

Ultrastructural Observation of the Human Milky Spots

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The structure of the milky spots were investigated by transmission electron microscopy on surgically removed specimens of the great omentum of 15 patients from 35 to 67 years old. Thin mesothelium without stomata openings on inconstant basal lamina covered extremely complicated contour over milky spots. The human milky spots were smaller and the cell components were disposed very sparsely. Significant differences in cell nature and number, as well as lack of constant order characterized the neighbouring milky spots. The present study demonstrated that largest population of macrophages, following lymphocytes and group of mast cells were principal cell types in norm. Other cell clusters consisted numerous neutrophilic leucocytes, large groups of mast cells and macrophages or in cell accumulations predominated connective tissue component. The microvasculature of milky spots was composed by large groups of blood vessels with different size, continuous capillaries and cistern-like lymphatic vessels with extremely flat lumens, oriented near to peritoneal surface.

Key words: electron microscopy, man, great omentum, milky spot, peritoneum.

Introduction

The great omentum has numerous tiny white lymphoid nodules, known as milky spots and for their protective role they have been called the “policemen of the abdomen”. In Fawcett’s book of histology they are described as round or oval patches of macrophages and other free cells along the blood vessels [1]. Since Ranvier named “taches laiteuse” [8] such milky spots, many workers have investigated them in different animals [6, 7]. Seifert reported for the first time milky spots in the human great omentum [9]. Data from the last twenty years widened the extra-omental localization of milky spots on the mediastinal pleura (Kampmeier’ foci), chest wall, pericardium, uterine fringe, pancreatic peritoneum, gastrosplenic ligament, splenoportal fat bands and mesenteric root [10, 11]. The number of milky spots per unit area gradually decreases with age [3]. Its microvasculature consists of an arteriole precapillary, postcapillary, collecting venule, venule, and beginnings of blind lymphatic capillaries, surrounded with cell clusters of macrophages (47.5%), B and T lymphocytes (40.8%) and rare mast cells (6.1%) [1, 2].

Material and Methods

Samples of different sectors of the great omentum peritoneum with the underlying tissue were obtained after laparotomy from 15 patients from both sexes (9 males and 6 females), aged 35 — 67 years (< 40 years: 2 cases; 40 -50: 3 cases; 50 — 60: 6 cases; > 60 years: 4 cases). Five patients had pancreatic, gastric and rectal carcinoma (without previous chemo- or radiotherapy), 3 echinococcoses, 4 cholelithiasis, 2 liver abscesses and 1 metastases after lung carcinoma. The blocks, measuring 3×1×1 mm were fixed in 1% glutaraldehyde in 0.1 M Na cacodylate buffer (pH 7.4) for 1h at room temperature and were postfixed for 1h in 1.5% OsO₄ (pH 7.4) in the same buffer. After dehydration the blocks were embedded in Durcupan ACM (Fluka). The regions without pathologic alterations (with continuous mesothelial covering and intact cells as vessels in the submesothelial layer) were identified on light microscopically on semithin sections, stained with 1% Toluidine blue. The contrasted thin specimens were examined in Hitachi 500 electron microscope.

Results

The largest surface of the human great omentum showed wide and shallow folds, separated by fine concavities. The serous covering was composed of continuous mesothelium over basal lamina and submesothelial layer. The mesothelial layer

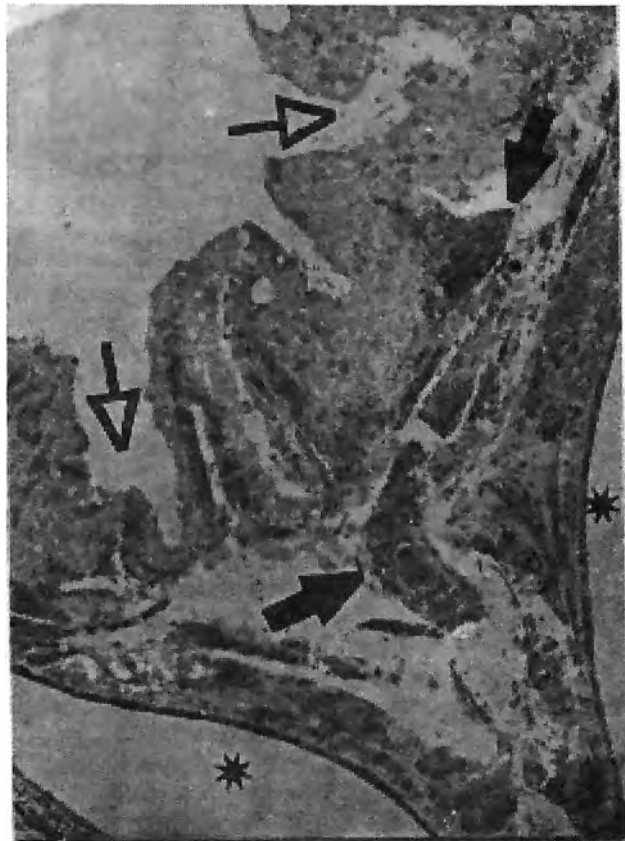


Fig. 1. Invaginations (empty arrows) between protrusions in the mesothelial layer. Fine collagen bundles (arrows) surrounded large intercellular spaces. Two lipocytes (asterisks) (× 7700)

