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Acid Secretion after Gastric Operations

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Abstract

In the early 20th century, the commonest surgical treatment of peptic ulcer was gastroenterostomy. Crohn and Wilensky demonstrated that this operation did not achieve its aim of markedly reducing gastric acidity or of accelerating motility. These results were highly controversial, but led to Lewisohn visiting Haberer in Austria in 1922, and convincing Dr. A.A. Berg to abandon gastroenterostomy and use partial gastrectomy as the standard ulcer operation, with additional vagotomy in those patients with duodenal ulcer with high acidity. In 1929, a few patients were treated by vagotomy and gastrojejunostomy by Dr. Ralph Colp, with discouraging results. It was only in the 1940s that Mount Sinai surgeons adopted transthoracic or subdiaphragmatic vagotomy and gastroenterostomy (or later, pyloroplasty) as their standard, effective acid-lowering treatment of peptic ulcers. **Key Words:** Gastric acid, gastroenterostomy, partial gastrectomy, vagotomy, pyloroplasty.

IN 1916, CROHN, REISS, AND WILENSKY began studies on gastric acidity after gastroenterostomy (1), using a heavy oatmeal gruel test breakfast (2) and motility by kymography (3). Neither test was novel, but the results of their studies on 37 patients, on whom Dr. Berg had performed a posterior retrocolic gastrojejunostomy, were new and important. The patients were divided into three groups. Group A consisted of 11 patients with few or trivial symptoms and Group B consisted of 14 patients who had developed new symptoms after their operation. Seven patients of the 12 in Group C had similar symptoms to Group B, but 2 had developed gastrojejunal ulcers and the other 5 had stomal constrictions. Wilensky and Crohn were careful, however, to point out that most of the patients were examined because of their symptoms and did not constitute a representative selection of patients after gastrojejunostomy. Their results suggested that this operation did not

achieve its aim of markedly reducing gastric acidity or of accelerating motility.

Around the same time, Dr. William Mayo was making one of his regular visits to Mount Sinai; he was invited to the laboratory by Libman to listen to these results. This prompted an invitation to Crohn and Wilensky to present a paper at the American Gastroenterological Association (AGA) in Atlantic City in May 1916, where it was well received by a standing ovation, according to Crohn (4).

Standing ovation or not, the discussion was critical and occupies ten pages of the published transactions (5), although it is not appended to the later paper (which does however provide graphs and kymograms) (1). Some discussants (5) claimed that in their centers, 85–90% of their patients “have been injudiciously chosen for operation and various surgeons good and indifferent have performed them.” Others advised pyloroplasty rather than gastroenterostomy. One speaker cited a non-American authority, Mathieu in Paris, where “very few, if any, of their cases of gastro-enterostomy, if followed over a sufficiently long time, failed to show some pathological symptoms, gastric or intestinal.” Crohn’s lengthy reply to his critics was so diplomatic that he was

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elected a member of the AGA in 1918 on the recommendation of Max Einhorn, Jacob Kaufman and Morris Manges (6). He became the first staff member of The Mount Sinai Hospital to serve as president of the AGA, from 1932 to 1933.

Despite the preaching by Manges and Aronson that the fractional test meal should not be used as a routine test, it was still so used (5). The use of such tests caused prolonged discussions on the postulated diagnosis of gastric hypersecretion (gastrochronorrhoea) (5), which in retrospect was clearly a non-diagnosis, since the test meal only provided qualitative measurements of gastric acidity. Quantitative measurements of juice volume, basal or stimulated, were yet to come (6).

Partial Gastrectomy

In 1922, Lewisohn returned from visiting Haberer in Innsbruck, Austria, with details of the new operation for peptic ulcer, namely partial gastrectomy, to replace gastroenterostomy for duodenal ulcer because of the unsatisfactory results seen in Europe after this drainage procedure (7). Lewisohn convinced Berg to change his practice, and Berg was soon able to perform hundreds of these new operations, because he operated mornings and afternoons six days a week, and sometimes on Sundays. Clinical efficacy was measured by meticulous follow-up involving Social Service. The physiological effects consisted of the anticipated abolition of postoperative free acidity in almost all cases, together with increased gastric emptying.

