BLOOD

reading Ch 28

Circulatory system

Definitions:

bacteremia - brief transit

septicemia - proliferation in the blood [=sepsis]

non-cellular component = plasma, leaks into most organs

white blood cells [wbc] can exit blood via the lymphatics.

fluid and wbc - in lymph, go through lymph nodes

spleen - abdominal lymphoid organ

Heart

Endocarditis - bacterial, occurs in the lining

subacute endocarditis - commonly caused by Staphlococci, also Strep. pneumonia, Strep. viridans, and Mycobacterium. If milder than acute form called subacute. The bacteria stay in small blood clot around a defective heart valve, this protects them from phagocytosis. "Vegetations" in clot can break off and cause distant blood vessel blockage.

acute endocarditis - Pseudomonas, Coxiella burnetti, Strep viridans

Myo/ ENDOcarditis - Acute Rheumatic Fever;

Follows severe throat infections by Streptococcus, which are of specific serotypes M1,M3, and M5.
This is of autoimmune origin. After infection approx. 3 weeks later heart problems begin. Strep. M proteins have antibodies made to them by the immune system, this cross-reacts with the heart and damage occurs. The bacteria does not cause this part of the disease. The damage is actually caused by the immune system

Septicemia

Enterobacteria: G neg sepsis; includes Salmonella, E. coli, Camphylobacter. They make endotoxins, when in bloodstream induce widespread blood clotting via the systemic release of TNF-alpha.

Lymph Node Infections

spread by node travel

Tularemia -

caused by Francisella tularencis. Lives on rabbits, and is spread by the bite of the arthropod. This is an intracellular parasite, G negative, aerobic, rod. Can survive within the macrophage. An anti-phagocytic capsule is used for pathogenicity. It also has endotoxin activity. At the first site and ulcer can be seen. Mostly seen in OZARKS=Arkansas, Oklahoma, and Missouri.

Brucella abortus -

in cattle, within the utters and uterus cause spontaneous abortion. G- rod. In man transit and invasion is through the skin. They are capable of surviving within the macrophage. Can cause abscesses locally or in lymph nodes.

Yersinia pestis -
causes bubonic plague. Requires presence of amino acids.

Virulence factors include:

1) adaptation to intracellular survival

2) presence of protein polysaccharide capsule.

3) plasmid dependent cytotoxic factors

Cause widespread hemorrhages. Transmitted by fleas.

NOTE: Common route of infection by direct flea bite. Alternative route: lung via breathing feces. Hemorrhages occur within the lung this is pneumonic plague. Mortality here is high. Widespread cell death due to cytotoxic factors made by Yersinia which is dependant on the plasmid.

VIRAL INFECTIONS OF THE LYMPHATIC SYSTEM

Epstein Barr Virus

causative agent of infectious mononucleosis

and Burkitt’s lymphomas.

which disease is dependant on nutritional state and the environment.

a Herpes virus

uses receptors to bind which has 3 names: complement C3d, CR2, CD21.

The receptor is found on epithelial cells and B lymphocytes.

In latent infection, the cells contain a small number of circular plasmid-like EBV genomes that replicate only during cell division. Here it makes EBNA, and shows LYDMA. The infected cell begins B cell proliferation, turns off programmed cell death pathway (apoptosis). These cells start making IL5, IL6, and IL10. EBV can make a viral mimic of IL10.

T cells kill infected B cells.
Cancer potential includes the epithelial cells in the pharynx—nasopharyngeal carcinoma. If the B cells are affected it will lead to Burkitt’s lymphomas.

**CYTOMEGALOVIRUS [CMV], a herpes virus**

- 50% of adults
- 0.5-2.5% of newborns

Causes hearing loss, mental retardation, most common cause of congenital effects,
disease prominent in immunocompromised, if cell mediated immunity is suppressed: blindness, pneumonia, meningitis, mono-like disease, hepatitis

Only a human pathogen, grows in fibroblasts, lymphocytes, some bone marrow cells, latent in T cells, macrophages

Transferred via blood or secretions

Virulence factors:

Avoids immunity by 2 strategies

1. stealth — infected cells lose MHC class I expression—so T cell cannot recognize them

2. decoy -- infected cells put up a decoy of MHC class I-lie molecules [no filled groove, no TCR recognition] BUT this molecule is sufficient to turn OFF killing by NK cells.

Malaria

*Plasmodium protozoa*
4 = vivax, malaria, ovale, falciparum

bite of mosquito--injects sporozoite

bind to liver cells, first replication in liver

merozoites burst out of cell --into blood

if stay in liver without replicating called hypnozoites [sleeping bugs]

now infect rbc, P. falciparum can infect any rbc which is why it causes the most severe infection, degrades and uses hemoglobin as its iron source, make knob protein which appear on surface of rbc, anchor deep in capillaries and prevent premature lysis of rbc

divides--ring forms--makes a cluster of "grapes" which is called a schizont

synchronous maturation of schizonts--cause burst of rbc--out into circulation, large number of cells dies and toxic metabolite cause recurring chills and fever [103-6°F]--exhaustion

merozoites reinfect rbc--cycles

merozoites of P. vivax retrun to liver cause exoerythrocytic cycle [more pathology]

causes anemia, spleen full of debris

infected rbc not as flexible, clump and sludge in small blood vessels--organ damage

sludge is most common is P. falciparum [infects more rbc], sludge in brain causes cerebral malaria, in kidney-black water fever

merozoites cannot be ingested by mosquitoes, a minority of rbc develop the sexual phases called gametocytes [male or female forms], these are picked up by mosquito [host sexual phase] and only there develop into sporozoites that can start human infection [host asexual phase] again.

Human evolution:

1. Sickle cell is only a disease in its homozygous state. Heterozygotes are more resistant to malaria

2 Some human MHC class II alleles predispose to cerebral malaria--low frequency in malaria endemic areas [Mexico, Middle East, Mediterranean, S.A, India, Africa.]