

New emerging blood-borne hepatitis viral pathogens and the feasibility of passing thorough the placenta: an appraisal

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Summary

In countries with a high prevalence of blood-borne pathogen infections, transmission to infants commonly occurs from an infected mother during pregnancy. Maternal diseases caused by bacteria, viruses and parasites may sometimes be transmitted vertically. For many pathogens, several questions remain unanswered about the pathogenesis of vertical transmission, the relative risk associated with each mode of transmission, the rate of transmission from mother to child, and the factors that might contribute to the efficiency of transmission. There is also a need to quantify the contribution made by intrauterine versus intrapartum events. Here, the feasibility of some new emerging blood-borne hepatitis viral pathogens (hepatitis G virus, hepatitis SEN virus and hepatitis TT virus) passing through the placenta was analyzed based on a consideration of nanostructure level.

Based on the particle size as a single factor, it is hereby proposed that the transmission of the studied viruses via the placenta is difficult. Possible infection due to other processes, especially intrapartum infection due to micro-trauma delivery, similar to HIV infection, might be a more important route of vertical transmission.

Key words: Placenta; Passing; Hepatitis SEN, TT, HG virus.

Introduction

In countries with a high prevalence of blood-borne pathogen infections, transmission to infants commonly occurs from an infected mother during pregnancy. Maternal diseases caused by bacteria, viruses and parasites may sometimes be transmitted vertically [1, 2]. Physiologically, the placental barrier, composed of fetal endothelium and syncytiotrophoblasts and their fused basal laminae, plays an important protective role and the maternal blood bathes the syncytiotrophoblasts only [3]. Concerns still remain on the issue of transmission via the placenta during pregnancy.

For many pathogens, several questions remain unanswered about the pathogenesis of vertical transmission, the relative risk associated with each mode of transmission; the rate of transmission from mother to child, and the factors that might contribute to the efficiency of transmission [1]. There is also a need to quantify the contribution made by intrauterine versus intrapartum events [1]. Here, the feasibility of some new emerging blood-borne hepatitis viral pathogens (hepatitis G virus, hepatitis SEN virus and hepatitis TT virus) passing through the placenta was analyzed based on a consideration of nanostructure level.

Materials and Methods

Basic considerations of the nanostructure level for transmission of pathogens via the placenta

Pathophysiologically, the main basis for transmission of any pathogen to an infant via the placenta is that the pathogen can be circulated from the mother and pass through the placenta to the neonate.

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Determination of the possibility of transferring pathogens via the placenta

An important indicator for the possibility of transferring a pathogen is the relative size of the pathogen compared to the pores of the placenta. Previous information [3-6] on the topic was reviewed and further comparisons of pore size were performed.

Studied pathogens

Some important new emerging hepatitis viral pathogens were selected for further study. These pathogens included hepatitis G, hepatitis SEN virus and hepatitis TT virus.

Results

According to the review, the placenta pore size is about 10 nm in diameter [3]. The reported sizes of each virus [4-6], with comparison to pore sizes, are presented in Table 1. All viruses are larger than placenta pores. SEN virus has the least discrimination and hepatitis G virus has the most discrimination.

Table 1. — *Reported viral sizes and comparison with pore sizes.*

Virus	Size (nm) Comparison	Comparison with pore sizes	
		Comparison	Discrimination (nm)
Hepatitis G virus	100	Larger	90
Hepatitis SEN virus	26	Larger	16
Hepatitis TT virus	30	Larger	20

Discussion

It is clear that vertical transmission is an important mode of mother-to-child transmission for many infectious diseases. For HIV, hepatitis B and hepatitis C, vertical transmission is well documented. However, there are many newly discovered blood-borne pathogens at present. Knowledge of the vertical transmission of those viruses is necessary in obstetrics. The present article is a

study on the feasibility of some new emerging blood-borne hepatitis viral pathogens passing through the placenta. The basic consideration of the nanostructure of the virus and placental pores as reported in a previous study for HIV vertical transmission has been applied [7].

The hypothesis is based in part on the notion that hepatitis G, hepatitis SEN and hepatitis TT are in the blood [8]. Although it has not been proven, the possibility of all studied viruses to be transmitted via the placenta during pregnancy can be expected. Based on the size, molecules of studied viruses cannot directly diffuse across the placenta during pregnancy. However, according to the present study, none of the investigated viruses seem to be able to directly enter into the pores of the placenta. This fact confirms that although viruses can be detected in blood, intrauterine transmission via the placenta is very rare. There are some reports on vertical transmission of the studied viruses. For hepatitis G, vertical transmission is well defined [9, 10]. Considering SEN [11] and TT [12] viruses, there is also supportive evidence of vertical transmission. However, for all three viruses there has been no report of confirmed transmissions via the placenta. The time of transmission and intrauterine or intrapartum periods is still controversial.

Based on particle size as a single factor, it is hereby proposed that transmission of the studied viruses via the placenta is difficult. It can also be concluded that "pore size" in the placenta and viral pathogen size influence infectivity. Impairment of the anatomical structures during preterm might be another risk factor for getting infection via the placenta. However, any possible infection due to other processes, especially intrapartum infection due to delivery micro-trauma, similar to HIV infection, or intrauterine placental pathology might be a more important route of vertical transmission. Based on discrimination, the SEN virus seems to be more vulnerable

for transmission in those cases. Nevertheless, there are other factors that should be considered in the feasibility of transmission of the studied viruses.

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