

EXPERIMENTAL INFLAMMATION OF THE HEMOCHORIAL PLACENTAE

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It is known that inflammatory placental changes are the reason for many forms of gynecological pathology. Pathomorphological changes in the placenta in the form of acute or chronic inflammations are observed during maternal infectious diseases: pregnancy toxemias, heart imperfection, kidney diseases, etc. There are indications that in these cases there are considerable changes in trophoblastic enzyme systems [6, 8] and in the permeability of the connective tissue of the fetal placenta [2]. All of the above data were obtained during investigations of the placenta at the height of the operation and do not give presentations concerning the peculiarities of inflammatory reaction in placental tissues.

Thus it appeared expedient to study placental inflammation in an experiment on animals with hemochorial type of placenta. During the past few years attempts have been made in this direction [3, 5, 7], but the results were contradictory in many respects and did not give the systematic characteristics of the inflammatory reaction of placental tissues.

EXPERIMENTAL METHODS

White rats were utilized in the experiments for the study of the placental inflammatory reaction. The inflammation was produced by introducing a foreign body into the placenta of 16-18 day embryos. For this purpose, the placenta together with the uterus were pierced with a silk thread which was left in the traumatized portion; this also accomplished the fixation of the placental disk. Altogether, 25 animals were operated on. The placenta was studied in 12, 24 hours and 2, 3 and 4 days after introduction of the foreign body. The animals were killed by bleeding, after which the placenta, with the corresponding part of the uterus, was fixed in 12% formalin. Serial paraffin sections were stained with Ehrlich's hematoxylin-eosin azure 2-eosin and picrofuchsin. The inflammatory reaction developed differently in the fetal and maternal portions of the placenta. For this reason it is expedient to present separately the results of the investigation on the labyrinthic and extralabyrinthic portion of the placenta.

EXPERIMENTAL RESULTS

Inflammatory reaction of the extralabyrinthic portion of the placenta. During the first 12 hours after introduction of the foreign body the surrounding tissues were subjected to destruction. Wide portions of the cytotrophoblast, during this stage, were represented by a structureless basophilic mass. Among the disintegrated and changed elements there were encountered individual surviving cells and even cells in mitotic division. The whole marginal zone was infiltrated with special leucocytes. In portions bordering with the marginal zone there was observed clearly expressed hyperemia, which was accompanied by hemorrhages and infiltration by leucocytes of the cytotrophoblast of this region. Proliferation in this region was expressed very weakly; infrequently in the cytotrophoblastic elements there were encountered amitosis and binucleated cells. Mitosis was absent.

At the end of the first day the marginal zone was still represented by changed cytotrophoblastic elements. Their cytoplasm was poorly stained and strongly vacuolated; the nuclei were shrunken and deformed. In many cells the nuclei were in the state of caryorexis or were completely absent. In the region of extravasation there could be observed a large number of round or polygonal basophilic cells with a vacuolated protoplasm and compact nucleus, situated predominantly eccentrically; their cytoplasm there were encountered phagocytized erythrocytic fragments. The topography, relation to stains, and morphology of these elements permitted one to consider them as transformed decidual cells, which under inflammatory conditions acquired phagocytic ability. The marginal zone was abundantly infiltrated with leucocytes, predominantly of the special variety, with strongly segmented nuclei. Among the necrotic cytotrophoblastic elements there were encountered large cells with peculiar nuclei; instead of the large nuclei characteristic for these cells, in the cytoplasm was situated a group of small nuclei, surrounded by a thin common membrane (Fig. 1). Genesis of these multinucleated structures could be treated as occurrences of endomitosis,

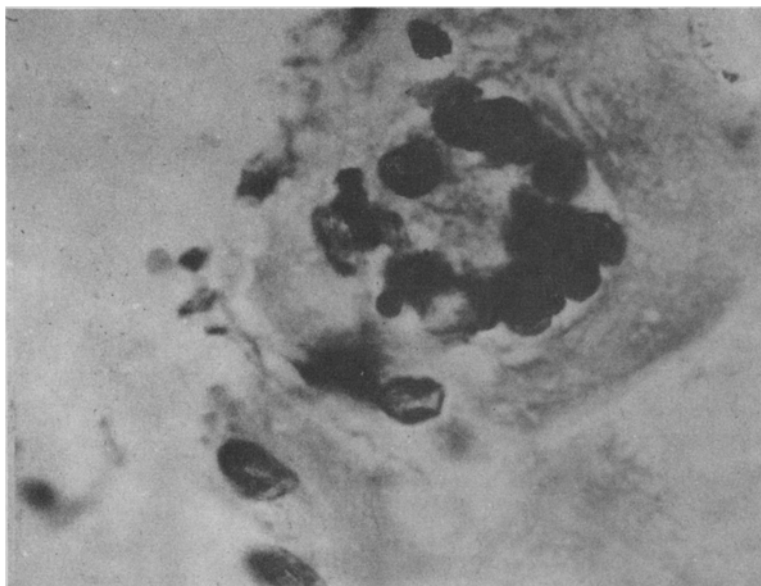


Fig. 1. Genesis of multinucleated structure from a gigantic cytotrophoblastic cell. Inflammation, 1st day. Staining with eosin-hematoxylin. Photomicrograph. Objective, 40 x.

previously described for the placenta [1, 4]. In cytotrophoblastic elements, bordering with the marginal zone, there were frequently observed cases of direct division, but mitosis was absent.

