ISSN NO: 2770-0003
November 2024

Early postnatal morphologic state of the stomach and liver of offspring under conditions of experimental maternal diabetes mellitus

M.P. Abdaliyeva, E.K. Kalmurzayev, D.B. Adilbekova, H.S. Abdurazakhov
Tashkent Medical Academy, Tashkent, Uzbekistan

Annotation. Experimental maternal diabetes mellitus causes inflammatory-dystrophic changes in the vascular-tissue structures of the stomach wall and liver of offspring. Morphofunctional disorders of intra-organ vessels of the microcirculatory bed of the organs play a significant role in developing the established pathomorphological disorders of postnatal development of vascular-tissue structures of the stomach and liver in offspring. These disorders then disrupt the trophics of tissue structures and cause dystrophic and degenerative changes.

Keywords: experimental diabetes mellitus in mother, offspring, stomach, liver vessels, tissue structures

Relevance. Diabetes mellitus is an urgent problem of modern medicine [3,8]. The number of patients with diabetes mellitus increases annually. According to WHO forecasts, the total number of patients with diabetes mellitus will increase to 250 million by 2025 [2,4,7]. This disease is characterized by a severe chronic course, disruption of all types of metabolism, and mainly carbohydrate metabolism [10]. Although pregnancy is a significant and content time in a woman's life, it also causes a great deal of stress for her body, leading to the fact that the future mother may develop or manifest disease in the presence of predisposition and favorable factors. Diabetes mellitus is one of these conditions. [6,8]. While the morphofunctional state of many organs in diabetes mellitus is relatively well studied, the morphofunctional condition of vascular and tissue structures of internal organs in children born to mothers with diabetes mellitus is poorly characterized [9]. Data on the morphologic state of tissue and vascular structures of the stomach and liver in children born under conditions of maternal diabetes mellitus are very scarce.

The study aimed to investigate the postnatal morphological state of tissue structures and intra-organ vessels of the stomach and liver in rats born with experimental maternal alloxan diabetes.

Materials and methods of study. Materials from the stomach and liver of rats born to mothers with experimental diabetes mellitus served as the object of our morphologic study. To create a model of diabetes, alloxan was administered intraperitoneally to female rats 1 time in an acetate citrate buffer at the rate of 11 mg% per 100 g of weight. On the 10th day of the experiment, the males were hooked up to the females. The materials for the study were the stomach and liver of offspring born to female rats with experimental diabetes mellitus obtained on the 7th-14th day of postnatal life. Morphological, morphometric, and variational-statistical research methods were used in the work.

Results and their discussion. The stomach wall of 3-day-old intact baby rats is thin; the mucous membrane is light pink with a grayish tinge. The surface of the mucosa has a small number of low folds. All four membranes are distinguished in the stomach wall: the mucous membrane, which is the thickest; the submucosal base (loose, unformed connective tissue); serous (mesothelium); and muscular (thin, consists of smooth muscles) membranes. The mucous membrane's and gastric pits' surfaces are covered with a simple columnar epithelium. Its cells are large with light cytoplasm. The nucleus has an oval shape.

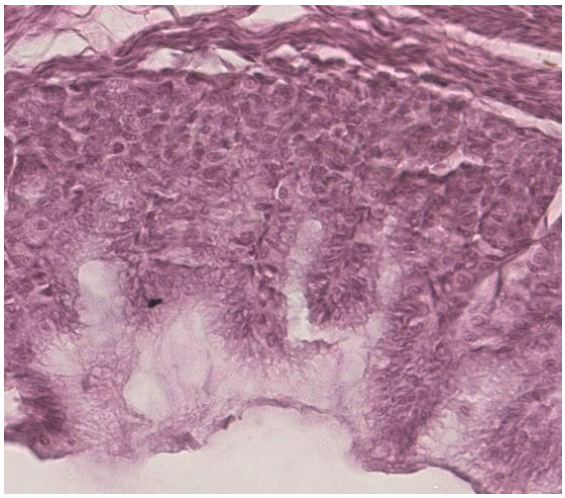
The stroma of the interosseous, fundal, and pyloric glands contains a small number of connective tissue cells. During this period, three types of glandular cells are detected in the fundal glands. Most cells are represented by

