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*Histological and ultrastructural investigations of placenta villi in intrauterine
growth restriction of fetuses (IUGR)*

In the obstetric practice there is more and more frequently observed intrauterine growth restriction of fetuses (IUGR) in healthy mothers. Up to the present time attempts to explain pathophysiology of this phenomenon did not produce univocal results. As follows from the reports of other authors (5, 7, 8, 9, 10) the cause of this phenomenon are first of all different changes in placenta villi (9).

Therefore we decided to compare the placentas from normal pregnancy with those of the children with intrauterine growth restriction /IUGR/ by means of histological and ultrastructural investigations.

MATERIAL AND METHODS

The investigations were carried out on five placentas derived from normal pregnancies and five placentas derived from the pregnancies with intrauterine growth restriction of fetuses (IUGR). The fragments of placentas were fixed in glutaraldehyde and OsO_4 and embedded in Epon 812. The histological observations were carried out on semithin sections (1μ) which were stained with methylene blue and azur. The photographs were taken using the camera produced by the Carl Zeiss Jena firm.

Ultrathin sections were contrasted with uranyl acetate and lead citrate according to the Reynold's method. Subsequently, they were investigated by the electron microscope BS-500 (Tesla).

RESULTS AND DISCUSSION

Based on the investigated material we observed two types of pathological changes present in the placentas derived from the IUGR pregnancies. The first type was characterized by strong diminution of vessel number in villi and even their lack in others. Simultaneously in the stroma a large number of macrophagic (Hofbauer's) cells was present (Fig. 1). The syncytiotrophoblast structure was normal. Also a number of

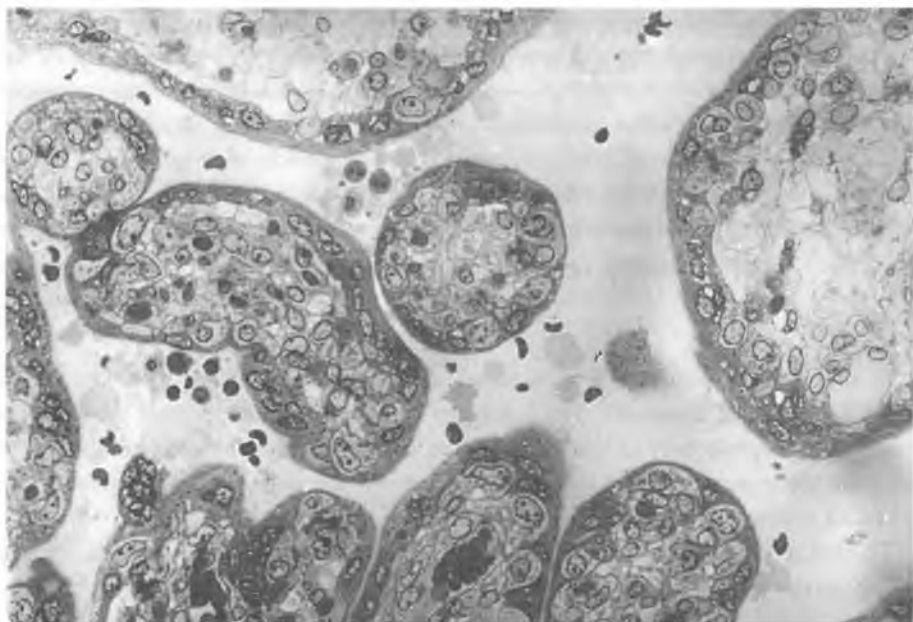


Fig. 1. IUGR. Lack of vessels in the villi stroma and a large number of macrophages are visible. Staining with methylene blue and azur. Magn. ca 400 x

pinocytic vesicles was similar to that in the control. Salafia et al. (10) report that in the pregnancies with the IUGR there are observed disturbances of blood flow, hyperplasia of the vessel media membranes and overgrowing of their lumen. Simultaneously other pathological changes like haemorrhagic inflammation of media membrane of vessels, intravessel thrombosis and also villitis (8) are reported. The cause of vessel lack in the villi according to Redline et al. (6) is thrombosis of the large fetus vessels in the placenta. Then greater probability of birth of IUGR child occur. Insufficient blood supply is responsible for placenta asthenia which significantly affects the fetus growth.

