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The Effects of HIV on Pregnant Women and the Role of the Placenta in Transmission to the Fetus: A Systematic Literature Review and Meta-Analysis

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Statement of purpose

- To investigate the effects of human immunodeficiency virus (HIV) on the health of pregnant mothers and their babies, as opposed to non-pregnant hosts.
- To investigate the transmission modes of HIV from Mother to Child (MTC), as well as the role the placenta plays in transmission and protection

Background and Significance

- Sexually transmitted infections (STIs) have major clinical significance around the world and are a topic that is actively researched. Specifically, human immunodeficiency virus (HIV) is a well-known STI that has been studied extensively and will be the focus of this review.

HIV Transmission:

- Vertical transmission in utero (during pregnancy), birth (delivery), and breast feeding.
- Direct transmission to Monocytes or T Cells through lesions in the placental barrier
- Transcytosis across trophoblast layer or infected cells
- Enters as maternal antibody complex
- During either late or early pregnancy is most likely
- Maternal viral load & antibodies play a role in transmission to infant

Treatments & Placental Protection:

- Anti-retroviral treatments helps prevent vertical transmission of HIV
- Placental macrophages play protective role, although their function is not well understood.
- Even with the increasing success of antivirals, pregnant women who are HIV-positive have a higher incidence of preterm and underweight babies.

Objective

- The main objective of this project is to create a systematic review on the impacts of HIV on pregnant women, transmission from mother to child, and how the placenta plays a role in protection of the fetus.
- To guide clinical practice for treatment and prevention of HIV effects in women and fetuses

Methods

- Accumulation, filtration, and analysis of scientific reviews using a bank of keywords relevant to the proposed study (Figure 1).
- Input keywords into Web of Science search engine
- Keywords were added or exchanged until there was a return of 20-40 relevant articles
  - Final keywords were “pregnant, HIV, transmission, placenta” with a return of 26 accessible reviews.
- Selected articles were then added to a database, Mendeley, accessed by all the group members.
- Articles were read by all group members and filtered based on inclusion and exclusion criteria
  - Articles were included based on if they discussed the topics of placental transmission of HIV, detrimental effects to mother and child, as well as some treatment methods
  - Articles were not excluded based on age of an article
  - Post filtration, this project had 16 included review articles
- Group members then read the included articles in full, compiling relevant data and information into a shared database amongst group members.
- Final data included information on the types of adverse effects found in mothers and babies, as well as the mode of transmission between mother and babies focusing on placental transmission, possible birth defects, occurrence of infection in pregnancy, and health of infected pregnant mothers versus health of non-pregnant hosts.

Figures

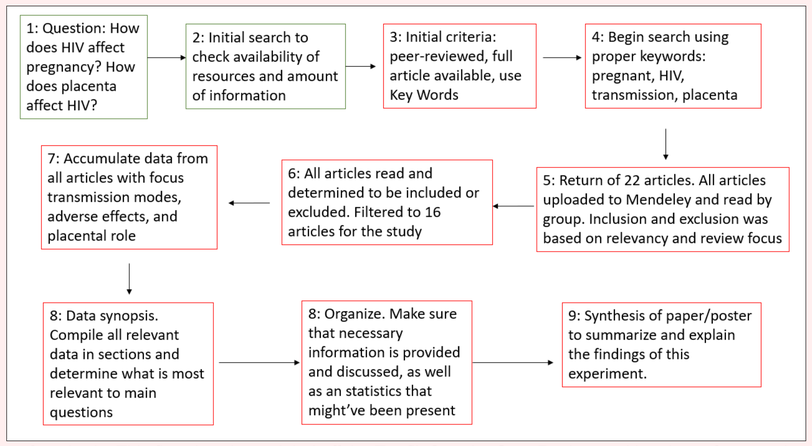

Figure 1. Flowchart of methods. This flowchart is modeled off the Tawfik Step-by-Step Review and has been formatted to be applicable to this research topic. It illustrates a brief overview of the methodology used to collect and synthesize information.

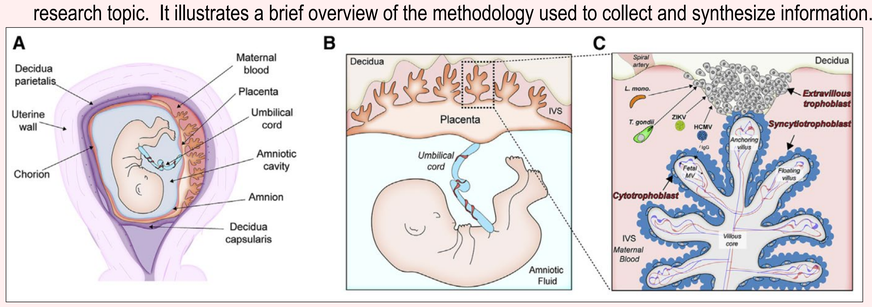

Figure 2: The structures of the placenta during pregnancy. This is referenced in an Arora et. al. which discusses vertical transmission of microbials via the placenta .

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Results & Discussion

- HIV positive pregnant women are at increased risk for negative perinatal outcomes, including low birth weight
- High levels of certain cytokines create a "placental barrier" effect by producing a protective environment that can control the spread of HIV in the placenta
- Some studies show that vitamin A deficiency can weaken the placental epithelium which increases risk of transmission to the fetus
- Anti-viral drugs administered to the mother can passively diffuse through the placenta, but the concentration of the drug as well as chemical properties such as polarity can affect diffusibility
- Hofbauer cells (placental macrophages) are a possible mode of entry for HIV
- In rare cases, mitochondrial toxicity syndromes can occur with antiretroviral treatment of combining multiple nucleoside reverse transcriptase inhibitors
- HIV infected macrophages create an inflamed uterine environment which may lead to negative perinatal outcomes

Conclusions

- HIV is a serious infection linked with debilitating conditions and birth defects
- The placenta acts as a natural barrier, but some infections can still cross it, including HIV
- Antiretrovirals are an important part of HIV treatment in pregnant women
  - Shown to lower mother to child transmission from 20% to <2%
  - Can pass through placenta to provide fetus with improved defense mechanisms

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