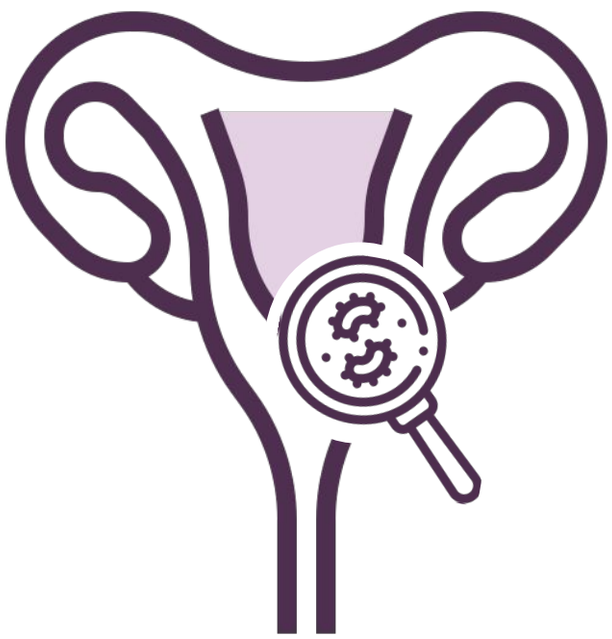
Transplacental infections



Editing File
Summary

MED439
KING SAUD UNIVERSITY

MICROBIOLOGY
Team 439

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Color index

- Girls' slides
- Main content
- Important
- 438 Drs' notes
- Boys' slides
- Extra
- Drs' notes

Objectives:

- To recognize the different types of infant infections.
- To know the major transplacentally transmitted pathogens causing congenital infections.
  - (Toxoplasmas, TP, ParvoV, VZV, Rubella V & CMV)
- To describe their structures.
- To know their major epidemiology features.
- To describe clinical manifestations of their congenital infections.
- To illustrate different laboratory diagnosis of maternal and congenital infections.
- To know their treatment and preventive measures.

Introduction

Terminology & Routes of transmission		
Classification [1]	**Timing of events**	**Mechanisms**
Congenital	**Intra-uterine** (In utero)	• Transplacental • Ascending infection
Perinatal	**Intra-partum** (During labour and delivery)	• Exposure to genital secretions and blood • Contact with infected material during delivery, faeces
Neonatal	**Post-partum** (After birth)	• Direct contact • Blood transfusion • Breastfeeding • Nosocomial

Risk of IUI & fetal damage depends on:

- Mostly due to viruses.
- Previously known as (**TORCH**) infections:
  - **T**= **T**oxoplasmosis (epidemiology is important)
  - **O**= **O**ther e.g. (Syphilis, parvovirus &VZV),
  - **R**= **R**ubella virus [2] (clinical features are important + screening is IMPORTANT)
  - **C**= **C**MV (importance of care after the baby is born/hearing loss screening)
  - **H**= **H**erpes (**H**epatitis & **H**IV)

Risk of IUI & fetal damage depends on:

- Type of Organism [3] (Teratogenicity)
- Type of maternal Infection (Primary [4] ,recurrent [5])
- Time during pregnancy [6] (1st,2nd,3rd Trimester)

Primary maternal infection in the first half of pregnancy poses the greatest risk to the fetus.

1. Classified based on the time of infection
2. The most important virus for prenatal **screening** , because it is preventable by vaccine.
3. Some organism more virulent than others. eg.(Rubella,VZV,CMV) are very virulent , While the others depend on the infection time either early or late in pregnancy.
4. Primary infection and 1st trimester of pregnancy are greatest risk for development serious infection to the baby.
5. Recurrent infection will not lead to any infection of the baby.
6. Toxoplasma commonly transmitted to fetus at the late stage of pregnancy, but the infection more severe at the early stage of pregnancy, While Rubella more common at early stage of pregnancy.

