

# HAEMOPOIETIC SYSTEM AND PARASITE EFFECTS

# PROTOZOAN PARASITES THAT AFFECT THE HEMOPOIETIC SYSTEM

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- ✘ Malaria
- ✘ Babesia
- ✘ Leishmania donovani
- ✘ Trypanosomiasis
- ✘ Amoebiasis
- ✘ Giardiasis
- ✘ Toxoplasmosis

# METAZOAN PARASITES THAT AFFECT THE HEMOPOIETIC SYSTEM

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- ✘ Schistosomiasis
- ✘ Filariasis
- ✘ Hookworm infestation
- ✘ Trichuriasis/ *Trichuris trichiura*

# MALARIA

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- ✘ Endemic in many parts of the world particularly in SE Asia and Africa
- ✘ Coast, Eastern, Western & Nyanza
- ✘ Species:
  - + Plasmodium falciparum – malignant malaria
  - + Plasmodium vivax
  - + Plasmodium ovale
  - + Plasmodium malariae
- ✘ Effects of the parasite:
  - + on the RBC: hemolysis
  - + of enlarged spleen causing dilutional effect (hypersplenism) with reduced red cell survival
  - + Inflammatory cytokines on the BM
  - + Folate deficiency in chronic malaria
  - + Effects of drugs (Primaquine)

# LABORATORY EVALUATION

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- ✘ Diagnosis
- ✘ Tests to determine haemopoietic and other effects

# CONT.

- ✘ TBC
  - + Progressive normocytic normochromic anemia appears after 48 hours then rapid fall over the next 4-5 days
  - + Polychromasia/Nucleated red cells/ fragments
  - + Parasites on film: density
  - + Macrocytic picture in chronic malaria with folate deficiency
- ✘ WBC
  - + Usually normal
  - + Monocytosis with or without pigment in monocytes
- ✘ Platelets: reduced in acute malaria
  - + Hypersplenism; platelets are pooled into the spleen
  - + Immune destruction
  - + Low grade DIC
  - + Raised Prothrombin Time and APTT (Activated Partial Thromboplastin Time)

# BIOCHEMISTRY

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- ✗ Raised total bilirubin (indirect)
- ✗ Renal function tests
- ✗ Blood sugar hypoglycemia in severe malaria
- ✗ Raised lactate level (metabolic acidosis)

# DIAGNOSIS

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- × Thick film
- × Thin film
- × Parasite density and identification
- × QBC (Quantitative Buffy Coat) method: Acridine orange fluorescence of parasites
- × Antigen detection test: chromatographic detection of histidine rich proteins (parasight Falciparum)
- × Molecular methods (PCR)



# LEISHMANIASIS

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- ✘ L. donovani causative agent for visceral leishmaniasis
- ✘ Hyperplasia of macrophages and lymphocytes
- ✘ Massive production of immunoglobulins
- ✘ Progressive hepatosplenomegaly
- ✘ Anemia due to hypersplenism
- ✘ Ineffective erythropoiesis
- ✘ Megaloblastosis due to folate deficiency

# TOTAL BLOOD COUNT

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- ✘ Normocytic normochromic anemia
- ✘ Leucopenia (neutropenia)
- ✘ Thrombocytopenia
- ✘ Raised ESR
- ✘ Raised CRP

# DIAGNOSIS

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- ✘ BM aspirate
- ✘ Splenic aspiration (most sensitive)
- ✘ Buffy coat preparation of PBF
- ✘ Immunological:
  - + Detect antibodies: ELISA (enzyme linked immunosorbent assay)
  - + FAT (Fluorescent antibody test)
  - + IHA (Indirect hemagglutination assay)
  - + Varying degrees of sensitivity and specificity
- ✘ CMI test: Leishman skin test with intra-dermal injection of killed promastigotes)

# BIOCHEMISTRY

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- ✘ Reduced albumin
- ✘ Raised gamma globulins

## Leishmania in situ

- ✘ L. donovani bodies (LD bodies) seen engulfed in the macrophage
- ✘ BM is hyperactive and megaloblastic

# BABESIA

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- ✘ Hemolytic anemia
  - + Reduced haemoglobin
  - + Increased total bilirubin (indirect)
  - + Renal function tests may be decreased because of intravascular hemolysis
- ✘ Diagnosis:
  - + PBF
  - + PCR
- ✘ Babesiae in situ
  - + Maltese cross appearance in RBC

# TRYPANOSOMIASIS

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- ✘ Hemolysis due to phagocytosis of antibody coated RBCs
- ✘ Also by hemolysins produced by parasite
- ✘ Moderate leukocytosis
- ✘ Deranged coagulation (late stage)
- ✘ Thrombocytopenia
- ✘ Increased fibrinolysis

# DIAGNOSIS

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- × Examination of blood
- × Lymph node aspirate
- × CSF
- × Blood film:
  - + Buffy coat preparation
  - + QBC
- × Trypanosomes in situ
- × Flagellated (they are hemoflagellates)
- × Kinetoplast
- × Extracellular
- × Polychromasia - hemolysis

# AMEBIASIS

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- ✘ Microcytic hypochromic anemia seen in chronic disease due to blood loss due or due to anemia of chronic disease



# GIARDIASIS

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- ✘ Seen in children
- ✘ Malabsorption of folate in acute giardial diarrhea
- ✘ Chronic giardia causes B12 deficiency due to damage of ileal receptor, utilization of B12 by parasite and bacterial overgrowth in the bowels

# METAZOAN PARASITES

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## ✘ Bilharzia

- + Effects of portal hypertension bleeding from esophageal varices
- + Splenomegaly
- + Granulomas cause various degrees of bleeding: GIT, Hematuria
- + Hypersplenism: normocytic normochromic anemia; leucopenia and thrombocytopenia
- + Deranged LFTs
- + Renal dysfunction due to hydronephrosis

# DIAGNOSIS

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- ✘ Direct visualization of parasite
  - + In urine: *S. hematobium*
  - + In stool: *S. mansoni*
  - + Rectal snip
- ✘ Newer diagnostic methods detect schistosoma antigen in serum and urine (expensive)
- ✘ Indirect tests
  - + Chemical reagent strips for detection of red cells and proteins useful in endemic areas as surrogate markers

# IMMUNOLOGICAL TESTS

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- × ELISA
- × IHA (Indirect Hemagglutination Assay)
- × IFAT (Indirect Fluorescent Antibody test)
- × RIA (Radio-immunoassays)
  
- × Schistosoma in situ
  - + Lateral spine – in *S. mansoni*
  - + Polar spine – in *S. hematobium*

# HOOKWORM

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- ✘ Blood sucked out:
  - + 0.03mL/day/worm for *N. americanus* (has a higher worm load following infection)
  - + 0.15 mL/day/worm for *A. duodenale*
- ✘ PBF:
  - + Microcytic hypochromic
  - + Eosinophilia
  - + Reduced proteins: edema
  - + Demonstrate Ova

# TRICHURIASIS

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- ✘ Heavy infection involves the cecum up to the rectum; blood loss results
- ✘ Direct demonstration of eggs and eggs count

# FOR ALL PARASITES:

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- ✘ Investigations:
  - + TBC and PBF
  - + Thick and thin film
  - + BM examination
  - + Aspirate of spleen and lymph node
  - + Urine and stool examination
  - + Immunological tests
  - + Biochemical tests

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**✖** **END**