

Rickettsial Diseases



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Human infections caused by *Rickettsia*, *Orientia*, *Ehrlichia*, and *Coxiella* species

Bacteria	Diseases
<i>Rickettsia prowazekii</i>	Epidemic or louse-borne typhus; relapsing louse-borne typhus or Brill–Zinsser’s disease
<i>Rickettsia typhi</i>	Endemic or flea-borne murine typhus
<i>Rickettsia rickettsiae</i>	Rocky Mountain spotted fever
<i>Rickettsia akari</i>	Rickettsial pox
<i>Rickettsia conori</i>	Boutonneuse fever (i.e., Kenya tick bite fever, African tick typhus, Mediterranean spotted fever, Indian tick typhus, and Marseilles fever)
<i>Orientia tsutsugamushi</i>	Scrub typhus
<i>Ehrlichia sennetsu</i>	Sennetsu fever
<i>Ehrlichia chaffeensis</i>	Monocyte ehrlichiosis
<i>Ehrlichia phagocytophila</i>	Human granulocytic ehrlichiosis
<i>Coxiella burnetii</i>	Q fever
<i>Rickettsia australis</i>	Queensland tick typhus
<i>Rickettsia sibirica</i>	North Asian tick typhus

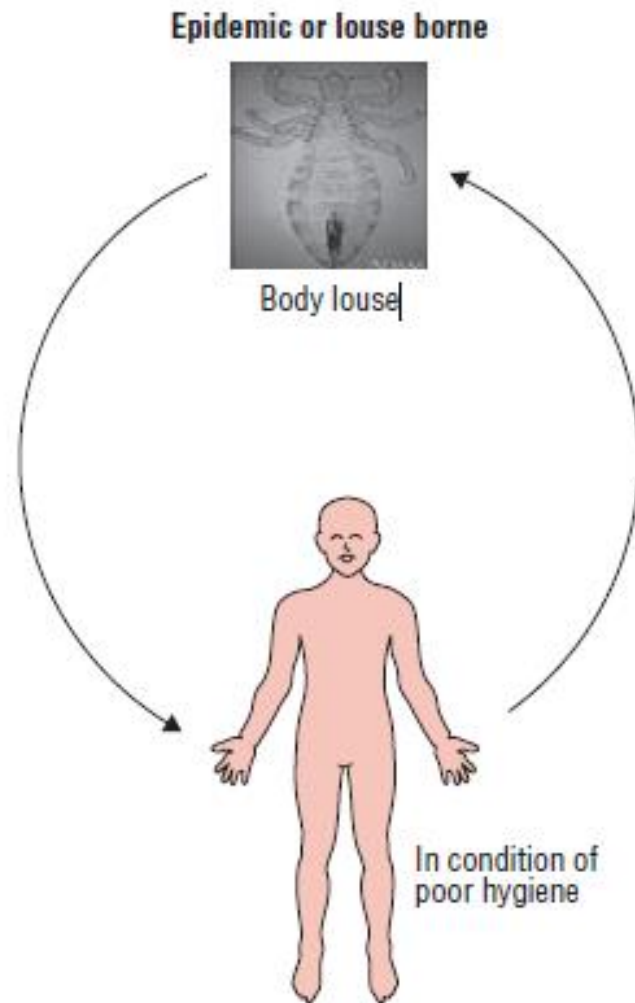
Rickettsia prowzekii

The bacteria

- *R.prowzekii* are Gram-negative, intracellular bacteria.
- They stain poorly with Gram stain, but stain best with Giemsa or Gimenez stain
- They grow in various tissue culture and in yolk sac of embryonated egg



Transmission of louse-borne typhus fever



Pathogenesis and Immunity

- They are obligate intracellular bacteria, multiply in endothelial cells of the blood vessels.
- Adhesins are the most important virulent factors

Clinical symptoms

- It causes typhus fever
- It may be epidemic typhus (louse-borne typhus) or recrudescent typhus (Brill-Zinsser's disease).



Epidemiology

- Epidemic typhus is present in central and south America, Africa (Ethopia and Nigeria), Northern china, and in India.
- Humans are the primary reservoir.
- Louse (e.g., body louse) is the most common louse vector.
- The disease is transmitted by bite of lice.

Laboratory diagnosis

- *R.prowazekii* Infection produces fever without any testicular inflammation in male adult guinea pigs.
- Weil-Felix test is positive in epidemic typhus; strongly react with OX19 antigen and weakly agglutinate with OX2 antigen; negative or weakly reactive in Brill-Zinsser's disease.
- Indirect fluorescent antibody test is the method of choice for diagnosis of epidemic typhus.
- PCR is used to detect rickettsia in blood or tissue.

Treatment and prevention

- Tetracycline and chloramphenicol are the drugs of choice.
- Control of human lice population and sanitation are effective to control epidemic typhus.

