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VERTICAL TRANSMISSION OF TORCH INFECTIONS: OCULAR AND SYSTEMIC MANIFESTATIONS IN MOTHERS AND NEONATES

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ABSTRACT

This publication examines key issues in maternal and neonatal health, with a specific emphasis on sepsis, bleeding, and hypertensive disorders in pregnancy. It underscores that maternal sepsis, difficult to measure because of different definitions for diagnosing maternal sepsis, continues to be an important cause of maternal death; particularly in low resource settings. Preeclampsia (severe high blood pressure) and postpartum hemorrhage are among the leading causes of maternal deaths and mother's requiring ICU admission in pregnancy. The text highlights that reductions in sepsis-related mortality in the general population do not necessarily translate to pregnant women due to specific pathological alterations. The publication also highlights the very high rates of maternal and neonatal mortality in low and middle-income countries, particularly Sub-Saharan Africa and Southern Asia. Some of the factors that have attributed to these results include poor access to good-quality health care, lack of infrastructure, poverty, and absence of trained attendants at birth. The importance of package-based approach through enhanced antenatal care, skilled birth attendance, emergency obstetric care, as well as early interventions such as antibiotics and antihypertensives and timely management of pregnancy and labor is emphasized to combat maternal and neonatal morbidities and mortalitieshigh.

Keywords: *Maternal Mortality, Neonatal Mortality, Sepsis, Postpartum Hemorrhage, Preeclampsia, Developing Countries, Healthcare Access, Skilled Birth Attendance.*

INTRODUCTION

TORCH infections, including toxoplasmosis, rubella, cytomegalovirus, herpes simplex virus, and syphilis, are a group of congenital infections that have wide implications for fetal and neonatal morbidity and mortality (Eng & Butler, 1997; Supit, 2021). Vertical transmission is still a major route for spread of these infections, as this mode contributes significantly to worldwide burden of congenital diseases (Kazibwe et al., 2025). The pathogenesis of TORCH infection is multifaceted and is affected by variables including the timing of the maternal infection, the specific pathogen, maternal immune response, and the gestational age of the fetus (Santis et al., 2012). The multifactorial nature of vertical transmission should be well understood in order to develop active prevention, early diagnosis and a timely intervention, to minimize the severe damage on both maternal and neonatal health that these infections produce. Preterm birth complications, hypoxic ischaemic encephalopathy and infections are major contributors of neonatal mortality (Mwaniki et al., 2012). > 300,000 maternal deaths

and >11% of these are due to infectious causes, and ~ 1 million fatalities of newborns within the first week of life due to infections (Desale et al., 2016). Congenital infections which are a part of vertical transmissions might result in various undesirable outcomes such as pregnancy loss, stillbirth, congenital malformations and sequelae of long-term neuro-logic effects in surviving infants (Kumar et al., 2022). A full understanding of the mechanism of vertical transmission will be important in the development of focused interventions to protect maternal and infant health on a global scale from these preventable infections.

TORCH Infections in the mother and Fetus

Toxoplasmosis

Newly acquired T gondii infection in the mother is responsible for approximately 1 in 1000 deliveries in the United States (Gilbert-Barness, 2010). It is often asymptomatic, however, lymphadenopathy or mononucleosis like syndrome can be observed (Garcia-Flores et al., 2022). The consequence of congenital toxoplasmosis in the neonate varies between subclinical infection and life-threatening systemic disease. Hydrocephalus, chorioretinitis, and intracranial calcifications are the so-called triad of congenital toxoplasmosis but are more frequently seen in severe cases. Ocular involvement, mostly chorioretinitis, is the most characteristic feature of congenital toxoplasmosis and may cause high-grade visual impairment if not treated. Other possible signs include hepatosplenomegaly, jaundice, thrombocytopenia and neurological abnormalities including seizures and developmental delay.

