth I. In this particular case, the jejunum is closed longitudinally as the bowel was dilated.

to prevent recurrence (Fig. 2). The patient has remained well for the past 6 years.

Comment. This is an infrequent cause of acute afferent loop obstruction. It is unusual for retrograde intussusception to follow retrocolic anastomosis. The afferent loop, however, was 15–20 cm. long and should have been placed closer to Treitz's ligament. That the gastro-enteric stoma was unusually large might have contributed to this complication.

Case 2. E. A., a 44-year-old man, was admitted to the hospital April 10, 1963 with the complaint of frequent vomiting of bile stained material. Eleven months before he had undergone truncal vagotomy, antrectomy, and a posterior Hofmeister reconstruction for duodenal ulcer. Symptoms were relieved for 3 months, when he began to vomit bile-stained fluid unmingled with food shortly after meals. Vomiting continued despite restricted diet, antispasmodics and other conservative measures. He lost 15 pounds, and the

vomiting became a daily occurrence. Gastro-intestinal x-rays showed no evidence of a marginal ulcer, and no obstruction.

Gastro-intestinal x-rays at this admission showed poor filling of the afferent loop. It was believed that the patient had recurrent afferent loop obstruction (Fig. 3).

At operation a long, thickened, dilated and angulated afferent loop approximately 24 inches in length was found. There was no evidence of recurrent ulcer. The gastro-enterostomy was dismantled, and the opening in the jejunum closed with two layers of sutures. The open end of the gastric pouch was then anastomosed end-to-end to the opened duodenal stump, converting the Billroth II reconstruction to a Billroth I (Fig. 4). The postoperative course was uneventful, and the patient has had no further nausea and vomiting over a 3-year follow up. He has regained the lost weight.

Comment. Although a retrocolic gastro-jejunal anastomosis was originally carried out, the afferent loop was too long and was the site of obstruction due to angulation.

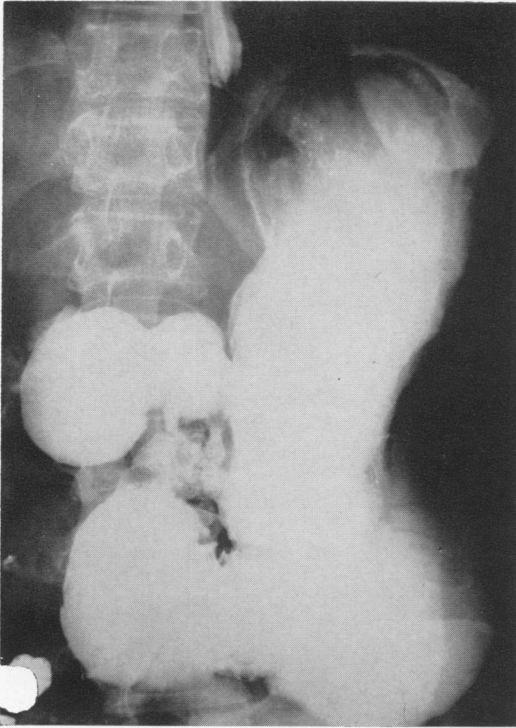


FIG. 5. (Case 3): Gastro-intestinal x-rays showing dilatation of the stomach and marked dilatation and obstruction of the proximal jejunal loops. These findings are consistent with an internal hernia.

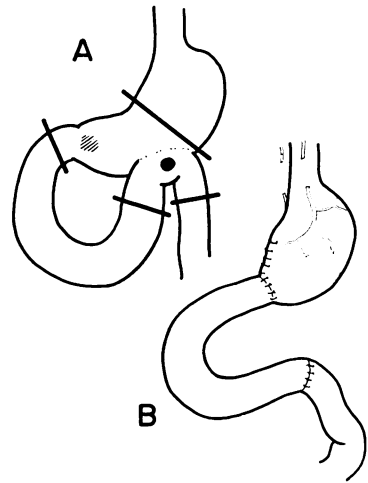


FIG. 6. (Case 3) (A): The internal hernia has been reduced and bloc resection of the gastric antrum and gastro-enterostomy are performed as outlined. (B): Bilateral truncal vagotomy, antrectomy, Billroth I reconstruction and jejunojunostomy have been done.

Simple conversion of a Billroth II type anastomosis to a Billroth I eliminated the afferent loop and relieved symptoms.

Case 3. M. H. H., a 63-year-old woman, was admitted to the hospital August 4, 1958 with a history for several months of vomiting bile stained material following meals. Twenty-five years before, she underwent wedge excision of a lesser curvature benign gastric ulcer combined with anterior gastrojejunostomy.

