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Histological criteria of maturity of the uterine-placental area of manure

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Abstract

In order to improve the procedure of morphological diagnosis of the degree of maturity of the uterine-placental area of the placenta, the authors conducted special studies of the structures of the placental bed of the uterus at different stages of gestation during physiological pregnancy and under various pathologies of the mother or placenta. Criteria for maturity of the uterine-placental area of manure in gestational segments 13-27, 28-36 and 37-40 weeks based on the percentage of spiral arteries with complete gestational remodeling of the walls due to the destructive effect of invasive trophoblast and the first parameters of the norm for the number of veins per unit area in the uterine-placental area. To morphologically determine the degree of maturity of the uteroplacental area, a table of the percentage of spiral arteries with complete gestational adjustment and the number of venous vessels per 1 mm²

area of histological section according to gestational age. For morphological diagnosis of the degree of maturity of the placenta at different stages of gestation during physiological pregnancy and under conditions of different pathology of the mother or placenta, it is recommended to conduct a comprehensive morphological assessment of placental structures using maturity criteria of placental chorionic tree and maturity criteria of placental placenta.

Key words: uterine-placental area; chorionic tree; histological criteria

Introduction. During pregnancy, the development of the fetus is ensured by the manure - a complex of interconnected structures, which include the chorionic tree, uterine-placental area (UPA), umbilical cord, membranes, amniotic fluid. Manure deficiency is the inability of the manure to deliver nutrients (nutrients) to the unborn child, to produce metabolic regulators and to remove waste [1].

Although the lack of manure can cause a violation of any of its elements, the main attention of scientists is focused on the complex "chorionic tree / UPA", which is commonly called the placenta. Thus, scientific research is currently developing in the direction of clarifying the maturation disorders of the two components of the placenta - the chorionic tree and UPA [2].

To assess the maturity of the chorionic tree in a particular placenta should apply the classification of disorders of maturation of the chorionic tree and to establish compliance of the chorionic tree with the gestational rate of the percentage of chorionic villi (according to gestational age) [3].

Particular attention of placentologists is focused on blood vessels (especially arteries) UPA, as the pathology of the latter, according to many authors, can explain the various complications of pregnancy [2]. Diverse pathology of UPA is a prerequisite for the development of uterine-placental insufficiency of manure, which is characterized by the fact that during pregnancy there is a violation of the formation of various structures of the placental bed of the uterus, especially spiral arteries and veins, and then, as a consequence, placenta [1-3]. Throughout pregnancy, according to the gestational age in the UPA with varying intensity of the processes of angiogenesis - vascular neoplasms of endothelial progenitor cells and vasculogenesis - the development of vessels from existing ones, which provide constant renewal of the capillary bed and the completion of new vessels of the placental blood. In the case of adverse factors, compensatory stimulation of angiogenesis allows to maintain adequate supply of the growing fetus with oxygen and nutrients. [3].

Today, the procedure of morphological diagnosis of the degree of maturity of the UPA of manure needs to be improved. In particular, no specific gestational norms for the percentage of UPA spiral arteries with complete gestational adjustment have been established, no other possible signs of UPA immaturity have been studied, such as the condition of venous vessels..

The aim of the study. To overcome these difficulties in determining the degree of maturity of the uterine-placental area of the placenta, we conducted special studies of UPA structures at different stages of gestation during physiological pregnancy and under conditions of different pathology of the mother or placenta.

Material and methods. Morphological studies were performed at the Department of Pathological Anatomy of Bukovynian State Medical University (Chernivtsi, Ukraine). We used the following sources of material of the uterine-placental site: the placenta or placenta obtained during cesarean section, when the basal plate has a sufficient thickness (IS Davydenko, AV Goshovskaya) [4]; biopsy of the uterine-placental area during caesarean section with the anterior location of the placenta on the basis of informed voluntary consent of the pregnant woman to collect manure (OA Tyuleneva, VM Zavaletsky) [5]; forensic autopsies of dead pregnant women (IS Davydenko, VO Zozulya). The study was conducted in compliance with the basic bioethical provisions of the Council of Europe Convention on Human Rights and Biomedicine (04.04.1997), the Helsinki Declaration of the World Medical Association on the ethical principles of scientific medical research with human participation (1964-2008), and the order Ministry of Health of Ukraine № 690 dated September 23, 2009.