Rubella

In the fetus, rubella can be fatal, and congenital rubella syndrome occurs in 80-90% if the exposure is in the first trimester. The burden has decreased with the introduction of the rubella vaccine. Eye findings of congenital rubella syndrome are cataracts, glaucoma, salt-and-pepper retinopathy. Cardiac anomalies such as patent ductus arteriosus and pulmonary artery stenosis are frequently seen in affected individuals. Sensorineural hearing loss is also a common consequence of congenital rubella infection and is associated with long-term communication and developmental issues. Microcephaly, developmental retardation, hepatosplenomegaly, and thrombocytopaenia are other possible presentations.

Cytomegalovirus

Cytomegalovirus is the most common congenital infection in the world, affecting approximately 0.2% to 2.2% of live births. The majority of maternal CMV infections are asymptomatic and vertical transmission can follow either a primary or recurrent maternal infection, although the risk is greater with primary infection. The clinical spectrum of congenitally acquired CMV infection ranges anywhere from asymptomatic infection to severe multisystem disease. Conjugated hyperbilirubinemia is common in symptomatic infants with symptomatic congenital CMV infection (Boppana et al., 2013). Eye complications include chorioretinitis and optic atrophy, with possible visual loss. Sensorineural hearing loss is the most frequent long-term outcome of congenital CMV infection, with an incidence of 10% to 15%. Neurological sequela, microcephaly, developmental delay, and seizures were also identified in symptomatic infants (Vijayalakshmi & Gilbert, 2018).

Herpes Simplex Virus

Neonatal herpes simplex virus infection is a rare condition with an estimated prevalence of 1/3,000-1/10,000 live births. Transmission and delivery HSV infection is commonly contracted during birth from exposure to infected maternal genital secretions. The newborn with HSV infection can have one of three presentations: disseminated disease, encephalitis, and skin, eye, and mouth disease. Neonates with HSV infection can have involvement of the eye, with conjunctivitis, keratitis, and chorioretinitis, which may result in visual loss. Encephalitis is a grave complication of neonatal HSV infection with neurologic sequelae. Disseminated disease occurs when organs such as the liver, lungs, and brain are affected, and has a high mortality rate.

TORCH Infections: An Overview

TORCH (Toxoplasmosis, Other [syphilis, varicella-zoster, parvovirus B19], Rubella, Cytomegalovirus, and Herpes simplex virus) infections are a group of pathogens that threaten both maternal and fetal health (O'Connor et al.,

2007). These infections may cause a diverse range of complications, such as fetal death, premature delivery, and lasting neurological and developmental effects. The nature and severity of TORCH infections can be influenced by the gestational age at which infection occurs, the pathogen involved and the immune status of the mother. The crossroad between genetic, immunologic and environmental factors during pregnancy affects the susceptibility of the fetus to congenital infections and its future well-being.

The child will never stop being premature and there is a higher prevalence of different ophthalmic deficiencies in the risk kids (O'Connor et al, 2007). Preterm births come with a burden of problems like retinopathy of prematurity, and preterm babies are much more likely to suffer disabilities including visual impairment, than healthy full-term counterparts (Vijayalakshmi & Gilbert, 2018). Visual functional impairments in preterm cohorts are not limited to visual acuity and affect functional capabilities in different respects and in particular also participants with normal visual acuity (O'Connor, 2011). Prematurely born are characterized by reduced visual function also in the adulthood (Pétursdóttir et al., 2019).

Subnormal MRI findings are associated with reduced visual acuity in preterm infants at term equivalent age (Wirth et al., 2018.). There is disturbed development of the peripapillary region in prematurely born infants, with a thicker central macula in preterm as compared with term-born children (Åkerblom et al., 2016). Prematurity complicates susceptibility to suffering ophthalmological and neurodevelopmental diseases.

The visual system of premature infants is sensitive to the premature birth effect and may lead to subtle neurological development and function changes (Madan et al., 2007). Subtle structural abnormalities of the central retina may occur in children born preterm but are not always well correlated with visual function (Fielder et al., 2014).

