

Hematogenous placental infection in acute respiratory infections

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Abstract

The study focuses on the macroscopic and microscopic aspects of the placentae resulting from abortions or febrile births and their correlation with acute disorders of the upper or lower respiratory apparatus in pregnant women in various stages of pregnancy. The viral, bacterial or mycotic disorders were considered responsible for triggering septic abortion, premature or full-term deliveries, followed by septic complications of the child/fetus or of the mother. When the mother's acute respiratory infection is induced by highly virulent pathogens, in patients with low immunity or lacking adequate medical treatment, the infection may spread through the mother's bloodstream to the placenta. The study was conducted on 90 placentae. Microscopic analysis of the tissue samples revealed acute inflammatory infiltration. Two of the study cases should be mentioned here: a four-month pregnant woman suffering from septic abortion and a nine-month pregnant woman whose fetus died in the womb because of acute pneumopathy on a non-breathing lung. Both pregnant women had the same type of disorder and neither followed any medical treatment prescribed by a physician. The prevention of placental infection is closely connected to the prevention of acute respiratory diseases or their proper treatment after their onset.

Keywords: placental infection, septic abortion, fetus.

Introduction

The prevention of placental infection during pregnancy represents the main objective both of the obstetrician and for the physicians of other specialties, including family medicine. They should consider, together, every possible pathway for the spreading of the infection: ascending, on the genital tract; contiguous, from endometrial injury; transtubal or hematogenous. Ascending infection from the vagina or the neck of the uterus may be intensified by various septic maneuvers and transmembrane dissemination is the most common way. Regardless of the source of infection and of its pathway, prognosis is more severe when the placenta already has a pre-existing vascular pathology [1].

The presence of the same microbial, viral or parasitic germs both in the uterus and in the point of origin confirms the causal relation. When microbial virulence is high (pneumococcus, staphylococcus, clostridia), placental infections may lead to septic abortion, premature birth, intrauterine death, diseases/death of the newborn. Maternal mortality and morbidity increase concurrently. The pathogenesis of intrauterine infections may also include placental vascular anomalies [2], premature membrane rupture, prolonged labor, placenta praevia. Hematogenous placental infection is more common in the early stages of the pregnancy, but it may also develop later on. Medical practice showed that the frequency of acute respiratory diseases is high in pregnant women and many of the pregnancies cannot be carried full term. This aspect determined the authors

to focus on the macro- and microscopic aspects of the placentae and the umbilical cord [3] of these women and to correlate the possibility of the hematogenous dissemination of the infection from its starting point to the placenta.

Materials and Methods

The study was conducted over a 10-year period (2002–2011) in the Laboratory of Pathological Anatomy of Timișoara Forensic Institute, Romania. In this period, 90 placentae were studied: 11 (12%) from aborted fetuses, 28 (31%) from prematures, and 51 (57%) from stillborn babies. The macroscopic images were obtained by studying both sides of the placentae. Consequently, tissue samples that were histologically studied were taken from the umbilical cord and from various areas of the placentae that were most affected. The slides were stained with Hematoxylin–Eosin and were studied with an optic Olympus BX51 with 10× and 40× lenses. For example, the authors present two cases, one where the placenta was taken from the female aborted fetus of 27-year-old T.B. patient, and another where the placenta was taken from the female stillborn fetus of 33-year-old A.M. patient; necropsy was performed on both cases, at the Timișoara Forensic Institute, to determine whether the death was pathological or violent. Both events took place in 2011.

Results

The placentae resulting from aborted fetuses, from prematures and from stillborn babies delivered at full

term were studied macro- and microscopically. We tried to differentiate pathological damage from injuries caused by violence. Of the 90 placentae, 79 (79%) were correlated with various pathological disorders and 11 (12%) with violence-induced injuries. The predominant pathology found in the placentae was represented by organic vascular and circulatory alterations, and

infections originating in various focal points, occurring in any stage of the pregnancy: intervillous blood stasis, also called aneurysmal hemorrhage, intervillous thrombosis, retroplacental hemorrhage, marginal decidual hemorrhage, recent placental infarction of the fetal facet, infarction of the maternal facet (Table 1, Figure 1).

