

Basic Research

Mechanisms, Preventing Coagulation of Placental Lacunar Blood

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Abstract

During gestation, placenta produce protective mechanisms against lacunar blood coagulation by synthesis glycosaminoglycans by the maternal epithelium of placenta. Due to exacerbation of herpes virus infection during pregnancy, synthesis of glycosaminoglycans by maternal placenta is reduced, as well as the content of heparin in placental homogenate. IJBM 2011; 1(4):---. © 2011 International Medical Research and Development Corporation. All rights reserved.

Key words: *pregnancy, placenta, glycosaminoglycans.*

Introduction

Contact of chorionic syncytiotrophoblast with the mother's blood could be possible only if the existence of mechanisms preventing blood coagulation. During the process of formation of maternal blood flow in the intervillous space, take place contact of the mother's blood with a large epithelial surface, as the mother's blood goes beyond the vascular endothelium. This epithelium must have special mechanisms preventing blood coagulation [1, 2, 7]. After childbirth, the fibrinolysis sharply increases, preventing blood clots formation [4, 5]. Appearance of degenerative changes in chorionic epithelium, usually leads to placental fibrinoids formation. This is apparently due to impaired ability of chorionic epithelium to synthesize surface glycosaminoglycans [6]. Studying the literature, we found no data indicating on change of glycosaminoglycans synthesis in pregnant women who have had exacerbation of herpes virus infection. The purpose of this study – to determine the possibilities of maternal placenta to heparin synthesis and heparin saturation of syncytiotrophoblast, define the content of heparin in the placental homogenate in parturients having the herpes virus infection in the third trimester of pregnancy.

Material and methods

We investigated placentae after childbirth in 25 pregnant women who have had an exacerbation of herpes virus infection in the third trimester of gestation with titer of antibodies to herpes simplex virus (G1) of 1:3200 (herpes virus infection of moderate severity) and 20 pregnant women who have had an exacerbation of herpes virus infection in the third trimester of gestation with titer of antibodies to herpes simplex virus type G1 – 1:12800 (severe herpes virus infection). In 15 parturients having no herpes virus infection during pregnancy, the placenta has been studied as a control. Investigations were conducted in the Clinic Hospital's Maternity Ward of the Far Eastern Scientific Center of Physiology and Pathology of Respiration SB RAMS. All studies were conducted with the requirements of the WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects, as amended in 2000 and "Rules for clinical practice in Russian Federation", approved by Order of the Ministry of Public Health from 19.06.2003 № 266.

The titer of antibodies to herpes virus (HSV-1) was determined (by the dynamics of IgG) using the standard set of "Vector-Best" JV (Novosibirsk) enzyme immunoassay (EIA) on spectrophotometer "Stat-Fax-2100" (USA).

In parturients who have had exacerbation of herpes virus infection of varying aggressiveness in the third trimester, what have been determine by the titer of antibodies to herpes virus, the placental pieces were collected and homogenated for heparin level determination. As control were used placental

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homogenates collected from parturients having no herpes virus infection during pregnancy. To obtain a homogenate the fetal part of placenta (chorionic villi) was sliced using a scalpel into small pieces of 2-3 cm² and 1 mm thick. Obtained extracts of serum and placental glycosaminoglycans were separated by disc electrophoresis [3] in a polyacrylamide gel on the unit "Biometra" (Germany). The optical density of the gel columns were determined by densitometry of the samples and then calculated their percentage per unit area. At the same time pieces of placenta were fixed in 10% neutral paraffin. Histological sections after deparaffinization and washing in water, stained in 0.05% alcian blue (8GX) on 0.1M acetate buffer containing 0.5-1.0M of MgCl₂. Staining lasted for 10-12 hours, then samples rinsed with water, alcohol, and placed into balsam. In concentration of MgCl₂ of 0.8-1.0 M were stained heparin and sialic acids.

Results

Morphological examination of the placenta from parturients having no herpes virus infection during pregnancy showed that, beginning from the first trimester epithelium covering the maternal part of placenta synthesizes GAGs intensely, and as shown by histochemical studies – primarily heparin (Fig. 1a). Pregnant women who have had exacerbation of herpes virus infection during pregnancy, GAG production was not high, because in the first trimester they often have vasculitis (Fig. 1b), and in the third trimester – signs of vascular thrombosis (Fig. 1c) with the fibrin formation (Fig. 1d). Produced heparin acts as an anticoagulation agent in the placenta of pregnant women preventing

lacunar blood coagulation and accumulates in syncytiotrophoblast.

Gel electrophoresis results showed that with the increasing in antibody titer to herpes virus content of heparin in placenta homogenate reduce: in antibodies titer was 1:3200 level of heparin was 25.82±0.80%, whereas antibodies titer was 1:12800 heparin level reduced to 20.86±0.62% (in control group – 29.70±0.71%; p(t)<0.05; p(F)<0.05).