Animal inoculation test

Rickettsial pathogen	Fever	Testicular inflammation or tunica reaction	Scrotal necrosis
<i>Rickettsia rickettsiae</i>	+	+	+
<i>Rickettsia typhi</i>	+	^	—
<i>Rickettsia conori</i>	+	+	—
<i>Rickettsia akari</i>	+	+	—
<i>Rickettsia prowazekii</i>	+	—	—

Weil-Felix test in rickettsial diseases

Rickettsial diseases	Agglutination		
	OX19	OX2	OXK
Epidemic typhus	+++	+	—
Brill-Zinsser disease			—
Endemic typhus	+++	+/-	—
Spotted fever	++	+ +	—
Scrub typhus	—	—	++ +

Rickettsia rickettsiae

- *R. rickettsiae* causes rocky mountain spotted fever, the most serious type of spotted fever.
- They are small intracellular bacteria which multiplies in the cytoplasm of the infected cells.
- They stain poorly with Grams stain but stain well with Giemsa or Gimenez stain.
- Rocky mountain spotted fever is characterized by appearance of rash that may develop after 3 or more days, and typically appears initially on wrist, ankles and palms and soles and then spread to trunks.
- *R. rickettsiae* are transmitted to humans through saliva during the act of bite by a tick.
- Direct detection of *R. rickettsiae* in skin biopsy specimen of the rash from infected patients by direct fluorescent antibody (DFA) test is rapid and specific method for confirming diagnosis of Rocky mountain spotted fever.
- Indirect Fluorescent assay (IFA) and enzyme-linked immunosorbent assay (ELISA) are new serological tests used for early diagnosis of the condition.
- Tetracyclines, chloramphenicol and fluoroquinolones such as ciprofloxacin are effective against *R. rickettsiae*

Rocky mountain spotted fever

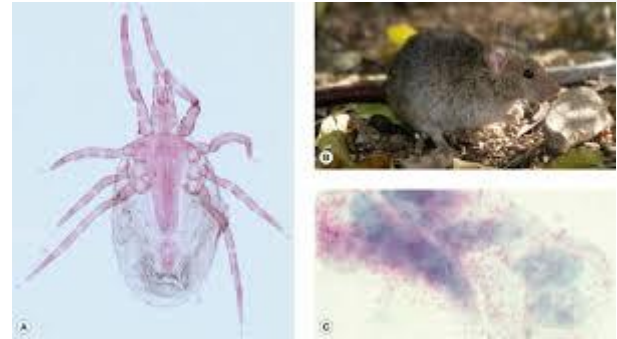
Rickettsia rickettsii



Ticks acts as vectors & reservoirs of Infection

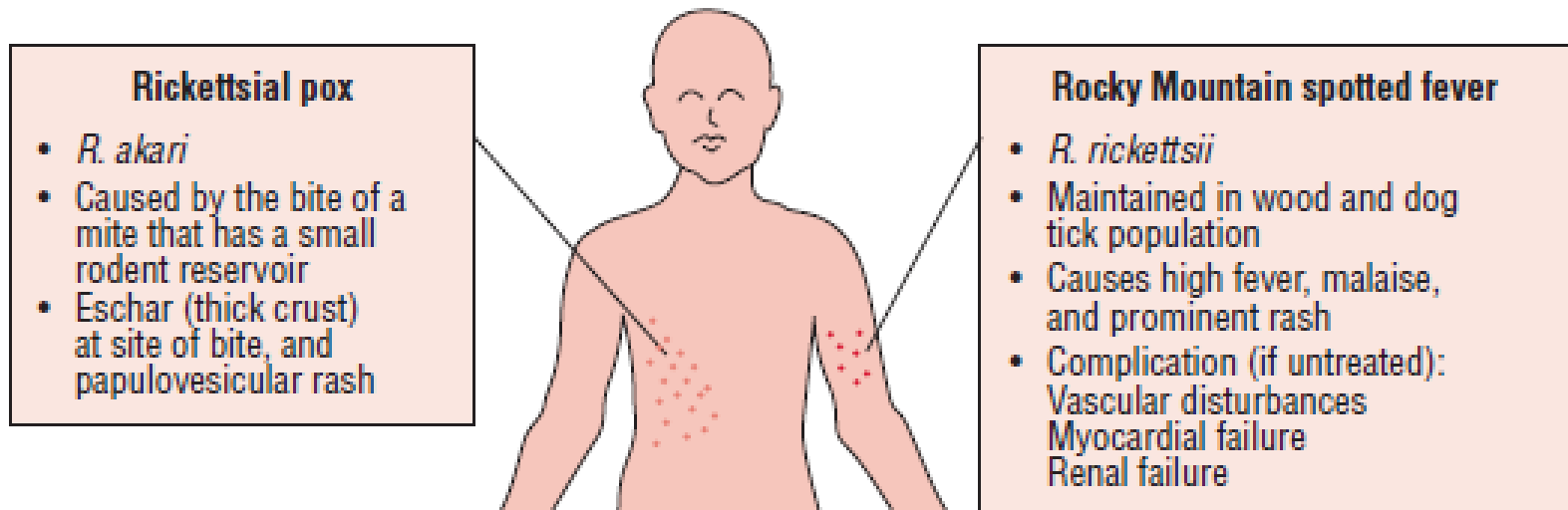


Rickettsia akari



- *Rickettsia akari* causes rickettsial pox.
- Infection is transmitted by the bite of mites
- The condition manifests by development of papule at the site of bite by mite.
- Weil-Felix reaction is negative.
- Treatment with doxycycline or chloramphenicol is highly effective.

