SOME CLINICAL FINDINGS IN SUBTOTAL GASTRECTOMY *

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Subtotal gastrectomy is obviously an indefinite term. It has come to be associated, however, with the removal of at least one-third of the stomach. Since Billroth's first successful pylorectomy in 1881, all the possibilities of resection of the stomach and anastomosis with the duodenum and jejunum have been developed to the limit of technical ingenuity. Until a few years ago subtotal gastrectomy was an operation reserved for operable or suspected malignancy and a few unusual or extensive gastric ulcers, and gastroenterostomy was the operation of choice for ulceration of the stomach or duodenum.

Two years ago in this Academy John N. T. Finney [1] delivered an address which reviewed the forty-five-year period since Billroth's success, and in this paper he discussed at length all the various theories as to etiology and treatment of gastric and duodenal ulcer, and the various types of operative relief with the advantages and disadvantages of each. I cannot do better than to refer you to this masterly work, as tonight I wish to confine myself to the findings, from the functional and physiological viewpoint, of subtotal gastrectomy as encountered on a general surgical service. This operation until the last decade was simply a mechanical method of removing a lesion benign or malignant, but since the war period the surgeons of Austria and Germany, particularly von Haberer [2] and Finsterer,[3] have used it as a means of altering the physiology of gastric secretion, the removal of the lesion being a somewhat minor consideration.

It is generally conceded that although the acid-forming cells are mostly in the fundus, hydrochloric acid is not produced in quantity without an impulse arising from the pyloric third of the stomach. Irrespective of what factor is accepted as being primary in ulcer formation, hydrochloric acid is rather widely credited with being a source of irritation, that is, an obstacle to healing and a cause of recurrence. The continental surgeons have proceeded on this basis and claim that a subtotal gastrectomy with removal of at least one-third of the stomach is effectual in producing achlorhydria, or at least a marked diminution of hydrochloric acid with the dual result of removal of the ulcer-bearing area and the prevention of recurrence.

Surgeons in this country have been somewhat lukewarm in adopting subtotal gastrectomy as the operation of choice in gastric ulcer, and almost unanimous in rejecting it as routine treatment for duodenal ulcers. The Mount Sinai staff of this city is a notable exception. This marked division of opinion between careful and conscientious surgeons is of course temporary.

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Post-operative results followed for a long period will determine the issue, for theoretical objections will naturally fade away before actual statistical proof.

Von Haberer and Finsterer have been publishing their results since 1922 and apparently demonstrated a low mortality and a high percentage of cures, but their publications do not include the statistical details that carry conviction. Dr. Henry Louria [4] recently published the results of a year's attendance at von Haberer's clinic, with a study of the follow-up system and the results covering the period from January 1, 1925, to January 1, 1927. There were 197 cases followed out of a total of 257. A letter was considered a successful follow-up. Out of a total of eighty-one gastric ulcers there were replies from fifty-four. Gastric secretion was determined one half hour after intake of tea and a roll, but no figures are given as to post-operative findings. As you know von Haberer removes from one-half to two-thirds of the stomach and reëstablishes the lumen by a gastric-duodenostomy, end to side. This is also Finney's method.

This careful study by Louria indicated that the follow-up system in this very large clinic is inadequate as a basis for convincing statistics.

Let me review briefly the arguments for and against this operative procedure. Conservatives complain that the operation is too mutilating; that the mortality is too high; that the ultimate physiological effect is not known; that achlorhydria may lead to pernicious anæmia; that the essential cause of the ulcer is not being attacked; that according to Balfour [5] marginal ulcer not infrequently occurs even after this operation, and, finally, that gastro-enterostomy is a satisfactory method of surgical relief in the great majority of cases. The radicals claim that the operation is practical and of low mortality; that the physiological results are good; that not only hydrochloric acid, but the ulcer-bearing area is removed; that the possibility of malignancy is lessened; that anæmia does not occur; that marginal ulcers are very rare, and that gastro-enterostomy is a failure as a method of treating gastric ulcer and an inadequate method of treating duodenal ulcer.

It must be admitted that the majority of clinics in this country have published very optimistic reports on the results of gastro-enterostomy where these reports have been based in many cases on even more inadequate follow-up systems than those abroad. This is particularly true where cases have been followed for only one or two years. However, no matter which method of reasoning appeals to us, we all encounter problems, exclusive of malignancy, where some form of gastric resection has to be done of necessity, and if the results in these cases are studied they should be of value as coming from an entirely neutral source.

