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MORPHOFUNCTIONAL CHARACTERS OF THE GREATER OMENTUM

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Annotation*:* The paper provides a brief data overview of the national and the foreign recent decades literature on various aspects of the morphofunctional organization of the greater omentum in the physiological and various pathological states of the organism (in the process of morphogenesis, in the conditions of age-related alterations, under various experimental exposures, as well as in the postoperative transformations after surgical interventions due to inflammatory and tumor processes). The data on morphofunctional organization of the greater omentum main tissue components (mesothelium, adipose and lymphoid tissues) have been analyzed and summarized.

Key words: omentum, adipose tissue, lymphoid tissue, epithelium, neoplasms.

A small number of publications have been devoted to the study of the morphofunctional characteristics of the greater omentum. However, in many works, the greater omentum is mentioned in connection with its reactive and adaptive transformations during various surgical interventions on abdominal organs, including surgical removal of tumors of various organs. At the same time, many questions concerning the role and significance of the greater omentum in physiological conditions, as well as during inflammatory and postoperative transformations in the abdominal cavity are debatable and need further research.

This review presents data from domestic and foreign literature of recent decades on various aspects of the morphofunctional characteristics of the structures of the greater omentum in physiological and various pathological conditions of the body (under conditions of age-related transformations, under various experimental influences, as well as during surgical interventions for inflammatory and tumor processes).

Morphogenesis, structural and functional characteristics and ontogenetic transformations of the greater omentum

In a human embryo, the formation of a greater omentum begins in the second month of embryogenesis, and in the period from the end of the fifth month of embryogenesis to birth, the greater omentum acquires the main structural characteristics characteristic of this organ. The greater omentum of fetuses and newborns has a lamellar structure, the content of adipose tissue in it is insignificant, it is located only along the course of the ventricular arteries and their large branches. Often in young children it is described as a transparent thin film devoid of adipose tissue. With increasing age, the content of adipose tissue in the organ also increases [1, 2, 3, 20].

The greater omentum is formed by four sheets of the peritoneum, fused together, between which there is a connective, including adipose tissue. The stroma of the organ is a cellular framework of connective tissue, in the layers of which there are blood and lymphatic vessels, nerve endings. The content of adipose tissue varies greatly. Thus, in people with a large amount of visceral fat, the mass of adipose tissue in the omentum is very significant [1,2,3,14]. According to S.E.Berezovskaya [1], 82% of adult women and 77.9% of adult men revealed a high content of adipose tissue in the greater omentum. One of the functions of the adipose tissue of the greater omentum is to protect the organs it closes from mechanical damage.

Another important function of this organ is to ensure the exchange of peritoneal fluid. According to S.E. Berezovskaya [1], in adults, in areas of the greater omentum with a low content of adipose tissue, the walls are thin, its serous membranes of each of the duplicates closely adhere to each other, while in such areas, through holes may form in the greater omentum, ensuring the transport of substances in the abdominal cavity. At the same time, mesotheliocytes located on the surface of the serous membrane secrete and absorb peritoneal fluid.

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The topographic location of the greater omentum depends on the age. So, in a full-term newborn, the greater omentum covers a quarter of the area of the small intestine, at 3-4 months - two-thirds, by the age of 5 it reaches the bends of the transverse colon, and at the age of 5-10 years, depending on the length and content of adipose tissue, it can be similar in structure to the greater omentum of adults [3, 5, 20].

Adipose tissue in the greater omentum is located both in the form of adipocyte complexes (sometimes called fat lobules), separated by large layers of connective tissue, and in the form of single fat cells. Inside the accumulations of fat cells are located blood and lymphatic vessels, nerve endings, as well as thin connective tissue trabeculae that make up the framework of the lobule. Adipose tissue circularly surrounds the intracranial blood vessels [16, 17], while more adipose tissue is more often located next to the venules than with the vessels of the bearing link. The thickness of the layer of loose connective tissue separating adipocytes from vessels varies from complete absence to 50-80 microns [17].

Adipose tissue is a complex hormonally active organ that plays an important role in regulating the energy balance and homeostasis of the whole organism as a whole [6, 18, 15, 16, 19.].

