CHAPTER X
RICKETTSIA AND OTHER RELATED ORGANISMS

General characteristics of Rickettsia

- Obligate intra cellular parasites except Rochalimea.
- Pleomorphic, appearing either as short rods or cocci and occur as singly, in pairs , short chains, and filaments; with Giemsa's stain they appear blue.
- Possess muramic acid; structurally similar to Gram negative bacteria.

- Can be cultivated in-Yolk sack of embryonated egg, lab. animals arthropods and living tissues.
- Repletion: similar to bacteria (budding).
- Produce various enzymes for metabolism.
- Sensitive to heat, drying and bactericidal chemicals
- Easily killed by storage at room temperature.

Three genera: Rickettsia, Coxiella and Ehrlichia.

Genus *Rickettsia*

Rickettsia species are divided into three main groups:

1. Typhus group

R. prowazekii Causes epidemic typhus (louse-borne typhus)

R. typhi Causes endemic typhus (murine, or flea-borne typhus).

2. Scrub typhus group

Orientia tsutsugamushi Causes mite-borne scrub typhus,also

known as Japanese river fever and Kedani mite disease.

3. Spotted fever group

- *Rickettsia rickettsii* - cause Rocky Mountain spotted fever.
- *Rickettsia conorii* - cause African and Indian tick typhus.
- *Rickettsia akari* - cause Rickettsial pox.

Virulence factors

Rikettsial pathogenesis is due primarily to destruction of endothelial cells by replicating bacteria.

The pathological manifestations results more from direct Riketsial injury than from immuno-pathological mechanisms

mediated via cytokine and cytotoxic T- lymphocytes, inflammation, intravascular coagulation or endotoxin.

Pathogenesis and clinical manifestations

- Rickettsiae multiply in the salivary glands of ticks and mice.
- In fleas and lice, multiplication occurs in the gut and excreted in the feces.
- Transfer to human host by crushing of the arthropod or arthropod defecation at the site(s) of the bite.
- Rickettsiae penetrated host’s skin and reach blood stream.

Observation of Rickettsiae in cell culture systems suggests that

the mechanisms of destructions of the host cell differ among the

three sero-groups.

1. R. prowazekii or R. typhi continue to multiply until the cell is packed with organisms and then bursts, possibly as a result of phospholipase A activity.
2. Spotted fever group seldom accummulate in large numbers and do not cause lysis of the host cells, but appear to induce the formation of filopodia, which the Rickettsiae enter and from which they escape.

3. Scrub typhus Rickettsiae also escape from host cells soon after infecting them but little is known abut the mechanisms by which these organism damage cells.

Coxiella burnetii

- *C. burnetii causes Q (‘query’) fever which has a worldwide distribution.*
- In Zaire it is known as Red River Fever.
- Natural reservoir hosts include cows, sheep, goats, rodents, wild mammals and several species of bird.
- *C. burnetii is transmitted* by ticks but unlike rickettsiae, it can

also be transmitted without a vector via placental tissue, dust particles, faeces and infected milk. .

- Human infection is commonly by inhaling contaminated aerosols and dust and occasionally by drinking untreated milk or by handling infected animals or their tissues.
- *C. burnetii infects the cells of the spleen and liver causing*

enlargement of these organs. Q fever resembles influenza with

high fever, severe headache, fatigue, and body pains.

- Usually there is no rash or only a slight one.
- Serious complications of Q fever include pneumonitis, chronic

infective endocarditis, and liver disease.

Laboratory diagnosis

Specimen: Serum for serological tests

The serological tests to diagnose typhus are:

1. Indirect fluorescent antibody test

2. Complement fixation test

3. Weil –felix reaction: Some of the antigen of Proteus strain

(OX-19, OX-2,OX-K) agglutinates with sera from patients with

rickettsial diseases.

