INTERNATIONAL SCHOOL OF MEDICINE

Department of Special Clinical Disciplines

Lecture

RICKETTSIAL INFECTION

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Overview

- Structure
- Clinical Manifestations
- Pathogenesis
- Epidemiology
- Diagnosis
- Control

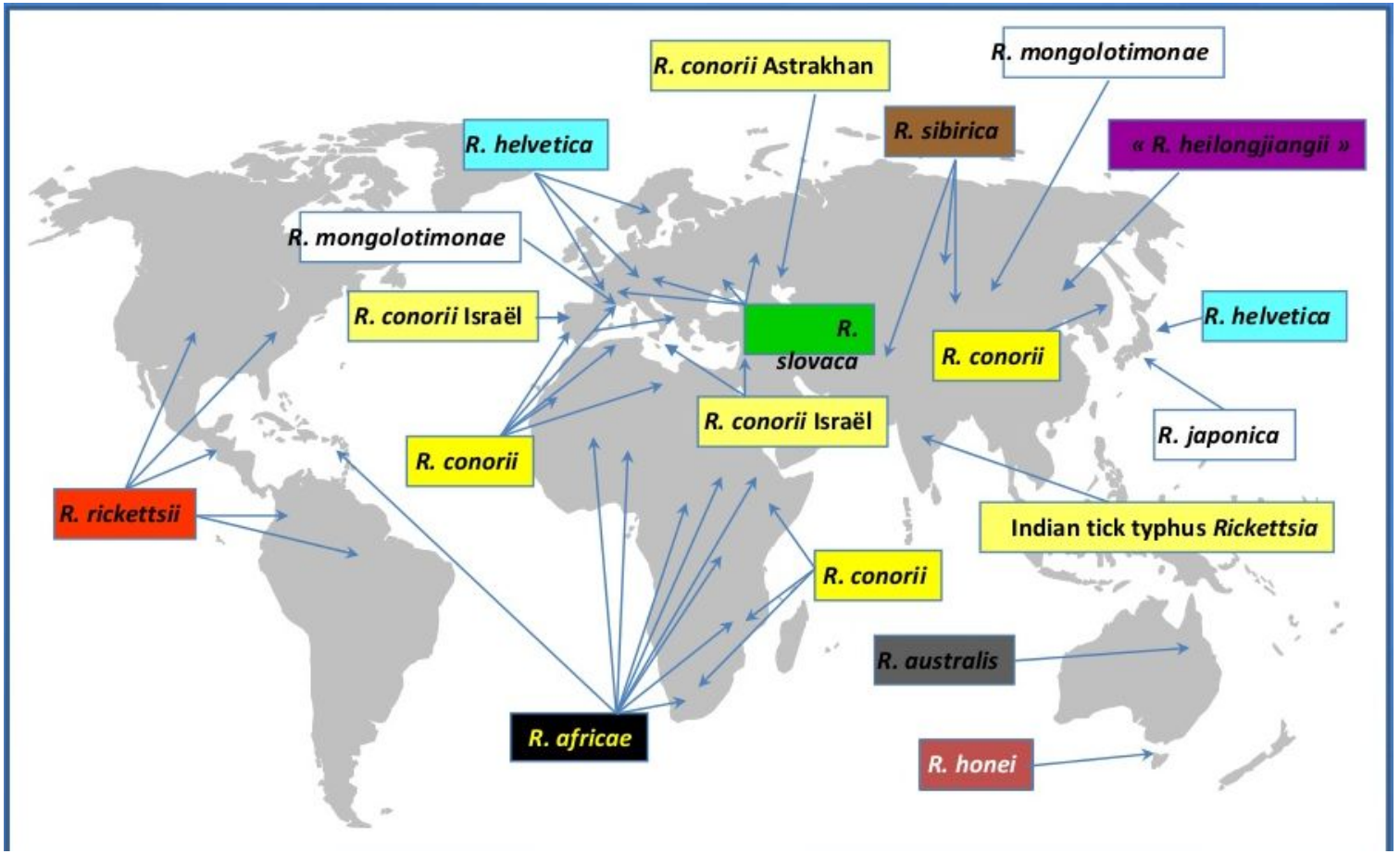
Definition of rickettsial disease

- Rickettsial disease in humans (spotted fevers, typhus or scrub typhus) is caused by a number of related species of intracellular bacteria of the genus Rickettsia that have blood-feeding arthropod vectors.
- Each species is associated with a different spectrum of clinical features, geographical distribution, insect vector (tick, louse, flea, mite or chigger), seasonal incidence and other epidemiological factors.

