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November 15, 2015

Bacterial and Viral infections in pregnancy

Viral Infections are common during a pregnancy and usually are well-tolerated, but several viruses are associated with increased risk of adverse prenatal outcome. Infections such as Syphilis during a pregnancy cause a significant burden of disease around the world. Congenital syphilis is associated with a multitude of adverse pregnancy outcomes and neonatal health complications. Then there are Infections like Gonorrhea and Chlamydia which are common sexually transmitted diseases that can cause significant long-term consequences if left undiagnosed or intreated. Virus's like Cytomegalovirus (CMV), Varicella-Zoster Virus (VZV, Chicken Pox), Parvovirus, and Rubella have the same symptoms as Influenza so it is hard to diagnose the issue until an outbreak occurs.

Cytomegalovirus is a DNA virus that is part if the herpes family. Transferred by infected secretion such as, blood, saliva, urine, or semen. CMV can reside inside the body dormant: occasionally reactivated. Signs and symptoms of CMV are flu like symptoms; Fever, chills, malaise (discomfort), and weakness. Less commonly patients present with pneumonia or hepatitis. Lab results will usually come back with Leukocytosis or the condition of having an excess amount of white blood cells. These white blood cells are responsible for immune response. There will also appear to be abnormal liver functions and shedding of the cervix. During a pregnancy CMV can cause an infection in the placenta. Dr. Nigro said

> *"CMV infections in pregnancy will lead to impaired oxygenation and nutrient provision, which can lead to growth restrictions and even death" (Nigro, 2011).*

Varicella-Zoster Virus also known as chicken pox is usually found in young children, however this infection can be acquired in adulthood especially during a pregnancy. Approximately 90% of the people that live in a developed country are immune to VZV, either because they have previously had VZV or because they have been vaccinated against it. VZV is also in the herpes family just like CMV, and it is acquired either by direct contact with vesicular lesions, or through airborne transmission. Signs and symptoms are headaches, fever, and weakness. The virus has an incubation period of 10-14 days, after which the characteristics diffuse, and fluid filled rashes appears. Afters a primary infection of VZV has taken place, the virus can remain dormant in a dorsal root in a ganglia (a cluster of nerves in the spinal column) and reactivates with stress, trauma, or immune compromise; this is known as shingles. During a pregnancy, primary varicella is low especially in developed countries. In rare cases, the infection would travel through the placenta wall and into the fetus. The risk of a spontaneous abortion, birth defects, growth restrictions, premature delivery, and fetal demise (growth) increases. If the virus is acquired closer to the due date it increases the potential of perinatal mortality. There is also Congenital Varicella Syndrome (CVS) that was first described in 1947 (Laforet, 1947) and can include effects on fetal skin (scarring), Microcephaly (small headed), hypoplasia (under development) of the limbs, and cataracts.

Parvovirus B19 is the only parvovirus that is known to infect humans. It's composed of a single strand DNA and causes a variety of pathology including sickle cell

disease, lack of red blood cell development, erythema infectionsum (reddening of the skin), myocarditis (inflammation of the heart muscle), and arthropathy (disease of the joints). One of the most common clinical manifestations of parvovirus is erythema infectionsum. The virus is transmitted through respiratory droplets and can cross the placenta and infect the fetus. Signs and symptoms can be shed before being clinically apparent; thus infected individuals may be able to transmit parvovirus before they know they have it. Other symptoms include flu-like symptoms and a “slapped-cheek” or “lace-like” rash around the mouth 2-5 days after exposure to the virus. followed by joint pain. “During a pregnancy the affect on the fetus is dependent on the gestational age” (Rodis, 1998). Infections in the first half of a pregnancy is associated with a worse outcome than in a later period.

Rubella also known as the German Measles or “the 3 day measles.” Rubella infections present as a mild self-limiting, and even subclinical illness and is actually less contagious than Measles or Influenza. Transmission occurs via respiratory air droplets and requires close contact. The virus enters through the respiratory tract and travels to the cervical lymph nodes, from there is enters the bloodstream and is disseminated throughout the body. The virus is present in secretions and blood, but takes several days (2-3 week incubation period) before clinical signs and symptoms are present. Signs and symptoms include low-grade fever, weakness, swollen lymph nodes, and a rash that lasts approximately 3 days. During a pregnancy, fetal transmission occurs via passage of virus from mothers blood to the placenta. Once the virus is inside the placenta it infects epithelial and endothelial cells and gains access to fetal circulation and

organs. Rubella induces change of cell growth leading to cell death, tissue necrosis (death of tissue), and organ hypoplasia (lack of organ development) with no treatment.

