EFFECTS OF TRUNCAL VAGOTOMY ON TISSUE GASTRIN CONTENT AND G CELL DENSITY IN RATS

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Summary

Tissue and serum immunoreactive gastrin (IRG) concentrations were measured by radioimmunoassay, and antral G cell density was studied by immunofluorescence in seven non-operative and ten vagotomized (one month postoperatively) rats.

In the non-operative rats, tissue IRG concentration was overwhelmingly high in the antrum, especially in the distal antrum, and much less in the small intestine, in which it tended to be lower toward the distal part.

There were no significant differences between the vagotomized and non-operative rats in antral G cell density, antral tissue IRG concentration, total IRG content of the anterior antrum and serum IRG level, although significantly increased wet weight of the specimen, which was considered a result of the operation, was observed in vagotomized rats.

The presence of G cell hyperplasia after vagotomy cannot be confirmed from our one-month postoperative observations in rats.

Key Words: gastrin, G cell, vagotomy, rat.

Introduction

G cell hyperplasia after vagotomy has been reported in dogs and has been also assumed in man. In a study based on endoscopic biopsies, however, it is difficult to avoid an erroneous conclusion drawn from data obtained through confined small bulks of specimens because recent progress in studies of the G cell population in the antral mucosa suggested that G cell distribution was not even in the mucosa and that, furthermore, it was strongly affected by atrophy and intestinal metaplasia of the mucosa. In this context, relatively extensive measurement of tissue immunoreactive gastrin (IRG) content would be of great help in determining changes of G cell population in the mucosa in response to surgical interventions of the stomach.

In this study, antral G cell density, serum gastrin concentration and gastrointestinal IRG content were examined in rats as the basic study, and then the effects of truncal vagotomy on these parameters were measured in the experimental study.

Materials and Methods

Basic study. This study was carried out in seven adult Wister strain rats of the same age, weighing from 270 to 300 g. The animals were anesthetized with ethyl ether after a 72-hour fast, during which water was allowed ad libitum. The stomach and intestine were rapidly removed and blood was obtained by
cardiac puncture for measurement of serum IRG level. The stomach was opened along the greater curvature and the antrum was easily distinguished from the fundus, isolated and divided along the lesser curvature into two parts: the anterior and posterior walls. The anterior antral wall and small intestine were prepared for measurement of tissue IRG concentration and total IRG content by radioimmunoassay, and the posterior antral wall was used for G cell counting by immunofluorescence.

Experimental study. This study was carried out in 10 adult Wister strain rats of the same age and weight as those in the basic study. The animals were surgically prepared with bilateral truncal vagotomy and all vagotomized rats recovered their body weight on 80th postoperative day when they were sacrificed. The stomach and blood were obtained using the same procedures as described in the basic study. At the time of laparotomy, dilated stomach, duodenum and jejunum were observed in the experimental animals, suggesting the effects of truncal vagotomy. Serum and tissue IRG concentration, total IRG content and G cell density of the antral mucosa were determined and compared with those of the basic study animals, which were considered as controls.

Preparation for determination of tissue IRG concentration. Full thickness specimens, weighing approximately 40 to 150 mg, from the proximal and distal antrum, duodenum, upper, middle and lower quarters of the small intestine (jejunum and ileum) and terminal ileum were weighed and immediately boiled for 30 minutes in distilled water in a test tube covered with aluminum foil to prevent tissue gastrin from being dispersed through vaporization. The sample and water were then homogenized into a fine suspension with a ground glass homogenizer, sonified and smashed with a sonicator for six minutes and finally diluted to 10 ml in 0.02 M veronal buffer. After centrifugation at 16,000 G at 4°C for 20 minutes, the supernatant was collected, added 100 mcg of Trasylol, frozen and stored at -20°C until assayed. The degree of homogenization of the specimen was estimated by comparing the protein concentration in the extract determined by Lowry's method with the original wet weight of the specimen. Serial dilution curves of IRG in these supernatants were determined and compared with a standard curve of synthetic human gastrin-1 (SHG-I) to ascertain whether IRG from various parts of the intestine was indistinguishable from that of the antrum or from SHG-I. Samples from the intestine had to be condensed to obtain a full range of the dilution curves.

Radioimmunoassay. Serum and tissue IRG concentrations were determined by radioimmunoassay using a rabbit antiserum to SHG-I (CIS, France), which had a very strong specificity to little gastrin among several components of circulating gastrin. The antibody and free 125I gastrin fractions were separated by a double antibody method. The details of the assay technique have been described elsewhere.

Immunofluorescence. The part of the antrum used for G cell counting was stretched, pinned on a cork board and fixed in 10% neutral buffered formalin solution (pH 7.4). Strips were cut from the proximal and distal antrum. The details of the immunofluorescence and G cell counting technique have been described previously.

Statistical analyses. All data are presented as the mean ± S.E.M. and the statistical analyses were based on the unpaired Student's t-test and test of the null hypothesis. P-values of less than 0.05 were regarded as significant.