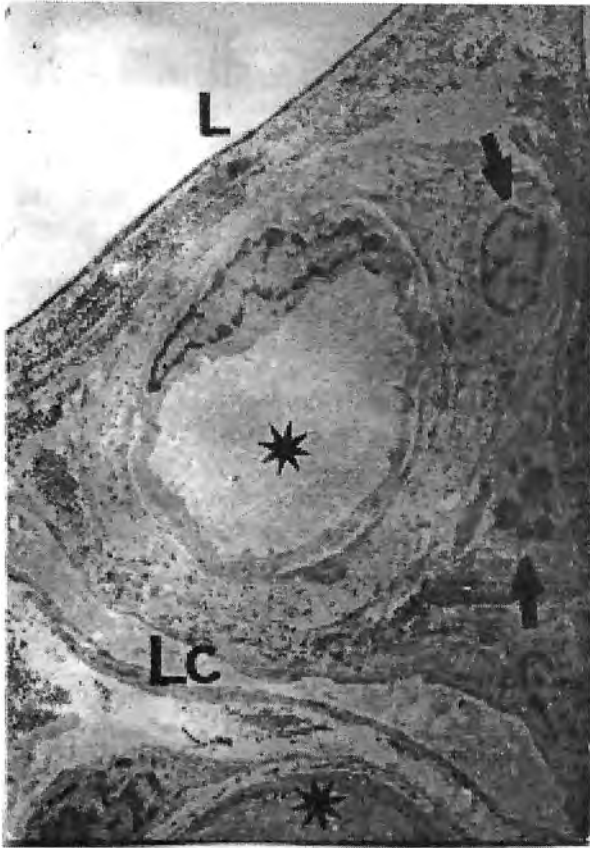


Fig. 2. Cells (arrows) in vicinity of lymphatic capillary (Lc) with extremely flat lumen and two blood capillaries (asterisks). Lipocytes (L) ($\times 7700$)

predominantly consisted of flat cells. They exhibited slightly protruded central portions with elongated nucleus and a scant perinuclear cytoplasm. A poor organelle apparatus was disposed in extremely thin peripheral zones. The cubic mesothelial cells occurred in small groups. The nuclear portions of the most cubic cells repeated the contour of the nucleus and were located in the submesothelial invaginations. The rich organelle apparatus occupied the perinuclear cytoplasm. In wide zones it was difficult to distinguish the mesothelial basal lamina. The superficial part of the submesothelial layer was composed by single cells (fibrocytes and free cells), blood capillaries and small group of smooth muscle cells. The largest portion of the same zone was occupied of loosely arranged collagen with different size, surrounded wide intercellular spaces. The adipose tissue built the entire thickness of the submesothelial layer in wide areas or filled its deep part only.

The mesothelium formed large ridges with a complicated contour, limited by deep furrows with different length and width over cell clusters and densely packed vessels, which were located in the superficial part of the submesothelial layer and more rarely in the deep adipose tissue (Fig. 1). Blood vessels with different size and continuous capillaries formed large groups in the cell accumulations (Fig. 2). Cistern-like lymphatic vessels with extremely flat lumens or with complicated contour, were oriented near to the peritoneal surface. The extremely thin, electron-lucent endothelium without basal lamina built the lymphatic capillaries. The free cells in the cell accumulations densely distributed and surrounded exclusively thin intercellular

spaces, while in other ones they were disposed sparsely over a net of fibrocytes and fine collagen bundles. The most numerous cell types were the macrophages, followed by lymphocytes and mast cells. Neutrophilic leucocytes, macrophages and groups of mast cells were observed in other clusters. Bundles of thin unmyelinated or occasional myelinated fibers were observed in vicinity of the vessels and the cells.

Discussion

The present study of the human great omentum confirm the general peritoneal structure in norm, as previously were described for other organs of the abdominal cavity [5]. The zones of milky spots represent significant morphological differences — mesothelium with complicated contour over inconstant basal lamina and submesothelial layer with cell accumulations in vicinity of vessels (blood and lymphatic), as compared with the remaining parts of the great omentum. In contrast with other studies [6] we did not observed stomata, which formed opening in the mesothelial layer. We consider that stomata in norm involve close contact between the mesothelial and endothelial cells and observed their typical image only in pathological conditions [4]. The structural complexity, allow us to propose, that the human milky spots are constant appearance, but they are smaller and the cell components are very sparsely disposed, as compared with the animals ones [6, 7]. Large differences in cell nature and number without constant order characterize the neighbouring milky spots. Our results are in contrast with the data of Shimotsu et al. [10], that the macrophages cover milky spots, while lymphocytes are found in the central portion. It is difficult to define the exact cell composition and vessel participation in the present routine observation, if do not pay attention of the age of the patients and an undefinable inflammatory alterations [2, 10]. The structural complexity of these zones are like the diaphragmatic units and suggest that both organs represent most specialized regions in the supporting of the peritoneal homeostasis.

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