Table. Weil-Felix Reactions

Organism	*Weil-Felix Reactions*		
	OX 19	OX 2	OXK
Typhus Group: *R. prowazekii**	+++	+/−	−
R. typhi	+++	+/−	−
Scrub Typhus Group: *O. tsutsugamushi*	−	−	+++/−
Spotted Fever Group: *R. conorii*	+/++	+/++	−
R. rickettsii	+/++	+/++	−

*In louse-borne typhus, the antibody titre against OX 19 may rise to 1 in 500 or more in the third or fourth week of infection, but rarely in Brill-Zinsser disease.

Treatment

Drug of choice: tetracycline and chloramphenicol.

Prevention and Control

- Personal hygiene.
- Delousing with insecticide.
- Removing of vegetations in which rates and mites live.
- Tick repellents.

Table. Summary of Rickettsial and Ehrlichial Diseases

Group	Organism	Disease	Geographic Distribution	Vector	Mammalian Resevoir	Clinical Features	Diagnostic Tests[1]
Typhus group	*Rickettsia prowazekii*	Epidemic typhus (louse-borne typhus), Brill-Zinsser disease	Worldwide: South America, Africa, Asia, ? North America	Louse	Humans	Fever, chills, myalgia, headache, rash (no eschar); severe illness if untreated	Serology
	Rickettsia typhi	Murine typhus, endemic typhus, flea-borne typhus	Worldwide (small foci)	Flea	Rodents	Fever, headache, myalgia, rash (no eschar); milder illness than epidemic typhus	Serology
	Orienta tsutsugamushi	Scrub typhus	Asia, South Pacific, northern Australia	Mite	Rodents	Fever, headache, rash (50% have eschar), lymphadenopathy, atypical lymphocytes	Serology
Spotted fever group[2]	*Rickettsia rickettsii*	Rocky Mountain spotted fever	Western Hemisphere (United States, South America)	Tick[3]	Rodents, dogs	Fever, headache, rash (no eschar); many systemic manifestations	Direct FA of rickettsiae in tissue; serology
	Rickettsia akari	Rickettsial pox	United States, Korea, Russia, South Africa	Mite[3]	Mice	Mild illness, fever, headache, vesicular rash (eschar)	Serology
	Rickettsia australis	Queensland tick typhus	Australia	Tick[3]	Rodents, marsupials	Fever, rash of trunk and limbs (eschar)	Serology
	Rickettsia conorii	Fièvre boutonneuse, Mediterranean spotted fever, Israeli spotted fever, South African tick fever, African (Kenya) tick typhus, Indian tick typhus	Mediterranean countries, Africa, Middle East, India	Tick[3]	Rodents, dogs	Fever, headache, rash, "tache noire" (eschar)	Direct FA of rickettsiae in tissue not sensitive; serology

	Rickettsia sibirica	Siberian tick typhus (North Asian tick typhus)	Siberia, Mongolia	Tick[3]	Rodents	Fever, rash (eschar)	Serology
Q fever	*Coxiella burnetii*	Q fever	Worldwide	Airborne fomites, tick	Sheep, cattle, goats, others	Headache, fever, fatigue, pneumonia (no rash); can have major complications	Positive CF to phase I, II antigens
Ehrlichiae	*Ehrlichia chaffeensis*	Human monocyte ehrlichiosis	South central, southeastern, and western United States	Tick	Deer	Fever, headache, atypical white blood cells	Inclusions in circulating monocytes; indirect FA for antibodies
	Neorickettsia sennetsu	Human monocyte ehrlichiosis	Japan, Malaysia	Trematode-infected fish?	Mammals	Fever, headache, atypical white blood cells	
	Anaplasma phagocytophilium	Human granulocyte anaplasmosis	Upper midwestern, northwestern, and West Coast United States and Europe	Tick	Mice, other mammals	Fever, headache, myalgia	Inclusions in granulocytes; indirect FA for antibodies
	Ehrlichia ewingii	Human granulocyte ehrlichiosis	Midwestern United States	Tick	Dogs	Fever, headache, myalgia	Inclusions in granulocytes; indirect FA for antibodies