Malaria Handout

MALARIA

- causative agent = *Plasmodium* species
- characterized by acute febrile attacks
- ~40% world's population lives in endemic areas
- primarily tropical and sub-tropical areas
- formerly throughout temperate areas
- 3-500 million clinical cases
- 1.5-2.7 million deaths (90% Africa)

General Clinical Features

- characterized by acute febrile attacks (malaria paroxysms)
- manifestations and severity depend on species and host status
  - immunity, general health, nutritional state, genetics
- recrudescences or relapses can occur over months or years
- can develop severe complications (especially *P. falciparum*)

Prodromal Symptoms

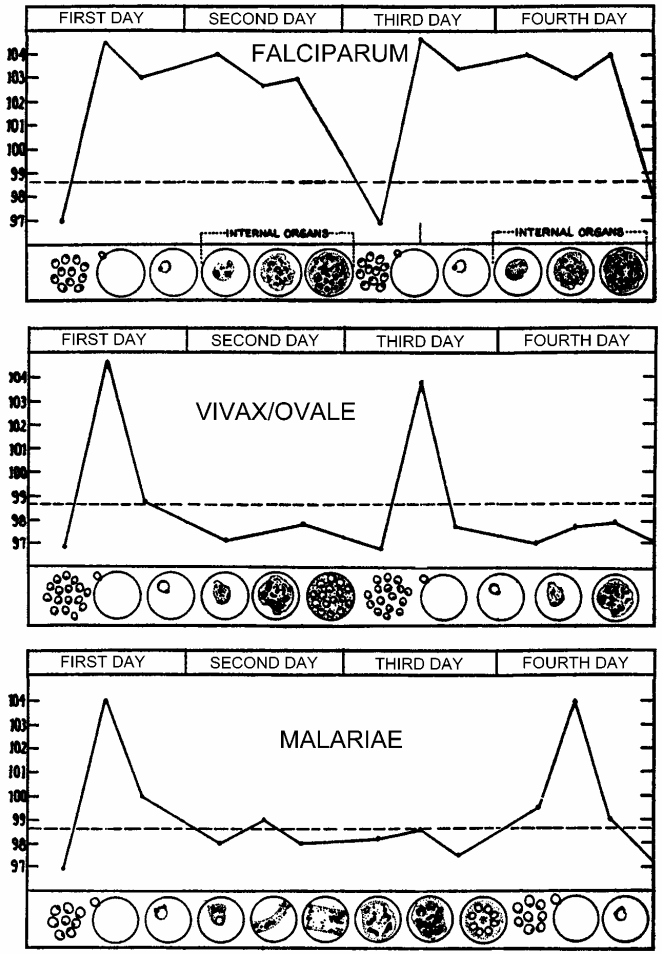
- end of incubation period
- 2-3 days before 1st paroxysm
- includes: malaise, fatigue, lassitude, headache, muscle pain, nausea, anorexia (i.e., flu-like symptoms)
- can range from none to mild to severe

Febrile Attack (Malaria Paroxysm)

- initially fever may be irregular before developing periodicity
- may be accompanied by splenomegaly, hepatomegaly (slight jaundice), hemolytic anemia

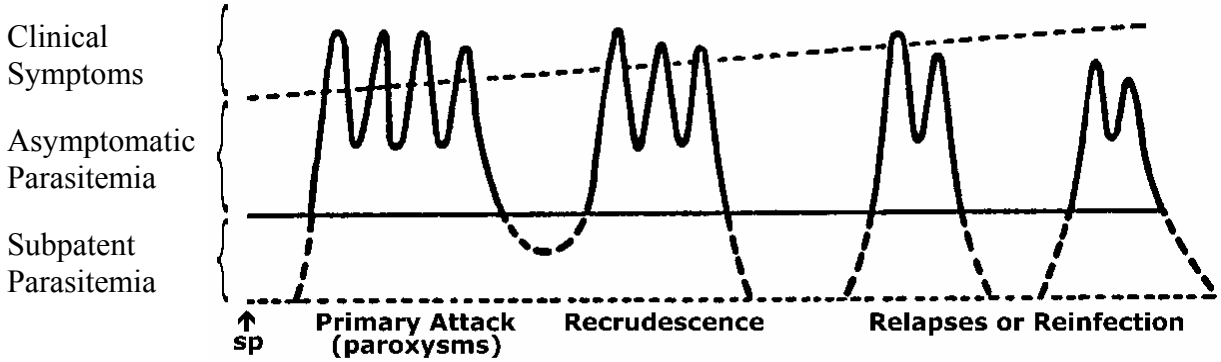
Febrile Attack (Malaria Paroxysm)