Thus, during pregnancy, placenta demonstrates its local mechanisms of anticoagulant protection. Maternal placenta during the formation of lacunar system allows the production of GAGs in epithelial cells lining the lacunae. As it shown by studies using disc electrophoresis, it was mainly heparin, which probably diffuses into the lacunary blood, and through it into the villi system through syncytiotrophoblast as using disc electrophoresis its level is very high in pregnant women. Exacerbation of herpes virus infection inhibits the synthesis of GAGs and in fact more than the higher aggressiveness of the infection. Level of heparin in placenta homogenate in herpes virus infection with antibody titer of 1:2800 is only 20.86±0.62%, whereas in healthy pregnant women its level was 29.70±0.71%.

Conclusions

Obtaining the placental homogenate from parturients having herpes virus infection during gestation and its investigation by densitometry and electrophoresis in polyacrylamide gel could help to determine that along with increase of aggression of herpes virus infection, content of heparin in placenta homogenate reduce. It

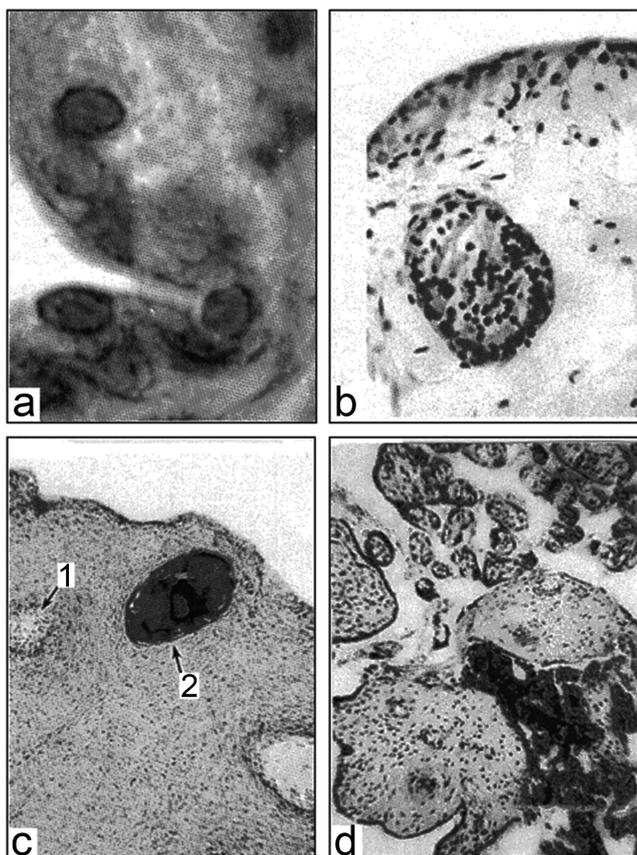


Figure 1
Maternal placenta.

a – maternal placenta; under the epithelium lining the lacuna, accumulates a large amount of glycosaminoglycans (heparin revealed). Stained with alcian blue (8GX) with MgCl₂ 0.8-1.0M. Magnification – 90×15;

b – vasculitis; staining with azure. Magnification – 40×15;

c – thrombosis of the maternal placenta (1, 2) in exacerbation of herpes virus infection (antibodies titer – 1:12800). Stained with Boehmer's hematoxylin and eosin. Magnification – 40×15;

d – villous part of placenta. Exacerbation of herpes virus infection (antibodies titer – 1:12800). Fibrinoid between fibers. Stained with Boehmer's hematoxylin and eosin. Magnification – 40×15.

probably depends on the suppression by the herpes virus of GAGs synthesis in epithelial cells lining the blood lacunae of maternal part of placenta.

References

1. Klimova NI. Influence of placenta on blood coagulation. PhD thesis. Chita, 1972.
2. Lutsenko MT, Andriyevskaya IA, Kolesnikova LM. The copyright application for the invention is № 2425372, dated 07.27.2011.
3. Merkurjeva RV. Electrophoretic separation of serum mucoproteins into fractions. Lab work 1966; 12:712-715.
4. Skipetrov VP. Tissue factors of blood coagulation in pregnancy dynamics. Obstetrics and Gynecology 1968; 1:8-14.
5. Skipetrov VP, Kusnik BI. Obstetric thrombohemorrhagic syndrome. Irkutsk, 1973.
6. Stacy MI, Barker CA. Carbohydrates of living tissues. Van Nostrand Co., London, 1962.
7. Tsirelnikov NI. Histophysiology of human placenta. Science (Siberian branch), Novosibirsk, 1980.