MUCOUS BARRIER AND PEPTIC ULCER
OF THE STOMACH

Futoshi IIDA, M.D.
Second Department of Surgery, Shinshu University Faculty of Medicine
Matsumoto, Japan

Summary

Mucous barrier was searched by the histochemical method of mucopolysaccharides and by the measurement of precipitated mucus of gastric juice. The neutral polysaccharide stored within the surface epithelial cells must be a source of the mucus of the gastric juice. The storage of the polysaccharide was decreased by a long-term stimulation by histamine, and the precipitated mucus volume was also decreased shortly after the stimulation. Therefore, some kind of the stimulation for the gastric secretion must be avoided for prevention of peptic ulcer. The oral administration of the sulfuric polysaccharide extracted from seaweed prevented the occurrence of experimental ulcer. It may be concluded that the exogeneous polysaccharide can take the place of the endogeneous polysaccharide.

Key Words: mucous barrier, mucopolysaccharides, neutral and acid polysaccharides, sulfuric polysaccharide, Poligeenan, histamine, serosa-searing ulcer, precipitated mucus.

The protective ability of gastric mucus to the mucous surface has been noticed by many investigators. Because of methodological difficulties of the proof, the biological behaviour of the mucus had not been sufficiently understood until Hollander has reported his two-component theory. On the other hand, chemical analysis of the gastric mucus by Glass revealed that the mucus is composed of visible and dissolved mucus, and the former may have a protective activity against peptic ulceration. Recently, histochemical techniques for mucopolysaccharides were improved by Spicer and Mowry etc. and the mucous layer covering the gastric mucous surface has become easily observed. Using these methods, the relationship of various pathological states of the stomach to the mucous secretion was studied on surgical materials of human stomach and with animal experiments.

Materials and Methods

As a histochemical observation of clinical materials, 63 specimens of gastric cancer, 37 of gastric and duodenal ulcer, and one of gastritis were subjected to this study. The specimens were fixed in formol-alcohol immediately after gastrectomy with careful management of the mucous membrane. PAS stain and Alcian blue stain at pH 2.5 and 1.0 were applied by combined and independent techniques. Furthermore, the methylation technique by Lillie was used to distinguish sulfuric components from acidic polysaccharides. Gastric juice was collected by a gastric tube before and after histamine stimulation using histamine analog at 0.5 mg per kg.
of body weight. Each sample of gastric juice was centrifuged for 10 min at 3000 rpm. The amount of precipitated mucus was represented by volume per cent for each sample.

In animal experiments, 24 male guinea pigs weighing 250 to 300 g were used and divided into a basal diet group and a group given the experimental diet containing 10% Poligeenan* which is sulfuric polysaccharide extracted from seaweed. All animals were injected intraperitoneally with 5 mg of promethazine followed within half an hour by an hour by an intramuscular injection of 30 mg/kg of histamine hydrochloride suspended in a 5 per cent (W/V) bees wax: arachis oil vehicle. The procedure was carried on every day for up to 6 days. A modified technique of serosa-searing method of Umehara7) was used for experimental production of peptic ulcer on rat's stomach. A metal stick which has a round tip measured 5 mm in diameter was heated up to 70°C and applied to the serosa of the rat's stomach for 15 seconds under ether anesthesia. The procedure was carried out for 30 male rats weighing 150 to 200 g. After the operation, they were divided into a basal diet group without administration of steroid hormone, a basal diet group with intramuscular injection of cortisone acetate of 7 mg/100 g every day, and a group given a diet containing 10% Poligeenan without steroid administration. The stomachs were removed immediately after sacrifice of the animals by deep ether anesthesia, and prepared by the same method as in clinical materials.

Results

Histological and histochemical observations

In the normal human stomach, gastric mucous membrane is covered by the adhesive mucus which is composed of a large amount of neutral polysaccharide and stained by PAS but not by Alcian blue, containing a small amount of acidic polysaccharide stained by Alcian blue at pH 2.5 (Fig. 1). It is also obvious that the fundic gland region is covered by a thicker mucous layer than covering the pyloric gland region. The observations of the mucous membrane revealed storage of neutral polysaccharide within the surface epithelial cells and storage of acidic polysaccharide within the mucous neck cells. Therefore, it must be considered that each component of the gastric mucus would be secreted by different epithelium, that is the neutral component may be secreted from the surface epithelium, and the acidic one from the mucous neck cells. These findings would be limited only to the cases which intestinal

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* Glaxo-Evans Laboratories in Paris and Nippon Chemiphar Co. in Japan.