Mechanisms of Vertical Transmission

Vertical transmission of TORCH agents is mediated by various mechanisms including transplacental passage, ascending infection, or intrapartum exposure. Transplacental transmission is the passage of infectious agents through the placenta from the maternal blood into the fetal blood leading to congenital infection. Ascending infection is defined as passage of pathogens from the lower genital tract into the amniotic cavity, with subsequent fetal exposure and infection. Intrapartum transmission occurs during labour with the infant exposed to infected maternal secretions or blood in the birth canal.

Systemic Manifestations in Neonates

Systemic manifestations of TORCH infection in neonates can be manifold and include hepatosplenomegaly, thrombocytopenia, anemia, bilirubinemia, and neurological abnormalities. Neurologic complications include microcephaly, hydrocephalus, seizures, and developmental delay. The severity of systemic disease can vary depending on the specific pathogen, gestational age at infection, and immune response of the neonate.

Maternal Considerations and Prevention Strategies

Maternal well-being is a significant factor in the prevention of vertical transmission of TORCH infections. It is very important to achieve prenatal screening of TORCH infection in order to find and identify high risk women and intervene. Maternal infection and congenital transmission caused by rubella and varicella-zoster infection may be prevented with vaccination.

Ocular Manifestations of Congenital Infections

The ocular manifestations of congenital infections transmitted vertically by pathogens may be mild to severe, and significantly interfere with visual development and function (Repka, 2002).

Systemic Manifestations of Congenital Infections

Systemic manifestations in neonates with the TORCH complex infections are varied in life-threatening clinical presentations that affect several organs leading to a high burden of morbidity and mortality. Early–onset sepsis is most commonly due to vertical transmission of infection to the neonate during delivery, or from retrograde migration of pathogens from the vagina/cervix to the uterus and amniotic fluid (Raturi & Chandran, 2024). Early-onset sepsis is usually caused by transplacental or ascent infections from the mother genital tract and late-onset sepsis is associated with exogenously

acquired nosocomially or communally organisms after birth (Dong & Speer, 2014).

Two types of neonatal sepsis have been defined: early-onset sepsis (EOS), that is sepsis diagnosed within the first 7 days of life, and late-onset sepsis (LOS), that is sepsis diagnosed after 7 days of life (Cortese et al., 2015). Prevention, early diagnosis, correct use of antibiotics, and the provision of supportive care immediately are crucial for preventing serious complications or death (Mahmoud et al., 2023). Both maternal and child factors as well as environmental exposure increase the risk for infection and a multifaceted approach of measures for prevention, careful clinical and microbiological evaluation of the newborn, as well as early treatment are necessary to avoid deleterious outcome (Camacho-González et al., 2013).

Neonatal sepsis is a challenging condition to diagnose due to the nonspecific features of temperature instability, respiratory distress, feeding intolerance, and signs of systemic inflammation (Shane et al., 2017). Neonatal sepsis clinical sequelae include bronchopulmonary dysplasia, patent ductus arteriosus and necrotizing enterocolitis (Röder, 2017). Early recognition and intervention with appropriate antimicrobial agents and supportive care can reduce mortality from sepsis (West & Peterside, 2012).

Discussion

Sepsis represents the leading cause of maternal mortality in the USA (Bauer et al., 2023). The exact incidence of maternal sepsis is challenging to calculate due to differences in diagnostic definitions and reporting, however, recent figures are estimated to be between 0.5 and 8 per 10,000 pregnancies (Fleischmann-Struzek et al., 2021; Sands et al., 2022). Sepsis is one of the leading causes maternal death, responsible for 11% of maternal deaths (Woodd et al., 2019). Success in reducing sepsis related death in the general population may not be transferable to pregnant women who have their own physiologic alterations and diagnostic challenges (Chen et al., 2021). Puerperal sepsis is a major cause of maternal mortality, especially in developing countries (Kwast, 1991). Although evidence is scarce, the risk is increased in developing countries where sterile techniques are not well adhered to and in which antibiotics are less available (Conroy et al., 2012). Infections drive up to 10% of maternal deaths worldwide (Zhang et al., 2024). This percentage is, however, much higher in the developing world where it contributes towards 25% of maternal mortalities. Hemorrhage, hypertensive disease and infection combined are responsible for over half of the maternal deaths in the world (Say et al., 2014). Poor patient recognition limits timely interventions, such as induction of labor, antihypertension, misoprostol, UAE, and antibiotics, which are essential in preventing maternal death (Nathan et al., 2018). Postpartum hemorrhage is still one of the most common causes of maternal death worldwide, contributing to 25% of maternal deaths (Bul et al., 2018). It is defined as blood loss of ≥500mL after vaginal delivery or ≥1,000mL after cesarean delivery (Assefa et al., 2023). Obstetric haemorrhage is a leading cause of maternal death globally, responsible for 30% of all direct maternal deaths (Quiñones et al., 2010). Early detection and management of severe hypertension with prompt delivery and antihypertensives are important in the management of preeclampsia, a leading cause of ICU utilization including during pregnancy (Zeeman 2006). Early and prompt diagnosis of maternal sepsis is crucial for reducing maternal mortality (Say et al., 2014).