The second type of pathological changes which we observed referred to syncytiotrophoblast ultrastructure. This external cytoplasmatic membrane surrounding the villi in many places did not adhere to the own basal membrane. In this way near the basal membrane or next to it the natural large space was formed (Fig. 3) filled probably with the

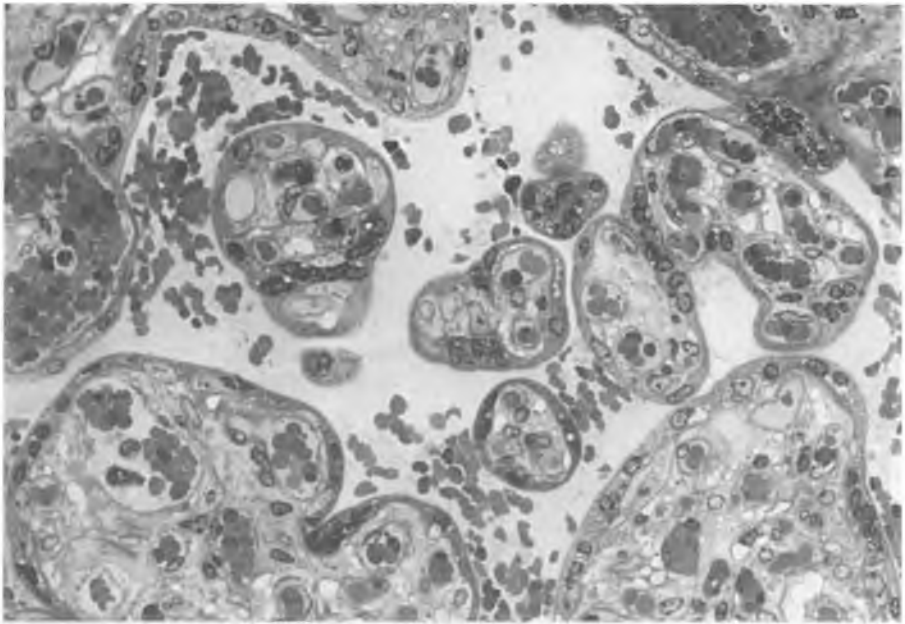


Fig. 2. IUGR. In the stroma of villi a larger number of vessels than in the normal placenta is visible. Staining with methylene blue and azur. Magn. ca 400 x

transudated liquid, which prevented the exchange between the maternal and fetal blood. The number of pinocytic vesicles in such a place was definitely smaller. This may be a result of syncytiotrophoblast ablation from the basal membrane in pemphigoid, the disease caused by the immunological phenomena. Then subepithelial bubbles filled with waterlight liquid are formed (3). Simultaneously in the placenta stroma the number of vessels was larger than that in the control and walls of these vessels were thinner. According to some authors this state indicates bad placenta perfusion and long lasting fetal hypoxia (1). The consequence of different pathological features observed in placenta villi in the IUGR pregnancies (2, 6, 9) is the disturbance of placenta – uterine circulation which discriminates the exchange between the fetal blood and the maternal blood.

It is difficult to find the reason for the changes we have observed. They are sure to affect generally the decrease in metabolism in the fetal body. It was described in the case of obscure intrauterine growth restriction (IUGR) of fetuses, limited only to placenta mosaicism (most often trisomia) (4). Also it is not possible to exclude the participation of complicated immunological mechanisms (expression of antigens of tissue agreement, immunosuppressing reactions) connected with conversion of endometrium to the decidual membrane (5).