Gastro-intestinal x-rays showed moderate dilatation of the stomach and marked dilatation of the jejunal loops just distal to the gastro-enterostomy stoma. Little barium passed this point. It was believed that the patient had an internal hernia (Fig. 5).

At operation the long afferent loop was found herniated posterior to the gastro-enterostomy site and obstructed. There was a marginal ulcer at the stoma and a scar in the duodenal cap. Treatment consisted of bilateral truncal vagotomy, dismantling the gastro-enterostomy, and jejunojunos-

tomy. The gastric antrum and duodenal bulb were excised, and a Billroth I reconstruction carried out (Fig. 6). The patient has now been followed more than 7 years and has remained well.

Comment. This patient had originally undergone an antecolic gastrojejunostomy with a long afferent loop. An internal hernia subsequently developed with a long afferent loop being displaced behind the efferent loop. When antecolic gastro-enterostomy is performed, one large potential hernial space is created above and below the transverse colon. Measures to suture the stomach and the afferent and efferent jejunal loops to the posterior parietal peritoneum above and below the transverse colon are important to obliterate this space.

Case 4. C. L., a 38-year-old man, was seen in the hospital in July 1959 after several weeks

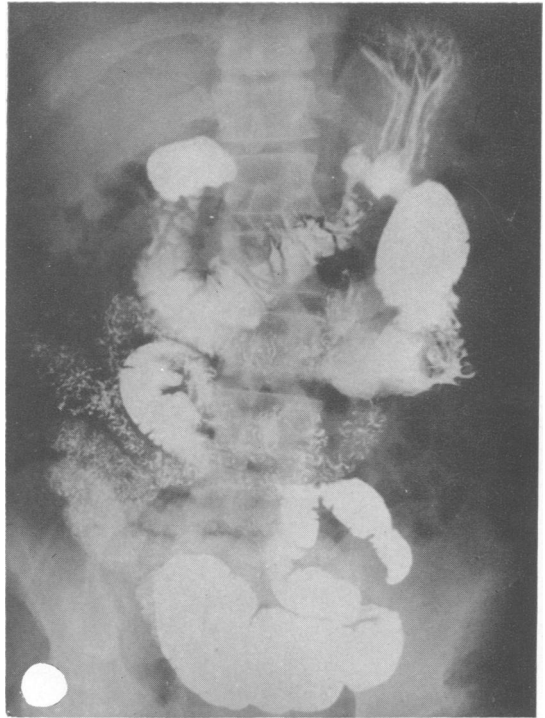
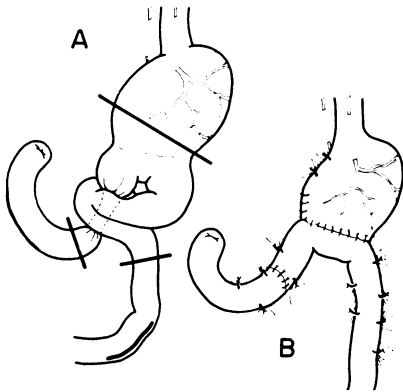


FIG. 7. (Case 4) (A): The internal hernia is depicted showing the efferent loop and its mesentery producing compression and obstruction of the afferent loop. (B): The hernia has been reduced, and a new gastrojejunostomy constructed including excision of the sacculated loops. The stomach pouch and both jejunal loops have been sutured to the posterior peritoneum to close the potential hernial space.

FIG. 8. (Case 4): Postoperative x-rays show adequate stomal emptying and excellent function of both the afferent and efferent loops.

of severe abdominal pain relieved temporarily by vomiting copious amounts of bile stained fluid. Attacks would follow meals and occurred daily. There had been a 25-pound weight loss in recent weeks. Fourteen months prior to admission, the patient had undergone truncal vagotomy, antrectomy, and a posterior Hofmeister reconstruction for a penetrating duodenal ulcer.

Gastro-intestinal x-rays showed dilatation of the gastric pouch and obstruction of the jejunal loops just beyond the gastro-enteric stoma believed to be afferent loop obstruction due to an internal hernia.

It was found at operation that the efferent jejunal loop passed anteriorly and behind the afferent loop. The weight of the efferent loop and its mesentery produced obstruction of the afferent loop. The duodenum and afferent loop up to the point of obstruction were dilated and the efferent loop was likewise dilated to the point where it crossed the afferent loop.