Thus, Lewisohn and Feldman (7) were able to persuade 88 patients to have a repeat Ewald test meal years after their gastric operations. They were the only patients to consent from the 191 surviving patients (out of a total of 213) who were operated on at Dr. Berg's service between 1915 and 1920. Simple gastroenterostomy ($n = 13$) changed acidity little and never abolished free acid; even with pyloric exclusion in addition ($n = 50$), only 2 patients lost their free acid. However, after partial or subtotal gastrectomy for gastric ulcer, free acid persisted in only 2 patients, and after gastrectomy for gastrojejunal or recurrent duodenal ulcer, each of 8 patients lost free acidity (7). Klein confirmed the different results with the various types of peptic ulcer (8). Every patient with a gastric ulcer lost free acid within 6 months of partial gastrectomy, compared with only one-quarter of patients with duodenal ulcer and one-half of those with gastrojejunal ulcers. These data were cited by Berg in his classic 1930 paper

(9), which finally convinced the next generation of American surgeons that subtotal gastrectomy was the rational and effective operation of choice for peptic ulcers. An update in 1933 by Winkelstein (10) of 122 patients after partial gastrectomy showed absence of free acidity in 55% of patients who originally had a duodenal ulcer, but in 88% of those operated on for gastric ulcer.

Ulcer Recurrences at Mount Sinai and the Jewish Question

Critical reassessment of gastroenterostomy at The Mount Sinai Hospital, begun by Wilensky and Crohn in 1916 (5), and continued by Berg's group in the 1920s, met with considerable opposition by advocates of the then-standard operation, both at Mount Sinai (4, 11) and elsewhere (12, 13). Surgeons claimed that "their" patients did well after "their" operations: "I have been able to follow 60 cases from 12 years to 3¹/₂ months. . . . In 88.33%, the result was satisfactory" (12). From 1905–1922, the Mayo clinic performed 7000 operations, but saw only 37 patients with recurrent gastric or duodenal ulcer (13).

Thus, the bad results at Mount Sinai were blamed not on the operation but on the poor selection of cases and/or poor operative techniques. However, the most bizarre explanation was Woolsey's attribution of the high Mount Sinai recurrence rate to their high proportion of Jewish patients (12), citing Eusterman from the Mayo Clinic: "There is a third type of case in which there is a tendency toward recurrence, in some instances repeated, over a short period. The Hebrew and the person with a hyperirritable nervous system who smokes excessively are illustrative of this type" (13).

Lewisohn rejected these disparaging suggestions to explain the high Mount Sinai gastrojejunal ulcer rate of 34% (14). "The large percentage was explained by the accuracy of our follow-up system, which included very careful personal examination of the patients."

Lewisohn submitted this question to Haberer and received the following answer: "The statement that gastro-enterostomy is followed by worse results in Jewish than in other patients is absolutely incorrect. I have among my patients less than 2 per cent of Jews; among those there are a number of gastrojejunal ulcers. These patients are as healthy today, following a subtotal gastrectomy, as the Gentile patients. I have never noticed any difference as to operative results between Jewish and Gentile patients. Professor Raffaele Bastianelli of Rome told me recently that

he was under the impression that 25% of his gastro-enterostomy patients developed trouble, probably as a result of gastrojejunal or jejunal ulcers. He states that there are almost no Jews among his patients.”

Vagotomy

Nevertheless, there were still patients with duodenal ulcer who developed jejunal ulceration even after partial gastrectomy, so that in 1938 Winkelstein and Berg (15) reconsidered the operative approach with their hypothesis that the problem lay with patients with high preoperative acidity. They found that patients with gastric ulcer or with duodenal ulcer with preoperative normal free acidity (20–40 mmol/L) had postoperative low or nil free acidity and negligible ulcer recurrences. Those with duodenal or juxtapyloric ulcers with high preoperative free acidity (> 60 mmol/L) were the group in which postoperative recurrent jejunal ulcers occurred, because of inadequate reduction of acidity. Recalculation of the data in their chart V shows that 13 patients who later developed jejunal ulcers had a reduction of free acidity from a mean and range of 76 (24–130) only to 61 (20–110) mmol/L after the partial gastrectomy.

