

Qualitative and Quantitative Differences in the Response of the Stomach to Pentapeptide and Insulin Secretory Stimulation at 2-3 Month Follow-up after Parietal Cell Mass Vagotomy

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THE DESIRED END of surgical treatment for patients with duodenal ulcers is to reduce gastric pepsin and acid secretion. The postcibal symptoms which too frequently follow both partial gastrectomy, and vagotomy and drainage, have motivated the introduction of "highly selective vagotomy" (HSV),⁵ and "parietal cell vagotomy" (PCV)¹ in elective treatment of patients with non-stenosing duodenal ulcers. These very similar procedures involve vagal denervation of the parietal cell mass, and specific preservation of the antral vagi. To the present time, postoperative follow-up studies have shown that ulcer symptoms are relieved, and that the incidence of postcibal symptoms is very low.² Pre- and postoperative X-ray studies indicate that antrum motility and gastric emptying are virtually unchanged.⁸

The following report is a study of spontaneous acid secretion, and pentapeptide and insulin stimulated secretion after PCV.

Material and Method

From January 1969 to January 1971, 52 patients with duodenal ulcers were treated by PCV. Secretion studies were made in 30 of these patients (seven women and 23 men—average age was 51 years (22–70 years)) preoperatively and between 2 and 3 months postoperatively.

The pentapeptide test (6 μ g Peptavlon/Kg. s.c.) was performed first, followed by the insulin test (0.2 I.U./Kg. i.v.) after an interval of few days. After an overnight fast, the patients underwent the tests in the laboratory the next morning. Gastric tubes were placed under X-ray

screening control as the patients lay supine, or slightly inclined to the left. Aspiration was performed by intermittent pump suction which was constantly supervised, and the aspirates were collected every 15 minutes.

The first 15-minute aspirate is designated "fasting secretion", and the total of the next four 15-minute aspirates is designated "basal secretion". After pentapeptide activation, six 15-minute aspirates were collected, and after insulin, there were nine 15-minute aspirate collections. Insulin test results, when blood sugar did not fall below 40 mg./100 ml., are not included.

For each aspirate over the 15-minute periods, volume, pH and acidity (by titration to pH 3.5) were measured.

Statistical Calculations

The significant differences between the mean values are determined by division of the difference by the standard error of the difference. One, two or three stars (as appended in the subsequent text and tables) represent the statistical significance (*p*) of, respectively, 0.05, 0.01 and 0.001. Titrations were made to pH 3.5. Thus gastric acidity after PCV is frequently nil, and the Student *t*-test cannot be directly applied. Calculations were, therefore, made in accordance with the theory of the truncated normal distribution, in which a 0 value is taken as that negative which together with observed positive values will give a normal symmetrical distribution. In the comparisons between two periods, and between pentapeptide and insulin tests, only differences are included where at least one of the observations was positive.

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TABLE 1. Spontaneous Gastric Secretion in Patients with Duodenal Ulcer before and 2-3 Months after Parietal Cell Vagotomy.

	Amount ml/15 min. mean	Acidity mEq/l mean	Total Acid Output mEq/15 min. mean
Fasting Secretion preoperative	123 ± 64	27 ± 18	3.4 ± 2.9
postoperative	76 ± 52	6 ± 10	0.5 ± 1.1
postoperative—preoperative	-47 ± 71 ^{xxx}	-21 ± 16 ^{xxx}	-2.9 ± 2.7 ^{xxx}
Basal Secretion preoperative	35 ± 15	37 ± 22	1.4 ± 1.1
postoperative	21 ± 9	7 ± 10	0.2 ± 0.3
postoperative—preoperative	-14 ± 16 ^{xxx}	-30 ± 20 ^{xxx}	-1.2 ± 1.1 ^{xxx}

Results

The reduction in spontaneous secretion is shown in Table 1. The studies preceded both pentapeptide and insulin stimulation, and there are, therefore, two preoperative and two postoperative spontaneous secretion studies. There were no significant differences in average values between the fasting secretion duplicates, but acidity of the first preoperative basal secretion was significantly higher than in the second ($p < 0.01$). Therefore the mean of the first preoperative spontaneous secretion test is used for comparison with the first postoperative test.