Analysis of All Cases of Subtotal Gastrectomy 1923–1927 for Benign Gastric Ulcer

Hospital—Bellevue; No. 1058. Occupation—machinist, thirty-eight years of age. Date and type of last operation—June 3, 1926; post-colic polya. Date and type of former operation—January 26, 1921; suture of perforated ulcer with gastro-enterostomy. Pre-operative X-ray findings—persistent duodenal ulcer; stoma normal; six hour residue.

Operative findings—persistent duodenal ulcer; inflamed stoma; attached to transcolon. Post-operative course—smooth; discharge on eighteenth day. Post-operative X-ray—October 22, 1924; partial gastrectomy; normal stoma; rapid emptying. Post-operative gastric analysis—November, 1928, total acidity 17; free hydrochloric acid 0; bile. Final follow-up—gaining weight; occasionally gas; no pain; health good; sticks to diet.

Hospital—Bellevue; No. 1928. Occupation—chauffeur, forty-one years of age. Date and type of last operation—February 10, 1927; anterocolic polya. Date and type of former operation—April 28, 1922; excision of duodenal ulcer; gastro-enterostomy. Pre-operative X-ray findings—February 1, 1927; duodenal ulcer—persistent; adhesions at stoma; stasis in proximal loop of jejunum. Operative findings—apparently healed duodenal ulcer; crater ulcer invading transcolon. Post-operative course—smooth; discharge on twenty-second day. Post-operative X-ray—October 30, 1928, stoma normal; rapid emptying. Pre-operative gastric analysis—January 15, 1922, total acidity 70; free hydrochloric acid 30; February 8, 1927, total acidity 30; free hydrochloric acid 12. Post-operative gastric analysis—November 11, 1928, could not get back test meal. Final follow-up—gaining weight; feels well; herniæ.

Hospital—Bellevue; No. 2230. Occupation—chauffeur, forty-two years of age. Date and type of last operation—October 31, 1924; Billroth No. 2. Date and type of former operation—April 20, 1922; excision of duodenal ulcer; gastro-enterostomy. Pre-operative X-ray findings—duodenal ulcer; tender stoma. Operative findings—recurrent duodenal ulcer; jejunal ulcer penetrating colon. Post-operative course—one severe vomiting attack; discharge twenty-fifth day; transfusion. Post-operative X-ray—April 28, 1926, hypersthenic; normal stoma; rapid emptying. Pre-operative gastric analysis—April 18, 1922, total acidity 80; free hydrochloric acid 30. Final follow-up—April 4, 1924, above weight; taxi driver; alcoholic; symptom free; July, 1928, symptom free.

Hospital—Bellevue; No. 3002. Occupation—laborer, fifty-three years of age. Date and type of last operation—January 26, 1923; Billroth No. 2. Date and type of former operation—none. Pre-operative X-ray findings—January 22, 1923; large perforating ulcer of lesser curvature, possibly malignant. Operative findings—massive penetrating lesser curvature ulcer. Post-operative course—discharge seventeenth day; transfusion; vomited twice post-operative. Post-operative X-ray—October 29, 1928, stoma normal in structure and function. Pre-operative gastric analysis—total acidity 45; free hydrochloric acid 25; guaiac lactic. Post-operative gastric analysis—November 25, 1928, total acidity 22; free hydrochloric acid 13. Final follow-up—slightly under weight; occasionally gas.

Hospital—Bellevue; No. 3514. Occupation—invalid, sixty-one years of age. Date and type of last operation—July 27, 1923; sleeve resection. Date and type of former operation—none. Pre-operative X-ray findings—ulcer of lesser curvature, possibly malignant. Operative findings—penetrating ulcer posterior wall of lesser curvature; base in pancreas. Post-operative course—pneumonia; transfusion. Post-operative X-ray—October 28, 1924, deformity pars media; tuberculosis both lungs. Final follow-up—died May 9, 1927, pulmonary tuberculosis.