Comparison of rickettsial pox and Rocky Mountain spotted fever



Orientia tsutsugamushi

- *Orientia tsutsugamushi* formerly

known as *R. tsutsugamushi* is the causative agent
scrub typhus



- The condition is transmitted to humans by the mite
Leptotrombidium akamushi and possibly by
Leptotrombidium deliense



- Scrub typhus is a mild and self-limiting disease.
- Tetracyclines, doxycycline, or chloramphenicol is highly effective in the treatment of scrub typhus.

Ehrlichia

The bacteria

- *Ehrlichia* are small and intracellular bacteria.
- They multiply in phagosomes of infected cells.

Pathogenesis and Immunity

- Intracellular location of these pathogens protects them from immune response of the host.

Clinical syndromes

- The bacteria cause
- Sennetsu fever
- Human monocytic ehrlichiosis
- Human granulocytic ehrlichiosis

Epidemiology

- Restricted in distribution
- Sennetsu fever is restricted mainly to Japan.
- Human monocytic ehrlichiosis: southeastern, mid-Atlantic, and south-central parts of United States.
- Human granulocytic ehrlichiosis: Northeast and central Atlantic states and in Midwestern states of the United States and also in Europe.
- Ehrlichiosis are tick-borne diseases.

Laboratory diagnosis

- Giemsa-stained smear of Blood films shows morulae, the intracellular form of the bacteria.
- IFA is used to demonstrate specific antibodies in the serum.
- DNA probes and PCR are used for specific diagnosis of *E.ewingii* and *E.chaffeensis* Infections.

Treatment and prevention

- Doxycycline is the drug of choice.

Coxiella burnetii

The bacteria



- *C. burnetii* gram-negative bacterium but stains poorly with gram staining.
- It primarily infects the monocytic macrophage cell and multiplies in phagolysosomes.
- *C. burnetii* in either phase does not show any antigenic sharing with rickettsia or *Proteus* bacillus antigen.

Pathogenesis and Immunity

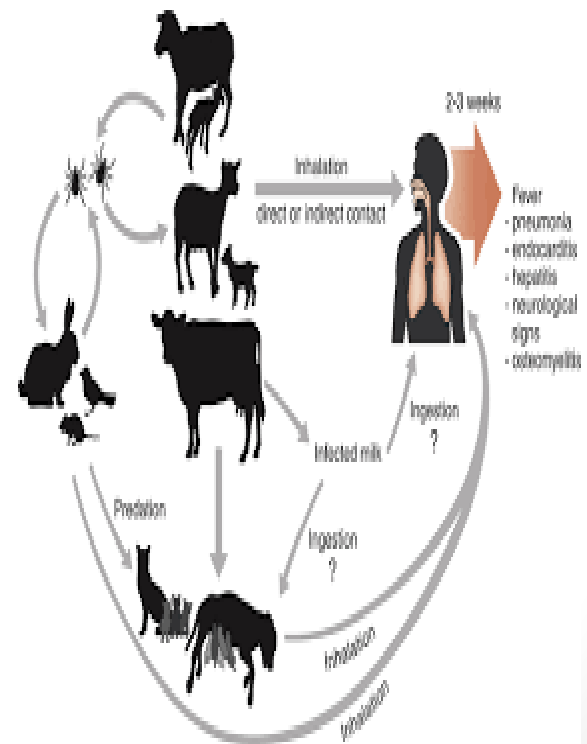
- They are obligate, intracellular bacteria.
- They typically grow and multiply in acidic environment of fused phagosome and lysosome.
- *Coxiella* causes diseases directly in various organs.
- Host mediated pathogenic mechanisms appear to play an important role in the pathogenesis of Q fever.
- Phase 1 form of *C. burnettii* are protected from the action of antibodies.

Clinical syndromes

- It causes Q fever, which can occur in acute or chronic forms.

Epidemiology

- Q fever is Zoonosis distributed worldwide
- Farm animals (sheep, cattle, and goats), cats, dogs and rabbits are primary reservoirs of infections
- Ticks do not play any role in transmission.
- Humans acquire diseases:
 - By inhalation of infected aerosols and
 - By consumption of infected milk.
- Person-to-person transmission does not occur.



Laboratory diagnosis

- Serology is the mainstay of diagnosis of Q fever.
- Serological tests detect antibodies against phase 1 and 2 antigens.
- PCR is yet to be used widely.

Treatment and Prevention

- Tetracyclines and doxycycline are effective for acute Q fever.
- Combination of tetracyclines, cotrimoxazole, or rifampicin for a prolonged period is essential for treatment of sub acute endocarditis and other chronic disease caused by *C.burnetii*.
- Preventive measures include:
 - Wearing protective clothing, Mask, gloves while handling carcasses and animal hides,
 - Pasteurization of milk by flash method.

Important Questions:

- Short Answer Questions:
- 1. Rickettsial Diseases
- 2. Weil Felix reaction
- 3. Q Fever