After two days the destructive processes spread through the cytotrophoblast situated beyond the limits of the marginal zone. Cytotrophoblastic elements took stains weakly, their borders were poorly expressed, cytoplasm was vacuolated, the nuclei looked like pale vesicles. The foreign body, the marginal zone, and the adjacent parts of the cytotrophoblast were infiltrated with special leucocytes. Decidual cells partly disintegrated, partly became rounded, and acquired the ability to phagocytosis. In the decidual cells and in the cytotrophoblastic elements amitoses were numerous; mitoses were absent.

On the third and fourth days the leucocytic reaction became weaker. Cytotrophoblastic cells on the border of the necrotic zone expanded strongly and acquired an elongated form. In the form of a narrow layer, they separated the zone of necrosis from the surrounding tissues and they were even wedged in the labyrinthic portion of the placenta (Fig. 2). Together with the above described proliferative occurrences there was observed here the formation of large multinucleated structures. These structures began to appear even during previous stages; they arose from cytotrophoblastic elements via nuclear fragmentation and via the previously described process of division, recalling the picture of endomitosis. In the cytoplasm of cytotrophoblastic cells there could be observed erythrocytic fragments.

Inflammatory reaction of the labyrinthic portion of the placenta. Twelve hr after the introduction of the foreign body, there was formed around it a marginal zone

with sharply dilated fetal vascular vessels filled with blood. Leucocytic reaction did not yet begin. Dystrophic changes of the elements in the chorionic symplast of the marginal zone were insignificant and were expressed as a lowering in protoplasmic basophilia and its vacuolization.

At the end of the first day, in the section belonging to the maternal portion, surrounding the foreign body there was formed a zone from necrotically changed placental tissue, infiltrated with special leucocytes with sharply segmented nuclei. Cytoplasm of the chorionic symplast of this zone was weakly basophilic and contained a fine azurophilic granularity. There were encountered sections where the chorionic symplast was completely necrotized, but the fetal vessels were preserved and were in contact with maternal blood. In the symplast, adjoining the zone of necrosis, the partitions were thinned out, the lacunae were sharply widened and filled with blood. The nuclei of the chorionic symplast of this zone were contracted, the protoplasm was stained weakly and vacuolated.

A somewhat different picture was observed in the region adjacent to the chorionic plate. The elements of this marginal zone were altered to a considerably lesser degree. In the marginal zone there were observed only small necrotic foci, in which were encountered surviving elements of the symplast. From the symplastic net there were isolated individual cells assuming a round or oval shape. Cytoplasm of these cells was sharply basophilic and vacuolated. The dark homogeneous nucleus contained one or two nucleoli. The fetal vessels of the marginal zone were preserved. Leucocytic reaction here was expressed more weakly than in the sections belonging to the maternal placenta. Symplastic rods, in the sections

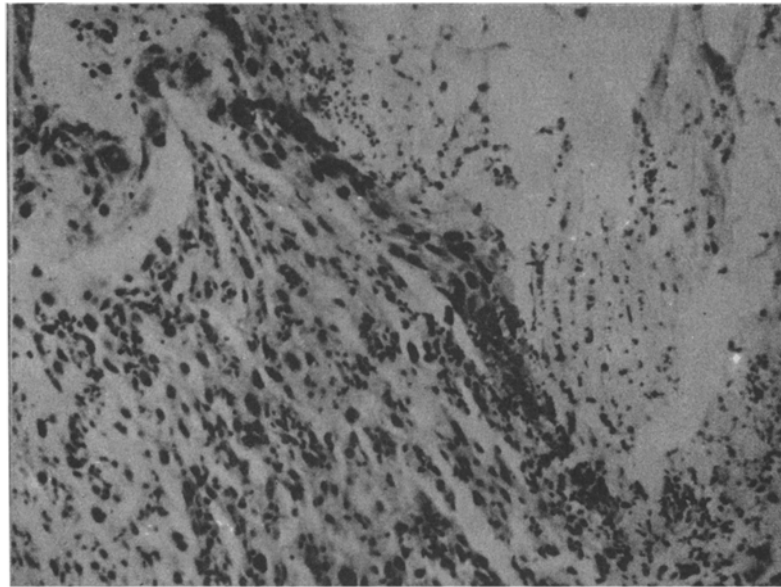


Fig. 2. Expansion of the cytotrophoblastic cells on the border with the foreign body. Inflammation on the third day. Staining with eosin-hematoxylin. Photomicrograph. Objective, 8 x.

bordering with the marginal zone, were thinned out and in places torn. Fetal vessels were dilated and filled with blood; extravasations were present. Symplastic protoplasm of this zone was sharply vacuolated. Sometimes there were observed in it erythrocytic fragments.