Congenital Infections

Common features of congenital infections

- **Intrauterine growth retardation(IUGR)**
- **Microcephaly** or hydrocephalus
- Hepatosplenomegaly(HSM)
- Fever
- Skin rash
- Jaundice
- Generalized Lymphadenopathy
- Thrombocytopenia may result in rash. There is also certain organ damage (eye ,ear and the heart)
- IgM, Persistent IgG

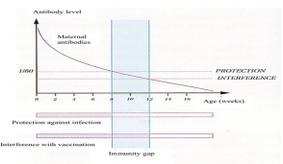
NOTE: Majority of Congenital infections are asymptomatic at birth however **some** develop mental retardation and hearing loss later in life. Preventative and therapeutic measures are possible for some of the agents

Risk of congenital infections

- Organism (Teratogenicity)
- Type of maternal Infection (primary or recurrent)
- Time during pregnancy (1 st,2nd,3rd Trimester)

Neonatal serological diagnosis

- IgM antibody.
- Absence of fetal IgM at birth doesn't exclude infection.
- Persistence of specific IgG antibody > 12 months of age.



Toxoplasmosis

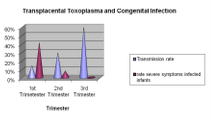
Clinical Features

- **Causative organism: Toxoplasma gondii**
  - Obligate intracellular parasite.
  - Definitive host is the domestic cat [1]

Epidemiology

Prof: Very important to remember

- European countries (ie France, Greece)
- Usually asymptomatic
- Most cases are due to primary maternal infection.
- Rarely, reactivation of a latent infection in immunocompromised pregnant woman
- **Infection (Transmission) rate higher with infection in 3rd trimester**[2]
- **Fetal death higher with infection in 1st trimester** [3]
  if the infection occurred in the first trimester, it will most likely lead to fetal death. However, fetus had a better prognosis if the infection occurred in the 3rd trimester (which is fortunately more common)
- Primary maternal infection in pregnancy



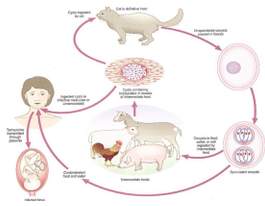
1. Small cat carry the parasite, and human acquired this parasite through the feces of cat esp.dry feces in the form of cyst flying through the air and aerosolized.
2. 80-90% and not affecting the fetus.
   Unlike rubella and parvovirus (where transmission rates are higher in 1st trimester).
3. 10% , 1-2 passing the infection to the fetus.

Toxoplasmosis

Keywords:
- Cat/undercooked meat
- Chorioretinitis
- IgG avidity
- Intracranial calcifications
- Hydrocephalus

Life Cycle

- Ingestion of **oocysts**: **cat feces contaminate fingers, soil, water**.
- Ingestion of **cysts** in **undercooked meats, garden products**
- **Blood transfusion** and **organ transplant**
- Vertical transmission: from mother to fetus (transplacental)



Morphology

Oocysts

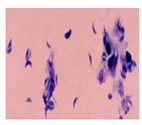
★ Shed in **CAT feces**
definitive host

Tachyzoites

Immunity +

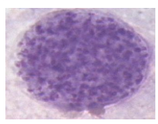
Immunity -

- Rapidly dividing forms
- **Acute phase**
- Can pass through placenta



Bradyzoites

- Slowly dividing forms
- **Chronic phase**

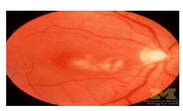


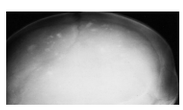
Clinical Presentation

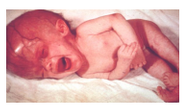
- **Mostly (70-90%) are asymptomatic** at birth, but are still at high risk of developing abnormalities, especially eye (chorioretinitis)/neurologic disease(MR) later. It almost asymptotic in everyone EXCEPT pregnant women it's dangerous

★ **Classic triad of symptoms:**

A- Chorioretinitis (inflammation of the **retina**)
B- Intracranial calcifications
C- Hydrocephalus (accumulation of fluid in the head)







- **Other symptoms include:**
  - Fever, rash, HSM, **microcephaly**,seizures, jaundice, thrombocytopenia, lymphadenopathy.
  - Abortion & Intrauterine death.

