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Questions 2008

1. Compare and contrast the virology and pathogenesis of measles and rubella virus (20mks)

Measles	Rubella
• Belongs to paramyxoviridae family • Belongs to genus morbilivirus • Has a negative sense RNA genome • Has a viral RNA polymerase • Has a helical nucleocapsid • Surface spike has Haemagglutinin and fusion protein • More likely to cause a still than congenital malformations • Causes Cytopathic effect such as multinucleated Giant cell formation • Involvement of the CNS causing encephalitis • Has a longer period of onset about 3 weeks	• Belong to Togaviridae family • Belongs to genus rubivirus • Has a positive sense RNA genome • Has no virion polymerase • Has an icosahedral nucleocapsid • Surface spike has only Haemagglutinin • May cause congenital malformations rarely a miscarriage • Cause little Cytopathic effect • Has a shorter milder disease on set of 2 weeks • Rarely involves the CNS

- Similarities
    - Both are RNA viruses
    - Both have a envelope
    - Both cause a maculopapular rash
    - Both are transmitted via respiratory droplets

2. Short notes on the following (20mks)
    a. Normal bacterial flora of the oral cavity

- Members include
    - Strept. Viridians group. Include strept mutans and strept sanguis
    - Neisseria species
    - Staph. Epidermidis
    - Lactobacillus species
    - Spirochete ; treponema denticola
    - Veillonella

    b. Mutation in bacteria

- Mutations involve alteration of the base sequence of genes in the bacteria
- Mutation serves as a source of diversity in bacteria along with gene transfer.
- Could occur via the following mechanisms

- Deletion; here a portion of the gene is deleted from the bacterial chromosome
- Insertion; a portion of gene from a different source is inserted into the bacterial chromosome
- Duplication; entails replication of a portion of the gene within the chromosome
- Inversion; a portion of the gene is inverted within the chromosome
- Translocation; a portion of the gene in the chromosome is shifted from one locus in the chromosome to another locus
- Frame shift mutation; occurs as a result of either insertion or deletion and results in a total different generation of codons that code for different proteins

c. Bacillus anthracis

- Gram positive rod found in chains
- Has an antiphagocytic capsule composed of D - glutamate
- Sporulates – form spores that are centrally located
- Is non motile
- Are facultative anaerobes
- Is heat resistant
- Has a plasmid that encodes for the anthrax toxin

d. Candida albicans

- Oval budding cells that stain gram positive
- Is a dimorphic fungus
  - Unicellular yeast (sexual form) non pathogenic
  - Filamentous fungi (asexual form) pathogenic form
- Forms chlamydospores in nutrition deficient media
- Forms hyphae in poorly aerated media
- Part of normal flora of upper respiratory tract, GIT and, genital area in females

3. Describe life cycle, pathological complications and diagnosis of Echinococcus granulosus infection in man (20mks)

- In the life cycle; dogs are the definitive host while sheep are the intermediate host, humans are normally dead end hosts
- Adults in the dog lay eggs that are excreted in feaces, the dog faeces contaminate the environment which the sheep feed on. Humans acquire organism via accidentally eating dogs faeces.
- In the intestines of sheep, the oncospheric embryo penetrate and enter circulation where they are transported to the lungs, bones, liver and brain
- The embryos develop into large fluid filled sacs called Hydatid cysts. The inner germinal layer of the cyst generated protoscolices.
- The cycle is completed when the entrails of the sheep are fed to the dog.
- Pathological complications
  - Space occupying lesion consequences
  - Rapture of cysts can induce a serious anaphylactic reaction
  - Release of the protoscolices from the cyst cause formation of other numerous cysts

- This may cause serious gastrointestinal haemorrhages
- Hepatic dysfunction due to presence of cyst may occur.

- Diagnosis
  - History
  - Physical examination
  - Ultrasound of liver for presence of Hydatid cysts
  - Serological tests for worm antigen
  - X rays for presence of cysts in tissues, lung as well
  - Radiological examination
  - CT scan of brain for cysts in brain
  - Skin test: cansoni skin test

4. Short notes on
   a. Complications of amoebiasis

- Intestinal perforations
- Forms flask shaped ulcers
- Bacteremia due to escape of the colonic normal flora via the perforations
- Liver abscesses
- Ameboma in the rectal and sigmoid colon. These are granulomatous lesions
- Lung disease as a result of penetration of diaphragm by right lobe liver abscess.

