EPITHELIOCYTES OF THE FUNDAL GLANDS AND RELATIVE EXTENT OF THE JUXTAMURAL MICROFLORA OF THE GASTRIC AND SMALL INTESTINAL MUCOSA IN EXPERIMENTAL CHRONIC DUODENAL ULCER

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The most widely used method of surgical treatment of duodenal ulcer is vagotomy [5, 6]. However, despite the considerable lowering of mortality in this method of treatment of peptic ulcer, many complications occur after vagotomy, including those due to the microflora [8], which plays an important role in the specific function of the stomach and intestine [7]. The writers previously investigated the effect of vagotomy on the fundal glands and juxtamural microflora in experimental chronic gastric ulcer [3, 4]. However, the morphological aspects of interaction of the microflora with the epitheliocytes of the gastric (GM) and small intestinal mucosa in experimental chronic duodenal ulcer (ECDU) and after vagotomy and, in particular, their effect on the fundal glands of GM and the juxtamural microflora have not been studied.

The aim of this investigation was to study changes in the relative volume of the juxtamural microflora in the fundal and pyloroantral portions of the stomach, the duodenum, and the jejunum and also the relative volume of cells of the fundal glands of GM in DU and after vagotomy.

EXPERIMENTAL METHOD

Experiments were carried out on 42 Wistar rats weighing not less than 140 g. Duodenal ulcers were induced in the animals by Okabe's method [1, 2], and subdiaphragmatic truncal vagotomy (STV) was performed on some of them after the ulcers had become chronic. Vagotomy also was performed on animals without induction of ulcers. Intact animals served as the control. All manipulations were carried out under ether anesthesia. The animals were killed by instant decapitation after food deprivation 20 and 30 days after induction of the ulcers, 10 days after vagotomy, and 10 days after vagotomy on animals in which ulcers had been induced 20 or 30 days previously. The material was washed twice for 30 sec each time in sterile physiological saline, fixed in glutaraldehyde and OsO_4, and embedded in Epon-Araldite by the usual method. The relative volume of chief, parietal, mucoid, and stromal cells of the fundal glands was determined in semithin oriented sections 1 μ thick, stained with methylene blue and fuchsin, by a stereometric method [1] (25-50 glands in each case). The relative volume of the juxtamural microflora was determined at a distance of up to 40 μ from the epitheliocytes, under an immersion objective.

EXPERIMENTAL RESULTS

In ECDU the relative volume of the parietal and chief cells was increased, whereas the relative volume of the mucocytes was reduced (Table 1). After vagotomy of animals without ulcers the relative volume of the parietal and, in particular, of the chief cells was reduced, whereas that of the mucocytes was increased. The fundal glands in these animals became twisted and shortened, their lumen was dilated, especially in its lower third (Fig. 1), and the number of lymphocytes and mast cells in the stroma was reduced. Vagotomy on animals with ECDU led to a decrease in the relative volume of the parietal and chief cells, whereas the relative volume of the mucocytes was increased.

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TABLE 1. Relative Volume (in %) of Fundal Gland Cells of GM of Rats with ECDU, after Vagotomy, and after Vagotomy for Ulcers

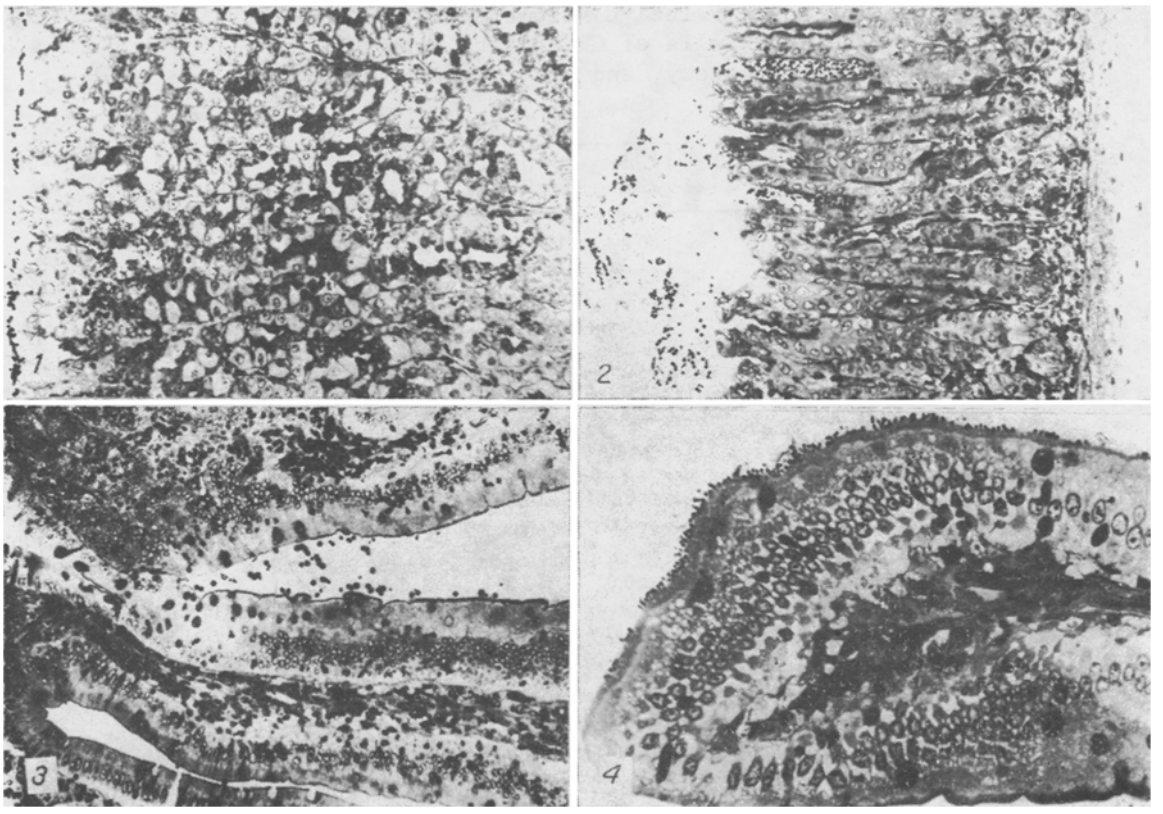
Experimental conditions	Chief cells	Parietal cells	Mucocytes	Connective tissue
Control	30,8±1,2	34,4±1,5	24,8±1,3	10,0±0,8
ECDU				
20 days	33,6±0,9	36,4±0,8	11,8±0,3	18,2±0,6
p	>0,05	>0,05	<0,001	<0,001
30 days	32,8±0,6	35,2±0,6	10,6±0,3	22,4±0,8
p	>0,05	>0,05	<0,001	<0,001
STV				
10 days	18,0±0,2	33,7±0,8	31,2±0,5	17,7±0,5
p	<0,001	>0,05	<0,001	<0,001
ECDU 20 days+ + STV				
10 days	24,5±0,5	30,1±1,0	27,3±1,3	19,1±0,7
p	<0,001	<0,05	>0,05	<0,001
ECDU 30 days + STV				
10 days	25,1±1,4	31,4±2,0	28,9±1,2	14,6±0,9
p	<0,01	>0,05	<0,05	<0,001