ISSN NO: 2770-0003
November 2024

glandular cells containing mucosal secretory granules in the cytoplasm. These cells subsequently differentiate into accessory cells. Among the mucous cells, there are differentiating parietal cells, which have a comparatively high number of mitochondria in their cytoplasm; single intracellular secretory tubules with a restricted lumen are found among them. In 7-day-old baby rats, more precise and more pronounced folds are revealed on the mucous membrane. The mucus content on its surface is reduced. On the incision, the stomach wall is thicker than in the previous period. The lumens of the gastric pits lined with cylindrical cells with light cytoplasm are expanded. The fundal glands and their parietal cells have a very distinct overall architectonics.

According to the findings of our study, in the early periods of postnatal life of the animals (3-7 days), whose mothers suffer from experimental diabetes mellitus, gastric mucosa exhibited inflammatory and dystrophic alterations. The stroma of the mucous membrane is edematous, expanded, and infiltrated by mononuclear cells. Epithelial cells are swollen, low-cylindrical in shape, the boundaries between them are indistinct (Fig.1).

Fig.1. Morphological state of the stomach of baby rats born to mothers with diabetes mellitus. Stained with hematoxylin and eosin. Magnification: 20×10.



The nuclei of cells are polymorphic and located in the basal part of the cells in a less orderly manner. Studies using electron microscopy have revealed significant intercellular edema and intercellular space expansion. Intra-epithelial lymphocytes with light cytoplasm and few organelles are frequently found among epithelial cells. In the serous-muscular membrane, edema, infiltration by cellular elements, fibrillation, and swelling of muscle fibers were revealed. The blood vessels of the mucosal stroma are often dilated, sinuous, and blood-filled. In the vascular-tissue structures of the liver of baby rats, the following pattern was observed: the processes of development of liver lobules, development of the microcirculatory bed, and hematopoiesis continued in the liver microstructure of intact newborn baby rats (3-7 days of postnatal life). The lobular structure of the liver is still poorly distinguishable; hepatocytes are very small in size, are located disordered, adhere tightly to each other, and do not yet form regular plates oriented around the central vein. In the liver plates, hepatocytes often form 3-4 rows. Polymorphism of their nuclei is noted. Mitotically dividing cells are quite common. Hepatocytes have different shapes – rounded or polygonal; their cytoplasm is homogeneous and fine-grained. Bile tubules with a very narrow lumen are clearly visible between the hepatocytes. A study of the liver of newborn baby rats born to female rats with diabetes mellitus showed that hepatocytes were loosely and randomly located, separated by wide and full-blooded sinusoidal hemocapillaries (Fig.2).

Some hepatocytes showed hydropic dystrophy. Histomorphometric studies have shown that the number of binucleated liver cells is relatively higher in intact baby rats. The liver lobules and beams are poorly contoured.