Treatment consisted of dismantling the gastro-enterostomy, jejunojejunostomy and reconstruction

of an anterior gastro-enterostomy according to the Polya method. The afferent and efferent jejunal loops were sutured to the posterior parietal peritoneum both above and below the transverse mesocolon to close the large potential hernial ring (Fig. 7).

The patient has remained well for the past 7 years and has gained weight. Gastro-intestinal x-rays show adequate stomal emptying and visualization of both afferent and efferent jejunal loops (Fig. 8).

Comment. Again a long afferent jejunal loop created a potential hernial ring posteriorly and the efferent loop herniated anteriorly and obstructed the afferent loop. Both afferent and efferent loops near the anastomosis were dilated and sacculated and, following reduction of the hernia, these loops were excised. A new gastro-enterostomy was constructed anterior to

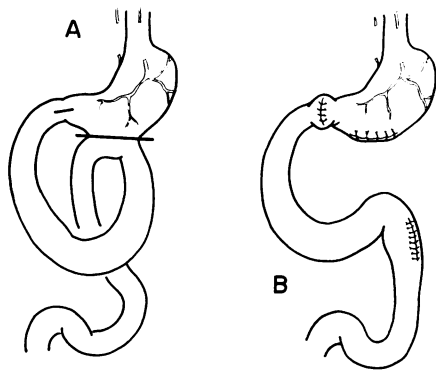


FIG. 9. (Case 5) (A): Afferent loop obstruction following vagotomy and gastro-enterostomy. (B): Correction of symptoms by converting the gastro-enterostomy to a pyloroplasty, thus eliminating the afferent loop.

the colon as induration, scarring, and edema of the transverse mesocolon precluded another retrocolic anastomosis. It would have been better to convert the Billroth II anastomosis to a Billroth I, but tissue reaction in the area of the duodenal stump prevented this. With the new antecolic gastro-enterostomy, measures were taken to suture the afferent and efferent jejunal loops to the posterior parietal peritoneum to prevent recurrent internal hernia.

Case 5. R. H., a 53-year-old woman, was admitted June 1958 because of several years of vomiting bile stained fluid after meals. The vomiting had become progressively worse and more frequent. The patient underwent a posterior gastro-enterostomy and truncal vagotomy 8 years before for duodenal ulcer.

Gastro-intestinal x-rays showed no evidence of a marginal ulcer, and the afferent jejunal loop failed to fill. A Hollander test indicated complete vagotomy. It was believed that the patient was suffering from marked partial and intermittent afferent loop obstruction, and operation was advised.

At operation no recurrent ulcer was found. The previous duodenal ulcer had healed. The afferent jejunal loop was dilated and sacculated and the site of recurrent obstruction. The gastro-enterostomy was taken down, and the openings in the stomach and jejunum closed. A Mikulicz type pyloroplasty was performed (Fig. 9). Postoperatively, the pyloroplasty site leaked with resultant abscess which required drainage. An abdominal

wall hernia resulted which was later repaired. The patient has been relieved of symptoms and has now been followed almost 8 years.

Comment. The most satisfactory measure to prevent afferent loop syndrome is to avoid an afferent loop. This is achieved when vagotomy and pyloroplasty and vagotomy with a Billroth I resection are performed. Vagotomy and gastro-enterostomy originally carried out in this patient resulted in ulcer healing. It was unfortunate that a leak at the pyloroplasty occurred when the conversion procedure was performed. This was due to an error in technic.

Case 6. L. C. D., a 39-year-old man, was seen August 23, 1965 with a 2-year history of intermittent vomiting of large quantities of greenish material unmixing with food. The episodes had become progressively worse and were of daily occurrence and there had been a recent 20-pound weight loss. Two years before the patient had undergone 75% gastric resection with antecolic Polya reconstruction for duodenal ulcer. The symptoms of bilious vomiting began shortly after operation.

Gastro-intestinal x-rays showed a small stomach pouch with poor filling of the afferent jejunal loop (Fig. 10). No marginal ulcer could be demonstrated. At operation an antecolic afferent loop approximately 24 inches long which had been anastomosed to the lesser gastric curvature was found. An obstruction could be demonstrated at the junction of the loop and the gastric pouch. At this point, the jejunum was kinked, angulated, and lay behind the gastric remnant.

The afferent loop was divided at the gastro-enteric stoma, and its distal end closed. The efferent (isoperistaltic) loop was divided 15 cm. distal to the gastro-enterostomy. This 15-cm. segment was anastomosed to the opened duodenal stump. No residual antral tissue was left attached to the duodenum. The proximal end of the afferent loop was then anastomosed to distal efferent loop to restore continuity. A bilateral truncal vagotomy was performed (Fig. 11). The patient was relieved of symptoms and has remained well over a 5-month follow up. Postoperative x-rays show the jejunal pouch functioning adequately (Fig. 12).