Among the structures of the greater omentum, the attention of researchers is attracted by the so-called "milky spots", which are small ovoid, rounded or irregularly shaped opaque areas of the omentum having an area of 0.5-3.5 mm2. Many authors associate "milky spots" with lymphoid tissue. Thus, a number of studies have shown the participation of "milky spots" in providing specific immunological reactions [2, 3, 4, 5, 7, 9]. Milky spots are detected in the greater omentum, starting from the middle of embryogenesis and exist in the organ throughout life. They are found throughout both surfaces of the stuffing box. Their number is subject to individual and age variability. At the same time, milky spots are clearly visible on the surface of the greater omentum of newborns and young children. With age, their number decreases, while in adults they are poorly distinguishable due to the higher content of adipose tissue in the omentum. In old age, the number of "milky spots" decreases, the density of the capillary network decreases in them, they undergo fibrosis and calcification. There are three types of milky spots [8, 10, 11, 12]: 1) primary (found in fetuses, newborns and children under 5 years of age), 2) passive (consisting of fat cells) and 3) active or secondary (containing a large number of leukocytes, including plasmocytes). Active milky spots are contained in the greater omentum normally, and with any irritations of the abdominal cavity, their number increases sharply - there is a restructuring of passive "milky spots" and the appearance of active ones on their basis. At the same time, the spots increase in size, the number of fat cells in them decreases, and the content of immunocytes increases [20]. Milky spots are characterized by the presence of numerous macrophages, lymphocytes, plasmocytes, mast cells. According to a number of authors, milky spots are a source of emergency release of free macrophages and plasmocytes into the abdominal cavity, where they carry out phagocytosis and the formation of immune antibodies [13, 14, 15].

The greater omentum is characterized by a high intensity of blood flow. For example, the level of blood flow in the omentum is higher than in the skin, mesentery, parietal leaf of the peritoneum [8]. According to these authors, the intensity of blood flow (expressed in perfusion units) in the skin was equal to 19.85 ± 0.8, in the parietal peritoneum - 23.42 ± 1.8, in the mesentery of the small intestine - 22.71 ± 1.1, in the area of the left lower edge of the greater omentum - 26.73 ± 1.3.

Morphofunctional transformations of the greater omentum in conditions of various injuries of the abdominal cavity and retroperitoneal space. Involvement in inflammation and reparative histogenesis

First of all, it should be noted the ability of the greater omentum to create a restrictive shaft around the intraperitoneal inflammatory focus [3, 20]. The role of the greater omentum in the formation of immune antibodies has been revealed. It has been shown that during the immunization of the body in the greater omentum, the content of plasma cells that are producers of immune antibodies increases many times [1, 23]. Using the example of various mammals, it was found that the titer of antibodies in the tissues of the great omentum far exceeds the titer of antibodies in the liver and spleen [1, 2].

A number of authors [1, 2] consider the greater omentum as an integral part of the mammalian immune system.

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The greater omentum is an extremely reactive organ. The structures of the greater omentum, first of all, covering its peritoneal leaves, demonstrate a complex of reactive changes in response to various effects on the abdominal wall, abdominal organs of the retroperitoneal space.

Thus, when 0.5% novocaine solution is injected into the peritoneal cavity, after 20 minutes, dystrophic changes develop in the mesotheliocytes of the peritoneal leaves. After 24 hours from the beginning of the experiment, focal exfoliation of mesotheliocytes was observed and areas of various sizes devoid of mesothelial cover were visible on the surface of the peritoneum, on the surface of which lymphocytes and macrophages were located [10]. Already three hours after the experimental local hypothermia of the pancreas, edema of the adipose tissue of the greater omentum was noted, and after 12 hours, foci of necrosis of the adipose tissue of the organ were noted in the greater omentum [7]. During the formation of an artificial abdominal wall using a Parietex polymer mesh, an inflammatory process with pronounced leukocyte infiltration of the structures of the greater omentum was also observed in the area adjacent to the inner surface of the implant. At the same time, areas of acute inflammation in the omentum alternated with zones of pronounced proliferative activity of fibroblastic cells [22, 25].

One of the main factors determining the course of the postoperative period in acute surgical pathology of the abdominal organs is the participation of the greater omentum in the formation of an intraperitoneal inflammatory focus. The greater omentum delimits the intraperitoneal focus of inflammation, forming infiltrative-adhesive processes, which can prevent the rapid spread of infection to other parts of the abdominal cavity [14, 18]. The greater omentum is a barrier to bacterial invasion and, as a result, can turn the source of possible development of peritonitis into a local abscess [20, 22]. It was found that the structures of the greater omentum are capable of encapsulating foreign bodies.

