- Parvovirus B19 ;

- It's the smallest DNA virus (ssDNA)
- Associated with childhood exanthema
- Have three capsid proteins VP1-3
- Its tropism (Primary site of replication): is the nucleus of immature cell in the erythrocyte lineage where it is cytotoxic for erythroid progenitor cells; this results in temporary arrest of erythropoiesis"
- Causes Erythema infectiosum or fifth disease (i.e. sparing or circumoral rash – face rash) ; It is Indurated (lacey ملمسه مثل الصوف) rash on the face (slapped-cheek) which spreads in 1-2 days to arms and legs.
- Rash may recur for 2-4 weeks upon: exposure to heat or sun light, on exercise or emotional stress.
- Symptoms: - Fever, malaise, headache and myalgia and itching
  - LNs, enlarged spleen and liver.
  - Sometimes associated with arthritis and vasculitis
- 50% of women of child-bearing age are immune
- When acquired by a non-immune pregnant woman the transmission rate to the fetus is 33%
- Causes hydrops fetalis; severe anemia*, congestive heart failure, generalized oedema and fetal death
- No evidence of teratogenicity.
- Risk of fetal death highest when infection occurs during the second trimester of pregnancy (12%).
- Minimal risk to the fetus if infection occurred during the first or third trimesters of pregnancy.
- Maternal infection during pregnancy does not warrant termination of pregnancy.
- Diagnosis by IgM-specific Ab (seroconversion occurs during infection with long life protection)
- Exchange transfusion in utero is appropriate therapy in severe cases (as hydrops fetalis) with administration of digoxin to the fetus in case of hydrops fetalis.

- Anemia*: Clinical consequence is minimal unless compromised by chronic hemolytic process such as sickle cell and thalassemia

- Herpesviruses ;

- dsDNA
- Cross reactivity between HSV and VZV
- Herpesviruses cannot be distinguished from each other under electron microscopy.
- Three subfamilies: –Alphaherpesviruses – **HSV-1, HSV-2, VZV**
  –Betaherpesviruses – CMV, HHV-6, HHV-7
  –Gammaherpesviruses – EBV, HHV-8
- Symptoms : painful skin ulcers, chickenpox, and encephalitis.
- Causes Acute infection followed by latent infection. During Latency : virus genome presents in the cell (as **episome**), not integrated.

➔ **Neonatal Herpes Simplex** ;

- The baby is usually infected perinatally during **passage through the birth canal.**
- The risk of perinatal transmission is **greatest when there is a primary infection** in the mother (i.e. Primary infection is more dangerous as there's no seroconversion yet), while it is **smaller risk from recurrent lesions** (reactivation) in the mother, probably because of the **lower viral load and the presence of specific antibody**.
- Other sources of infection are: transplacental, oral lesions from the mother or a herpetic whitlow in a nurse.
- There are two types : Type 1 (HSV1) & Type 2 (HSV2) ;
  Type 1 infection typically produces less severe symptoms and relatively little local manifestation compared **with type 2 infection which is more common.**
- Manifestations generally occur between the 1st and 2nd wk of life (rarely at 4th wk)

➔ The spectrum of neonatal HSV infection varies from a **mild disease localized to the skin** to a fatal **disseminated** infection (MR 60%) , as the following ;

- **Skin vesicles are common with either type, occurring in about 55% overall**. Neonates with no skin vesicles usually present with localized CNS disease.

a. Localized disease (divided into 2 groups) ;

One group has **encephalitis** manifested by neurologic findings, CSF pleocytosis, and elevated protein concentration, **with or without concomitant involvement of the skin, eyes, and mouth**. The other group has **only skin, eye, and mouth** involvement and no evidence of CNS or organ disease.

b. Disseminated disease:

•Neonates with disseminated disease and **visceral organ involvement** have hepatitis, pneumonitis, DIC, or a combination, **with or without encephalitis or skin disease**.

➔ Diagnosis ;

Samples are taken from skin vesicles (most common), nasopharynx, eyes and CSF for **Tzanck test** that shows characteristic **multinucleated giant cells and intranuclear inclusions.**

➔ Treatment ;

- Parenteral **acyclovir (Zovirax)**
- Supportive therapy: appropriate IV fluids, alimentation, respiratory support, correction of clotting abnormalities, and control of seizures.
- Concomitant topical therapy with a drug such as trifluridine or vidarabine for Herpetic keratoconjunctivitis .