The new Mount Sinai protocol (which Winkelstein [16] states was the idea of Dr. Eugene Klein) was to add subphrenic anterior vagotomy to partial gastrectomy in patients with duodenal ulcer with high free acidity (> 60 mmol/L) (15). After this operation, in a group of 31 patients, free acidity disappeared immediately in 16 and within months or years in another 10; all 26 remained well after 4–9 years' follow-up. However, there were 5 patients whose free acidity was not abolished by the new radical operation, but was reduced immediately from a mean (range) from 96 (74–135) to 25 (20–36) mmol/L, and within months or years to 23 (10–30) mmol/L; these 5 were without recurrences for up to 6 years (15).

According to Winkelstein, he had speculated in 1929 that if the addition of an anterior vagotomy to a partial gastrectomy further reduced acidity, then gastroenterostomy plus vagotomy should be tried for duodenal ulcer (16): “This operation was then carried out on the service of Drs. Berg and Lewisohn in two cases of rather severe duodenal ulcer with pyloric obstruction (one case operated by Dr. S. Hirshfield and the second by Dr. P. Klingenstein).” In case 1, free acidity was reduced from 70 to 10 mmol/L at 2 months after operation and at 3, 4, 5 and 7 years

were 10, 0, 20 and 60 mmol/L, respectively. In case 2, acidity was reduced from 50 to 10 mmol/L at 3 months after the operation and after 3 and 4 years were 40 and 10 mmol/L, respectively. Both patients remained well. Three other patients were treated similarly, but no follow-up was reported (17).

These patients operated on in 1929 were probably the first patients with duodenal ulcer to be treated by vagotomy and gastrojejunostomy to reduce their gastric acidity, as distinct from reducing their pain by cutting vagal afferents. Two further patients were studied at Mount Sinai by Klingenstein on Dr. Colp's service. In one, in 1942 (case 6 of Weinstein et al. [18]), posterior gastroenterostomy and anterior vagotomy had little effect on alcohol- and insulin-stimulated acid. With the other patient, in 1939, there are discrepancies between the descriptions of case 5 of Weinstein et al. (18) and the case report of Cornell (19) as to whether the patients ever had duodenal ulcer. The latter patient was published (19) as “probably the first known case of attempted ‘complete’ subphrenic vagotomy for duodenal ulcer performed without any other operation.” There were marked motor effects (no gastroenterostomy was added) but the acidities were little altered. Clearly, only partial vagotomy had been achieved.

Thus, deliberate partial vagotomy had been mostly unsuccessful in reducing gastric acidity; the one attempt at complete vagotomy had also been unsuccessful in lowering acid. Moreover, the Mount Sinai surgeons were reluctant to attempt the rational transthoracic or subdiaphragmatic vagotomy because of the added risk (18). After Dragstedt's epoch-making supradiaphragmatic bilateral vagotomy in 1943, Colp's group (20) reported 101 poor-risk patients with duodenal ulcer in whom gastroenterostomy and vagotomy led to an operative mortality of 5% compared with 0.7% for subtotal gastrectomy. Moreover, the recurrent ulcer rate was 15% for gastroenterostomy alone, 10% for gastroenterostomy and vagotomy, 8% for subtotal gastrectomy, and 0.6% for subtotal gastrectomy and vagotomy.

Nevertheless, Dragstedt's truncal vagotomy, or the later selective or proximal gastric (highly selective) vagotomies, became the standard operation for reducing acid in patients with ulcer for the rest of the 20th century. The operation of truncal vagotomy and pyloroplasty was used extensively at Mount Sinai from 1959 (21), with 76% mean reduction of maximal histamine-stimulated acid (22). Thus, over these decades, Mount Sinai had produced evidence that the efficacy of operations for ulcer was related to their acid-low-

ering results, allowing later gastroenterologists at Mount Sinai to aim at healing ulcers by acid-lowering drugs (see chapter 14).