Fasting secretion volume was reduced by 38%; acidity by 78%, and total acid output (TAO = volume × acidity) by 85%. The comparative figures for basal secretion were, respectively, 40%, 81%, and 86%.

Pentapeptide and Insulin Stimulated Acid Secretion

The averages of volume secretion, acidity and TAO for each 15-minute aspiration period are given in Figures

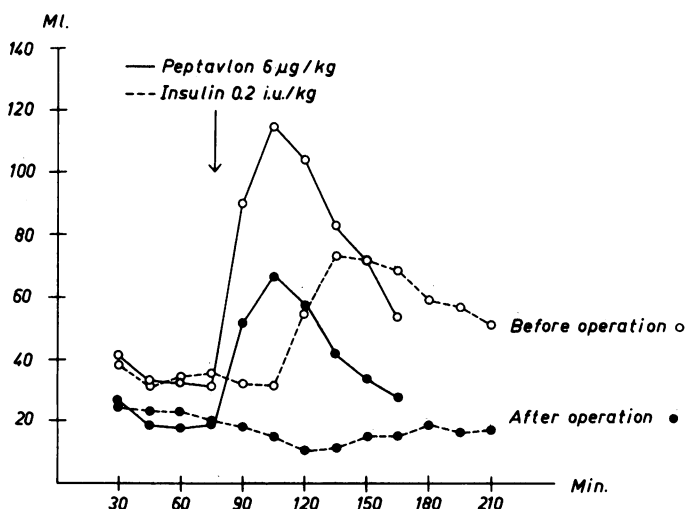


FIG. 1. Pentapeptide and insulin stimulated gastric secretion before and 2-3 months after PCV in patients with duodenal ulcer. Volume.

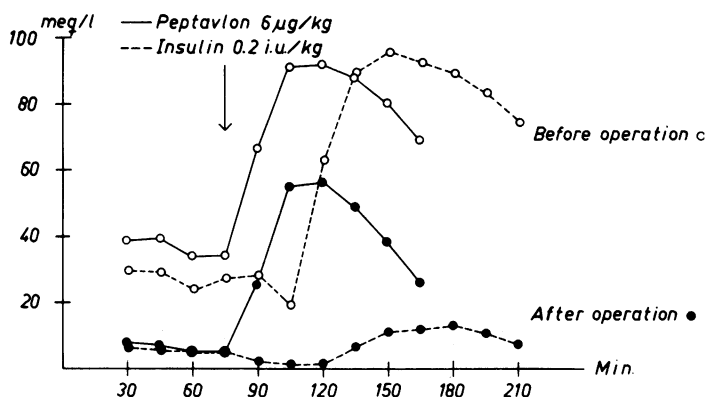


FIG. 2. Pentapeptide and insulin stimulated gastric secretion before and 2-3 months after PCV in patients with duodenal ulcer. Acidity.

1, 2 and 3. The preoperative secretion curves do not differ from those recorded in a previous study of a larger patient series.⁴ The postoperative pentapeptide secretion pattern was similar to the preoperative pattern, but volume was markedly reduced (15-30 minutes after stimulation preoperative secretion was 115 ml, but 67 ml, postoperatively—a 42% reduction ($p < 0.001$)), and the highest acidity fell from 92 mEq/l (the preoperative finding) to 56 mEq/l—a reduction of 39% ($p < 0.001$). Maximal TAO (15-30 minutes after stimulation) consequently fell from 10.5 mEq to 3.9 mEq—a reduction of 63% ($p < 0.001$).

