

# **RICKETTSIA, ORIENTIA and COXIELLA**

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## Introduction:-

- Rickettsial diseases are considered some of the most covert emerging or reemerging diseases.
- Rickettsial infections are difficult to diagnose clinically hence occurrence often goes unrecognized.
- Failure of timely diagnosis – Significant morbidity & mortality.

## History:-

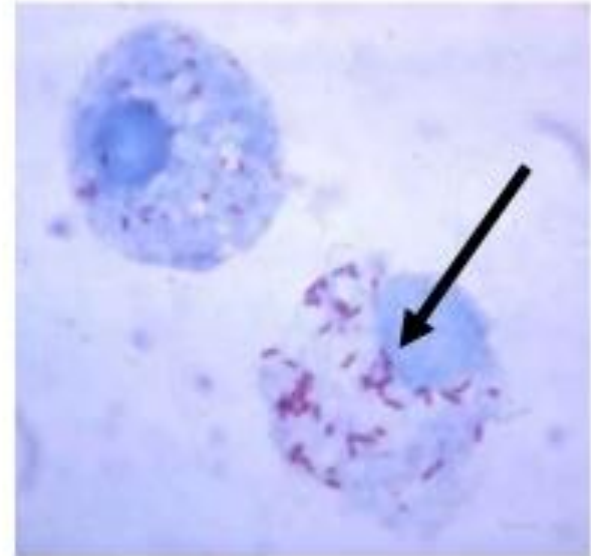
- Hippocrates in 460 BC used the term Typhus, meaning 'smoke' to describe the confused state of intellect i.e. stupor.
- Rickettsia named after **HOWARD TAYLOR RICKETTS** died of Typhus fever contracted during his studies discovered Spotted fever Rickettsia (1906).
- It has been documented in India since 1930s with reports of Scrub typhus from Kumaon region, Assam in soldiers during 2<sup>nd</sup> world war & Murine typhus from Jabalpur, M.P and Kashmir.



- Orientia is only one species *O. tsutsugamushi* and differs from **Rickettsia** in the 16S rRNA sequence and cell wall structure.
- Both share in following characters:

# Rickettsial characteristics:

- Obligate intracellular parasite.
- Gram negative pleomorphic bacteria.
- Most are zoonoses spread to humans by arthropods (except Q fever).
- Cannot grow in culture media, but cultivable only in living tissue.
- No human to human transmission.