Hospital—Bellevue; No. 3788. Occupation—barge captain, forty years of age. Date and type of last operation—June 1, 1926; post-colic polya. Date and type of former operation—December 7, 1923; gastro-enterostomy. May 25, 1925; post-colic polya with jejunojejunostomy. Pre-operative X-ray findings—recurrent jejunal ulcer. Operative findings—diffuse acute inflammation of entire stoma and ulcer lower angle. Post-operative course—very stormy; transfusion. Post-operative X-ray—October, 1928, fluoroscopy showed normal stoma. Pre-operative gastric analysis—December 4, 1923, total acidity 95; free hydrochloric acid 80; June 30, 1926, total acidity 65; free hydrochloric acid 25. Post-operative gastric analysis—December, 1928, no gastric residue after test meal. Final follow-up—December, 1928, working as barge captain; no complaints.

Hospital—Bellevue; No. 4270. Occupation—carpenter, fifty years of age. Date and type of operation—June 3, 1924; Billroth No. 2. Date and type of former opera-

tion—none. Pre-operative X-ray findings—penetrating ulcer, lesser curvature; pars media. Operative findings—large lesser curvature ulcer pars media; many large nodes. Post-operative course—temporary obstruction; re-open; no cause found—tube passed; afterward smooth. Post-operative X-ray—September 28, 1928, rapid emptying; stoma tender. Pre-operative gastric analysis—September 28, 1920, total acidity 60; free hydrochloric acid 40. Post-operative gastric analysis—November 11, 1928, total acidity 25; free hydrochloric acid 0. Final follow-up—symptom free; neurotic.

Hospital—Bellevue; No. 4485. Occupation—laborer, forty-two years of age. Date and type of last operation—October 10, 1924; sleeve resection. Date and type of former operation—none. Pre-operative X-ray findings—ulcer lesser curvature pars media. Operative findings—large lesser curvature, penetrating ulcer both walls, anterior and posterior. Post-operative course—infection of hypodermoclysis, otherwise smooth. Final follow-up—May 19, 1925, pain immediately after meals for fifteen minutes; lost.

Hospital—Bellevue; No. 4542. Occupation—chauffeur, thirty-six years of age. Date and type of last operation—November 7, 1924; anterocolic polya. Date and type of former operation—November 3, 1921; suture of acute perforated duodenal ulcer. Pre-operative X-ray findings—ulcer of first part of duodenum with adhesions. Operative findings—healed duodenal ulcer; large indurated ulcer posterior wall lesser curvature, near pylorus. Post-operative course—very smooth; discharge eighteenth day. Post-operative X-ray—October 30, 1928, normal stoma; slight delay in distal jejunum. Post-operative gastric analysis—November 4, 1928, total acidity 5; free hydrochloric acid 0. Final follow-up—ignores diet; works thirteen hours a day; underweight, but symptom free; excessive tobacco.

Hospital—Bellevue; No. 4664. Occupation—housewife, forty-eight years of age. Date and type of last operation—January 16, 1925; post-colic polya with partial closure of stomach. Date and type of former operation—none. Pre-operative X-ray findings—penetrating ulcer lesser curvature pars media; no retention. Operative findings—perforated ulcer lesser curvature; found by exploring gastric lumen. Post-operative course—very smooth; discharge twenty-eighth day. Post-operative X-ray—April 14, 1925, normal stoma. Post-operative gastric analysis—November 4, 1928, amount twenty-five cubic centimetres; total acidity 7; free hydrochloric acid 0. Final follow-up—has some distress after meals.

Hospital—Bellevue; No. 4974. Occupation—laborer, forty-nine years of age. Date and type of last operation—May 21, 1925; post-colic polya. Date and type of former operation—none. Pre-operative X-ray findings—gastric ulcer. Operative findings—double ulcer lesser curvature near pylorus with craters. Post-operative course—smooth; discharge twentieth day. Pre-operative gastric analysis—May 16, 1925, total acidity 30; free hydrochloric acid 20. Final follow-up—April 20, 1927, ignores diet, alcoholic; symptom free.

Hospital—Bellevue; No. 5355. Occupation—clerk, twenty-four years of age. Date and type of last operation—November 6, 1925; Billroth No. 1. Date and type of former operation—none. Pre-operative X-ray findings—ulcer of first part of duodenum. Operative findings—circumferential ulcer just beyond pylorus. Post-operative course—discharge seventeenth day. Post-operative X-ray—June 5, 1928, irregular first part of duodenum; no ulcer. Post-operative gastric analysis—October 18, 1928, total acidity 24; free hydrochloric acid 14. Final follow-up—October 18, 1928, now symptom free; has had occasional after meals' distress; neurotic.