Diagnosis, Treatment & Prevention (very difficult to diagnose)

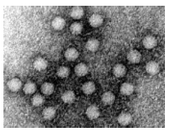
Pregnant mother	**Serology**[1]	**-IgM** /IgA -IgG **-IgG avidity**[2]. -IgG seroconversion compared to booking blood.
Infant	Prenatal	**- Ultrasound.** **- PCR**. - Culture.
	Postnatal/ Newborn	**1- Serology**[3]: (- IgM - **High IgG or persistently +ve >9- 12 months.)** **2- PCR** **3- Culture** **4-** Evaluation of infant e.g.neuroimaging
Treatment	Spiramycin, Pyrimethamine and sulfadiazine (**Prof**: i will not ask u about treatment but just know that it needs to be treated)	
Prevention	**1- Avoid:** Exposure to cat feces and contaminated food and water. **2- Wash:** - Hands with soap and water. - Fruits/vegetables - Surfaces that touched fruits/vegetables/raw meat. **3- Cook:** all meats thoroughly.	

1. A positive IgG result simply means that you have been infected at some point in your life; it cannot tell you when. The IgM antibody test can tell us whether the infection was recent or not.
2. High avidity: recurrent infection. Low avidity: primary infection.
3. Usually we diagnose it by IgM, because it cannot cross the placenta, While IgG cross the placenta so we don't depend on it.

Parvovirus P19

Keywords:
- Hydrops fetalis
- Anemia, rash
- slapped cheek

General information



- **Family:** Parvoviridae
- Non-enveloped, Icosahedral capsid and SS DNA genome
- Causative agent of Fifth disease[1] (erythema infectiosum)

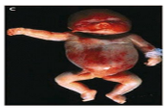
Epidemiology

- Worldwide distribution, Most of the population is eventually infected.
- Half of women of childbearing age are susceptible to infection.
- Humans are known hosts evidence of teratogenicity

Transmission

- Respiratory route
- Blood transfusion
- Transplacental route

erythema infectiosum



Hydrops fetalis

Clinical presentation

Acquired infection		Congenital infection
Immunocompetent host	Immuno-compromised host	Risk of congenital infection is greatest when infection occur in 1st 20 weeks (1st and 2nd trimesters): 1. **Infection in 1st trimester** [2] → IUD (Intrauterine death) 2. **Infection in 2nd trimester** → **HF (Hydrops fetalis)** 3. **Infection in 3rd trimester** → Lowest risk Causes fetal loss through hydrops fetalis, **severe anaemia** (due to hemolysis of RBC), CHF, generalized edema and fetal death.
• **Erythema infectiosum (Rash)** • Usually self-limiting	-	

Diagnosis, Treatment & Prevention

Diagnosis	Pregnant mother	○ Specific IgM. ○ IgG seroconversion.
	Infant	○ Ultrasound (hydrops) ○ Not grow in cell culture ○ PCR may be used on amniotic fluid.
Treatment important		★ **Intrauterine transfusions** (blood transfusion transplacentally) and administration of digoxin to the fetus.
Prevention		○ Hygiene ○ No vaccine

1. Erythema infectiosum is called "fifth disease" because it is one of the five most common pediatric disease. (Team 438)
2. in adults, it only causes mild sickness/rash. (but it can be severe in cases of **sickle cell anemia**)
3. It doesn't cause deformity of the fetus, it is causing hemolysis of RBCs in baby and that will develop anemia, Heart failure, Tachycardia, and edema and will lead to fetal death.

Keywords:
- Vesicular rash, VZIG
- Chickenpox,Shingle

Varicella Zoster Virus

General information

- **Family:** Herpesviridae
- dsDNA , Enveloped, Icosahedral Virus
- 90% of pregnant women **already immune**
  (very rare during pregnancy because most females are immune)
- Primary infection during pregnancy carries a greater risk of severe disease

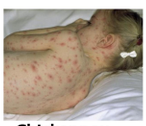
Transmission

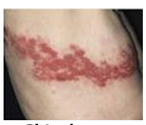
- Respiratory route.(Mainly)
- Transplacental route.
- Direct contact with ruptured varicella vesicles

Acquired infection

1- Varicella (Chickenpox) :
- Primary illness
- Generalized vesicular
- Common in children.