History

The name ***Rickettsiaceae*** honors Haword Taylor Ricketts for his brilliant experiments. Ricketts, as well as another famous rickettsiologist, Von Prowazek, died of rickettsia during their study period

Epidemiology



- In 1993, WHO reported that, these are major causes of febrile illnesses throughout the Asia-Pacific region, also present in several parts of the Indian subcontinent.

- From India in 2010 reported that 45.6% had spotted fever group and 30.7% scrub typhus & untreated cases can have fatality rates as high as 30-35%.

- For India, the reported numbers are an underestimate due to lack of community based data and non-availability of confirmatory laboratory tests.

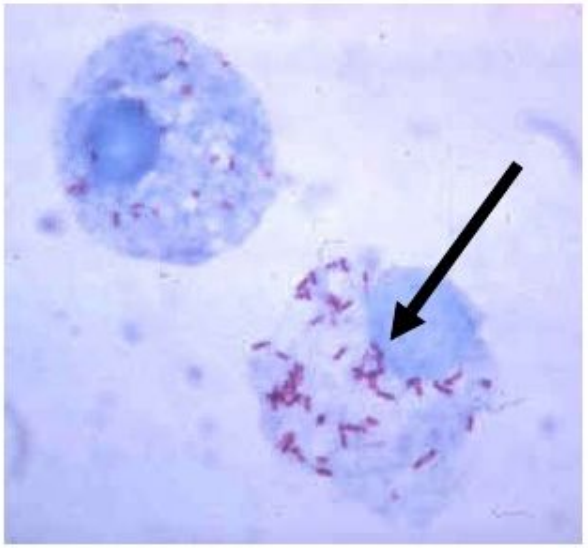
- Rickettsial disease in India has been documented from Jammu, Kashmir, Himachal Pradesh, Uttaranchal, Rajasthan, Assam, West Bengal, Maharashtra, Kerala and Tamil Nadu

TRANSMISSION

- Vectors: fleas, lice, mites and ticks.
- The specific vectors that transmit each rickettsial pathogen.
- Transmission by bites from these vectors or by inoculating infectious fluids or feces from the ectoparasites into the skin.
- Inhaling or inoculating conjunctiva with infectious material.
- Transmission of some rickettsial diseases after transfusion or organ transplantation is rare but has been reported.

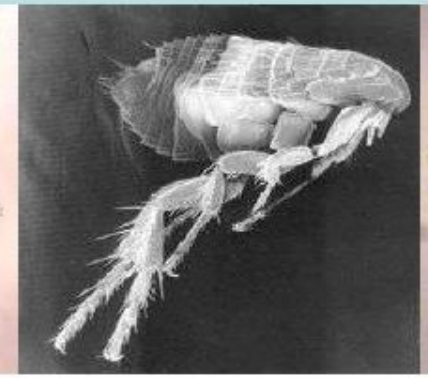
Rickettsiae

- Obligate intracellular parasite
- Gram negative pleomorphic rods
- Parasite of arthropods – fleas, lice, ticks and mites.
- No Human to human transmission.