ISSN NO: 2770-0003
November 2024

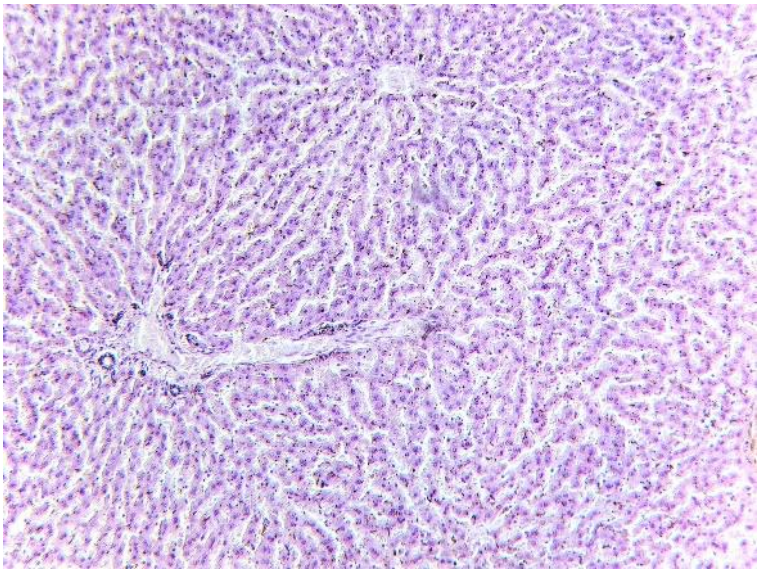


Fig. 2. Morphological picture of the liver of baby rats born to female rats with diabetes mellitus. Stained with hematoxylin and eosin. Magnification: 20×10.

Conclusions. 1. Maternal diabetes mellitus will negatively affect the morphofunctional state of the digestive tract of the offspring.

2. Experimental diabetes mellitus in the mother causes inflammatory-reactive and dystrophic changes in the vascular-tissue structures of the stomach and liver of the offspring.

3. Pathomorphological abnormalities in the intraorgan vessels of the microcirculatory bed of organs are a major factor in the development of established pathomorphological disorders of the postnatal development of the vascular-tissue structures of the stomach and liver of offspring, which in turn cause a disruption of the trophic level of the tissue structures.

References.

1. Damm P, Houshmand-Oeregaard A, Kelstrup L, Lauenborg J, Mathiesen ER, Clausen TD. Gestational diabetes mellitus and long-term consequences for mother and offspring: a view from Denmark. // Diabetologia. 2016 Jul;59(7):1396-1399.
2. Golalipour MJ, Kafshgiri SK, Ghafari S. Gestational diabetes induced neuronal loss in CA1 and CA3 subfields of rat hippocampus in early postnatal life.// Folia Morphol (Warsz). 2012 May;71(2):71-7.
3. Li X, Luo SJ, Zhang K, Yang HX. Streptozotocin-induced maternal intrauterine hyperglycemia environment and its influence on development and metabolic in adult offspring with high birth weight in rats].// Zhonghua Fu Chan Ke Za Zhi. 2012 Oct;47(10):769-76.
4. Ozkan H, Topsakal S, Ozmen O. Investigation of the diabetic effects of maternal high-glucose diet on rats.// Biomed Pharmacother. 2019 Feb;110:609-617.
5. Адилбекова Д.Б. Морфологическое состояние сосудисто-тканевых структур тонкой кишки у потомства, рожденного от матерей с хроническим токсическим гепатитом в условиях коррекции гепатита//Новый день в медицине. - 2013.- № 2 (2). - С. 62-65.
6. Ахмедов А.Г., Иброхимова Л.И., Расулова Н.Б. Сосудисто-тканевые изменения в стенке тонкой и толстой кишки у старых крыс на фоне сахарного диабета//Морфология. - 2014. - Т. 145, № 3. - С. 23.
7. Елиневская Г.Ф., Прилуцкая В.А., Елиневский В.Б. Влияние метаболических нарушений у матерей на состояние здоровья детей периода новорожденности//Медицинский журнал. - 2012. - № 1 (39). - С. 34-37.

ISSN NO: 2770-0003
November 2024

8. Папышева О.В., Харитонова Л.А., Котайш Г.А., Шурыгина Д.А. Состояние липидного и углеводного обменов у детей, родившихся от матерей с гестационным сахарным диабетом//Экспериментальная и клиническая гастроэнтерология. - 2019. - № 1 (161). - С. 137-144.
9. Римашевский В.В. Состояние плода и новорожденных, родившихся от беременных с сахарным диабетом 1-го типа, в зависимости от вида анестезии при операции кесарева сечения//Репродуктивное здоровье. Восточная Европа. - 2021. - Т. 11. № 4. - С. 441-460.
10. Харитонова Л.А., Папышева О.В., Богомаз Л.В., Богомаз Д.С. Особенности наблюдения за детьми, родившимися от матерей с различными нарушениями углеводного обмена//Гастроэнтерология Санкт-Петербурга. - 2019. - № 2. - С. 45-46.