Table 1 – The vascular pathology macroscopic placentae: number of cases

The vascular pathology macroscopic placentae	Normal in full-term placentae	Premature placentae	Placenta of aborting	No. of placentae
Intervillous aneurysmal hemorrhage (IAH)	8	10	9	27
Hemorrhage				
Retroplacental (HR)	2	9	13	24
Decidual marginal (HDM)	3	5	3	11
Intraplacental (HI)	3	4	2	9
Intervillous thrombosis (TI)	2	5	9	16
Infarction				
Fetus facet (IFF)	–	1	–	1
Maternal facet (IFM)	–	1	1	2

Microscopic aspects studied in the 316 fragments collected from the placenta reveals: fibrinoid degeneration, interstitial hemorrhage with villous hemosiderinic deposits, vascular thrombosis, recent infarction focal points, old infarction focal points, villous atrophies, intravillous or intervillous granulocytic inflammatory focal points, intravillous, extravillous or intravascular acute lympho-plasmocytic inflammatory focal points (Figure 2).

The macroscopic aspects found both on the placenta of the aborted fetus and on the placenta of the stillborn baby show pathological damage extended both to the deep parenchyma and to its facets. The placenta of the aborted fetus shows, on the maternal facet, old infarctions extended to more than half of its surface, recent infarctions, severely impaired vascularization in the areas with old infarctions as well as turgescient vessels in the thrombotic areas. The placenta of the stillborn baby shows, on the maternal facet, signs of marginal chronic infarction, acute infarctions and multiple disseminated thrombosis, hemorrhagic focal points, while on the fetal facet it presents a severely impaired vascularization and subchorial fibrin deposits.

In both cases, the macroscopic aspects are the result of the alteration of the placental vessels secondary to the hematogenous spreading of the infection, which, eventually, resulted in fetal death (Figures 3–6).

The microscopic aspects found in the histological samples show focal necrosis, acute intravillous inflammatory infiltration, which, when becomes intervillous, look like extensive abscesses. We also found necrosis of the villous trophoblast, hydropic degeneration, stromal inflammatory infiltration, Hofbauer hypercellularity, vascular endothelial proliferation, fibrin deposits on the villous surfaces, and intervillous thrombosis. Membrane damage as well as umbilical angiitis are characterized by the presence of diffuse inflammatory infiltration and diffuse interstitial edema. Based on these general morphopathological aspects, the placenta of the aborted fetus whose mother suffered from acute laryngitis showed acute granulocytic inflammatory infiltration. The second placenta, of the stillborn baby whose mother had interstitial pneumonia, had lympho-plasmocytic inflammatory infiltration (Figures 7 and 8).

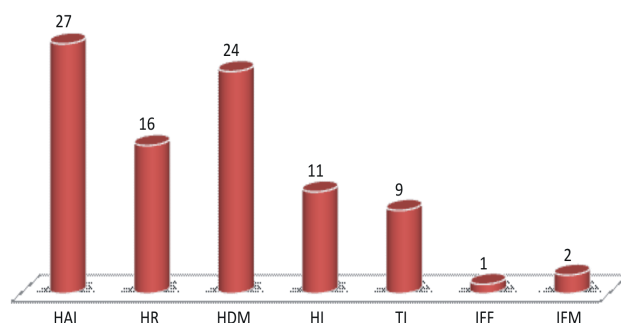


Figure 1 – Macroscopic aspects of placental vascular pathology. HAI: Intervillous aneurysmal hemorrhage; HR: Retroplacental hemorrhage; HDM: Marginal decidual hemorrhage; HI: Intraplacental hemorrhage; TI: Intervillous thrombosis; IFF: Recent placental infarction of the fetal facet; IFM: Infarction of the maternal facet.