Due to the difficulty of obtaining the material of the uterine-placental area, currently the criteria for the maturity of UPA have been developed only in the gestational periods of 13-27, 28-36 and 37-40 weeks (table 1).

The material was fixed for 22-24 hours in a 10% neutral buffered formalin solution, ethanol dehydration and paraffin filling were performed. On serial histological sections with a thickness of 5 μm performed: histochemical method for fibrin and collagen fibers (differentiated determination) by NZ Slinchenko and for the review purpose of staining with hematoxylin and eosin.

Digital copies of the image were obtained using a Delta Optical Evolution 100 microscope (planochromatic lenses) and an Olympus SP-550UZ digital camera. For each study group, the arithmetic mean and its error were calculated. Statistical processing of digital material was performed using a two-sided odd Student's test. Differences at $p \leq 0.05$ were

considered statistically significant (computer program PAST 3.06, free license, O.Hammer, 2015) [6].

Results of the research. The criterion of maturity was the percentage of spiral arteries with complete gestational remodeling - when most of the artery wall has acquired gestational transformation due to the destructive effect of invasive trophoblast - in physiological pregnancy at 37-40 weeks, this figure is $99 \pm 0.1\%$ (98 -100). Quantitative parameters of UPA vessels at gestational periods 13-27, 28-36 and 37-40 weeks are shown in table 1.

Table 1 - Percentage of spiral arteries and number of venous vessels per 1 mm² of uterine-placental area of manure with complete gestational adjustment during physiological pregnancy depending on gestational period

Vessels of the uterine-placental area	Gestation period		
	13-27 weeks (n=16)	28-36 weeks (n=18)	37-40 weeks (n=28)
Spiral arteries with complete gestational adjustment (%)	89±0,4 (86-92)	94±0,4 (91-97)	99±0,1 (98-100)
The number of venous vessels per 1 mm ²	3,1±0,21 (1,4-4,8)	7,9±0,28 (5,5-10,3)	8,4±0,22 (6,0-10,7)

A higher concentration of spiral arteries per unit area of histological section was observed in the biopsies of the projection of the central part of the placenta compared with the peripheral parts of the UPA.

We first determined the parameters of the norm for the number of veins per unit area in the UPA at 37-40 weeks of physiological gestation - 8.4 ± 0.22 (6.0-10.7) venous vessels per 1 mm² area of histological section. Venous vessels were located mainly in groups so that on histological sections their number ranged from 4 to 8 per 1 mm². The described morphological picture is illustrated in Figure 1.

The effectiveness of this approach to assess the maturation of the uteroplacental area was tested by us under conditions of various pathologies of the mother and placenta - iron deficiency anemia in pregnant women, chronic inflammation of the placenta, extrachorionic placenta (developmental abnormality), eco-dependent (chemical) placental pathology. The data of the scientific literature and the results of our studies of cellular and molecular aspects

of maturation of UPA (gestational rearrangements of spiral arteries) suggest the following mechanisms of immaturity of the placental bed of the uterus.