Comment. A transposition operation employing an isoperistaltic jejunal segment 15 cm. long interpolated between the stomach remnant and duodenum eliminated the afferent loop. The interpolated isoperistaltic

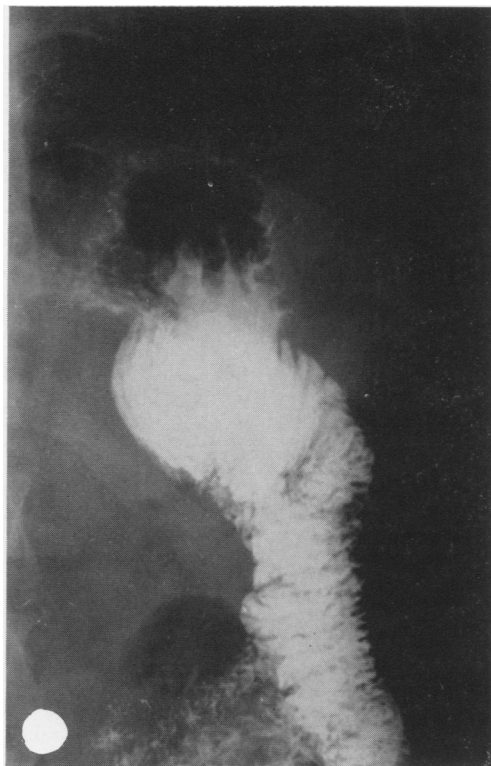


FIG. 10. (Case 6) Left: Preoperative x-rays showing poor filling of the afferent loop.

segment, by direction of its peristalsis, prohibits regurgitation of alkaline duodenal contents back into the segment. This factor coupled with the free flow of hydrochloric acid from the gastric remnant into the jejunal segment makes vagotomy mandatory to prevent ulceration in the interpolated segment. Had a short reversed (antiperistaltic) jejunal segment been used as the interpolation organ, regurgitation of duodenal contents into the segment would take place, and vagotomy would assume a lesser role of importance as part of the operative procedure.

Case 7. C. H. K., a 66-year-old man, was admitted May 26, 1959 with epigastric and sub-sternal discomfort followed by vomiting of copious amounts of bile stained fluid. Symptoms dated back 8 months following a 75% distal gastrectomy, splenectomy, and antecolic Polya reconstruction for fungating adenocarcinoma of the gastric corpus.

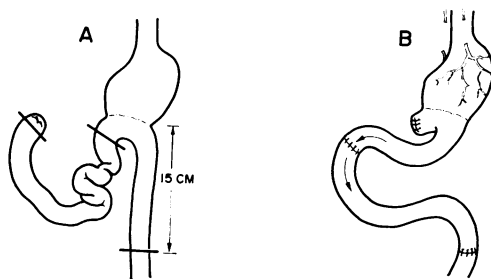


FIG. 11. (Case 6) (A): Kinking and angulation of the long afferent loop producing partial obstruction. (B) The afferent loop has been divided near the gastro-enterostomy and the distal end closed. The efferent loop has been severed 15 cms. beyond the gastro-enterostomy and anastomosed to the opened duodenal stump. Jejunojejunostomy has been done to restore continuity. Complimentary vagotomy is always added when employing an isoperistaltic jejunal transfer.

There had been a 30-pound weight loss since operation, and the patient was weak.

Gastro-intestinal x-rays showed a small residual gastric pouch which emptied rapidly (Fig. 13). The afferent and efferent jejunal loops filled readily. There was no evidence of recurrence of the carcinoma. It was believed that the patient was suffering from intermittent afferent loop obstruction with gastritis and esophagitis.

At operation, the liver was normal, and there was no evidence of recurrent carcinoma. The long afferent loop had been anastomosed to the lesser curvature of the gastric pouch and was twisted and angulated. The gastro-enteric stoma and the efferent jejunal loop were normal. The afferent loop was divided at the gastro-enterostomy site, and the distal end was closed. The long afferent loop was then anastomosed end-to-side to the efferent loop below the transverse mesocolon and approximately 24 inches beyond the gastro-enteric stoma. Vagotomy was then performed (Fig. 14). Postoperative studies showed normal emptying of the gastric pouch (Fig. 15). Symptoms were relieved by this procedure, and the patient gained weight. He remained free of vomiting and abdominal distress for over 3 years at the end when carcinoma recurred and a rapid downhill course followed.