Hospital—St. Vincent's; J. B. Occupation—Waiter, forty-six years of age. Date and type of last operation—November 27, 1925; anterocolic polya. Date and type of former operation—none. Pre-operative X-ray findings—carcinoma of pylorus. Operative findings—very large callous penetrating ulcer of pylorus; accessory pancreatic duct divided. Post-operative course—pancreatic fistula; death in four weeks from progressive malnutrition. Final follow-up—died twenty-five days post-operative; pancreatic fistula.

Hospital—St. Vincent's; M. H. Occupation—housewife, fifty-two years of age.

Date and type of last operation—December 6, 1925; anterocolic polya. Date and type of former operation—none. Pre-operative X-ray findings—carcinoma of pylorus with obstruction. Operative findings—apparently a localized linitis plastica of pylorus portion. Post-operative course—very smooth. Post-operative gastric analysis—October, 1928, only a few cubic centimetres returned on lavage in one-half hour after meal. Final follow-up—October, 1928, gaining weight; is eating everything; moderately alcoholic.

Hospital—Bellevue; No. 6432. Occupation—laborer, forty-one years of age. Date and type of last operation—May 24, 1927; anterocolic polya. Date and type of former operation—May, 1918; suture of acute perforated gastric ulcer. Pre-operative X-ray findings—ulcer lesser curvature about junction of para pylorus and para media. Operative findings—lesser curvature para media, penetrating ulcer covered with omentum and liver; many adhesions from old peritonitis. Post-operative course—(illustration) ulcer; wound infection; discharge thirty-third day. Pre-operative gastric analysis—total acidity 70; free hydrochloric acid 60. Final follow-up—October, 1928, ignores diet; alcoholic; no gastro-intestinal complaints.

Hospital—Bellevue; No. 6666. Occupation—fishmonger, thirty-nine years of age. Date and type of last operation—November 4, 1927; post-colic polya. Date and type of former operation—none. Pre-operative X-ray findings—ulcer of lesser curvature. Operative findings—posterior wall para media penetrating ulcer, deep crater. Post-operative course—thirty-six hours shock, then very smooth; discharge twentieth day. Post-operative X-ray—October, 1928, mobility excellent; rapid evacuation; no deformity of stoma or jejunum. Pre-operative gastric analysis—total acidity 78; free hydrochloric acid 51. Post-operative gastric analysis—November, 1928, total acidity 15; free hydrochloric acid 0; bile. Final follow-up—November, 1928, occasionally gas and slight after meals' distress two or three times a week for a time; now O. K.

Hospital—Bellevue; No. 2911. Occupation—carpenter, thirty-three years of age. Date and type of last operation—October 27, 1926; anterocolic polya. Date and type of former operation—December 28, 1922; cholecystectomy; appendicectomy, June 22, 1923; excision and cauterization of gastric ulcer; gastro-enterostomy. Pre-operative X-ray findings—October 22, 1926; penetrating ulcer upper part of lesser curvature; gastro-enterostomy; stoma patent and tender. Operative findings—lesser curvature ulcer; healed pyloric ulcer. Post-operative course—post-operative pneumonia; recovery. Post-operative X-ray—no irregularity at site of anastomosis; stoma function excellent; no six hour residue. Pre-operative gastric analysis—June 13, 1923; total acidity 72; free hydrochloric acid 45; combined hydrochloric acid 12. Final follow-up—no complaints; symptom free; January 4, 1927, July 10, 1928, December 20, 1928.

With this in view I have made a study of all my cases of subtotal gastrectomy performed for a benign ulcerated condition. The series covers a period of eight years and includes seventeen cases, fifteen of which were on the First Surgical Division of Bellevue Hospital and two on the First Surgical Division of St. Vincent's Hospital. In seven cases there had been a previous operation on the stomach and in one case there had been two previous operations. This was the only case in which a marginal ulcer occurred after subtotal gastrectomy. Four had had a previous gastro-enterostomy for gastric ulcer; one had had a previous gastro-enterostomy for chronic ulcer; one had had a previous gastro-enterostomy following closure of acute perforated duodenal ulcer; two had had simple closures of acute perforations, one of duodenal and one of gastric ulcer.