- periodic febrile episodes alternating with symptom-free periods
- cold stage
  - ♦ feeling of intense cold
  - ♦ vigorous shivering
  - ♦ lasts 15-60 minutes
- hot stage
  - ♦ intense heat
  - ♦ dry burning skin
  - ♦ throbbing headache
  - ♦ lasts 2-6 hours
- sweating stage
  - ♦ profuse sweating
  - ♦ declining temperature
  - ♦ exhausted and weak → sleep
  - ♦ lasts 2-4 hours



Other Features of the Paroxysm

- paroxysms associated with synchronous release of merozoites
- initially periodicity may be irregular as parasites synchronize
- high levels of tumor necrosis factor-α correlated with paroxysm
- between paroxysms temperature is normal and patient feels well
- *P. falciparum* may not exhibit classic paroxysms
  - continuous fever
  - 24 hr periodicity
- may be accompanied by splenomegaly, hepatomegaly (slight jaundice), hemolytic anemia
- paroxysms become less severe and irregular as infection progresses
- semi-immune may exhibit little (1-2 days fever) or no symptoms
- *P. falciparum* can be lethal in non-immune (eg., children, expatriates)



Disease vs Infection

Anti-Parasite Immunity

- immune response prevents merozoite invasion, eliminates infected erythrocytes, etc.

Anti-Disease Immunity

- neutralization of exo-antigens or toxic effects

Distribution of malarial parasites

- *P. vivax*
  - ♦ most widespread, found in all endemic areas including temperate zones
- *P. falciparum*
  - ♦ primarily tropics and subtropics
- *P. malariae*
  - ♦ similar range as *P. falciparum*, but less common and patchy distribution
- *P. ovale*
  - ♦ occurs primarily in tropical west Africa

Stable or endemic malaria

- constant incidence over several years
  - includes seasonal transmission
  - levels of endemicity can vary
- immunity and disease tolerance correlate with level of endemicity (especially adults)

Unstable or epidemic malaria

- periodic sharp increase in malaria
- little immunity in population
- morbidity and mortality can be high

Roper et al (1996) AJTMH 54:325

Date Tested	% Incidence (smear/PCR)*	
Sep 93	**13% (2/8)**	} 33% reported symptoms
Jan 94	**19% (4/11)**	
Apr 94	**24% (8/11)**	} no symptomatic cases
Jun 94	**19% (0/14)**	

*Number of individuals testing positive by blood smear and PCR. PCR assay detects ~2.5 parasites/μl (4-10X more sensitive than thick smears).

- **Study site**: eastern Sudan (mesoendemic, seasonal transmission)
  - rainy season = June-Sept
  - peak symptomatic cases = Oct-Nov
- **Methods**: followed cohort of 79 individuals for one year using thick blood smears and PCR
- **Results**: incidence rates are constant throughout dry season in the absence of transmission and symptomatic disease (Table)
- Subsequent studies showed that most individuals were infected with a parasite of the same genotype throughout dry season (Parasitol. 120:447, 2000)

Malaria Control

- reduce human-mosquito contact
  - ♦ impregnated bed-nets
  - ♦ repellents
  - ♦ protective clothing
  - ♦ screens, house spraying
- reduce vector
  - ♦ environmental modification
  - ♦ larvacides/insecticides
  - ♦ biological control
- reduce parasite reservoir
  - ♦ diagnosis and treatment
  - ♦ chemoprophylaxis