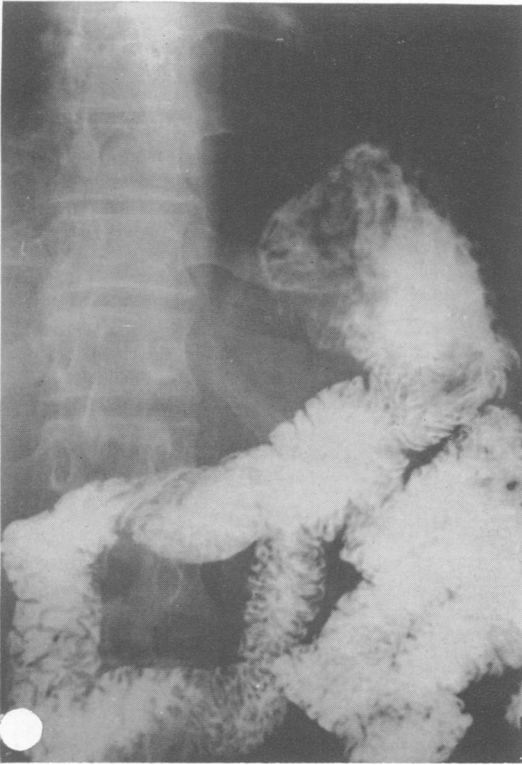


FIG. 12. Postoperative film showing jejunal transfer placed between the stomach pouch and duodenum.

Comment. There were several operative choices in this case to correct the afferent loop obstruction. The Polya procedure could have been converted to a Billroth I, the Soupault-Bucaille principle, which keeps the gastro-enterostomy intact, and either the afferent or efferent jejunal limb is anastomosed to the duodenal stump, a jejunal transposition, could have been applied. It was decided, however, to simply transect the long afferent loop at the gastro-enterostomy stoma, close the distal end, and anastomose the afferent loop to the efferent loop in Roux-Y fashion. With the small amount of parietal cell mass which remained, it appeared unlikely that shunting alkaline afferent loop contents away from the gastric stoma would produce sufficient gastric hyperacidity to induce ulceration. Bilateral vagotomy was done to fur-



FIG. 13. (Case 7) Left: Gastro-intestinal series showing rapid emptying of the small gastric pouch.

ther reduce gastric acidity and to decrease the sensitivity of the remaining parietal cell mass. Had the original operation been carried out for duodenal ulcer instead of gastric carcinoma, vagotomy at the time of the Roux-en-Y procedure would have assumed added importance.

Discussion

It is recognized that postgastrectomy symptoms may result from a variety of causes. Understanding of the physiologic and mechanical basis for these symptoms has resulted in the formulation of several distinct syndromes. Afferent loop obstruction is one of this group.

Bilious vomiting occurred following antecolic gastro-enterostomy soon after its introduction by Wölfler in 1881. A few years later when gastric resection with gastro-

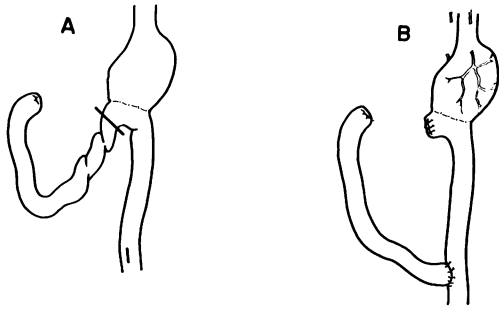


FIG. 14. (Case 7) (A): Sketch showing angulation and kinking of the afferent loop. (B): Treatment consisted of diversion of the afferent loop at the gastro-enterostomy with closure of the distal end. The long afferent loop has been anastomosed end-to-side to the efferent loop. Vagotomy has been performed as a precaution against recurrent ulceration.