2- Zoster (Shingles):
- Recurrent infection
- Localized painful unilateral vesicular rash
- Common in old people


Chickenpox

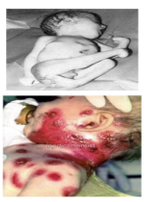

Shingles

Congenital infection

Primary infection carries a greater risk of severe disease, in particular pneumonia.

Intrauterine infections:

1- Congenital varicella syndrome(CVS):
- **1st 20 weeks of Pregnancy** [1]
- The incidence of CVS is ~ 2%
- **Symptoms:**
  -Scarring of skin
  -Hypoplasia of limbs
  -CNS & Eye defects



2- Neonatal varicella:(Occurs during delivery)
- Less than 5 days before delivery → severe disease
- More than 5 days before delivery → mild disease
- Can be prevented by Cesarean delivery

Diagnosis, Treatment & Prevention

Pregnant mother		**Direct from the vesicles:** ○ vesicular fluid for virus isolation (culture) ○ cells scraping from the base of vesicles → ImmunoFluorescent(Ag) ○ DNA-VZV by **PCR** **Serological**: ○ **IgM** AB ○ Rising IgG
Infant	**Prenatal**	○ Ultrasound and MRI. ○ VZV DNA in fetal blood or amniotic fluid or placenta villi (usually the sample is amniotic fluid) by PCR
	Postnatal/ Newborn	○ VZV IgM ○ Virus isolation (culture) ○ VZV DNA in VF or CSF (CSF infection) by PCR ○ Direct fluorescent antibody (DFA)
Treatment		○ **Acyclovir at first sign of varicella pneumonia**
Prevention **Not important** (Prof: there is no way i'm asking u about it)		○ **Pre-exposure:**Varicella live-attenuated vaccines. Contraindicated to use in immunocompromised patients and pregnancy. ○ **Post-exposure:** VZIG (Varicella zoster immunoglobulin): Susceptible pregnant women have been exposed to VZV. infants whose mothers develop Varicella < 5 to 2 days after delivery.

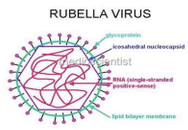
1. Can lead to deformity, loss of extremities, skin rash, as well some CNS manifestation.
2. Treatment depend on the stage of the infection we give Acyclovir, in post exposure or premature baby we give them immunoglobulin as well as vaccine.

Rubella Virus

(Very important congenital infection)

Keywords:
- Routine antenatal screening
- Maculopapular rash
- blueberry muffin
- Cardiac malformations (PDA.)

General information



- Family: Togaviridae
- vSS RNA genome, Icosahedral capsid, Enveloped Virus
- Rubella = German measles

Epidemiology

- **Vaccine-preventable disease in human** → No longer considered endemic

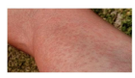
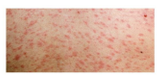
Transmission

- **Respiratory route**. (Mainly)
- **Transplacental route.**

Clinical presentation[1]

Acquired infections

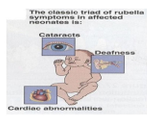
- **Ex. Maculopapular rash**

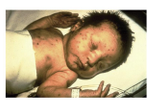
Congenital infections

Only focus on the red ones (dr said its enough)

- Normal → Congenital rubella syndrome (CRS) → IUD
- Risk of acquiring congenital rubella infection varies and depends on gestational age of the fetus at the time of maternal infection:
  0-12 weeks → 70%
  13-16 weeks → 20%
  >16 weeks → infrequent



- **Congenital rubella syndrome:** Triad of abnormalities affect → Ears, Eyes and Heart:
  Eyes: **Cataracts and glaucoma** ("Salt and Pepper" **retinopathy**)
  Heart: Cardiac malformations e.g. Patent ductus arteriosus(PDA)
  Skin: Skin rash.
  Neurologic defects (Less common)
  Others: Growth retardation, Bone disease, HSM, Thrombocytopenia, **"blueberry muffin" lesions/rash**