Syphilis is a systematic infection caused by the *Spirochete treponema palladium* and is transmitted sexually though contact with infected lesions. In *2007,* the World Health Organization (WHO) estimated that annually more than two-million pregnant women are infected with syphilis world wide (Newman, 2013). More than 50% of untreated pregnant women will have complications including stillbirth, neonatal death, premature delivery, low birth weight, and congenital anomalies (deriving from normality) (Hawkes, 2013). Neonatal syphilis include long-term health complications like deafness and neurological impairments. Italian physician Garpar Torella described signs of syphilis on the faces of nursing children. Although it was thought to be acquired from the "wet nurse," researchers eventually determined that the infection was acquired from the mother. It was not until the development of penicillia on 1943 that the rates of congenital syphilis in the United States began to decrease dramatically. More pregnancies are affected adversely by syphilis then are affected by infection with Human Immunodeficiency Virus (HIV) (Galvao, 2013). In 1986, the rate of congenital syphilis in the United States reached an 15-year peak with congenital syphilis affecting nearly 1 in every 10,000 live-born infants. In 2007 initiative for the Global Elimination of Congenital Syphilis aims to have syphilis testing rates at least 90% in pregnant women and to endure adequate treatment of at least 90% of seropositive (positive via blood) pregnant women by 2015 (Newman, 2013). Between 1991and 2005, the rate of congenital syphilis in the United States declined by 92.4% from a peak of 107.6 cases to 8.2 per 100,000 live births.

Treponema Pallidum is the only treponemal subspecies that readily crosses the placenta. It can gain access to the fetus as early as 9-10 weeks gestation, but characteristic clinical disease is not present before 18 weeks gestational (Genc, 2000, and Cunningham 2010). The risk of congenital syphilis is very high during the first 4 years following maternal infection. Transmission of syphilis can also occur during delivery in maternal genital lesions are present (Cunningham, 2010). Breast feeding doesn't lead to transmission unless infectious lesions are present on the breast. There are 4 stages of syphilis as seen on table 1.

Table 1

Stage of Syphilis	**Clinical Manifestation**
Primary syphilis	wart of the external genitalia, disease of the glands and lymph nodes.
Secondary syphilis	generalized rash, skin lesions, arthritis, gland disease
Latent syphilis (both early and late)	asymptopmatic
Tertiary syphilis -cutaneous disease -cardiovascular disease -central nervous system disease	Soft non-cancerous growth aortic aneurysm aortic insufficiency paresis seizures blindness dementia

Among women with untreated syphilis who deliver a term live-born infant, the risk of congenital syphilis in the infant if the mother has syphilis is 40%-50% for early syphilis and 10% for late syphilis (Norwitz, 2014). A systematic review found that pregnant women with untreated syphilis had a 21% increased frequency of stillbirths, 9.3% increased risk of neonatal death, and a 5.8% increase in preterm birth or low birth rate compared to women without syphilis (Gomez, 2013).

The presence of congenital syphilis in infants varies from minor abnormalities to serve system disease as seen in table 2.

Table 2

Phases of Congenital Syphilis	Clinical Manifisetations	Notes
Early congenital syphilis	Diffused rash mucous of the skin and membranes	Rhinitis is common (runny nose)
Symptoms before 2 years of age	“claw nail” deformity inflammation of the bone cartilage enlargement of the liver and spleen anemia	involves 4th and 5th digits
Late congenital syphilis	Hutchison’s triad: -intersitial keratitis (hardening of the eye) -dental defects -neural deafness	unilateral photophobia (light sensitivity) pain excess tearing blurred vision notched teeth
Symptoms after 2 years of age	neurosyphilis	least common

Treatment for syphilis is usually a heavy dose of antibiotics (penicillin), but cannot reverse any damage previously caused by the infection or prevent reinfection. Treatment strategies for different stages are shown on table 3.

Table 3

Syphilis Category	Treatment
Early syphilis (less than one year)	Benzathine Penicillin G, 2.4 million units IM (intramuscular) *some recommend a second dose in one week.
Latent syphilis (more than one year)	Benzathine Penicillin G, 2.4 million units IM (intramuscular) weekly times three doses.

Syphilis Category	Treatment
Nuerosyphilis	Benzathine Penicillin G, 2.4 million units IV (intravenous) every four hours for 10-14 days or aqueous procaine penicillin, 2.4 million units IM (intramuscular) daily and Probenecid, 500 mg orally four times daily for 10-14 days.