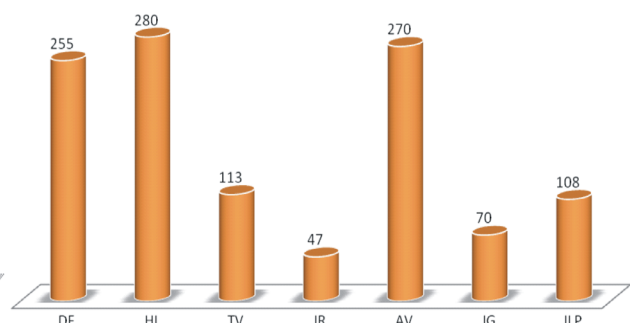


Figure 2 – Microscopic aspects of placental vascular pathology. DF: Fibrinoid degeneration; HI: Interstitial hemorrhages with villous hemosiderin deposits; TV: Vascular thrombosis; IR: Recent infarction focal points; AV: Villous atrophies; IG: Intra- or inter-villous granulocytic inflammatory focal points; ILP: Intra-villous, extravillous or intravascular acute lympho-plasmocytic inflammatory focal points.

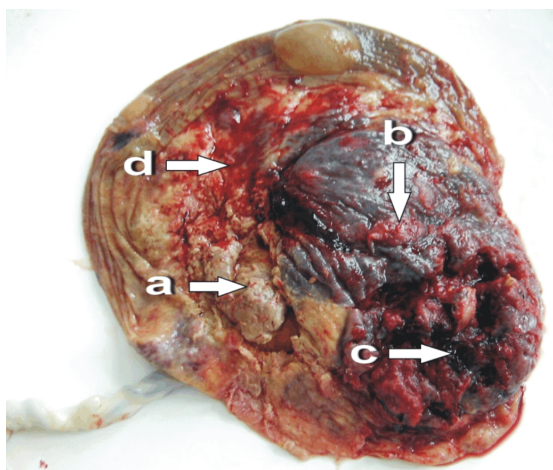


Figure 3 – The placenta of the aborted fetus shows, on the maternal facet: (a) Chronic infarctions; (b) Recent infarctions; (c) Thrombosis; (d) Hemorrhagic focal points.

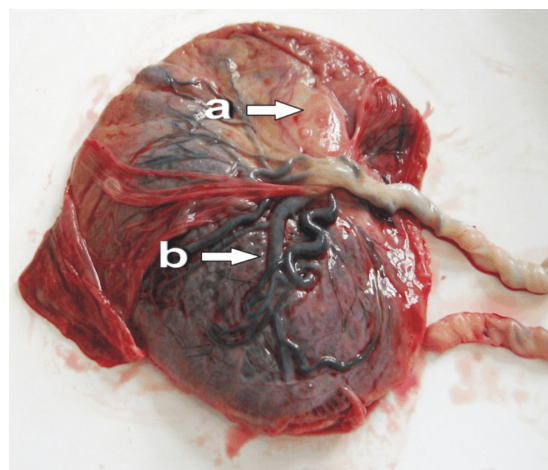


Figure 4 – The placenta of the aborted fetus shows, on the fetus facet: (a) Marginal chronic infarction; (b) Turgescent vessels in the thrombotic areas.

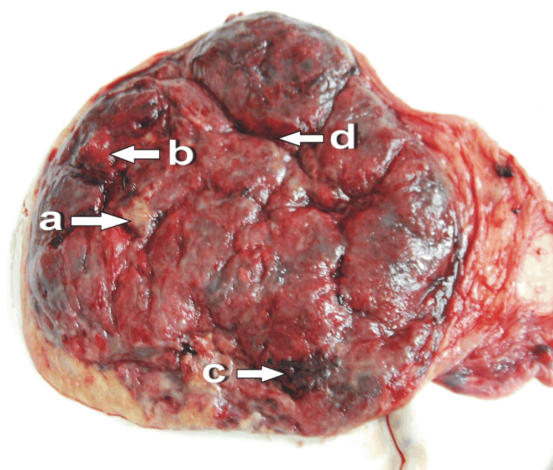


Figure 5 – The placenta of the stillborn baby shows, on the maternal facet: (a) Marginal chronic infarction; (b) Acute infarctions; (c) Thrombosis; (d) Hemorrhagic focal points.