Performing a protective function, the greater omentum itself often causes prolonged inflammation and adhesions in the early postoperative period, which in some cases leads to the need for repeated surgical interventions. [14, 15, 16, 17, 18, 19.]. Questions concerning the influence of biologically active substances produced in the structures of the omentum on the activation or inhibition of the process of adhesion formation are very important. For example, it was found that increased expression of transforming growth factor P-1 by mesothelial cells contributes to the formation of adhesions [15, 20, 22].

It should be emphasized that the structures of the greater omentum take an active part not only in limiting the inflammatory process in the abdominal cavity, but also in protecting the organs of the abdominal cavity, and in their various (traumatic, postoperative) injuries, which is also realized in the form of an adhesive process [20, 22, 24].The problem of postoperative formation of adhesions and the various complications associated with it continue to be one of the important problems in abdominal surgery. Postoperative adhesions are found in a significant number of patients who have undergone abdominal surgery. For example, the participation of the greater omentum in the formation of the postoperative adhesive process in children ranges from 23 to 40% [3, 20]. In the mechanism of formation of adhesions, the first link is damage to the peritoneum, which triggers the entire cascade of pathogenetic mechanisms. At the same time, the serous membranes (especially the mesothelium of the serous membranes), which take part in the formation of adhesions, thicken [4-11]. In the initial stages of its formation, adhesions are formed by young loose connective tissue with pronounced leukocyte infiltration in it. In the future, the connective tissue of the adhesions undergoes sclerosis, its blood supply worsens, as evidenced by a decrease in the content of capillaries in the tissue [17, 18].

In a number of works there is information concerning the issues of morphofunctional transformations of the greater omentum during the tumor process in the body [21, 23]. For example, in the works reflecting the structural and functional characteristics of the greater omentum, in the presence of metastases in it in the conditions of the tumor process in the ovary, it is shown that the greater omentum in women with ovarian cancer looks wrinkled, thickened, the content of adipose tissue in it is increased [13, 19]. The greater omentum in patients with ovarian cancer has smaller dimensions. Statistically significant are the differences in the length and area of the large gland. Thus, the length ranged from 5 to 30 cm (on average - 9.4± 3.0 cm), and the average area

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was 450.5±23.9 cm2 (minimum value - 115.1 cm^2, maximum - 945.7 cm^2). The surface of the mesothelium of the greater omentum in the absence of metastases looked more relief, in the presence of metastases, the relief of the mesothelium was smoothed. It is shown, for example, the role of the greater omentum in the dissemination of ovarian cancer. It is described that the volume of metastases in the greater omentum can significantly exceed the mass of the primary tumor. The appearance of ovarian cancer metastases in the greater omentum in half of the cases of observations led to the formation of a continuous lymphocytic shaft around them. At the same time, there was a significant increase in the number of plasmocytes [23]. Metastasis is also facilitated by the presence of a developed network of lymphatic vessels in the omentum, as well as the activation of the synthesis of growth factors by mesothelial cells contributes to the metastasis of tumors on the abdominal organs [20]. The content of lymphoid tissue in ovarian tumors in the greater omentum is reduced [3-15], the number and size of milky spots in the organ are also reduced. Despite the existence of works concerning the role and significance of the greater omentum in malignant neoplasms of the abdominal cavity and retroperitoneal space, the role of the greater omentum in malignant neoplasms has not been fully clarified and needs further in-depth study. Thus, the issues concerning omentectomy during surgical interventions on the organs of the abdominal cavity and retroperitoneal space are controversial [20, 23]. It should also be noted that there are not enough studies in the domestic and foreign literature concerning the study of omentum structures not affected by metastases during the tumor process in the body.

Thus, the analysis of the literature indicates that the greater omentum is an organ that performs diverse functions in the body. Protection of the abdominal organs from mechanical damage, maintenance of homeostasis in the abdominal cavity, participation in immune reactions, production of a large number of biologically active substances. However, many aspects of the role and significance of the greater omentum in the body need further in-depth research.

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