Preoperative insulin stimulation gave an initial inhibition of secretion which lasted approximately 30 minutes. Acidity fell ($p < 0.05$), as did TAO ($p < 0.05$). Thereafter, significant increases ($p < 0.001$) occurred in volume, acidity and TAO. Postoperatively volume increase was eliminated. There was an initial inhibition of gastric secretion ($p < 0.001$) lasting some 75 minutes. Volume secretion did not reach the basal secretion level within

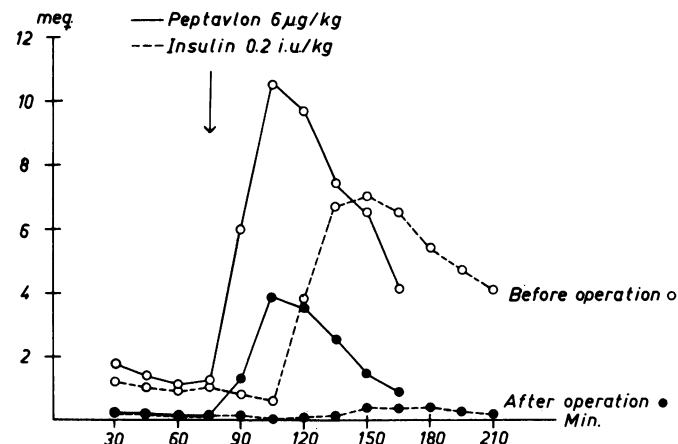


FIG. 3. Pentapeptide and insulin stimulated gastric secretion before and 2-3 months after PCV in patients with duodenal ulcer. Total acid output.

the period of observation. Acid production was inhibited ($p < 0.001$) during the first 45 minutes, but thereafter increased slightly ($p < 0.01$). At 105 minutes after stimulation, however, acidity was only 13 mEq/l compared with the preoperative figure after the same time of 90 mEq/l—a reduction of 86% ($p < 0.001$). Initial reduction, postoperatively, in TAO lasted over 45 minutes ($p < 0.05$). Over the remainder of the observation period acid secretion again reached the spontaneous secretion level.

Discussion

Both volume and acid content of spontaneous secretion was markedly reduced, postoperatively, in all 30 patients. Only one patient had a fasting secretion volume over 200 ml, which argues that emptying of the undrained stomach was entirely satisfactory.

The parietal cell mass vagotomy reduced spontaneous acid secretion by 85%, and the pentapeptide stimulated acid secretion by 60%. These results are similar to those observed after truncal vagotomy,⁷ and selective gastric vagotomy.⁶ Our technic of selective gastric vagotomy, and of PCV, involves ligation of the gastric arteries in the vicinity of the denervation dissection. That this is not done when truncal vagotomy is performed argues against the possibility that changes in the vascular supply to the stomach influence the reduction in gastric secretion.

While the pattern, though not the degree, of response to pentapeptide stimulation is similar pre- and postoperatively, after PCV, insulin's stimulation of volume secretion is eliminated and acidity increase is markedly reduced and delayed, reflecting a prolonged inhibitory action of insulin. Hart³ supposes that the antral vagi are significant in an antral acid inhibitory function, and the findings of our present study do not dispute this, but the same phenomena have been observed after selective gastric vagotomy (with pyloroplasty) in which we denervate the antrum.⁶ It would thus rather seem that insulin induced inhibition should be explained in terms of a direct action on the cells, or an action relayed by an organ supplied by the extragastric vagi. We have no series of truncal vagotomy patients with which to compare, but the comparable observations in such patients could further clarify the situation.

Acid secretion reduction after PCV is similar to that

observed after selective gastric vagotomy, and after truncal vagotomy. The 3-month follow-up studies are fully satisfactory. Although it is recognized that complications may be manifested later, at present we find no contraindications to the use of parietal cell vagotomy.

Summary

Spontaneous gastric acid secretion, and pentapeptide and insulin stimulated secretion in 30 patients with duodenal ulcers was studied before and after parietal cell vagotomy (PCV).

The pattern of response after pentapeptide was qualitatively unchanged after operation. Maximal acid production occurred in the second 15-minute period after stimulation and was reduced by 63% after operation.

Before operation, a 30-minute period of secretion inhibition followed insulin administration. This inhibition period was extended after operation. Volume secretion response was lost, and the increase in activity was markedly reduced and delayed.

Acknowledgements

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