Both gonorrhea and chlamydia can be treated successfully and cured. However, if undiagnosed and untreated, these infections can lead to serious health complications. One major long-term consequence is Pelvic Inflammatory Disease (PID), leading to infection in the uterus, uterine tubes, and adjacent pelvic structures not associated with surgery or pregnancy. This occurs in up to 40% of women with gonorrhea or chlamydial infections. Women with PID can develop additional medical complications including ectopic pregnancy, infertility (seen in 20% of women with PID), and chronic pelvic pain (Guttmacher, 2009). Gonorrhea infections can become systematic, causing disseminated gonococcal infection (DGI). This condition often manifests in the skin and joints and can lead to septic arthritis. Occasionally, DGI is complicated by perihepatitis and, rarely, by endocarditis or meningitis. This infection must be treated in the hospital and scheduled regulation of antibiotic therapy (Miller, 2006). During a pregnancy Antenatal Gonorrhea/Chlamydial infections have an increased risk of premature rupture of membranes, premature delivery, and delivering a low-birth weight infant (Peipet, 2003). If a pregnant women has gonorrhea or a chlamydial infection present at the time of delivery, she can transmit the infection to the neonate. When maternal infection is present at the time of delivery, in 20%-50% of cases, neonatal chlamydial infections cause neonatal ophthalmia, which can lead to blindness, and also causing sepsis (CDC, 2010).

There are several options for treatment in the case of gonorrhea or chlamydial infections provided by the Center for Disease Control (CDC). These treatment options are indicated on table 4 with the alternate regimens for those allergic to penicillin, and for pregnant women.

Table 4

Infections	**Recommended Regimens**	**Alternative Regimens**	**Pregnancy**
Gonorrhea	Ceftriaxone, 250 mg IM, single dose plus either Azithromycin 1 gm or Doxycycline, 100 mg orally, twice a day for seven days.	Cefixime, 400 mg orally single dose plus either Azithromycin 1 gm orally in s single dose or Doxycycline 100 mg orally twice a day for seven days followed by TOC (test of Cure) in one week.	Same treatment plan, however you are subject to use Azithromycin instead of Doxycycline. Doxycycline is to be avoided in pregnancy.
Chlamydia	1. Azithromycin, 1 gm oral single dose (directly observed) 2. Doxycycline, 100 mg orally twice a day for seven days (test for pregnancy first, less treatment adherence)	1. Erythromycin base, 500 mg orally four times a day for seven days (with TOC in three weeks). 2. Erythromycin ethylsuccinate, 800 mg orally four times a day for seven days (TOC in three weeks). 3. Levofloxin, 500 mg orally every day for seven days (cannot be used during breastfeeding). 4. Oflaxacin, 300 mg orally twice a day for seven days (cannot be used during breastfeeding).	1. Azithromycin, 1 gm orally in a single dose 2. Amoxicillin, 500 mg orally three times a day for seven days (TOC in three weeks) 2nd line alternatives (with TOC in three weeks): 1. Erythromycin base, 500 mg orally four times a day for seven days or 250 mg orally four times a day for 14 days 2. erythromycin ethylsuccinate, 800 mg four times a day for seven days or 400 mg for 14 days

To conclude, bacterial and viral infections during a pregnancy if left untreated can lead to severe medical conditions harmful to the fetus. Viral infections are common dur-

ing pregnancy and usually well-tolerated, but several viruses are associated with increased risk of adverse perinatal outcomes. Syphilis infections during pregnancy causes a significant burden. Congenital syphilis is associated with a multitude of adverse pregnancy risks and neonatal health complications. Gonorrhea and chlamydial infections, although curable with antibiotics like syphilis, can cause long-term consequences if left undiagnosed and untreated. That is why it is important to raise awareness and decrease the percentage of infants effected by viral and bacterial infections each year.

Work Cited

Bard, Elizabeth. MD. and Harrington, Amy. MD. “Urogenital Gonorrhea and Chlamydia.” (2015). Rochester, NY. Print.

This case describes long-term consequences of untreated gonorrhea and chlamydial infections. It tells how gonorrhea and chlamydia are both successfully treated and cured. However, if undiagnosed and left untreated the risk for high end consequences and health risks. Although these infections can be treated and cured many of the medications used to do so are not to be taken during pregnancy or while breast feeding.

Chen-Olsen, Courtney. MD. and Seligman, S. Neil. MS. “Syphilis in Pregnancy.” (2015). Rochester, NY. Print.

This case study describes the pathogenesis associated with Syphilis, along with the outcomes associated Syphilis. It also interprets the fetal heart rate tracing of a pregnant patient with Syphilis. Pregnant women who are pregnant with Syphilis have a 5.8% increase of having a preterm birth of a infant with low birth weight compared to a women without Syphilis. A women with untreated Syphilis who deliver a term live-born infant, the risk of congenital Syphilis in the infant if the mother has Syphilis is 40%-50% for early Syphilis development and 10% of late Syphilis development.

Sheth, Tejas. MD. and Glantz, J. Christopher. MD. M.P.H. “Viral Infections during pregnancy.” (2015). Rochester, NY. Print.

This article describes the clinical characteristics of cytomegalovirus, varicella-zoster virus, and rubella in pregnancy. Developmental cells can become destroyed or harmed if a virus infects a pregnant mother. This cell death can also lead to vascular inflammation, this is associated with a higher risk of fetal infection. There are ways to test the risk of infection through the umbilical cord’s blood.

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