Rickettsia inside the host cell

TICK



FLEA

LICE

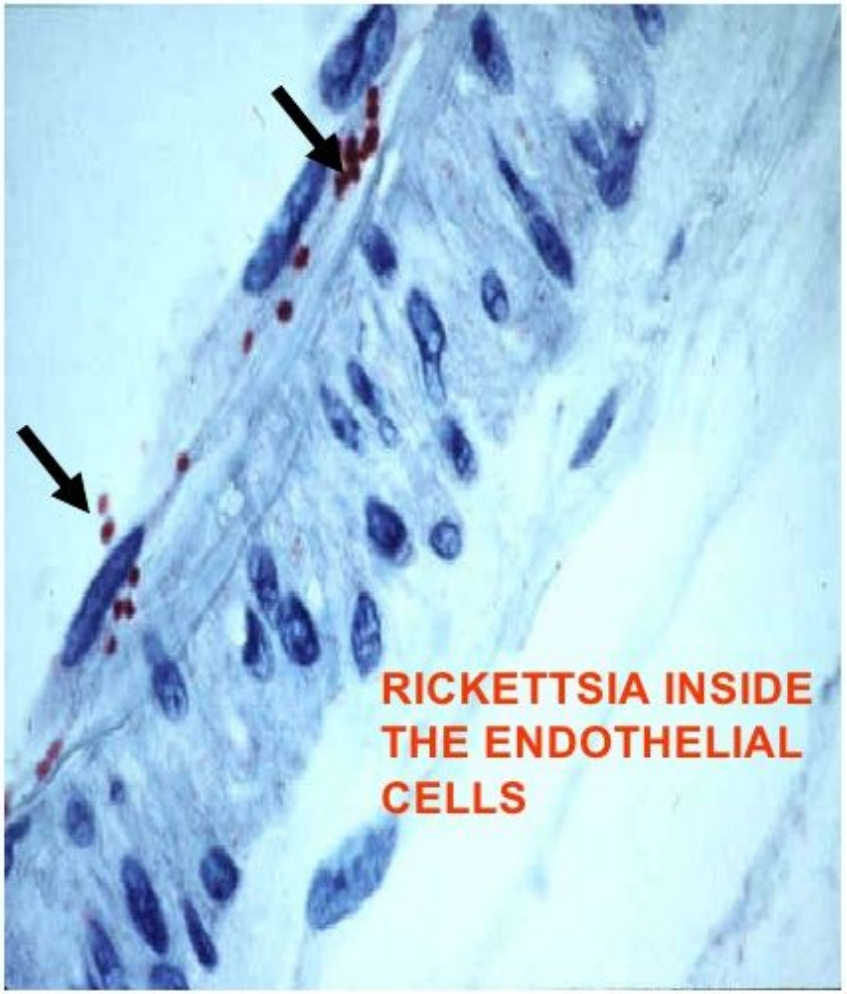
MITE

Rickettsiae

- Rickettsia (11 species)
- *Orientia*
- Ehrlichia (2 species)
- Coxiella (1 species)

GENERAL PATHOGENESIS

- Rickettsia are transmitted to humans by the bite of infected arthropod vector.
- Multiply at the site of entry and enter the blood stream.
- Localise in the vascular endothelial cells and multiply to cause thrombosis lead to rupture & necrosis.



EPIDEMIC TYPHUS (CLASSICAL TYPHUS)

Cause: Rickettsia prowazekii

Vector:

Human body louse (Pediculus humanus corporis)

Human head louse (Pediculus humanus capitis)

Incubation period – 5-21 days

Mortality rate is 20-30% in untreated cases.

LICE

SYMPTOMS

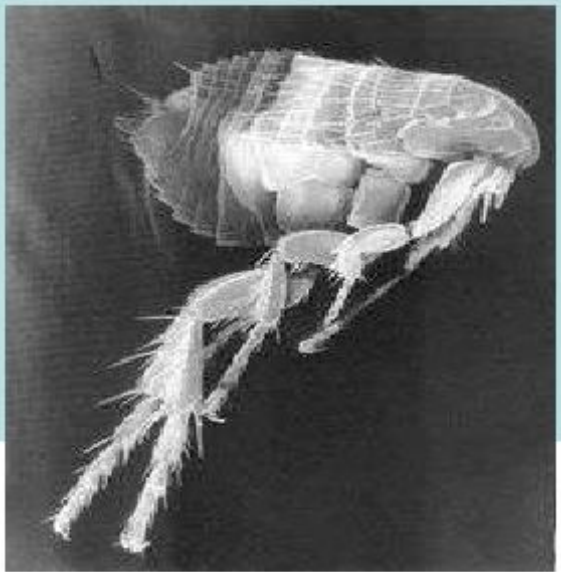
- Severe headache
- Chills
- Generalised myalgia
- High fever (39-41^{0}C)
- Vomiting
- Macular rash after 4-7 days – first on trunk and spreads to limb.
- Lacks conciousness.