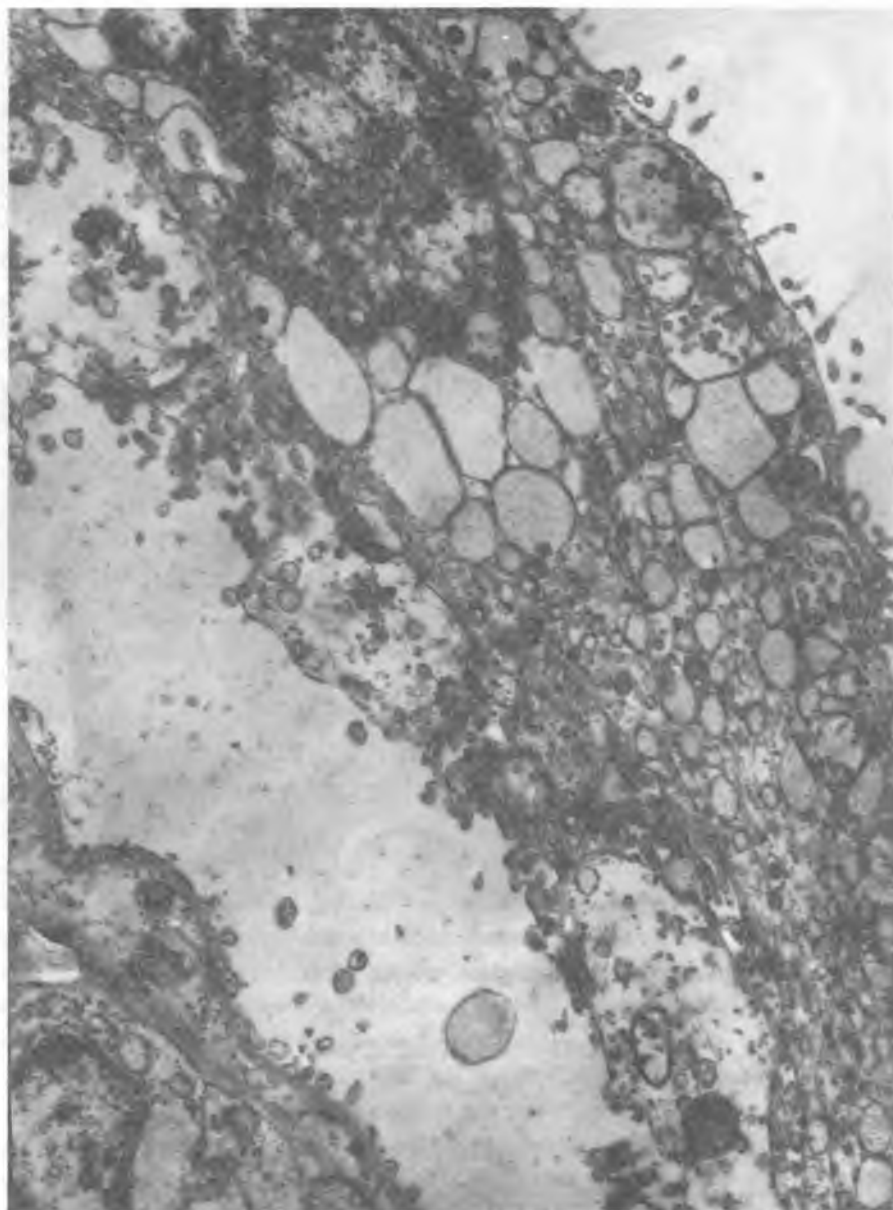


Fig. 3. IUGR. Between the syncytiotrophoblast and the basal membrane a wide space is visible. Reynold's method. Magn. ca 8000 x

CONCLUSIONS

In the intrauterine growth restriction of fetuses (IUGR) the following changes in the villi structure of placenta were observed:

1. Significant decrease in the number of blood vessels.
2. Increase in the number of macrophages in the stroma.
3. The presence in some villi next to the basal membrane of syncytiotrophoblast of a large space preventing the exchange between the maternal blood and the fetal blood.

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SUMMARY

The investigations were carried out on five placentas derived from normal pregnancies and on the five placentas derived from the pregnancies with intrauterine growth restriction (IUGR) of fetuses. Semithin sections were stained with methylene blue and azur and estimated by light microscope. Ultrathin sections were stained according to the Reynold's method and estimated by the electron microscope.

Two types of irregularity were observed: 1) lack of vessels with a concomitant increase of macrophage number in the stroma of villi, 2) an increased number of vessels and the presence in syncytiotrophoblast of a wide space near the basal membrane preventing the exchange between the maternal blood and the fetal blood.

Badania histologiczne i ultrastrukturalne kosmków łożyska w wewnątrzmacicznym zahamowanym rozwoju płodu (IUGR)

Badania wykonano na 5 łożyskach pochodzących z ciąży prawidłowych oraz na 5 pochodzących z ciąży z wewnątrzmacicznym zahamowanym rozwojem płodu (IUGR). Półcienkie skrawki barwiono błękitem metylowym i azurem i oceniano w mikroskopie świetlnym. Ultracienkie skrawki barwiono według metody Reynoldsa i oceniano w mikroskopie elektronowym. Wykryto dwa rodzaje nieprawidłowości: 1) brak naczyń z towarzyszącym wzrostem liczby makrofagów w zrębie, 2) zwiększoną liczbę naczyń i obecność w syncytiotropoblaście szerokiej przestrzeni w pobliżu błony podstawnej, utrudniającej wymianę między krwią płodową i matczyną.