TABLE 2. Relative Volume (in %) of Juxtamural Microflora in Fundal and Pyloroantral Portions of Stomach, Duodenum, and Jejunum of Rats with ECDU, after Vagotomy, and after Vagotomy for Ulcers

Experimental conditions	Fundal part of stomach	Pyloroantral part of stomach	Duodenum	Jejunus
Control	5,1±0,6	9,6±0,2	5,6±0,6	0,9±0,1
ECDU				
20 days	3,1±0,9	5,4±0,7	3,1±0,7	1,0±0,2
p	>0,05	<0,001	<0,01	>0,05
30 days	2,3±0,3		3,3±0,3	0,9±0,2
p	<0,001		<0,01	>0,05
STV				
10 days	12,0±0,4	20,7±1,4	10,6±1,6	6,2±0,8
p	<0,001	<0,001	<0,01	<0,001
ECDU 20 days+STV				
10 days	6,5±0,6	6,3±1,1	3,4±0,3	1,3±0,1
p	>0,05	<0,01	<0,01	<0,01
ECDU				
30 days + STV				
10 days	6,1±0,5		3,6±0,3	0,8±0,1
p	>0,05		<0,01	>0,05

In animals with ECDU, after vagotomy, and after vagotomy for ulcers the relative volume of the juxtamural microflora was changed. The greatest relative volume of microorganisms was found in the pyloroantral portion, in both control and experiment (Table 2; Fig. 2). In ECDU, the relative volume of the microflora was reduced compared with the control in the fundal and pyloroantral portions of the stomach and also in the duodenum but in the jejunum the changes were not significnat. The greatest increase in relative volume of the juxtamural microflora was found after vagotomy without induction of ulcers: in the fundal and pyloroantral portions of GM and in the duodenum it was approximately twofold, in the jejunum it was sevenfold (Fig. 4). After vagotomy for ulcers some increase in the relative volume of the juxtamural microflora also was discovered (Table 2).

Most of the microorganisms were large cocci (2-3 μ) and in the intestine spirilla and bacteria of the *E. coli* type also were found. Where the microorganisms were in contact with epitheliocytes, changes were observed, namely swelling of the cells, translucency of the apical parts of the cytoplasm, and injuries to the plasma membrane and microvilli (Figs. 1, 2, and 4). Epitheliocytes in contact with microorganisms usually contained only a little secretion (Figs. 1 and 2).



Figs. 1-4

Fig. 1. Concentrations of microorganisms (arrows) on surface of cells of epithelium lining pits, and widening of lumen in lower third of fundal glands. Fundal portion of stomach after vagotomy (10 days) or ulcers (30 days). Magnification 200 ×. Here and in Figs. 2-4: semithin section stained with methylene blue and fuchsin.

Fig. 2. Concentrations of microorganisms. Pyloroantral portion of stomach after vagotomy (10 days) or ulcer (20 days). Magnification 140 ×.

Fig. 3. Microorganisms on surface of enterocyte and in lumen; numerous lymphoid cells in stroma. Duodenum in presence of ulcers (20 days). Magnification 140 ×.

Fig. 4. Microorganisms on surface of enterocytes. Jejunum, vagotomy (10 days). Magnification 280 ×.

These investigations thus showed that ECDU in rats cause an increase in the relative volume of the chief and parietal cells of the fundal glands, whereas vagotomy leads to a decrease. The relative volume of the mucocytes, on the other hand, was reduced in the presence of ulcers and increased after vagotomy. The relative volume of the juxtamural microflora was reduced in the presence of ECDU, but increased after vagotomy, possibly due to corresponding changes in the relative volumes of the chief and parietal cells.

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