Conclusion

Despite progress, maternal mortality is still a major global health problem, with a higher burden in low- and middle-income countries (Alexander et al., 2021; Oyeneyin et al., 2019). In 2017, nearly 295,000 women died during and after pregnancy and childbirth (Gliozheni & Gliozheni, 2018). Some 94% of these deaths were in low and lower-middle-income countries. Approximately two-thirds of the global maternal deaths was from Sub-Saharan Africa (Teixeira et al., 2021). Deteriorating quality of care, lack of infrastructure and economic inequality are among the causes of maternal mortality. Tackling such determinants will involve collective action to reinforce health systems, increase skilled birth attendance, and address gender inequality. If recent trends persist, 48 million children aged under 5 years will die in this decade (between 2020 and 2030), with half of them being newborns (Kumari et al., 2023). Over 5 million children die each year before reaching their fifth birthday. Most take place in sub-Saharan Africa

and Southern Asia, about half among neonates (Hossain & Rahman, 2019; Nyfløt & Sitras, 2018). The worldwide infant mortality rate is 17 deaths per 1,000 live births. Africa south of the Sahara has the highest rate, 27 deaths per 1,000 live births. Nigeria has one of the highest maternal mortality ratios in the world, and maternal mortality is an obstinate challenge in Nigeria (Mohammed et al., 2022). This demonstrates the pressing need to enhance quality of care and interventions among mothers. Combating maternal mortality will involve a multi-dimensional strategy that will include focusing on enhancing access to good antenatal care, skilled birth attendance, as well as emergency obstetric care (Akinwaare, Williams, Li, Hossain, & Chen, 2021; "Postpartum Depression among Postnatal Women as a Result of Disrespect and Abuse during Labour and Delivery," 2020b; Saleem, Rouse, & McClure, 2014; Teferra, Alemu, Woldeyohannes, & Bayisa, 2012).

The restricted availability of skilled birth care and unfavourable socio-economic determinants result in adverse pregnancy outcomes, which are common especially in Sub-Saharan Africa (Camara et al., 2021). Worldwide, it is estimated that 303,000 maternal deaths took place in 2015, of which Sub-Saharan Africa was responsible for about 66 %. The rate of neonatal mortality is alarmingly higher in sub-Saharan Africa as compared to the developed world (Tembo et al., 2024). In this setting, one in nine children dies before attaining the age of five; more than 16 times that average found in developed areas (Tura et al., 2013). More than 98% of all neonatal deaths occur in developing countries thereby, emphasizing the pressing demand for better neonatal care in these regions (Walana et al., 2016). Although some progress in reducing neonatal mortality has been made worldwide, almost half of the 5.9 million under-five deaths in 2015 occurred during the first 28 days of life (Nyishime et al., 2018). Preterm birth, infections and birth asphyxia are some causes of neonatal deaths. South-Central Asian countries have the highest numbers of neonatal deaths, and rates are highest in sub-Saharan African (Lawn et al., 2005). Trained attendants are also present in only 35% of deliveries in South Asia and 41% in sub-Saharan Africa (Paul, 2005). In these countries, many births still occur at home with unskilled birth attendants.

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