**Rickettsia inside the host cell**



**TICK**



**FLEA**

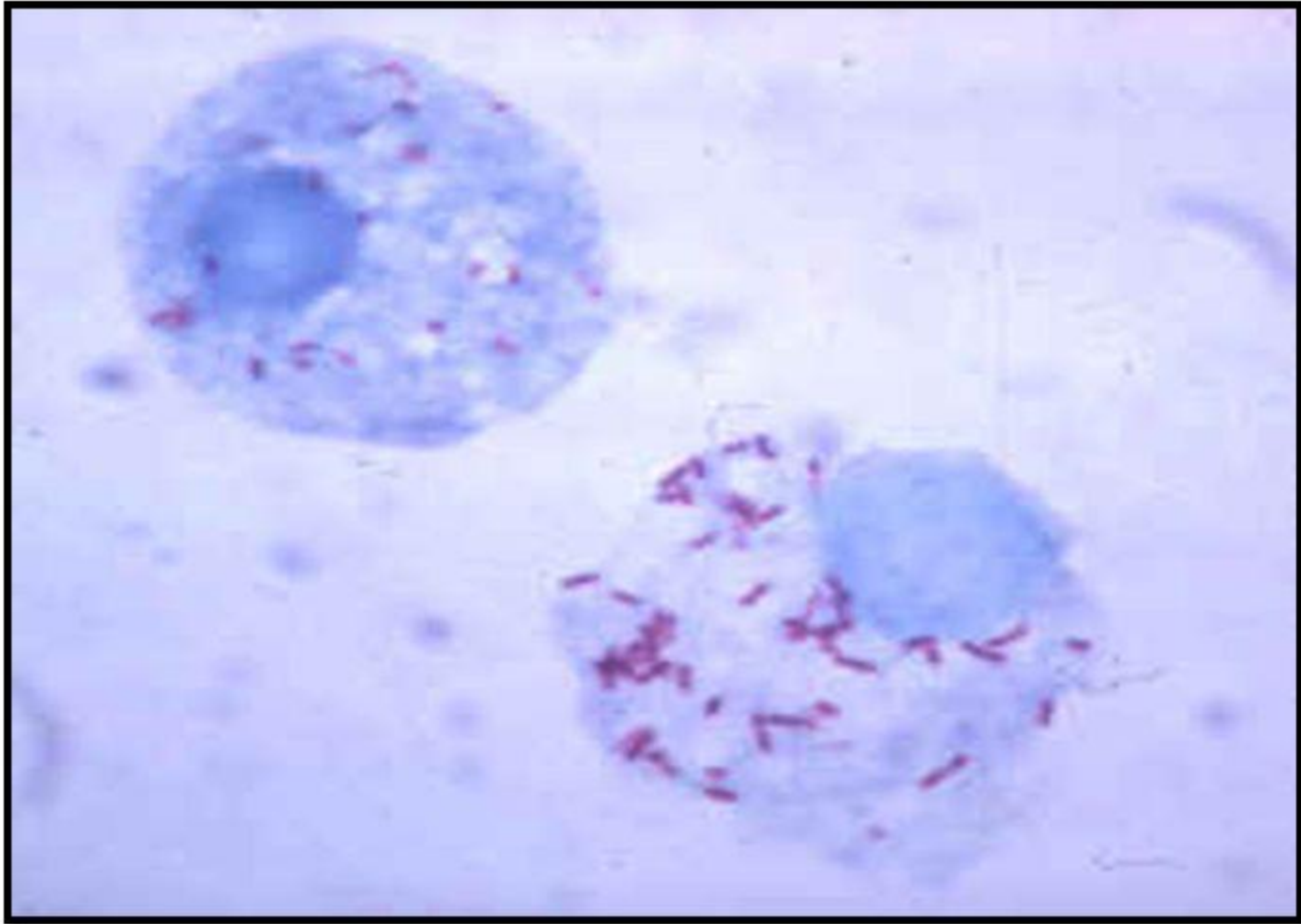


**LICE**



**MITE**

# Giemsa stain of tissue culture cells infected with *Rickettsia rickettsii*



# Rickettsial infections- classification

Diseases	Rickettsial agent	Insect vectors	Mammalian reservoirs
<b>1. Typhus group</b>			
a. Epidemic typhus	<i>R. prowazekii</i>	Louse	Humans
b. Murine typhus	<i>R. typhi</i>	Flea	Rodents
c. Scrub typhus	<i>R. tsutsugamushi</i>	mite*	Rodents
<b>2. Spotted fever group</b>			
a. Indian tick typhus	<i>R. conorii</i>	Tick*	Rodents, dogs
b. Rocky mountain spotted fever	<i>R. rickettsii</i>	Tick*	Rodents, dogs
c. Rickettsial pox	<i>R. akari</i>	Mite*	Mice
<b>3. Others</b>			
a. Q fever	<i>C. burnetii</i>	Nil	Cattle, sheep, goats
b. Trench fever	<i>Rochalimaea quintana</i>	Louse	Humans

Source : (2). \* Also serve as arthropod reservoir, by maintaining the rickettsiae through ovarian transmission.

# Epidemic typhus/ Classical typhus



Rickettsial agent: - *Rickettsia prowazekii*

Insect vector :- Louse

Mammalian Reservoir :- Human, flying squirrels

Transmission :-

Human to human via louse vector, directly in blood, or as the contaminated louse feces is scratched into the bite wound, or inhalation of infected louse feces or dust.