Diagnosis [2]

Pregnant mothers	Infants	
	Prenatal	Postnatal
Serological diagnosis: **1-** Rubella specific IgM **2-** IgG seroconversion (Maternal IgG is useless!)	**1-** Ultrasound **2-** Culture **3-** PCR	**1-** Serology: - IgM : recent postnatal or congenital infection. - Persistence of IgG >9-12 months (Rising monthly IgG titers suggest congenital infection) **2-** Culture **3-** PCR

Prevention[3]

- **Rubella vaccine (Live attenuated vaccine)**
- Routine Antenatal screening: Rubella Specific IgG
- Maternal screening (best way for prevention and give her vaccine)
- Non-immune women → vaccination (avoid pregnancy for 3 months)

1. Rubella only causes rash **but in case of pregnant ladies** it lead to very severe deformity and anomaly of the baby in (early pregnancy).
2. IgM is diagnostic either from the mother or the baby + increasing IgG titer
3. There is no treatment, supportive care only.

Cytomegalovirus (CMV)

Keywords:
- Owl's eye, intranuclear inclusion bodies
- Urine
- Deafness

General information

- Family: Herpesviridae
- dsDNA , Enveloped ,Icosahedral Virus.
- Establishes in latent form → reactivation → Recurrent infection.
- Most common congenital viral infection~40,000 infants per year.
- Mild, self limiting illness

★ **Most common congenital infection**

Epidemiology

- Transmission can occur with primary infection or reactivation of virus but 40% risk of transmission in primary infection
- Increased risk of transmission later in pregnancy but more severe sequelae associated with earlier acquisition

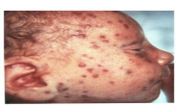
Transmission [1]

Horizontal transmission	Vertical transmission
-Young children: saliva (in day care) [2] -Later in life: sexual contact -Blood transfusion & organ transplant	-Primary CMV infection (40%) -Recurrent CMV infection (~1%)

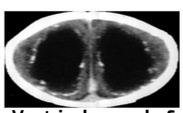
Clinical presentation [3]

★ **DEAFNESS: most common cause of non-inherited sensorineural hearing loss (important)**

- **Clinically normal (80%) / asymptomatic at birth (90%)**
- **develop symptoms later (**Hearing defect and mental retardation**) (15%) :**
  -CNS abnormalities → microcephaly, periventricular calcification, neurological deficits
  -Eye → chorioretinitis
  -Ear → sensorineural deafness
  -Liver → HSM and jaundice.
  -Lung → pneumonitis
  -Heart → myocarditis
  -Thrombocytopenic purpura (petechiae)
- **Cytomegalic inclusion disease (4%):**
- **Death (1%)**



Blueberry muffin" spots



Ventriculomegaly & calcifications of congenital CMV

Diagnosis [4]

Pregnant mothers	Infants	
	Prenatal	Postnatal
Serological diagnosis: **1-** CMV IgM **2-** CMV IgG (shows only past infection) **3-** CMV IgG avidity	**1-**ultrasound **2-** culture **3- PCR**	**1-** By isolating CMV or detection of its genome in first 3 weeks of life. Body fluid(Sample) : urine, saliva[5], blood. Using: - Standard tube culture method - Shell vial assay - PCR (Viral load and DNA copies can be assessed by **PCR**) **2-** Histology; Detection of Cytomegalic intranuclear Inclusion Bodies in affected tissue (Owl's eye). **3-** Serology; CMV IgM

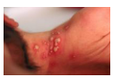
Serologies not helpful given high antibody in population

Treatment	**Symptomatic infants → Ganciclovir (x6wks)**
Prevention	No vaccine, Education about CMV & how to prevent it through hygiene; hand washing