➔ Prevention ;

- Parenteral acyclovir, decreases the mortality rate in CNS and disseminated disease by 50% .
- **Universal screening has not been recommended or shown to be effective**, and most maternal infections with risk of transmission are asymptomatic
- **Cesarean delivery** for women known to have a high risk of transmission has been shown to decrease transmission and is **recommended. (Very important)**

- Varicella-Zoster Virus ;
  - Cause Chicken box in children , and Shingles in adults .
  - ds DNA virus
  - Communicability 2days before, 3-4 days into the rash
  - Latency : the virus remains latent in the cerebral or posterior root ganglia. And when reactivates it tracks down the sensory nerve to the area of the skin innervated by the nerve, producing a varicella form rash in the distribution of a dermatome.
  - 90% of pregnant women already immune, therefore primary infection is rare during pregnancy
  - Primary infection during pregnancy- especially the First 20 weeks of Pregnancy- (the remnant 10%) carries a greater risk of severe disease, in particular pneumonia, of these there is up to 3% chance of transmission to the fetus, Leading to congenital varicella syndrome;
    -Scarring of skin
    -Hypoplasia of limbs (short limbs)
    -CNS and eye defects
    -Death in infancy normal

  - In general, exposure to zoster does not lead to fetal infection.
  - There's a vaccine, بس عليه حكي كثير.
  - VZV can cross the placenta in the late stages of pregnancy.

➔ Neonatal varicella may vary from a mild disease to a fatal disseminated infection.

Acute varicella in the time period from 2 days before to 5 days after delivery is associated with a high risk of severe disseminated varicella in the newborn

•If rash in mother occurs more than 1 week before delivery, then sufficient immunity would have been transferred to the fetus. (I.e. More than 7 day before delivery, the body formed its own Abs that can cross the placenta) (very important)

•Zoster immunoglobulin should be given to susceptible pregnant women who had contact with suspected cases of varicella (within 96 hours of exposure) to modify the illness in the mother.

•Zoster immunoglobulin should also be given to infants whose mothers develop varicella during the last 7 days of pregnancy or the first 14 days after delivery. And if any lesions develop, IV acyclovir should be given. (very important)

- HBV (Hepatitis B virus) ;
  - It causes either : - Acute infection in children (85 %)
    - Or Chronic infection in adults (15%)
  - The **only DNA hepatitis** virus (i.e. partial dsDNA)
  - It is the only major cause of neonatal hepatitis.
  - HBV infection occurs during delivery from an infected mother.
  - **The risk of transmission is 70 to 90% from women seropositive for hepatitis B surface antigen (HBsAg) and hepatitis B e antigen (HBeAg) at the time of delivery.** (actively replicating)
  - Women without the e antigen or with anti-HBe transmit the infection only 5 to 20% of the time (i.e. the virus is not actively replicating)
  - •Mother–infant HBV transmission results **primarily from** maternofetal **microtransfusions during labor or contact with infectious secretions in the birth canal. (Don't advise C. section)**
  - Other ways for transmission ; Transplacental -in < 2% of infections.
    Postpartum occurs rarely (e.g. exposure to breast milk..)

➔ Symptoms and signs

- Most neonates are asymptomatic but develop chronic, subclinical infection characterized by persistent HBsAg antigenemia and variably elevated transaminase activity.
- Possible outcomes of hepatitis B infection:
  - Acute hepatitis B, which is usually mild and self-limited. They develop jaundice, lethargy...
  - Occasionally, severe infection with hepatomegaly, ascites, and hyperbilirubinemia (primarily conjugated bilirubin) occurs.
  - Rarely, the disease is fulminant and even fatal , which occurs more often in neonates whose mothers are chronic carriers of hepatitis B
- Chronic HBV infection with persistence of HBsAg occurs in
  - up to 90% on infants infected vertically (perinatally),
  - 30% of children 1 to 5 years old infected after birth
  - in 5 to 10% of older children, adolescents and adults with HBV infection

➔ Serology testing ; (the doctor only discussed ; HBsAg, IgM anti-HBc and HBeAG)

Hepatitis B Serology*

Marker	Acute HBV Infection	Chronic HBV Infection	Prior HBV Infection†
HBsAg	+ released in active replication	+ if persists more than 6 months	–
Anti-HBs	–	–	+‡
IgM anti-HBc	+ +only serelogical marker at window period	–	–
IgG anti-HBc	–	+	±
HBeAg	± released during active replication	±	–
Anti-HBe	–	±	±
HBV-DNA (viral load)	+	+	–

*Antibody to hepatitis D virus (anti-HDV) levels should be measured if serologic tests confirm HBV and infection is severe.