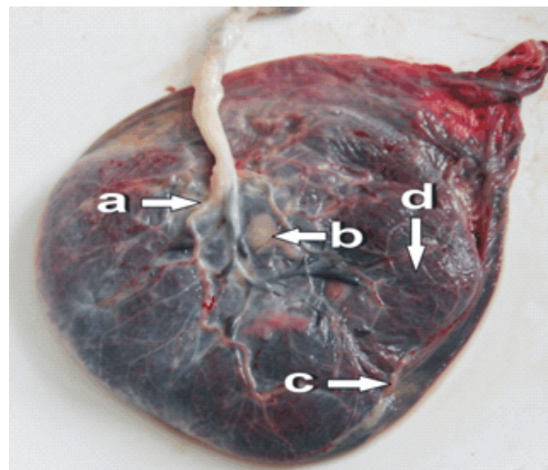


Figure 6 – The placenta of the stillborn baby shows, on the fetus facet: (a) Severely impaired vascularization; (b) Subchorial fibrin deposits; (c) Winkler-Waldeyer ring; (d) Recent infarction.

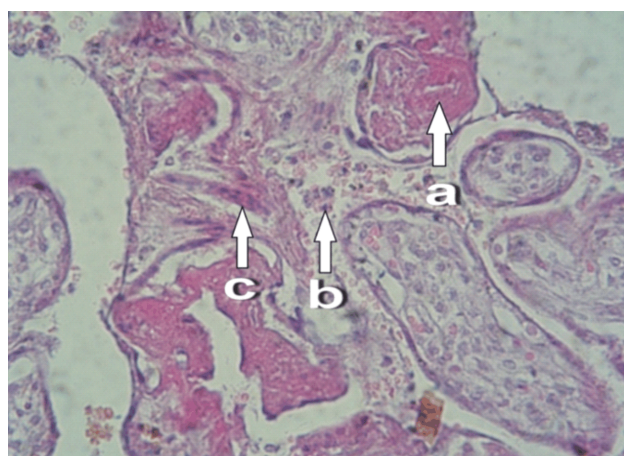


Figure 7 – (a) Fibrinoid degeneration; (b) Granulocytic inflammatory infiltration; (c) Necrosis of the villous trophoblast. HE stain, ob. $\times 40$.

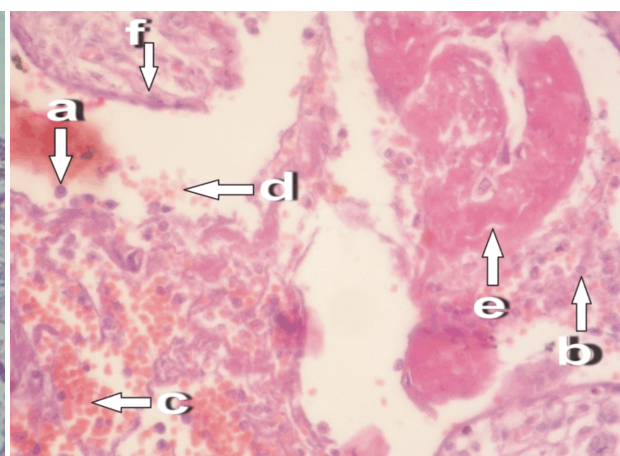


Figure 8 – (a) Plasmocytes; (b) Lymphocytes; (c) Hyperemia; (d) Hemorrhagic focal points; (e) Fibrin deposits; (f) Degeneration the villous trophoblast. HE stain, ob. $\times 40$.

Discussion

Vascular hypoxia leads to decrease development of vascular endothelium, of placental growth factor and of

fetal development [4]. Accentuation of hypoxia leads to microscopic and macroscopic changes in the placenta [5] sometimes responsible for the appearance of pre-

eclampsia [6, 7]. Development of chorionic villi from the placenta [8–10], the trophoblast [11–15], the arteriogenesis [16–19] and apoptosis [20] have been studied including the electronic microscope. Chronic pathological processes, such as diabetes mellitus [21], diseases accompanied by anemia [22], cause obvious changes to the placenta and fetus. Immunohistochemical researches were trying to reveal the trophoblastic changes in prematurity [23, 24]. Acute respiratory infections of the pregnant women being frequent, we searched for the hematogenous way of transmission of the infection to the fetus.