1. Transmission of the virus from the mother to her baby through transplacental route cause congenital infection, on the other hand both transmission during delivery by passing through an infected birth canal and after delivery by ingestion of breast milk are causing prenatal infections.
2. Usually second baby infected because first baby bring the infection from daycare then infect her mother and transmitted to the new baby.
3. **CMV is the most common cause of sensorineural hearing loss.**
4. Best way: urine/saliva PCR **or** urine culture.
5. CMV secreted in saliva and urine in large amount. (it's difficult to obtain urine sample from babies so the best sample is saliva)

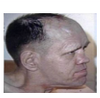
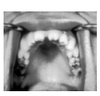
Syphilis and Herpes simplex

Herpes simplex

General information	○ HSV1 (in oral cavity causing Herpes labialis) ○ HSV2 (genital infections)
Epidemiology[1]	○ Primarily transmitted through infected maternal genital tract ○ Primary infection with greater transmission risk than reactivation ○ Indications for **C-section delivery** prior to membrane rupture
Clinical presentation	○ Most are asymptomatic at birth ○ 3 patterns of equal frequency with symptoms between birth and 4wks: ○ Skin, eyes, mouth, CNS disease, Disseminated disease (present earliest) ○ Initial manifestations very nonspecific with skin lesions NOT necessarily present. ○ It can lead to sepsis in babies 
Diagnosis	○ Culture of maternal lesions if present at delivery ○ Cultures in infant ○ CSF PCR (Mainly) ○ Serologies is useless
Treatment[2]	○ Maximum dose of **acyclovir**

- **Pregnant lady having herpes simplex for the first time (primary) → C section is indicated**

Syphilis

General information	○ Treponema pallidum (spirochete) ○ Transmitted via sexual contact[3] ○ Mother with primary or secondary syphilis[4] ○ Typically occurs during second half of pregnancy ○ Intrauterine death in 25%
Clinical presentation[5]	**3 major classifications:** ○ Late abortion or stillbirth  ○ Infantile:  - ★**Anal Rash/ulcer**★ and Funisitis (umbilical cord vasculitis) - Osteochondritis, periostitis, liver and lung fibrosis ○ Childhood: - Interstitial keratitis, Hutchinson teeth, 8th nerve nerve deafness, disfiguring - Frontal bossing, Short maxilla, High palatal arch, Saddle nose and Perioral fissures (but these presentation not specific only for congenital syphilis)
Diagnosis	○ **RPR/VDRL**: non-treponemal test [6] ○ **MHA-TP/FTA-ABS:** specific treponemal test ○ Confirmed if T. pallidum identified in skin lesions, placenta, umbilical cord, or at autopsy
Treatment	○ Penicillin G
Prevention	○ **RPR/VDRL screening** in ALL pregnant women early in pregnancy and at time of birth

1. Virus can present in vaginal secretion even without vesicles.
2. prof: if you see a lesion like this in ER immediately start the maximum dose of acyclovir and do PCR. If negative, you stop the acyclovir.
3. if the mother acquired the infection in the first 5 months of pregnancy, fetus will most likely suffer congenital syphilis.
4. Only mother with primary or secondary syphilis not tertiary can thair baby develop congenital syphilis
5. Baby present with **ulcer around the anus (distinctive characteristic for syphilis)**
6. Non- treponemal test sensitive but not specific , we should confirm it by treponemal test.

Drs' notes

Prof. Ali

- Virulent organism and primary maternal infection and stage of pregnancy 1st trimester all of these factor contributing to result in dangerous infection to the baby.
- Characteristics of congenital infection:(Skin rash, jaundice, organomegaly, sometimes fever).
- Q: How we Prevented pregnant lady when she come? by screening for (Syphilis,Rubella(perinatally), Toxoplasma).

Toxoplasmosis:

- Parasitic infection caused by Toxoplasma gondii and carried by cat, acquired through either inhaling of cyst from dry feces or ingestion of cyst from undercooked meats.
- **Commonly transmitted from mother to fetus in 3rd trimester**
- **Clinical presentation: Remember that mostly in head (Hydrocephalus,intracranial calcifications) and eyes (Chorioretinitis).**
- **Diagnosis: when IgM of the baby +ve that is mean acute infection.**

Parvovirus P19:

- Can cause rash like (Measles,Rubella,etc...)
- **Group that are in high risk from infection are pregnant women in early stage of pregnancy, and could lead to fetal death.**
- It doesn't cause deformity of the fetus, **it is causing hemolysis of RBCs in baby and that will develop anemia,** Heart failure, Tachycardia, and edema, **(Hydrops fetalis)** and will lead to fetal death.