Billroth No. 1 was performed only once and hardly forms the basis of an opinion. Von Haberer and Finney have had their best results with this

operation. The Billroth No. 2 operation was done three times. Objections to this operation are that it requires more time and that the stoma is not as well placed physiologically as in other methods. Sleeve resection was done twice and in one instance gastric symptoms persisted after operation. Retrocolic polya was done five times. It seems to me less satisfactory than the anterocolic polya. The opening in the posterior mesocolon may constrict the stoma or jejunum, and if this is provided for by a jejunojejunostomy we lose the benefit of the duodenal contents in alkalinization of the gastrojejunal stoma.

The anterior polya was done six times and I regard it as the operation of choice for the average surgeon. The theoretical objection has been raised that the jejunum passing in front of the transverse colon may constrict it, but after the pyloric part of the stomach has been removed with the corresponding portion of the gastrocolic omentum the colon falls posteriorly, so that the jejunum can be brought up to the gastric stoma without difficulty. After division of the duodenum and ligation of the greater and lesser omental attachments to the stomach, the jejunum can be sutured to the posterior wall of the stomach with seromuscular stitches proximal to the line of division before the ulcer-bearing area is removed. This makes the anastomosis much easier and allows a firm approximation at the lesser curvature where difficulty is so often encountered. I do not know who first advocated this procedure, but it was recommended to me by Doctor McCreery.

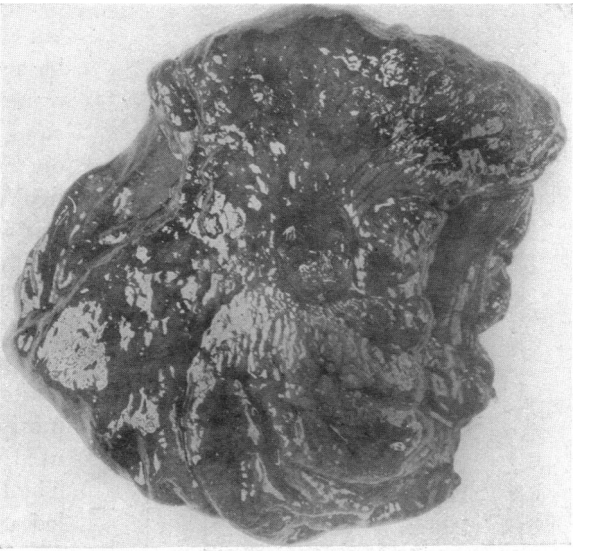

FIG. 1.—Photograph of gastric ulcer removed by sleeve resection.

The pre-operative X-rays throughout the series were remarkably accurate, even to the exact localization of a jejunal ulcer in one case.

Operative Findings.—The lesions found were either primary or secondary. The primary lesions were mainly large crater ulcers of the lesser curvature, of which eight were situated in the pars media, two of them having their bases in the pancreas. There was one instance of what seemed to be a linitis plastica of the pyloric portion of the stomach causing obstruction. There were two instances of double ulcer, one on each side of the pylorus. In all of these penetrating ulcers there was a great deal of surrounding induration and infiltration extending into the omentum or pancreas. There

were seven cases that had had previous operation, five having had a gastro-enterostomy, and two, simple suture of acute perforation. Of the five cases that had had gastro-enterostomy, four showed jejunal ulceration and in three of the four the ulcer was the penetrating type and attached to the posterior wall of the transverse colon in what was obviously an early stage of a jejunocolic fistula. The fourth case of jejunal ulceration had occurred at the stoma of a previous post-colic polya operation. It is not uncommon to find multiple ulcers in these recurrent lesions, and one is lead to believe that there is an ulcer-forming type in which a subtotal gastrectomy is particularly indicated, but it is hard to see how that can be recognized at the time of the primary lesion. The dense adhesions found in these secondary operations add greatly to the difficulty and length of time, and this feature is a strong argument in favor of primary resection.

FIG. 2.—Gastric ulcer. Polya type of resection. Good result.

The jejunum involved in the gastro-enterostomy should be resected at once and the lumen restored by an end-to-end anastomosis, the distal portion being used for the anterocolic polya. The Roux method is unsound and led to recurrence in the one instance where it was used. A median epigastric incision being used more than once is prone to herniation.

It is my belief that speed is quite essential in these operations and that the danger from soiling is too slight to justify the time consumed in elaborate technic. We know that the peritoneum can successfully handle soiling from gastric contents for several hours following perforation without the necessity of drainage after closure. There was no instance in this series of post-operative intraperitoneal infection.