†Patients have had HBV infection and recovered.

‡Anti-HBs is also seen as the sole serologic marker after HBV vaccination.

Anti-HBc = antibody to hepatitis B core; anti-HBe = antibody to HBeAg; anti-HBs = antibody to HBsAg; HBeAg = hepatitis B e antigen; HBsAg = hepatitis B surface antigen; HBV = hepatitis B virus

➔ Other diagnostic tests; CBC with platelets, ALT and α-fetoprotein levels, and liver ultrasonography

➔ Treatment ;

- Neither corticosteroids nor hepatitis B immune globulin (HBIG) is helpful for acute infection.
- No therapy prevents the development of chronic, subclinical hepatitis once infection is acquired. (i.e. Acute to chronic development can't be prevented)
- All children with chronic HBV infection should be immunized with hepatitis A vaccine.
- Children with chronic HBV infection may benefit from antiviral drugs (eg, interferon alfa)

➔ Notes ;

- In Jordan, hepatitis B vaccine is available and given at the beginning of the 3th, 4th and 5th months of age. While in western countries it's given to the baby at his first day concurrently with two other injections (i.e. vitamin k & hepatitis b Immunoglobins). Also they give two injections of hepatitis b vaccine after 1 and 6 months of age.
  (The first dose of HB vaccine & HBIG are given at different sites to avoid neutralization)
- For medical field workers who are not immune as were not vaccinated, they take 3 doses as follows; at day 0, 1 month and 6 months later. Medical field workers who have low titers of anti- HBs antigen, they take a booster.

- Treatment of some HBsAg-positive women with lamivudine or telbivudine during the 3rd trimester may prevent perinatal transmission of HBV
- Infants born to mothers with unknown HBsAg status at the time of delivery should receive their first dose of vaccine at birth and receive HBIG IM as soon as possible (up to 7 days) after delivery if maternal testing is positive for HBsAg.
- Testing for HBsAg and anti-HBs at 9 to 15 months is recommended for all infants born to HBsAg-positive mothers
- **Separating a neonate from its HBsAg-positive mother is not recommended, and breastfeeding does not seem to increase the risk of postpartum HBV transmission, particularly if HBIG and HBV vaccine have been given**
- Carrier state following vertical transmission has been estimated to increase the risk of chronic liver disease x20 times & hepatoma x86 times.

- HCV ; (in contrast to HBV ; 15% acute & 85% chronic)
  - Most transmission is around the time of birth (perinatal)
  - Vertical transmission rate = 6.7% and there is a high rate of spontaneous clearance (25-50%) in the children/ acute infection.
  - **Cesarean sections are not recommended.**
  - **Breastfeeding is considered safe if the nipples are not damaged or cracked**.
  - The presentation in childhood may be asymptomatic or with elevated liver function tests.
  - While infection is commonly asymptomatic both cirrhosis with liver failure and hepatocellular carcinoma may occur in childhood
  - Treatment: with interferon, ribavirin and Sofosbuvir.

ꕥ Control & Prevention of Congenital, Perinatal & Neonatal infection ;

•precautions with clinical examination

•use of standard / universal precautions when coming into contact with blood or secretions.

•Serological screening in pregnancy

–Rubella, syphilis, Hepatitis B, HIV: "routine" حكيناهم بالميد

•**Handwashing to control; CMV, toxoplasmosis**

•Modification of "at risk" behavior for blood borne viruses & sexually transmitted infection.

•Avoidance of certain foods as Soft cheeses and undercooked meats (to avoid lesteriosis)

•**Active herpes at term – avoid vaginal delivery (i.e. DO C. Section)** مهم مهم مهم