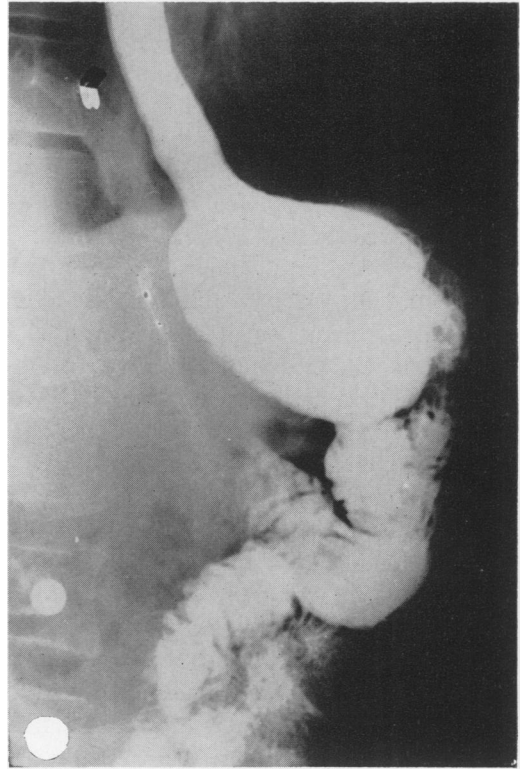


FIG. 15. Postoperative barium study showing normal emptying of the gastric pouch. The Roux-en-y anastomosis is visualized.

enterostomy was introduced by Billroth, bilious vomiting was likewise a complication. During this era many gastro-enterostomies were performed for such conditions as gastric neurosis, gastropptosis, and emotional states, and the morbidity due to the postoperative bilious vomiting was appalling. As a result, modifications in gastro-enterostomy technics were described by Rockwitz,³⁵ Kronlein,²⁶ Brenner,¹⁰ and Kocher,^{24, 25} but the results were not satisfactory. To prevent bilious vomiting, Launstein²⁹ and Jaboulay²² advocated an entero-entero shunt below the gastrojejunal site. Braun, in 1893, described a similar procedure. Roux transected the jejunum beyond Treitz's ligament and with the distal end performed an antecolic gastro-jejuno-stomy. The proximal end of jejunum was then anastomosed end-to-side to the distal jejunum. In the years that followed, surgeons introduced varied modifications when gastro-enterostomy was performed

alone or when carried out in combination with gastric resection to prevent bilious vomiting.^{2, 8, 9, 16, 19, 27, 30, 31, 32, 34, 38} These technics were recently reviewed by Frederick and Osborne.¹⁸

While various modifications of gastro-enterostomy were being introduced, the real cause for the bilious regurgitation remained poorly understood. Billroth believed symptoms resulted from protrusion of a mucosal spur of jejunum through the gastro-enterostomy site into the stomach. Roux believed that gastric resection might injure the nerve supply of the duodenum. The complication of postoperative bilious vomiting was so prevalent and distressing that Pribram in 1925 labeled gastro-enterostomy a disease.

During the past decade or two, British surgeons have shown interest in this com-

plication, but it was Hoffman,²⁰ a German surgeon, who first made the distinction between bilious vomiting and the dumping syndrome. This type vomiting results from partial or complete obstruction of the afferent jejunal loop and has been termed the *afferent loop syndrome*. Excellent reviews have been written by Lake,⁸ Wells,^{45, 46, 47} Muir,³³ Stammers,⁹³ Capper,¹³ and Welbourn.⁴⁴ It is estimated that afferent loop symptoms occur in from 5 to 20% of patients who undergo gastro-enterostomy alone or gastro-enterostomy combined with gastric resection. With all known technics of gastro-enterostomy, this complication has not been eliminated. With short loop gastro-enterostomy, and with careful attention to other technical details, its incidence has, however, been reduced.¹⁷ Recent clinical interest in vagotomy, pyloroplasty, and the Billroth I anastomosis for duodenal ulcer while not directed toward eliminating this complication, have served to prevent afferent loop complications. Fortunately, in many instances, symptoms of afferent loop syndrome are mild and transient and do not require surgical treatment.

Surgical procedures directed toward suspension of the afferent loop, entero-anastomosis, and simple suture to prevent recurrent kinks or twists may be inadequate. More definitive operations which eliminate the afferent loop are more appealing.

Infrequently a patient with afferent loop symptoms may have no anatomic cause for obstruction found at operation. Woodward encountered five such cases and believes that distention of the gastric remnant producing torsion might be a factor. Also, there may exist a disturbance in jejunal motility at the anastomotic site producing afferent loop retention.

Summary

Symptoms of acute and of chronic recurring afferent loop obstruction were first described shortly after gastro-enterostomy

and gastric resection with gastro-enterostomy were introduced by Wölfler and Billroth, respectively. Only in recent years, however, have the symptoms and pathogenesis been elucidated. This has resulted in large part from experimental and clinical observations made by British Surgeons.

The condition may result from obstruction along the course of the afferent loop or at the gastro-enteric stoma. Volvulus, kink, twist, internal hernia or retrograde intussusception may be responsible for the symptoms.