Post-operative Course.—Ether anæsthesia was used throughout, and there was always some degree of post-operative shock, varying from slight to severe. In four cases it was necessary to give a tranfusion of from 500 to 1000 cubic centimetres. After two of the Billroth No. 2 operations persistent vomiting occurred and this, I think, was due to transient failure on

FIG. 3.—Gastric ulcer resected by subtotal gastrectomy. Polya method. Good result.

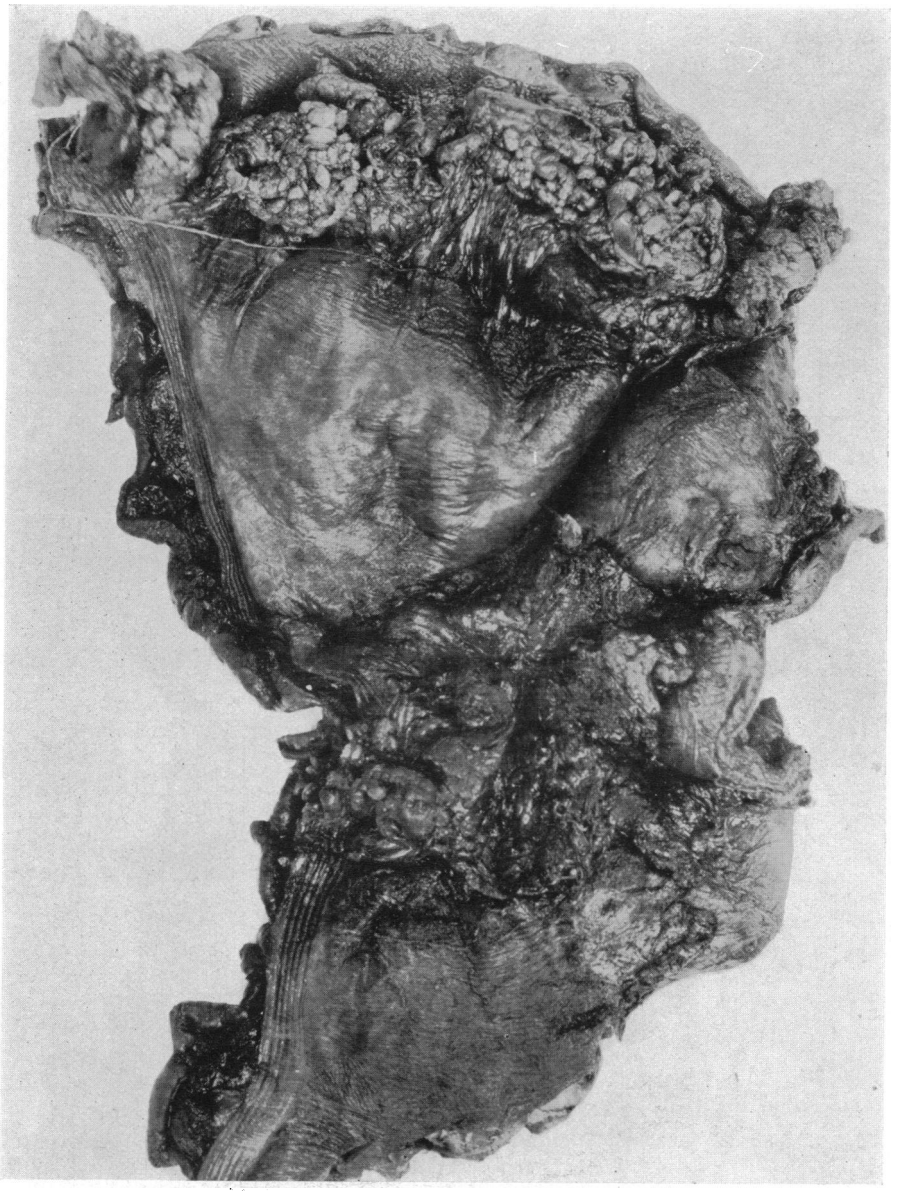

FIG. 4.—Peritoneal aspect of preceding specimen.

the part of the stomach to use the new stoma. In one instance it was so persistent that obstruction was feared and the wound was re-opened on the fifth day. No obstruction was found, but as a precaution a stomach tube was passed and manipulated through the stoma before closing the abdomen. This procedure was followed by a smooth convalescence. No contraindication for gastric lavage was recognized, hæmorrhage being regarded as an indication. Returns from lavage invariably showed old blood and, I believe, as a rule, there is considerable post-operative oozing, in spite of the great care observed in hemastasis at the time of operation. Following the first twenty-four to thirty-six hours the convalescence is very uneventful, but during this first period careful nursing is essential.