   b. Oral parasitic infections

- Include;
  - Ascariasis
  - Trichuriasis
  - Enterobiasis
  - Amoebiasis
  - Giardiasis
  - Fasciolopsis
  - Metagonimiasis
  - fasciolosis

   c. Advantages and disadvantages of use of insecticides

- Advantages
  - Assist in the control of insect vectors that transmit infectious disease
  - Saves on the cost to be spent on the treatment of diseases transmitted by the insect vectors
  - Saves lives especially where the disease in question transmitted by the insect vector shows high morbidity and mortality rate such as yellow fever virus
- Disadvantages
  - Their toxic effect accumulates in the environment causing pollution
  - In case of consumption by animals that serve as food source to humans, then the toxic substances are transferred to humans implicating serious conditions such as carcinogenesis, as was the effects of DDT

d. Pathological complications of ascaris

- Complications include
  - Intestinal obstruction
  - Cholecystitis
  - Pancreatitis
  - Peritonitis
  - Biliary Ascariasis
  - Appendicitis
  - Intestinal perforations

5. Discuss the mechanism by which the body mounts on immune response to microbes. Briefly describe how microbes evade the immune system. (20mks)

- These mechanisms are classified based on the microorganism involved
  - Extracellular bacterial immunity
    - Innate immunity
      - Involve complement activation
      - Phagocytosis
      - Inflammation
    - Adaptive immunity
      - Humoral
        - Antibodies cause, neutralization of toxins
        - Agglutination of bacterial pathogens
        - Opsonization
        - Activate complement
      - Cell mediated
        - T helper cells are presented the bacterial antigen causing their activation and secretion of cytokines that activate macrophages
        - Macrophages phagocytose bacteria
        - ADCC also involved
  - Intracellular immunity
    - Innate immunity
      - Natural killer cells kill cells infected with intracellular bacteria
      - NK secrete Interferon gamma
    - Adaptive immunity
      - Cell mediated
        - Macrophages are activated to phagocytose cells infected
        - Lysis of affected cells by CTL
        - Granulomatous type of reaction
        - Delayed type of hypersensitivity
- Antiviral immunity
- Innate components include:
  - Interferon and Natural killer cells

    - Interferon are secreted by virally infected cells as well as inflammatory cells
    - Mode of action of interferon include, prevention of replication of the virus within cell
    - And is involved in the activation of NK cells that kill virally infected cells
- Specific components include
    - Humoral immunity
        - Antibodies
            - Neutralize free virus particles
            - Prevent attachment of virus to its receptors on the cells
            - Cause agglutiniation of virus particles
            - Opsonize the virus particles
            - Complement mediated lysis
        - Cell mediated immunity
            - Mediated by the T helper cells that recognizes viral antigens and secretes cytokines that activate macrophages and cytotoxic T lymphocytes
            - cytotoxic T cells kill virally infected cell based on the presentation of viral antigens on MHC class I
            - Macrophages are activated to phagocytose virally infected cells
            - Natural Killer cells are activated to kill virus infected cell
            - Antibody dependent cellular cytotoxicity depends on antibody to bind to virus and then facilitate its removal via Phagocytosis via macrophages, NK cells or polymorphonuclear leucocytes
- Antifungal immunity
    - Innate
        - Neutrophils and macrophages
    - Acquired
        - Mostly cell mediated immunity
- parasite immunity
    - intracellular protozoan mainly cell mediated immunity
    - Helminthes
        - Mainly IgE antibody production that results in tissue/blood Eosinophilia, mast cell involvement
        - Eosinophil mediate ADCC
- Evasion of immunity by microbes
    - Bacteria
        - Possession of an antiphagocytic capsule by pneumococcus
        - Production of toxins such as streptolysins that degrade neutrophils
        - Production of enzymes that breakdown host defensins
        - Induction of apoptosis by Shigella flexinerri
        - Inhibition of phagolysosome fusion by intracellular bacteria such as Mycobacterium tuberculosis