In many instances, symptoms of afferent loop obstruction may be mild and intermittent and not require surgical treatment. On the other hand, there are cases in which symptoms are disabling. Remedial operations currently employed to correct the afferent loop syndrome have been described. Methods which employ conversion technics or jejunal transposition operations are recommended as these procedures eliminate the afferent loop. Experiences with the surgical management of several patients have been detailed.

References

1. Aylett, S. O.: A New Operation for Chronic Peptic Ulcer. *Brit. Med. J.*, 1:454, 1951.
2. Balfour, D. C.: Emergency Complications Occurring after Operations on the Stomach and Duodenum and their Treatment. *Coll. Papers, Mayo Clinic*, 25:58, 1933.
3. Ballon, H. C. and Niloff, P. H.: Elevation of Serum Amylase with Postgastrectomy Jejunal Obstruction and Perforation. *Canad. Med. Ass. J.*, 80:339, 1959.
4. Bastable, J. R. G. and Huddy, P. E.: Retro-anastomotic Hernia. *Brit. J. Surg.*, 48:183, 1960/61.
5. Birman, K. L. and Stahlgren, L. H.: Post-operative Duodenojejunal Obstruction Following Gastric Resection. *Arch. Surg.*, 80:464, 1960.
6. Blomquist, H. E.: Acute Obstruction of Afferent Loop Following Gastric Resection A. M. Billroth H-Hofmeister. *Acta Chir Scand.*, 126:92, 1963.
7. Blomstedt, B. and Dahlgren, S.: The Afferent Loop Syndrome. *Acta Chir Scand.*, 120:347, 1961.
8. Braun, H.: Ueber Gastro-Enterostomie and Gleichzeitig Ausgeführte Entero-anastomose. *Arch. Klin. Chir.*, 45:361, 1893.