Brill –Zinsser/ Recrudescent typhus

- This occur after the person recovered from epidemic typhus and reactivation of the rickettsia prowazekii which remained latent for years.
- Mild illness and low mortality rate.

ENDEMIC TYPHUS (MURINE TYPHUS)

- R. typhi
- Vector: Rat flea (Xenopsylla cheopis)
- Reservoir: Rat
- Infection occurs after rat flea bite



Spotted fever group

Rocky mountain spotted fever

- Most serious form
- Cause – R. rickettsii
- Infection occurs after tick bite
- Incubation period – 1 week
- More similar to typhus fever but the rash appears earlier and is more prominent.

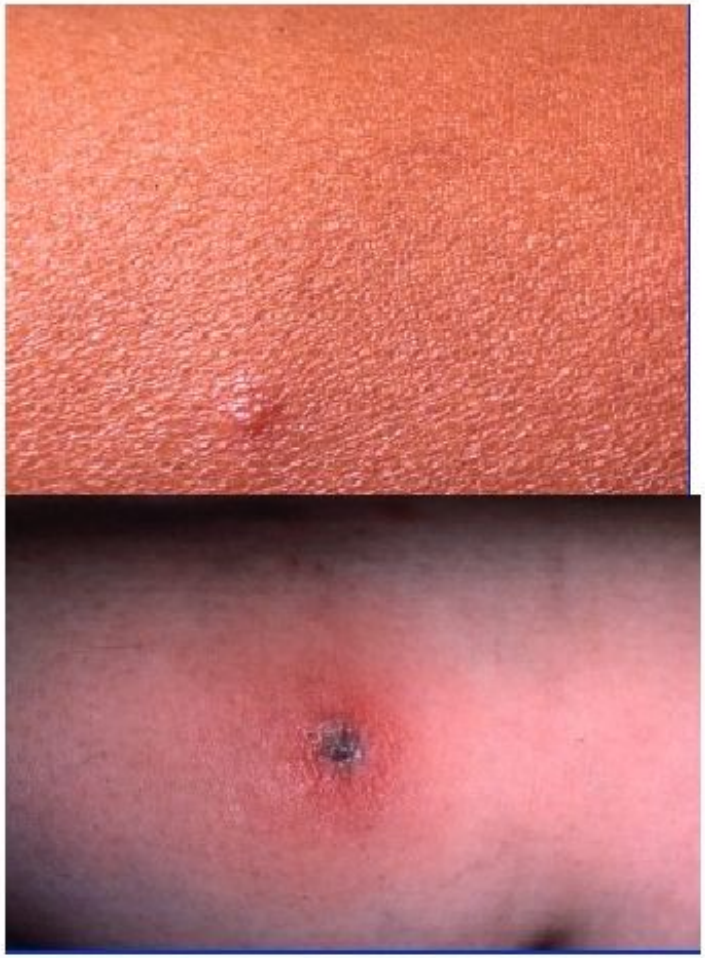
- The clinical symptoms of other spotted fevers are very similar to Rocky mountain spotted fever

Early (macular) rash on sole of foot.

Late petechial rashes on palm and forearm.

Rickettsial pox

- Benign febrile illness with vesicular rash resembling chickenpox.
- Vector: Liponyssoides sanguineus
- Reservoir: Domestic mouse (Mus musculus)
- Self-limiting, non-fatal.



