PHYSIOLOGICAL AND LIGHT-ELECTRON MICROSCOPICAL STUDIES OF PARIETAL CELLS AND G CELLS BEFORE AND AFTER SELECTIVE VAGOTOMY WITH PYLOROPLASTY

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Summary

The function of residual parietal cells and G cells following selective vagotomy with pyloroplasty (SV+P) in 21 duodenal ulcer patients was assessed by light-electron microscopical studies of gastroendoscopic biopsy material and determination of gastric acid secretion and serum gastrin levels.

The postoperative decrease in number of parietal cells was not so great when compared with the reduction of acid secretion. However, the ultrastructural changes of parietal cells suggested hypofunction of the cells. In addition, the response of parietal cells to histalog stimulation was also decreased according to morphological observations under electron microscope.

Basal plasma gastrin was significantly increased (p<0.01) one month after surgery. Integrated gastrin response (IGR) to meat extract and insulin hypoglycemia stimulation was also increased significantly (p<0.01) six months postoperatively. The G cells were still increasing in number six months after SV+P, and G cell hyperplasia became more remarkable after one year. Emiocytotic figures were observed in denervated G cells which were stimulated by meat extract or insulin hypoglycemia.

On the basis of the findings of this study, it is considered necessary to conduct complete vagotomy on the parietal cell region when SV+P is performed.

Key Words: parietal cell, G cell, vagotomy, electron microscope, gastrin.

In recent years the trend in surgery has been to avoid large resections in cases of duodenal ulceration. In lieu of the conventional partial gastrectomy, various new operative procedures of vagotomy have been introduced; namely, selective gastric vagotomy with antrectomy (SV+A), selective gastric vagotomy with pyloroplasty (SV+P) and selective proximal vagotomy with or without pyloroplasty (SPV±P).

Since 1967 we have used SV+A and SV+P as the routine procedure in patients with duodenal ulcer. A comparison of clinical results using the two procedures failed to demonstrate a significant difference. Good to excellent results were obtained in 94.9% of patients with SV+A and in 90.5% with SV+P, and no recurrence was found after either procedure. Reduction rate of maximal acid output (MAO) after
SV+A was higher than after SV+P, because in SV+P, the gastric antrum and gastric gland in the body of the stomach are preserved. The gastric antrum is responsible for the humoral phase, and the release of gastrin from the antrum is dependent upon the stimulatory influences resulting from delayed emptying of the stomach, presence of food, chemicals, bile or alkaline, and hypomotility and distension. Any decrease or increase in this mechanism is dependent upon the type of surgical procedure performed. SV+P which results in delayed gastric emptying would increase the output of gastrin from the retained antrum. Furthermore, hypergastrinemia which owes its origin to the retained antrum exerts a trophic effect on parietal cells or peptic cells.

In order to assess the function of the oxyntic gland and the retained antrum following SV+P, we performed gastric analysis, and measured the plasma gastrin, and also observed the parietal cells and the G cells under electron microscope.

Materials and Methods

Patients: The present materials consist of 21 patients who had uncomplicated duodenal ulcer. The diagnosis of duodenal ulceration was made on barium meal and duodenofiberscopic examination. Ages of patients ranged from 25 to 62, averaging 39 years. All patients underwent SV+P which was selected on the basis of acid secretory responses to medical vagotomy of Gillespie and Kay1) (1961).

Measurement of gastric acid secretion: Determination was made after an overnight fast of at least 10 hours by guiding the tube into the appropriate portion of the stomach. Residual gastric contents were aspirated manually and discarded. Both basal and maximally stimulated rates of gastric acid output were measured. Basal gastric output (BAO) was determined by titration of four consecutive 15-minute collections of gastric juice to pH 7.0 with the use of 0.1 N sodium hydroxide. After assay of BAO, MAO was measured during the next 60 minutes in a similar manner after the subcutaneous administration of betazol hydrochloride (2 mg per kilogram of body weight). The rates of BAO and MAO were expressed as milliequivalents per hour. Before and the 1st, 3rd, 6th, 12th and 24th months after SV+P, almost all the tests were performed by the same laboratory assistant, who is both experienced and technically skilled.

Circulating gastrin levels: Gastrin was measured after overnight fast in the basal stage, 10, 20, 30, 40, 50 and 60 minutes after ingestion of 150 ml of Campbell's beef broth or after intravenous administration of insulin 0.2–0.3 IU per kilogram of body weight. Serum samples were kept frozen at 20°C from time of separation until time of analysis. Gastrin was measured by radioimmunoassay using a CIS-RIA-kit. Gastrin responses after the stimulations were expressed by a integrated gastrin response (IGR) based on calculation of the area under the curve between zero time and 60 minutes. Almost all these tests were performed before surgery and the 1st, 3rd, 6th, 12th and 24th months after SV+P.

Biopsy review by light and electron microscopy: Biopsy specimens were taken after overnight fast under Olympus Duodenofiberscope Type JF-B2 from the corpus of the stomach about 5 cm distal to the cardia on the greater curvature for parietal cells, and from the antrum about 2 cm proximal to the pylorus on the lesser curvature for G cells. Three biopsy specimens were obtained from each portion a few days before surgery and the 1st, 3rd, 6th and 12th months after SV+P. There were no complications resulting from the biopsy procedure. In order to observe the morphological changes of the exocrine activity of parietal cells, biopsies were performed before and after