MORPHOLOGY OF MESOTHELIOCYTES IN THE CAPSULE OF THE LIVER IN NORMAL RATS AND IN EXPERIMENTAL PERITONITIS

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Sufficient data have now been obtained on the structure and differences between different parts of the peritoneum under normal and pathological conditions [1, 2, 3, 4]. However, the morphology of the mesotheliocytes of the liver capsule and their response to inflammation of the peritoneum have been inadequately studied. Investigation of cells of the mesothelial cover of the liver capsule is necessary both under normal conditions and in peritonitis, because of the development of complications such as paracortical necrosis of the hepatic parenchyma and perihepatic abscesses.

EXPERIMENTAL METHOD

The structure of the liver capsule was studied in 10 normal rats and 46 rats with acute diffuse peritonitis. Peritonitis was induced by intraperitoneal injection of a 10% fetal suspension (1 ml/100 g body weight). The animals were decapitated 4, 12, and 24 h and 2, 3, and 5 days after injection of the infected suspension. Pieces of liver with the capsule were fixed in a 2.5% solution of glutaraldehyde in 0.1 M phosphate buffer (pH 7.3), postfixed in 1% OsO_4 solution and, after dehydration, embedded in Epon-Araldite blocks. Semithin and ultrathin sections were obtained from the blocks, and the latter, after staining, were examined in a "Hitachi" H-600 electron microscope (Japan). Some pieces were examined in the "Hitachi" S-405A scanning electron microscope, under an accelerating voltage of 15 kV and with an angle of slope of the specimen of 30°C. Simultaneously with the study of the mesotheliocytes of the liver capsule, mesotheliocytes of the peritoneum covering the small intestine and of the tendinous part of the diaphragm also were studied.

EXPERIMENTAL RESULTS

Numerous long (up to 20 μ), sometimes branching microvilli (Fig. 1a) were always present on the surface of the mesothelial cells of the liver capsule of the control rats. The boundaries between the cells, on examination in the scanning electron microscope, could not be distinguished. The mesotheliocytes were flat, their oval nucleus had an uneven distribution of chromatin, and the cytoplasm contained a few pinocytotic vescicles and a poorly developed Golgi complex and rough endoplasmic reticulum (RER). The cells lay on a basement membrane, and in the apical regions between them they formed connective complexes. The mesothelicoytes in the peritoneum of the small intestine and diaphragm had a similar structure (Fig. 1b).

From 4 to 12 h after injection of the fetal suspension the surface of the mesotheliocytes became convex and the microvilli became shorter and thicker. The boundaries between the cells had the appearance of deep grooves (Fig. 1c). The number of pinocytotic vesicles in the cytoplasm increased, profiles of the RER widened, and the nuclei developed invaginations of the nuclear membrane. The intercellular spaces were widened and contained myelin structures (Fig. 2a). The intercellular junctions were preserved. More marked swelling of the cytoplasm of the cells, with marked widening of the intercellular boundaries and disturbance of intercellular connections was observed in the mesotheliocytes of the peritoneum of the diaphragm and small intestine (Fig. 1d).

After 1-2 days the changes described above progressed: cells of the mesothelium were swollen (Fig. 2c) and their surface contained a few short microvilli. Leukocytes and peri-