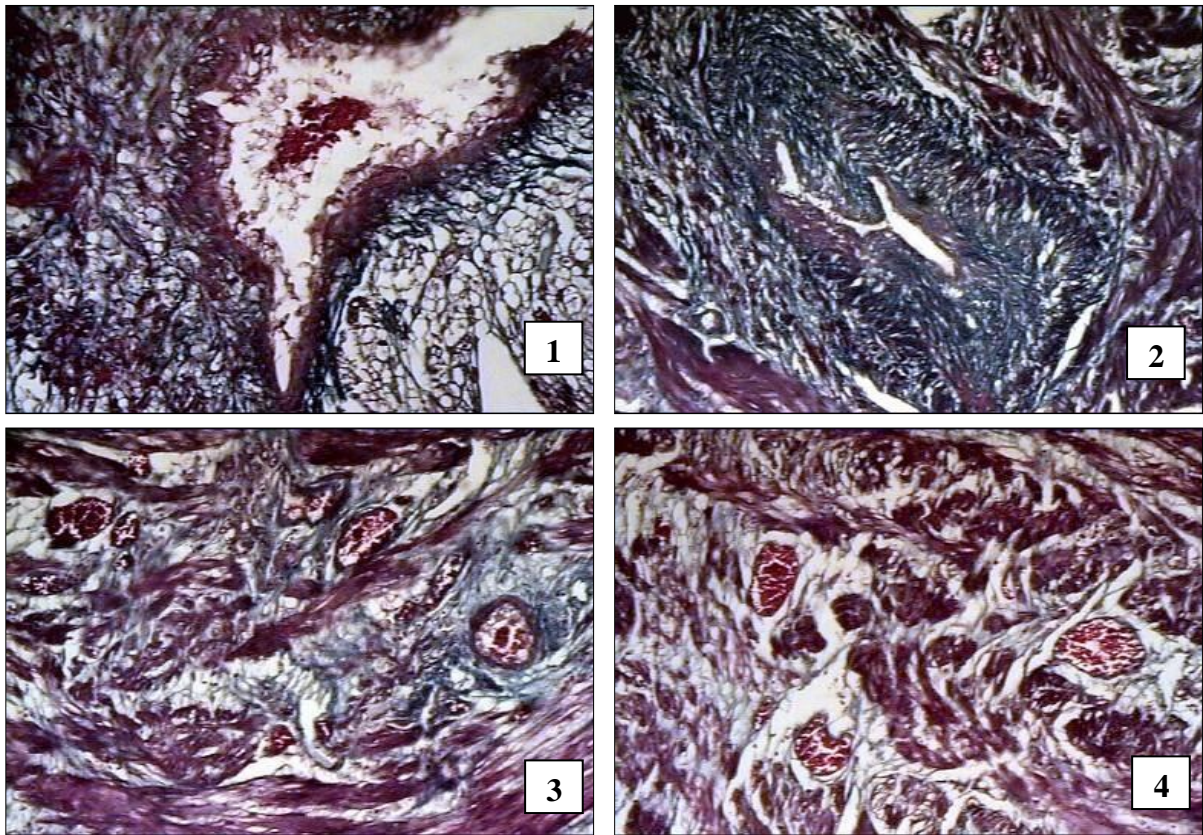


Fig. 1. Biopsies of the uterine wall in the area of attachment of the placenta 39-40 weeks of pregnancy: 1 - observation without clinical signs of chronic insufficiency of manure, the area of projection of the central part of the placenta: spiral artery with complete gestational reconstruction of its wall; 2 - observation with clinical signs of chronic insufficiency of manure, the area of projection of the central part of the placenta: spiral artery with incomplete gestational reconstruction of its wall, narrow lumen; 3 - observation without clinical signs of chronic insufficiency of manure, the area of projection of the central part of the placenta: hyperplasia of venous vessels (in the field of view of 12 vessels of venous type); 4 - observation with clinical signs of chronic insufficiency of manure, the area of projection of the peripheral part of the placenta: a decrease in the number of venous vessels (in the field of view 3 vessels of the venous type).

Staining with chromotropic-aqueous blue. Ob.10x, Ok.10x. Microphotographs.

Conclusions

1. To morphologically determine the degree of maturity of the uterine-placental area, it is recommended to use the proposed table of the percentage of spiral arteries with complete gestational adjustment and the number of venous vessels per 1 mm² area of histological section according to pregnancy.

2. For morphological diagnosis of the degree of maturity of manure at different stages of gestation during physiological pregnancy and under conditions of various pathology of the

mother or placenta, it is recommended to conduct a comprehensive morphological assessment of mature structures using maturity criteria of placental chorionic tree and maturity criteria of placental placenta.

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