CELLS WITH FEATURES OF CHIEF AND PARIETAL CELLS IN THE HUMAN GASTRIC MUCOSA IN CHRONIC GASTRITIS

V. G. Sharov

UDC 616.33-002.2-018.1-091-8

An electron-microscopic study was made of diagnostic biopsy material from the gastric mucosa of 50 patients, 44 of whom had marked evidence of chronic gastritis in the fundal glands. In atrophic gastritis cells with features of chief and parietal cells, resembling the oxynticopeptic cells of lower vertebrates in their structure, were found. The appearance of these cells in the human gastric fundal glands in chronic gastritis can be attributed to disturbances of regeneration taking place at the intracellular level. The existence of such cells in the human gastric mucosa indicates pathological changes in the organ, and in that sense in is an ultrastructural criterion of chronic gastritis.

Sedar [8] described cells of a special type in the gastric mucosa of the frog which are not present in higher mammals. Their ultrastructure combines the features of the chief and parietal cells; they produce pepsinogen, and they also participate in hydrochloric acid synthesis. These cells were called oxynticopeptic cells. They were subsequently found in the stomach of birds [10, 14] and bats [7]. There are no reports in the literature of the existence of such cells in man.

EXPERIMENTAL METHOD

Diagnostic biopsy material obtained during gastroscopic examination of 50 patients (Candidate of Medical Science Yu. V. Vasil'ev) was studied. The test object in 40 cases was the gastric stump in patients who had undergone operations for peptic ulcer. Pieces of mucosa were excised from two places (near to and 3-5 cm away from the gastroenterostomy). Histological investigation of the same objects showed marked evidence of atrophy in the region of the gastroenterostomy in nearly every case (L. I. Aruin). Different forms of chronic gastritis were found in the stump. In 6 cases (peptic ulcers of the jejunum) the mucosa of the stump was normal in structure. In 10 patients the mucosa of the whole stomach, which was affected to a varied degree by a chronic gastritis, was studied.

After fixation in 1% osmic acid solution in phosphate or veronal-acetate buffer for 2 h at 4°C, the stomach tissue was dehydrated in increasing concentrations of ethanol and embedded in Epon 812. Ultrathin sections were cut with the LKB "Ultratome," negatively stained with uranyl acetate and (or) lead citrate, and examined in the UÉMB-100V electron microscope.

EXPERIMENTAL RESULTS

Cells not previously described in higher vertebrates were found in the fundal glands of the stomach in atrophic gastritis. Their cytoplasm contained large secretory granules indistinguishable in their structure and size from the zymogen granules of chief cells. They bore no resemblance to the secretory vacuoles of mucoid cells, for they had a well defined boundary membrane and the contents of the large granules were paler and uniformly distributed throughout the granule. The number of secretory granules was significantly

Laboratory of Pathomorphology, All-Union Scientific-Research Institute of Gastroenterology, Ministry of Health of the USSR, Moscow. (Presented by Academician of the Academy of Medical Sciences of the USSR V. Kh. Vasilenko.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 75, No. 6, pp. 108-111, June, 1973. Original article submitted October 5, 1972.