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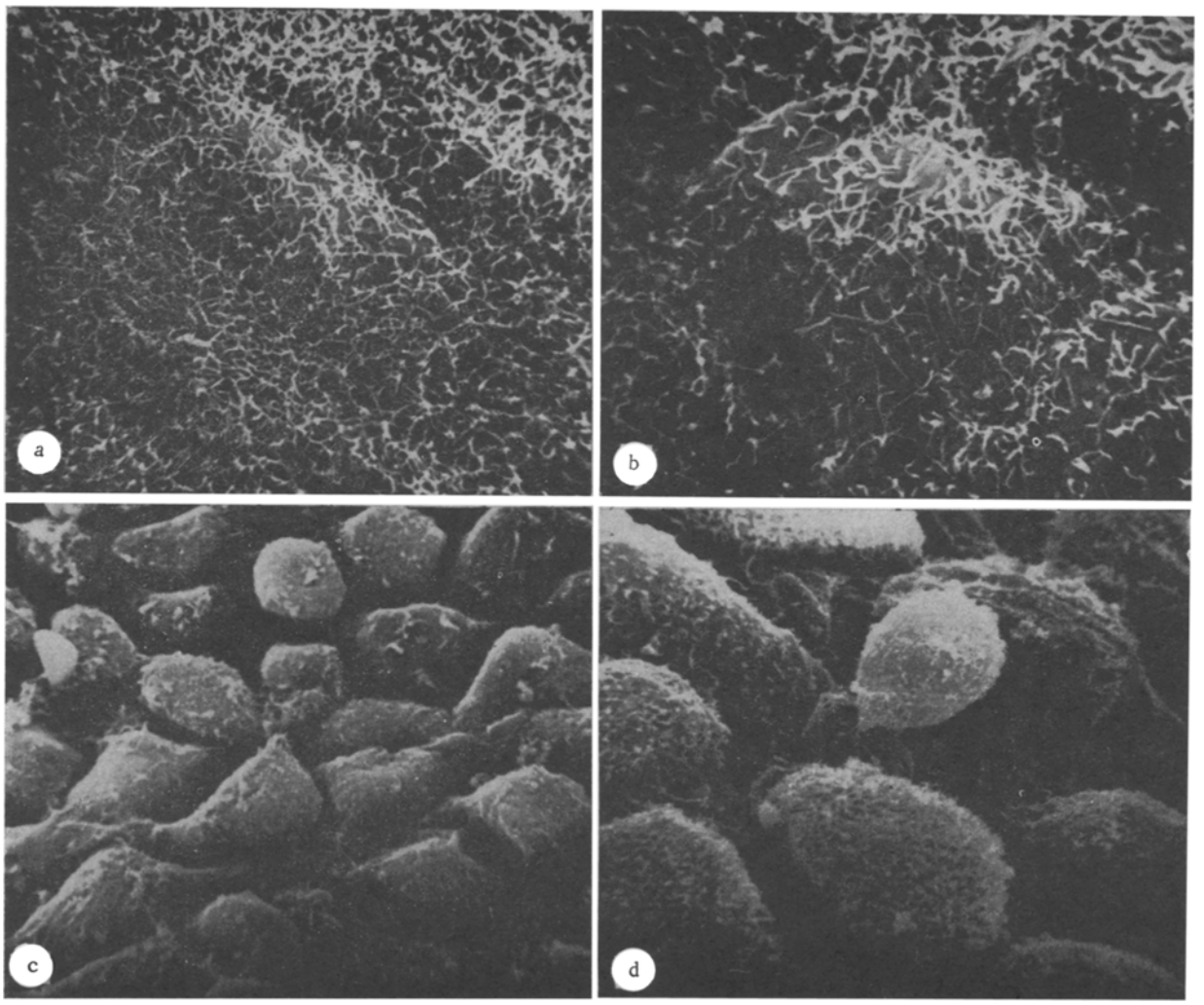

Fig. 1. Microrelief of surface of mesotheliocytes in normal rat and in rat with diffuse peritonitis. a) Mesotheliocytes of liver capsule of control rats. 4000 ×; b) Mesotheliocytes of diaphragmatic peritoneum of control rats. 6000 ×; c) Swelling of mesotheliocytes of liver capsule, reduction of number and length of microvilli in rats with peritonitis (12 h). 2000 ×; d) Swelling of diaphragmatic mesotheliocytes, disturbance of intercellular connections in rats with peritonitis (12 h). 4000 ×. Scanning electron microscopy.

toneal exudate cells were found on them. The number of pinocytotic vesicles was reduced, large vacuoles appeared, and profiles of the RER were greatly widened. The intercellular spaces resembled canals between the lateral surfaces of the mesotheliocytes, while connective complexes were preserved in the apical parts of the cells (Fig. 2d). More marked changes were observed in the peritoneal mesotheliocytes of the diaphragm and small intestine: vacuolation of the cytoplasm, detachment of the cells from the basement membrane, gross widening of the intercellular spaces, and absence of intercellular tight junctions (Fig. 2b, e). The mesothelial cover of the liver capsule was intact 3-5 days after the beginning of development of peritonitis, but most cells were detached from the basement membrane. Their surface was virtually free from microvilli and had numerous folds and projections. The submesothelial space was widened. It contained polymorphonuclear leukocytes (polymorphs), macrophages, lymphoid cells, and fibrin. Peritoneal exudate cells migrated through the widened intercellular spaces. However, most mesotheliocytes had connective complexes with neighboring cells, unlike in the peritoneum of the diaphragm and small intestine, where desquamation of most mesotheliocytes and the formation of massive deposits of fibrin, with polymorphs, macrophages, and microorganisms embedded in it, was observed.