        - Inhibition of complement components
        - Enzymatic inhibition of active oxygen species
        - Adhesion molecules
    - Viral evasion
- Antigenic drift
    - Entails random mutation in the viral genes rendering preformed antibodies ineffective. An instance is minor changed in the HA and NA proteins in influenza virus
- Antigenic shift
    - Entails reassortment of viral genome, following mixing of genes that result in emergence of new viral strains to which the body has no immunity to
- Interference with interferon synthesis
    - Viruses may block interferon induced transcription responses
- Inhibition and modulation of cytokines and chemokines
    - Cytokines required for activation of effector immune cells may be inhibited by virus
- Inhibition of apoptosis
    - Virus infected cells programmed for cell death are prevented from achieving the goal
- Immunomodulation of the lymphocytes and other immune cells
    - Viruses such as CMV induces cell mediated immunosuppression
- Viruses may suppress expression of the MHC class I on virally infected cells hence host surveillance system is rendered blind to see virally infected cells
- Inhibition of inflammation. Without inflammation, the virus escapes detection by the host immune system.
- Parasite evasion
- Through secretion of IgA proteases that cleave mucosal IgA responsible for mucosal immunity
- Through antigen masking using host antigens such as making its own glycolipids as it travels using host glycoproteins. Entamoeba hystolitica masks its surface antigens using host glycoproteins
- Through cyst formation by various parasites such as helminthes. These cysts are resistant to immune responces. Hydatid cyst formed by echinococcus granulosus
- Residing in GIT lumen where they are sheltered from host Cell mediated immune response. Adults ascaris lumbricoides are located within the GIT lumen where they are safe from Cell Mediated immune responce
- Antigen variation that renders preformed antibodies ineffective towards the new surface antigenic mutations in the parasites. In plasmodium for instance, different stages express different antigens thus antibodies for a certain stage are ineffective for a subsequent stage. Giardia lamblia also exhibits antigenic variation at the various stages of its life cycle.
- Anatomical seclusion of the parasites in areas where they are sheltered from host immune defences, such as in the case of plasmodium species residing within red blood cells. Leishmania species and trypanosomes reside within macrophages.
- Induction of immune suppression by the parasites rendering the immune response absent is strategy that plasmodium species employs in evasion of immune response

- Prevention of fusion of the phagolysome (Phagosome and lysosome fusion) is prevented by lesishmania species thus escaping the destructive lysosomal enzymes.
- Production of parasitic enzymes that have anti immune effect. Filarial worms produce glutathione oxidase and superoxide dismutase that enables them escape antibody dependent cellular cytotoxicity and oxidative stress.

Questions 2010 –(incomplete)

1. Write short notes on (20mks)
    a. Lab diagnosis of tinea capitis

- Specimen to be used: Skin scrapings, hair pluckings
- Treatment of specimen using 10 % KOH that dissolves most tissues
- Direct Microscopic observation for athrospores and athroconidia
- Culture in SDA – Saboraud Dextrose Agar usually 10 – 14 days
- Lactophenol blue staining of a portion of culture, identification of microconidia for microsporum species, and macroconidia for M. canis

    b. Methods of isolating strict anaerobes

- Use of anaerobic cabinet

    c. Enteric fever

- caused by gram negative rods; salmonella typhi, and salmonella paratyphi A, B, and C. These organisms are obtained via ingestion of food or water contaminated with human faeces or animal wastes. Humans and animals serve as reservoirs for these organism. Human carriers or mechanical vectors such as the housefly, Musca domestica, or the cockroach, are involved in the transmission. Typhoid fever prevails mostly in the developing countries where standard of living is low.

    d. Haemophilus Influenza

- Is a gram negative coccobacillus with a polysaccharide capsule
- It is among the leading cause of bacterial meningitis.
- Serotype b is associated with invasive disease such as meningitis
- Also causes infections within the respiratory system such as pneumonia
- Requires factor V (NAD) and factor X (Heme) for laboratory growth
- Cultured in Chocolate blood agar

2. (20mks)
    a. Briefly describe the shared properties of retroviruses using HIV – 1 as an example.
    b. Briefly distinguish between antigenic shift and drift as applied in virology. Use specific examples.
        - Antigenic shift entails reassortment of viral genome with the end result being emergence of new strains of virus, for Influenza virus for instance, antigenic shift is possible only in Influenza A, and is thought to be possible due to the segmentation of viral genome

- It occurs when different strains of Influenza virus mix, for instance a human strain of influenza infects chicken that already has its own avian strain still present would cause reassortment of the RNA segments to yield a new strain
- Antigenic drift on the other hand entails mutations of the RNA, causing minor variations in strains. Mutation occurs in type A and B, rarely in C, and mostly affects Haemagglutinin

c. Write short notes on the classification of human herpes viruses

- family herpesviridae
- Sub family include; Alpha herpesvirinae
  - Members include; HSV 1, HSV2 and Herpes Zoster virus
- Beta herpesvirinae
  - CMV, HHV6 and HHV7
- Gamma herpesvirinae
  - EBV, and HHV8 (Kaposi related herpes virus)

d. Write short notes on the lab diagnosis of Hepatitis B virus (HBV). Distinguish acute from chronic infection.

- Serological markers of HBV infection include;
  - Hepatitis B surface antigen (HBsAg) indicator of carrier state
  - Antibody to Hepatitis B surface antigen (antibody to HBsAg) indicates immunity
  - Hepatitis B core antigen (HBcAg)
  - Antibody to Hepatitis b Core antigen (Antibody to HBcAg)
  - Hepatitis B e antigen (HBeAg)
  - Antibody to hepatitis B e antigen (Antibody to HBeAg)