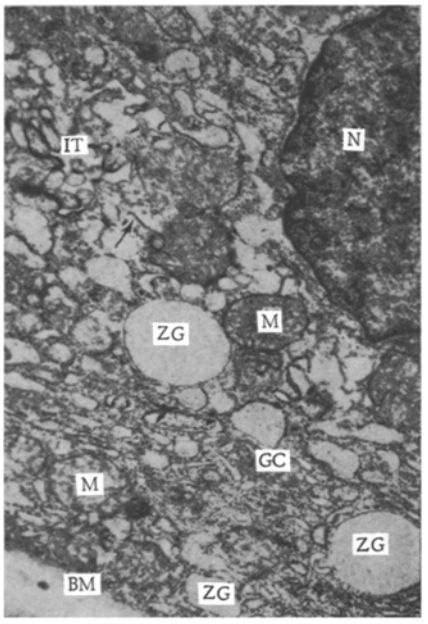

Fig. 1

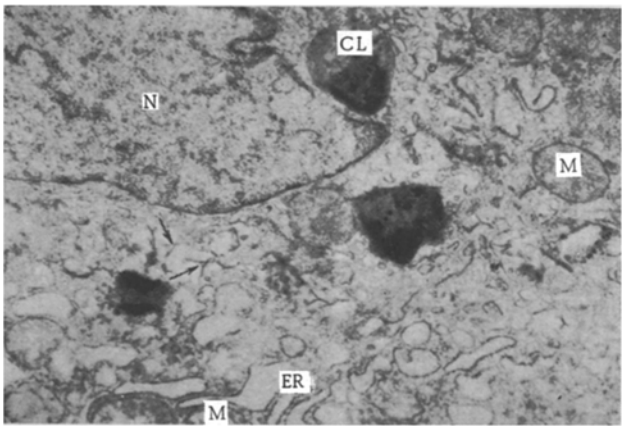

Fig. 2

Fig. 1. Mixed cell in gastric mucosa of patient with atrophic gastritis. N) nucleus; M) mitochondrion; BM) basement membrane; IT) intracellular tubule; ZG) zymogen granule; GC) Golgi complex, tubulovesicles indicated by arrow, 12,000×.

Fig. 2. Chief cell in gastric mucosa of patient with atrophic gastritis: together with typical features of the chief cell, its cytoplasm contains mitochondria with closely packed cristae, tubulovesicles (marked by arrow), cytolysomes (CL), and granular endoplasmic reticulum (ER); 10,000×.

less than in the chief cells, and they were not located chiefly in the apical cytoplasm. The Golgi complex was less developed than in the chief cells, but more marked than in the parietal cells. In some cases secretory vacuoles could be seen separating by bud formation from the elements of the Golgi complex. Almost exactly as in ordinary chief cells there was a well-defined granular endoplasmic reticulum, the cisterns of which in the basal part of the cytoplasm were parallel to the basement membrane, and there were many free-lying RNP granules. Mitochondria containing a moderate number of cristae and a matrix of low electron density, indistinguishable from the mitochondria of the chief cells, were found. Many of the mitochondria, on the other hand, contained closely packed cristae and a dense mitochondrial matrix and were almost indistinguishable from the same organoids in the parietal cells. Sometimes formations identical in structure with the intercellular or intracellular tubules of the parietal cells could be seen in the cytoplasm of these cells, and there was always a certain number of tubular structures, considerably fewer than in the parietal cells, but evidently analogous to the system of tubulovesicles of these cells (Fig. 1).

This mixing of the characteristic features of the chief and parietal cells was rare. More frequently individual tubulovesicular elements, large mitochondria with a dense mitochondrial matrix, and closely packed cristae could be seen in a typical chief cell (Fig. 2).

Sometimes parietal cells containing vacuoles, resembling zymogen granules, were found in chronic gastritis. However, unlike the latter, membranous structures of various types were always visible in them, and sometimes the boundary membrane of the granules projected inward as a short microvillus (Fig. 3). It has been shown [4] that these structures arise as the result of dilatation of the intracellular tubules. Evidence pointing to this is given by the existence of intermediate structures between the intracellular tubules and the vacuoles described above. The appearance of such vacuoles in the parietal cell is thus not evidence of the appearance of structures characteristic of cells of the other type. As investigations have shown [8-10, 14, 15], cells combining the features of chief and parietal cells are found only in the stomach of lower vertebrates. The similarity between the cells now discovered and the analogous cells of lower vertebrates suggests a reversion to a more primitive method of regeneration in certain cases under pathological conditions. In addition, the appearance of cells with features of chief and parietal cells in the human