Neonatal Varicella:

- Very rare in pregnancy because of immunization.
- At early stage of pregnancy can lead to deformity, loss of extremities, skin rash, as well some CNS manifestation.
- **Treatment depend on the stage of the infection we give Acyclovir, in post exposure or premature baby we give them immunoglobulin as well as vaccine.**

Rubella Virus:

- **Very important congenital infection.**
- **The most important virus for screening , because it is preventable by vaccine.**
- **Can lead to very severe deformity and anomaly of the baby in early pregnancy.**

CMV:

- **CMV is the most common cause of sensorineural hearing loss.**
- **CMV secreted in saliva and urine in large amount.**
- **Diagnosis mainly : by** culture**, PCR (mainly).**

HSV:

- Primary infection of herpes , **pregnant should deliver by C-Section.**
- Virus can present in vaginal secretion even without vesicles.
- **Diagnosed by PCR mainly , Treated by Acyclovir.**

Syphilis:

- Only mother with primary or secondary syphilis not tertiary can thair baby develop congenital syphilis.
- **Clinical presentation:** Baby present with ulcer around the anus (distinctive characteristic for syphilis).
- Can lead to deformity of face and teeth.
- **Diagnosis:** by non-treponemal test and should confirmed by treponemal test.

Quiz

MCQ

Q1: Congenital rubella syndrome: Triad of abnormalities that affects ?

A- Eye-nose-heart
B- Eye-Ears-Heart
C- Stomach-Brain-Ears
D- Mouth-Heart-Lungs

Q2: Which of the following viruses has a distinct feature of intranuclear Inclusion Bodies (Owl's eye)?

A- Rubella Virus
B- Varicella Zoster Virus
C- Parvovirus
D- CMV

Q3: Which of the following is the treatment of choice for Varicella Zoster Virus ?

A- Acyclovir
B- Ganciclovir
C- Intrauterine Infusion
D- Spiramycin

Q4: This virus causes a mononucleosis-like syndrome caused by a latent herpesvirus; it is often a congenital infection. Large amounts of the virus are excreted in the urine; thus, urine becomes the fluid of choice for diagnosis of this disease which is caused by:

A- Toxoplasma gondii
B- Rubella virus
C- CMV
D- VZV

Q5:2-week-old premature male infant is examined in the neonatal intensive care unit, and shows a wide pulse pressure and a holosystolic and holodiastolic murmur. On echocardiography he has blood flow between the left pulmonary artery and the aorta. Which of the following symptoms would the mother have experienced during pregnancy to increase the risk of having a child with this disorder?

A- Maculopapular rash spreading from face to body
B- Mild fever, sore throat, body aches, malaise, and swollen glands
C- Prolonged, persistent paroxysmal cough
D- Vaginal itching and mucopurulent discharge

Answers: Q1:B | Q2:D | Q3:A | Q4:C | Q5:A

SAQ

Case:At birth, a newborn is noted to be unresponsive to verbal stimulation from the doctors, nurses, and his parents. A routine physical examination of the child reveals a split S2 heart sound with an accentuated P2 component (PDA). The newborn has bounding pulses with a wide pulse pressure. After a week the newborn's parents notice that he has developed shortness of breath and respiratory distress. What pathogen did the mother contract during her pregnancy that could explain the newborn's current condition?

Q1: What is the most likely diagnosis ?

Answer:Congenital rubella syndrome

Q2: What pathogen did the mother contract during her pregnancy that could explain the newborn's current condition ?

Answer: Rubella virus

Q3: How is it transmitted ?

Answer: Respiratory, transplacental routes

Q4: How to prevent it ?

Answer: 1- Rubella vaccine (Live attenuated vaccine) 2- Routine Antenatal screening: Rubella Specific IgG

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