The experiments thus demonstrated that structural changes in the mesotheliocytes of all parts of the peritoneum are found in peritonitis, but they differ in degree. In the peri-

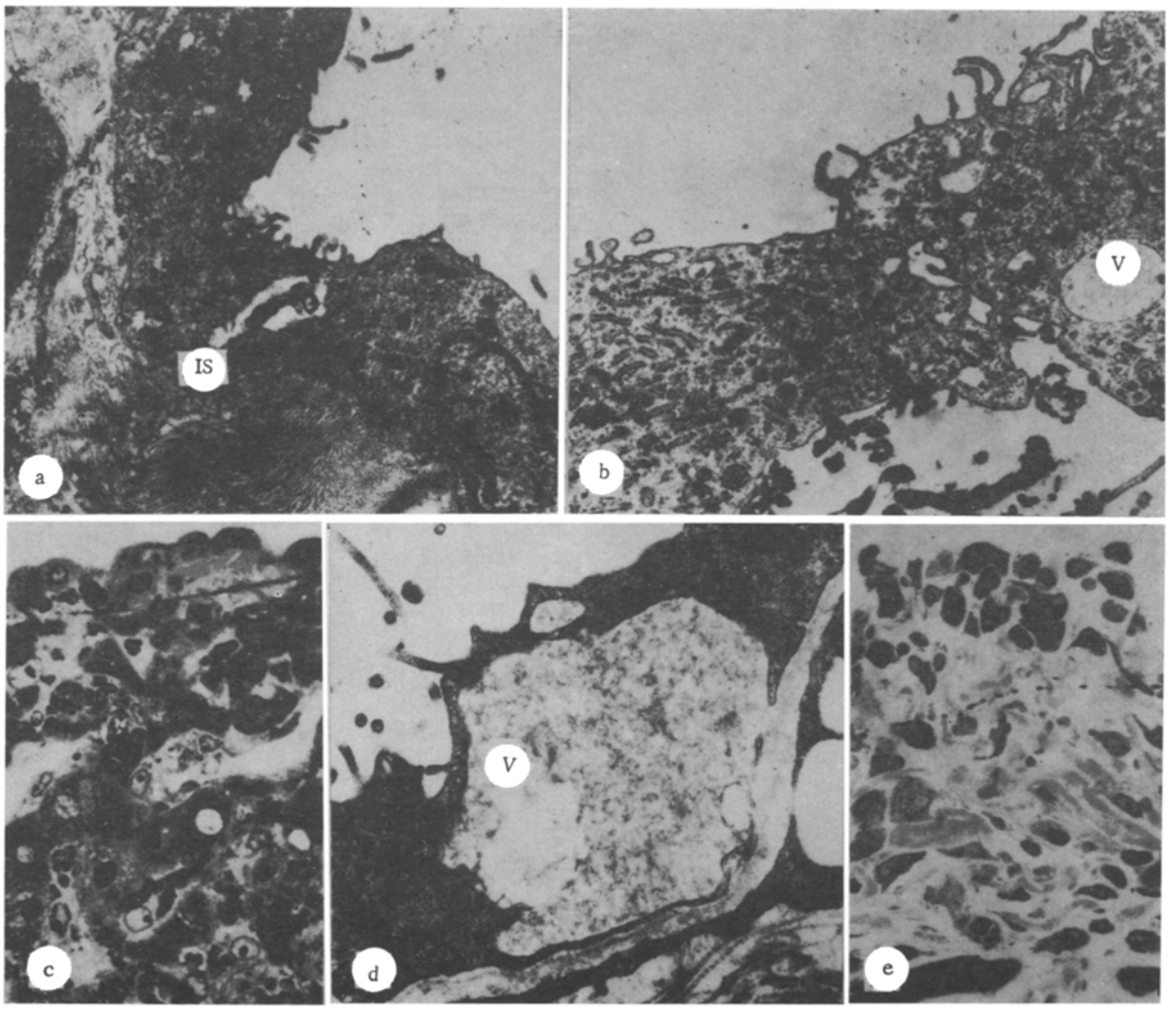

Fig. 2. Changes in mesotheliocytes in peritonitis: a) widening of intercellular space (IS) between mesotheliocytes of liver capsule. Transmission electron microscopy (TEM). 5000 ×; b) Detachment of mesotheliocytes of diaphragm from basement membrane of vacuole in cytoplasm (V). TEM. 10,000 ×; c) swelling of mesotheliocytes of liver capsule. Semithin section. Methylene blue—fuchsin. 400 ×; d) marked widening of intercellular space between mesotheliocytes of liver capsule. TEM. 15,000 ×; e) swelling and desquamation of mesotheliocytes of diaphragm. Semithin section. Methylene blue—fuchsin. 400 ×. b-e) Duration of diffuse peritonitis 2 days.

toneum of the diaphragm and small intestine these changes lead to disturbance of the integrity of the mesothelial cover and to its desquamation, whereas in the liver capsule, integrity of the mesothelial cover is not significantly disturbed.

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