In two days the leucocytic reaction became weaker; in the marginal zone the leucocytes formed small aggregates. Placental tissue on the border with the foreign body underwent a quite peculiar change: the chorionic symplast began to expand, its rods became elongated and

acquired a fusiform shape, forming around the foreign body a lamellar capsule (Fig. 2). During the process of expansion there was observed a partial separation of the symplastic elements, acquiring cellular structure.

On the third and on the fourth day the foreign body was separated from the surrounding tissues by the continuing expansion of the chorionic symplast. The capsule thickened; trophoblastic elements entering into its composition acquired a more compact distribution. Some of them separated, but the majority remained in a syncytial

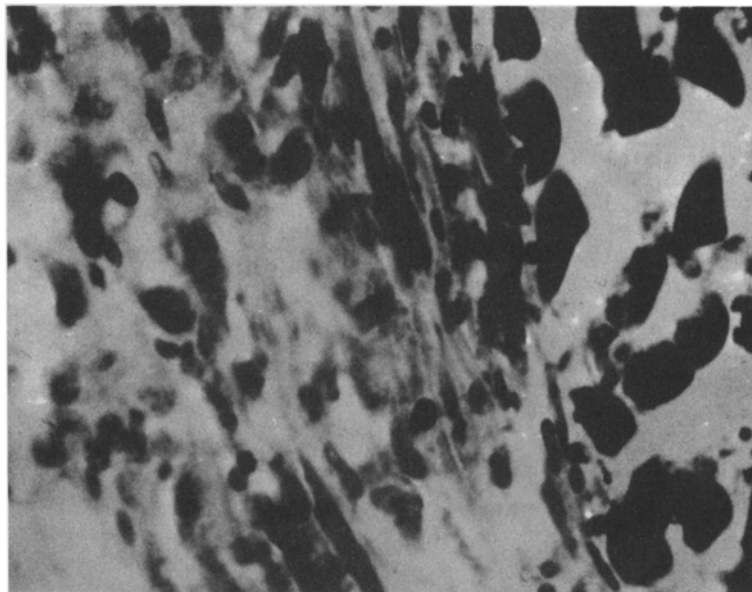


Fig. 3. The lamellar capsule formed around the foreign body by the elements of the chorionic symplast. Inflammation on the fourth day. Staining with azure-2-eosin. Photomicrograph. Objective, 40 x.

union with one another and with the unchanged labyrinth. It should be noted that in no inflammatory stage was there observed a noticeable reaction from the endothelium and the adventitial cells of the fetal vessels.

Comparison of the above-described occurrences for the separate parts of the placenta allowed us to conclude that under the conditions of experimental inflammation the most intensely reactive processes were expressed in the extralabyrinthine portion of the placenta and in the adjacent sections. Here, there was an earlier beginning and expansion through larger portions of the cytotrophoblast of the necrotic and dystrophic processes, the leucocytic reaction had a more active course, and first signs of proliferation from the cytotrophoblastic cells appeared more rapidly. In this respect, the study of the injured portion situated on the border of the labyrinthine and extralabyrinthine portions of the placenta is of considerable interest.

In two days there was noted a profuse leucocytic infiltration; from the site of the cytotrophoblast it was expressed particularly sharply. Leucocytes were distributed as large aggregates; on the border with the necrobiotically changed marginal zone they formed an actual leucocytic bank. In the marginal zone, from the side of the labyrinthine portion of the placenta, the leucocytic reaction became considerably weaker; the leucocytic bank was not formed, necrobiotic processes proceeded very sluggishly and occupied small sections.

It is in this way that the inflammatory reaction developed in the placenta as the result of introduction into it of a foreign body; in different portions of the placenta it proceeded unequally. The inflammation was expressed most actively in the extralabyrinthine portion of the placenta. A peculiarity of the placental inflammation was the absence of a typical macrophage phase. Separate and rare phagocytizing elements were derived from decidual cells and trophoblastic elements. The inflammatory reaction ended basically on the third day, whereupon at the end of this period there was activation of the proliferation in the trophoblastic elements. As a result of the active overgrowing of the foreign body by

cytotrophoblastic cells and symplastic rods there was formed a many-layered capsule separating the injured part from the surrounding tissues. In the encapsulating process of the foreign body, there took place isolation of separate elements of the chorionic symplast which had acquired a cellular structure.

SUMMARY

In experimental inflammation of placenta induced in white rats by passing a silk thread through the placental disk the most active reaction is shown by tissues of the extralabyrinthine portion. In the process of inflammation, there develops leukocytic reaction with almost no macrophagic response. Individual phagocytes are formed mainly from decidual cells. The foreign body is encapsulated by the cytotrophoblastic and chorionic symplast elements.

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