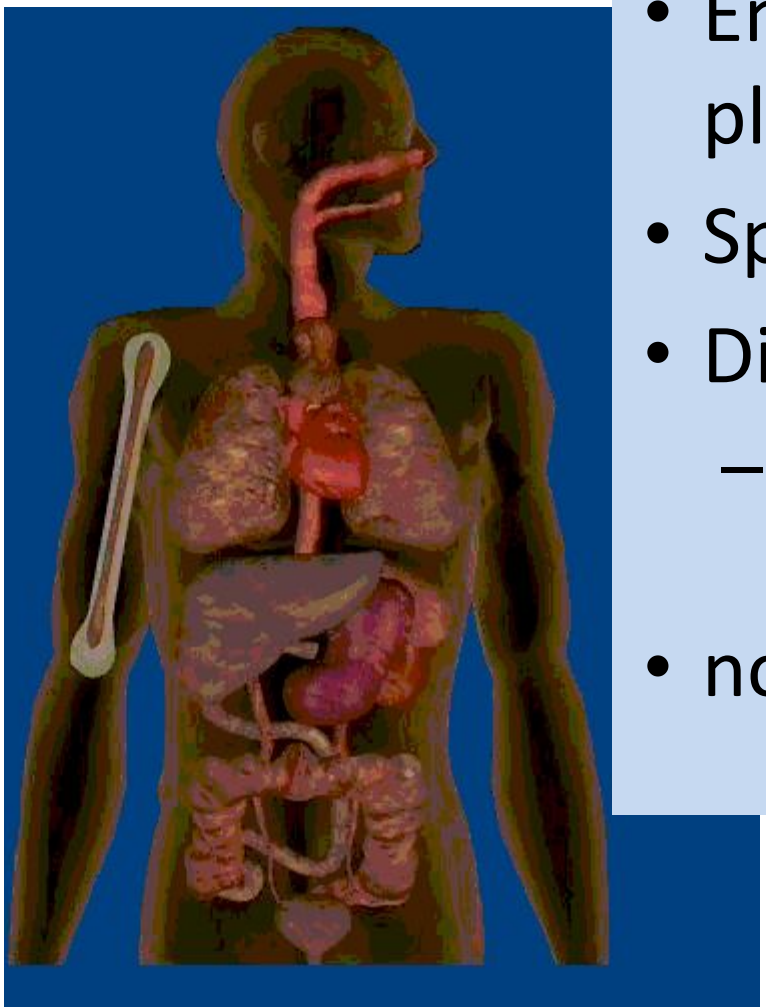
Complications of rickettsial diseases

- Bronchopneumonia
- Congestive heart failure
- Multi-organ failure
- Deafness
- Disseminated intravascular coagulopathy (DIC)
- Myocarditis (inflammation of heart muscle)
- Endocarditis (inflammation of heart lining)
- Glomerulonephritis (inflammation of kidney)

C burnetii

- C.burnetii differs from other rickettsia in that it is enclosed in a persistent vacuole during growth and division. Six to ten daughter cells will form within a host cell before the cell ruptures and releases
  them.
- No arthropod vector
- Q fever

Clinical Manifestations: Q Fever



- Entry: aerosol from infected placenta of sheep goats cattle
- Spread: blood stream
- Disease
  - Pneumonitis endocarditis, granulomas
- no Exit

LABORATORY DIAGNOSIS

- **Isolation from experimental animals**
- **Serology**

Specimens:

Blood – collected in febrile illness

Note: Rickettsia is highly infectious so specimens should be handled very carefully.

ISOLATION

- Blood is inoculated in guinea pigs/mice.
- Observed on 3rd – 4th week.
- Animal responds to different rickettsial species can vary

Symptoms:

- Rise in temperature – all species.
- Scrotal inflammation,swelling,necrosis – R.typhi, R.conori, R.akari (except R.prowazekii)

Serology

- Reliable test to confirm rickettsial diseases
- Antibody detection by Weil-felix test
- Antigen detection by IFA

WEIL-FELIX TEST

- Heterophile agglutination test using

non motile proteus strains (OX 19, OX 2, OX K)
to find rickettsial antibodies in patient's serum.

Procedure:

- Serum is diluted in three separate series of tubes followed by the addition of equal amount of OX19,OX2,OXK in 3 separate series of tubes.
- Incubation at 37^{0}C for overnight.
- Observe for agglutination.

INTERPRETATION OF WEIL-FELIX TEST

- Strong Agglutination with OX 19 – means epidemic & endemic typhus.
- Strong agglutination with OX 19 & OX 2 – means Spotted fever
- Strong agglutination with OX K – Scrub typhus

(Scrub typhus by Orientia tsutsugamushi (one of the rickettsial disease)

Other Serological tests

- Complement fixation test
- Latex agglutination test
- Enzyme immunoassay

All tests uses rickettsial antigens only to detect rickettsial antibodies.

Treatment

- Treatment should be started early in the first week of illness.
- Doxycycline (first choice)
- Tetracycline (alternate)