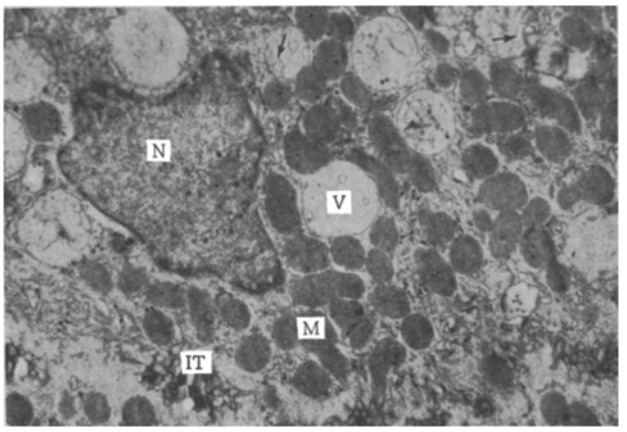

Fig. 3. Parietal cell in gastric mucosa of patient with atrophic gastritis: vacuoles (V), some of them containing remnants of microvilli (arrow), are formed through dilatation of intracellular tubules; 7,000×.

gastric mucosa is further evidence in support of the origin of the chief and parietal cells from undifferentiated cells, and not as a result of division of their mature forms as Teir et al. [13], Stevens and Leblond [12], and Hunt [6] consider.

Much attention has recently been paid to the study of the fine structure of the gastric glands in chronic gastritis [2, 3, 5]. However, the problem in interpretation of many ultrastructural findings described in the pathologically changed gastric mucosa remains unsolved. All that is known is that the number of immature cell forms is increased in the gastric glands in chronic gastritis [11], and they undergo translocation. As a result of disturbance of coordination between the phases of proliferation and differentiation during regeneration of the gastric epithelium, immature cells from the base of the pit and the neck of the gland spread downward and upward along the whole length of the gland [1]. It is now considered that these findings are typical of chronic gastritis and characterize this pathological state of the mucosa to a certain degree as a disturbance of regeneration at the tissue level. The appearance of cells with features of the chief and parietal cells in the gastric fundal glands in chronic gastritis can also be explained by disturbances of regeneration, but these occur at the intracellular and not the tissue level, and in this sense the presence of such cells is an ultrastructural criterion of chronic gastritis.

LITERATURE CITED

1. L. I. Aruin and V. G. Sharov, Arkh. Pat., No. 10, 21 (1971).
2. V. P. Salupere, Chronic Gastritis in Peptic Ulcer [in Russian], Doctoral Dissertation, Tartu (1969).
3. S. I. Chubchenko and V. G. Pinchuk, Abstracts of Proceedings of the 8th All-Union Conference on Electron Microscopy [in Russian], Vol. 3, Moscow (1971), p. 70.
4. C. Aleman-Gavotti, B. Bruni-Celli, and J. Valencia-Parparcén, Arch. Mal. Appar. Dig., 59, 239 (1970).
5. L. Demling, I. Günter, and K. Teubner, Z. Gastroent., 4, 145 (1966).
6. T. E. Hunt and E. A. Hunt, Anat. Rec., 142, 505 (1962).
7. S. Ito, in: C. F. Code (editor), Handbook of Physiology, Vol. 2, Washington (1967), p. 705.
8. A. W. Sedar, J. Biophys. Biochem. Cytol., 10, 47 (1961).
9. A. W. Sedar, J. Cell Biol., 14, 152 (1962).
10. W. A. Selander, Acta Anat. (Basel), 55, 299 (1963).
11. Shiao-Fu Chiao and H. Weisberg, Gastroenterology, 59, 36 (1970).
12. C. E. Stevens and C. P. Leblond, Anat. Rec., 115, 231 (1953).
13. H. Teir, A. Schauman, and B. Sundell, Acta Anat. (Basel), 16, 233 (1953).
14. P. G. Toner, J. Anat. (London), 97, 575 (1963).
15. P. G. Toner, K. E. Carr, and G. M. Wyburn, The Digestive System. An Ultrastructural Atlas and Review, London (1971).