Post-operative X-ray.—A check up of X-rays at varying intervals after operation was obtained in twelve out of fifteen living cases. A notable fact in the polya operation was the position of the gastric stump and the gastro-jejunal stoma, the stomach being absolutely vertical in position and well over to the left side. In all of the cases there was a very rapid emptying time. The Billroth No. 2 operation showed the persistence of a small pocket beyond the anastomosis.

Gastric Analysis.—The pre-operative gastric analyses were not always obtainable, but the recurrent type in general showed a high acidity. In ten of the fifteen surviving cases recent gastric analyses were obtained, varying from six months to several years post-operative. The Ewald test meal of a roll and a glass of water was given and expressed one-half hour later. In three cases the stomach was apparently empty and no contents could be expressed. Two of these had had an anterocolic polya and one a post-colic polya. In the other seven instances there was either a diminution of or a complete absence of hydrochloric acid. However, although the Ewald test meal is the one used by the von Haberer's clinic, it seems to me we should have some more exact method of determining the physiology of the stomach after subtotal gastrectomy.

Final Results.—Of the seventeen cases comprising this report, fifteen are living and at work. One was last seen about a year after a sleeve resection and has since failed to report. He was then complaining of pain about fifteen minutes after meals. Two others have had occasional attacks of epigastric distress and gas after meals, possibly due to decreased size of the stomach. One has had gastric symptoms which has occurred only after the onset of a tender gall-bladder. The others are entirely free from any complaint and only one has failed to gain weight.

Of the two deaths, one died four years after a sleeve resection from pulmonary tuberculosis, and previous to this had had no post-operative symptoms referable to the gastro-intestinal tract. There was one patient who died as the result of a pancreatic fistula following operation.

HISTORY OF CASE OF OPERATIVE DEATH

At operation the pylorus and first portion of the duodenum were involved in a large indurated mass enfolding the gall-bladder. On separating this from the gall-bladder there

was found an old perforation about one centimetre in diameter leading into the pyloric end of the stomach. An anterocolic polya operation was performed.

In turning in the proximal end of the divided duodenum under purse-string sutures a very small, white band on the mesial side was divided. Being rather suspicious of this structure, it was probed and found to have a lumen which extended down the body of the pancreas. The common duct was then investigated and found to pass down through the head of the pancreas and into the duodenum, well beyond the area of resection. It was taken for granted that the duct of Wirsung accompanied the common duct into the papilla of Vater, and that the small-sized band was the accessory duct of Santorini entering the duodenum at a very high level. It was firmly ligated with chromic catgut, as there was no possibility of implanting it into the duodenum because of its minute size and because of its position.

The patient made a good recovery from operation, but forty hours later a discharge of clear, syrupy fluid appeared from the upper part of the wound. It was colorless, and a specimen which was sent to the laboratory was diagnosed as pancreatic juice. It became very profuse in amount.

Temperature and pulse remained normal and emaciation and weakness developed to an alarming degree. After two weeks the fluid tended to decrease in amount. Emaciation and weakness steadily increased and he died of malnutrition on the twenty-ninth day.

Examination of the fæces showed no free fat. Blood chemistry showed blood sugar, creatinine and urea normal. Non-protein nitrogen high.

I do not know of any procedure that could have been attempted, post-operatively, to save this patient. The accessory duct, which was divided, occurs in this high position, according to the Dissection Room Records, only once in a hundred and fifty times, and it is exceedingly rare to have it the main pancreatic duct.

CONCLUSIONS

1. After recurrent ulcers of the stomach or duodenum and after marginal or secondary jejunal ulcers, the polya operation offers a reasonably safe and satisfactory method of relief from chronic invalidism.

2. As far as can be determined by X-ray and by the Ewald test meal, subtotal gastrectomy establishes and maintains a very rapid emptying of the stomach with marked diminution or disappearance of free hydrochloric acid in proportion to the amount of stomach removed.

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