The vascular pathology involved [25] consisted in: intervillous blood stasis, also called aneurysmal hemorrhage, intervillous thrombosis, retroplacental hemorrhage, marginal decidual hemorrhage, recent placental infarction of the fetal facet, infarction of the maternal facet. Certain aspects may coexist in the same placenta. Certain macroscopic aspects are considered normal in full-term placentae, when the mother and child are healthy. They become pathological when they induce certain disorders or even the death of the fetus/mother. A severe intricate placental vascular pathology is accompanied by fetal death.

Microscopy shows aspects correlated with the literature data [26] from fragments taken various areas of the placentae resulting from spontaneous abortions, premature births or stillborn babies. The fragments studied by us showed fibrinoid degeneration, interstitial hemorrhages with villous hemosiderin deposits, vascular thrombosis, recent infarction focal points, old infarction focal points, villous atrophies, intra- or intervillous granulocytic inflammatory focal points, intravillous, extravillous or intravascular acute lympho-plasmocytic inflammatory focal points. The fragments obtained from the placentae resulting from full-term births presented the following pathology: fibrin deposits, edema focal points, recent interstitial hemorrhages, all considered normal aspects. Depending on the stage of pregnancy, certain microscopic aspects may be considered pathological or normal.

The development of acute granulocytic inflammatory or intervillous, extravillous or intravascular lympho-plasmocytic focal points made us look for the pathways for spreading the infection from various visceral points of the pregnant woman to the placenta. Possible infection pathways are: ascending, from the vulva or vagina, by contiguity from endometrial damage, transtubal or hematogenous, from a distance.

Of all the above, we were concerned with the possible hematogenous spreading of the infection from the upper or lower airways of the pregnant woman to the placenta, and we would like to describe two cases autopsied in the Timișoara Forensic Institute in 2011.

The patients' history showed that neither patient suffered from any chronic disorders only from acute disorders catalogued as common colds. Neither patient consulted her GP or her obstetrician. They self-administered anti-inflammatories, anti-cough medication and vitamins, as for a common cold, fearing that other medication might prove harmful during pregnancy.

In the third month of pregnancy, the patient T.B.

develops a fever of 39.8°C. After three days of treatment with anti-inflammatories, she starts hemorrhaging and shivering, her fever goes up to 40°C, and she aborts spontaneously. The patient's history, recorded upon admission to hospital, revealed that she also had a sore throat, swallowing and speaking difficulty, dry cough, symptoms that developed concurrently with the feverish episode and which were still present on discharge. Subsequently, the patient was diagnosed with acute laryngitis and was treated accordingly by an ENT specialist.

The second case, patient R.I., pregnant in nine months, gives birth to a stillborn baby. The patient's history reveals that a week prior to her admission to hospital the patient developed a fever of 38°C, shivering, severe dry cough and retrosternal pain. She took anti-inflammatories, anti-cough medication, vitamins, and she claimed that she could not feel the fetus moving a day before admission and therefore she decided to consult a gynecologist. She continued to present symptoms of viral pneumopathy during hospitalization, but the symptoms receded under treatment. Laboratory findings were irrelevant, both on admission and after discharge because, due to her symptoms, the patient was immediately treated with antibiotics.

In both cases, we consider that the events were a consequence of the hematogenous dissemination of the infection from the patients' airways to the placenta. The other causes of placentitis were excluded through anamnesis. Both cases were autopsied in the forensic department in order to exclude a possible violent death.

☞ Conclusions

The hematogenous spreading of the infection from the upper or lower airways to the placenta may occur in any stage of a pregnancy and depends, on the one hand, on the virulence of the pathogenic agent and, on the other hand, on the pregnant woman's immune response, her consulting a physician and on the administered medication. Placental hematogenous infections may induce spontaneous and/or septic abortions, premature births, fetal damage or intrauterine fetal death, or stillbirth. They increase the morbidity and mortality of the pregnant woman. The prevention of respiratory disorders in pregnant women and their proper treatment once they have developed decreases the rate of the hematogenous dissemination of the infection, as well as the duration of medical care.

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