References

1. Wilensky AO, Crohn BB. Studies in the physiology and pathology of the stomach after gastroenterostomy. *Am J Med Sci* 1917; 153:808–824.
2. Crohn BB, Reiss S. Studies in fractional estimations of stomach contents. *Am J Med Sci* 1917; 154:857–873.
3. Crohn BB, Wilensky AO. Studies in the variations of the tonus of the gastric musculature in health and disease. *Arch Intern Med* 1917; 20:145–160.
4. Crohn BB. Notes on the evolution of a medical specialist 1907–65. New York: Burrill B. Crohn Research Foundation; 1984.
5. Wilensky AO, Crohn BB. Studies in the physiology and pathology of the stomach after gastroenterostomy. *Trans Am Gastro-Enterol Assoc* 1916; 198–221.
6. Baron JH. Clinical tests of gastric secretion. History, methodology and interpretation. London: Macmillan; 1978.
7. Lewisohn R, Feldman RH. Failure of gastroenterostomy to effect a decisive reduction in gastric acidity. *Am Surg* 1925; 82:925–939.
8. Klein E. Gastric secretion after partial gastrectomy. *J Am Med Assoc* 1927; 89:1233–1239.
9. Berg AA. The mortality and late results of subtotal gastrectomy for the radical cure of gastric and duodenal ulcer. *Ann Surg* 1930; 92:340–359.
10. Winkelstein A. Some physiological and pharmacological aspects of the gastric secretory changes in peptic ulcer before and after partial gastrectomy. *Trans Am Gastro-Enterol Assoc* 1933; 206–214.
11. Lyons AS, editor. Dr. Burrill Bernard Crohn. Recorded April, 1965. Archives, The Mount Sinai Hospital.
12. Woolsey G. The question of gastro-enterostomy in duodenal ulcer. *Surg Gynecol Obstet* 1926; 42:90–94.
13. Eusterman GB. Recurrent ulcer of stomach and duodenum: Clinical notes on incidence, diagnosis and etiology. *Minn Med* 1923; 6:698–702.
14. Lewisohn R. Gastroduodenal ulcers: Partial gastrectomy versus gastro-enterostomy in their surgical treatment. *J Am Med Assoc* 1927; 89:1649–1652.
15. Winkelstein A, Berg AA. Vagotomy plus partial gastrectomy for duodenal ulcer. *Am J Dig Dis* 1938; 5:497–501.
16. Winkelstein A. Subphrenic vagotomy plus gastro-enterostomy for duodenal ulcer. *J Mt Sinai Hosp* 1937; 4:304–307.
17. Winkelstein A. Some observations on the relationship of the vagus nerve to peptic ulcer. *J Mt Sinai Hosp* 1942; 9:859–862.
18. Weinstein VA, Colp R, Hollander F, Jemerin EE. Vagotomy in the therapy of peptic ulcer. *Surg Gynecol Obstet* 1944; 79:297–305.
19. Cornell A. Changes in gastric acidity and motility in a case of bilateral subphrenic vagotomy alone for duodenal ulcer. *J Mt Sinai Hosp* 1951; 17:855–871.
20. Weinstein VA, Druckerman LJ, Lyons AS, Colp R. Gastroenterostomy and vagotomy in the treatment of duodenal ulcer. *Ann Surg* 1955; 141:482–487.
21. Canter JW, Kavee DJ, Reiss R, et al. Vagotomy and pyloroplasty for duodenal ulcer. *J Mt Sinai Hosp* 1960; 27:561–564.
22. Gelb AM, Baronofsky ID, Janowitz HD. The effect of vagotomy and pyloroplasty on the maximal acid response to histamine. *Gut* 1961; 2:240–245.