8. Braun, H.: Ueber die Gastroenterostomie und Gleichzeitig Entero-anastomose. *Zentralbl. f. Chir.*, 19:102 (Suppl.), 1892.
10. Brenner, A.: Zue Technik der Gastroenterostomie. *Wien. Klin. Wchnschr.*, 5:375, 1892.
11. Capper, W. M. and Airth, G. R.: Post-gastrectomy Biliious Vomiting. *Lancet*, 1:323, 1957.
12. Capper, W. M. and Butler, T. J.: A Clinical Study of the Early Postgastrectomy Syndrome. *Brit. Med. J.*, 11:265, 1951.
13. Capper, W. M. and Welbourn, R. B.: Early Post-cibal Symptoms Following Gastrectomy. *Brit. J. Surg.*, 43:24, 1955.
14. Conyers, J. H., Hall, R. A., Laing, D., Pulvertaft, C. N. and Wilson-Pepper, J. K.: The Use and Risks of the Roux-en-Y Anastomosis in the Relief of Post-gastrectomy Symptoms. *Brit. J. Surg.*, 47:533, 1959/60.
15. Dahlgren, Sven: The Afferent Loop Syndrome. *Acta Chir. Scand. (Supplement)*, 8:321, 1964.
16. Doyne, E.: Contribution a l'etude de la Chirurgie de l'estomac et de l'intestin: 12 Observations Personnelles de Chirurgie Stomacale Suivies de 20 Observations d'enterotomie et d'enterostomie. *Arch. Prov. de Chir.*, 1:22, 1892.
17. Dunphy, J. E.: A Method of Handling the Jejunal Loop in Gastrectomy with a Posterior Anastomosis. *Surg., Gynec. & Obst.*, 110:109, 1960.
18. Frederick, P. L. and Osborne, M. P.: The Development of Surgical Procedures for the Treatment of Peptic Ulceration of the Stomach and Duodenum, 58:884, 1965.
19. Hall, J. B.: A New Route for Posterior Gastroenterostomy. *Brit. Med. J.*, 2:895, 1903.
20. Hoffman, V.: Klinische Krankheitsbilder nach Magenoperationen. *Munch Med Wschr.*, 86:332, 1939.
21. Hoffman, W. A. and Spiro, H. M.: Afferent Loop Problems. *Gastroenterology*, 40:201, 1961.
22. Jaboulay, M.: La Gastroenterostomie; la jejunoduodenostomie; la Resection du Pylore. *Arch. Prov. de Chir.*, Par. 1:1, 1892.
23. Jordan, G. L.: The Afferent Loop Syndrome. *Surgery*, 38:1027, 1955.
24. Kocher, T.: Ueber eine neue Methode der Magenresection mit Nachfolgender Gastroduodenostomie. *Arch. f. klin. Chir.*, 42:542, 1891.
25. Kochere, T.: Mobilisierung des Duodenum und Gastroduodenostomie. *Zentralbl. F. Chir.*, 30:33, 1903.
26. Kronlein, R. U.: Mittheilungen aus der chirurgischen Klinik, Cor. Bl. f. Schweiz. Aerzte, 18:316, 1888.
27. Lahey, F. H.: A Simple Useful Anterior Gastroenterostomy. *Surg., Gynec. & Obst.*, 78:169, 1944.
28. Lake, N. C.: The Aftermath of Gastrectomy. *Brit. M. J.*, 1:285, 1948.
29. Lauenstein, C.: Zur Indikation, Anlegung und Funktion der Magendunndarmfistel. *Zentralbl. f. Chir.*, 18:776, 1891.
30. Mayo, W. J.: Chronic Ulcer of Stomach and Duodenum. *Ann. Surg.*, 60:220, 1914.
31. Mayo, W. J.: The Technique of Gastrojejunostomy. *Ann. Surg.*, 43:537, 1906.
- 31a. Mollin, D. L., Hines, J. D., Clark, C. G., Booth, C. C. and others: Late Post-gastrectomy Syndromes. *Proc. R. Soc. M., Lond.*, 57:575, 1964.
32. Moynihan, B. G. A.: The Direction of the jejunum in the Operation of Gastroenterostomy. *Ann. Surg.*, 47:481, 1908.
33. Muir, A.: Post-gastrectomy Syndromes. *Brit. J. Surg.*, 37:165, 1949.
34. Peterson, W.: Anatomische und Chirurgische Beitrage zur Gastroenterostomis. *Beitr. z. klin. Chir.*, 29:597, 1900-1901.
35. Rockwitz, C. X.: Die Gastroenterostomie an der Strassburger Chirurgischen Klinik. *Deutsche Ztschr. f. Chir.*, 25:502, 1886-1887.
36. Roux, P. P. E.: Chirurgie Gastro-intestinale. *Rev. de Chir.*, 13:402, 1893.
37. Schindler, R. and DeGradi, A. G.: Gastroscopic Observations Following Various Types of Surgery for Gastroduodenal Ulcer. *Surg., Gynec. & Obst.*, 100:78, 1955.
38. Schmilinsky, H.: Die Einleitung der gesamten Duodenalsaftes in de Magen (innere Apotheke). *Zentralbl. f. Chir.*, 45:416, 1918.
39. Stammers, F. A. R.: Small Bowel Obstruction Following Antecolic Partial Gastrectomy. *Brit. J. Surg.*, 20:58, 1952.
40. Steinberg, M. E.: Gastric Surgery—Errors, Safeguards and Management of Malfunction Syndromes. *Appleton-Century-Crofts*, 1963.
41. Steinberg, M. E.: Personal Communication.
42. Steinberg, M. E.: Prevention of Some Post-gastrectomy Difficulties by New Gastrectomy Technique (Pantaloon Anastomosis). *J. Internat. Coll. Surg.*, 14:194, 1950.
- 42a. Tanner, N. C.: Disabilities Which May Follow Peptic Ulcer Problem. *Proceedings of the Roy. Soc. of Med.*, 59:362, 1966.
43. Viseck, A. H.: A Study of the Failure after Gastrectomy. *Ann. Royal Coll. Surg., England*, 3:266, 1948.
44. Welbourn, R. B., Butler, T. J. and Capper, W. M.: Discussion on Post-gastrectomy Syndromes. *Proc. Roy. Soc. Med.*, 44:773, 1951.
45. Wells, C. and Johnston, J. H.: Revision to Roux-en-Y Anastomosis for Post-gastrectomy Syndromes. *Lancet*, 2:479, 1956.
46. Wells, C. and MacPhee, I. W.: The Afferent Loop Syndrome. *Lancet*, 2:1189, 1952.
47. Wells, C. and Wellbourn, R.: Post-gastrectomy Syndromes. *Brit. M. J.*, 1:546, 1951.
48. West, J. P.: Obstruction of Proximal Jejunum Following Gastric Resection and Antecolic Anastomosis. *Surgery*, 34:98, 1953.
49. Woodward, E. R.: Post-gastrectomy Syndromes. *C. C. Thomas Publishers*, 1963.
50. Woodward, E. R.: Personal Communication.
- 51a. Woodward, E. R.: The Pathophysiology of Afferent Loop Syndrome. *Surg. Clin. No. Amer.*, 46:411, 1966.