Incubation period: 5-21 days



# Epidemic Typhus or Brill-Zinsser Disease



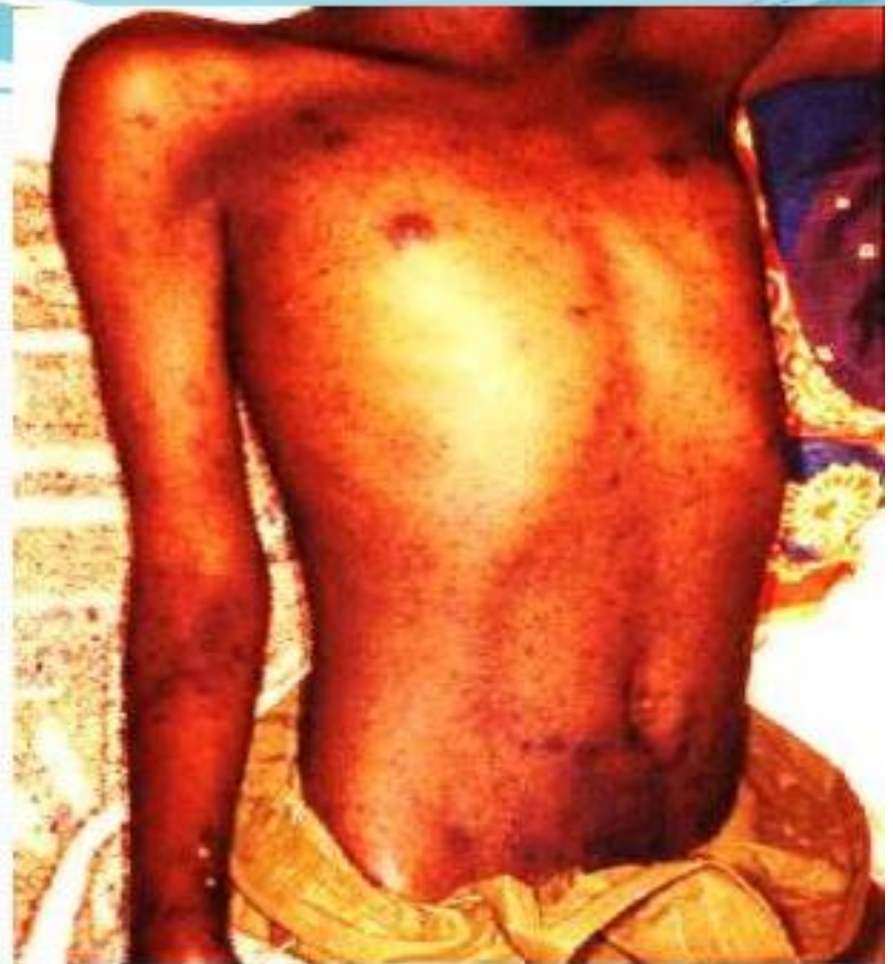
ePainAssist.com

Louse

- The *Rickettsia prowazeki* circulate in the blood stream during the first week. They invade the capillary endothelium causing vasculitis in the brain, heart and other organs. Disseminated intravascular coagulation and vascular occlusion may occur. Survivors remain with long lasting immunity.

## Symptoms:

- Acute febrile illness
- Headache
- Myalgia
- Neurologic manifestations-  
Stupor, delirium
- Vasculitis
- Gangrene
- Rash : 40-80% macular, centrifugal spread,  
spare palms and soles



# Brill –Zinsser disease/Recrudescence typhus

(or these days “jail fever”)

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

- **If such individuals are exposed later to factors which lower their immunity, the rickettsia may be activated to produce disease again. This condition is known as Brill's disease in which the infection is endogenous. A person with Brill's disease may be the point of start of an epidemic in a louse infested susceptible population.**

- **Prevention:**
- Anti-lice measures
- **personal hygiene.**

# Endemic typhus (Murine typhus)

- **Cause:** *Rickettsia typhi*
- **Vector:**
  - ✓ Rat flea
- Infection occurs **after** rat flea bite
- Murine typhus is an under-recognized entity, as it is often **confused** with viral illnesses.
- Most people who are infected do not realize that they have been bitten by fleas.



Scanning electron microscope (SEM) depiction of a flea



- **Prevention:**
- Rodent control measures in infested area



# Spotted fever group

## **"Rocky mountain spotted fever"**

- **The name "Rocky mountain spotted fever" is derived from the region in which the disease was first found. It accounts for 95% of rickettsial diseases in USA**

# Rocky mountain spotted fever

Rickettsial agent:- R. rickettsii

Insect Vector: - Tick

Mammalian Reservoir: -Rodents, dogs

Incubation period:- 3-7 days

Symptoms:- Abrupt onset fever, chills, headache, myalgia

Rash : first appears in extremities, moves centripetally and involve palm.

Mortality: 70% if left untreated in elderly

Complications:- HSM, jaundice, myocarditis, uremia, ARDS



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.**

- **Prevention:**
- **Reduce exposure by wearing protective clothings & avoid tick infected area.**
- **using tick repellents,**
- **Disinfection of dogs**
- **Health education about mode of transmission**

# Diagnosis of Rickettsial diseases

- **Early diagnosis and prompt treatment are lifesaving.**
- **Direct detection** :in blood and skin biopsy specimens from the rash; by immuno-histochemical methods and PCR. These methods are very useful for establishing a diagnosis in the acute stage.

- **Isolation procedures** are only done in few laboratories, as they are hazardous.

Inoculation of guinea pigs, mice or yolk sac of embryonated eggs have been replaced by tissue culture methods, which give results in 2-3 days.

- **Serologic diagnosis** is based on detection of it rising antibody titre by indirect immunofluorescence, ELISA, latex agglutination and Western blot, which detect specific antibodies. Serology is mainly used to confirm the diagnosis for epidemiologic investigations.



# Treatment of rickettsial diseases

- The treatment of choice for all rickettsial diseases is tetracyclines, with chloramphenicol as the second choice

# Doxycycline saves lives!

Use it to treat suspected  
rickettsial infections in  
patients of all ages.

New research shows **NO**  
evidence of tooth staining  
when used in short courses.



[Click to learn more.](#)

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When you Suspect sooner .....

Treatment is easier .....

- 1.Clinically
- 2.Tick exposure
- 3.Epidemiological data
- 4.Lab features
- 5.Rapid defervescence with proper antibiotics

# Q FEVER (QUERY FEVER)



- *Coxiella burnetii* is the only species and causes Q fever.
- It is similar to rickettsia in most characters; however, it differs from rickettsia in being more resistant to drying, disinfectants and **UV**. It can survive for months in dried animal discharges (placental tissues or amniotic fluid) faeces, urine or milk; due to **endospore formation** during an intracellular developmental cycle.

- *C. burnetii* exist in two antigenic forms called phase I and phase II.
- **Phase I** :is the virulent form that is found in humans with Q fever and in infected vertebrate animals, and it is the infectious form
- **Phase II** is the avirulent form

# Q fever

Etiology: *Coxiella burnetti*

Vector : None

Reservoir: Cattle, sheep, goat

MOT: ingestion of dust containing organisms or aerosols excreted in urine, feces, milk etc.

I.P:- 2-3 wks

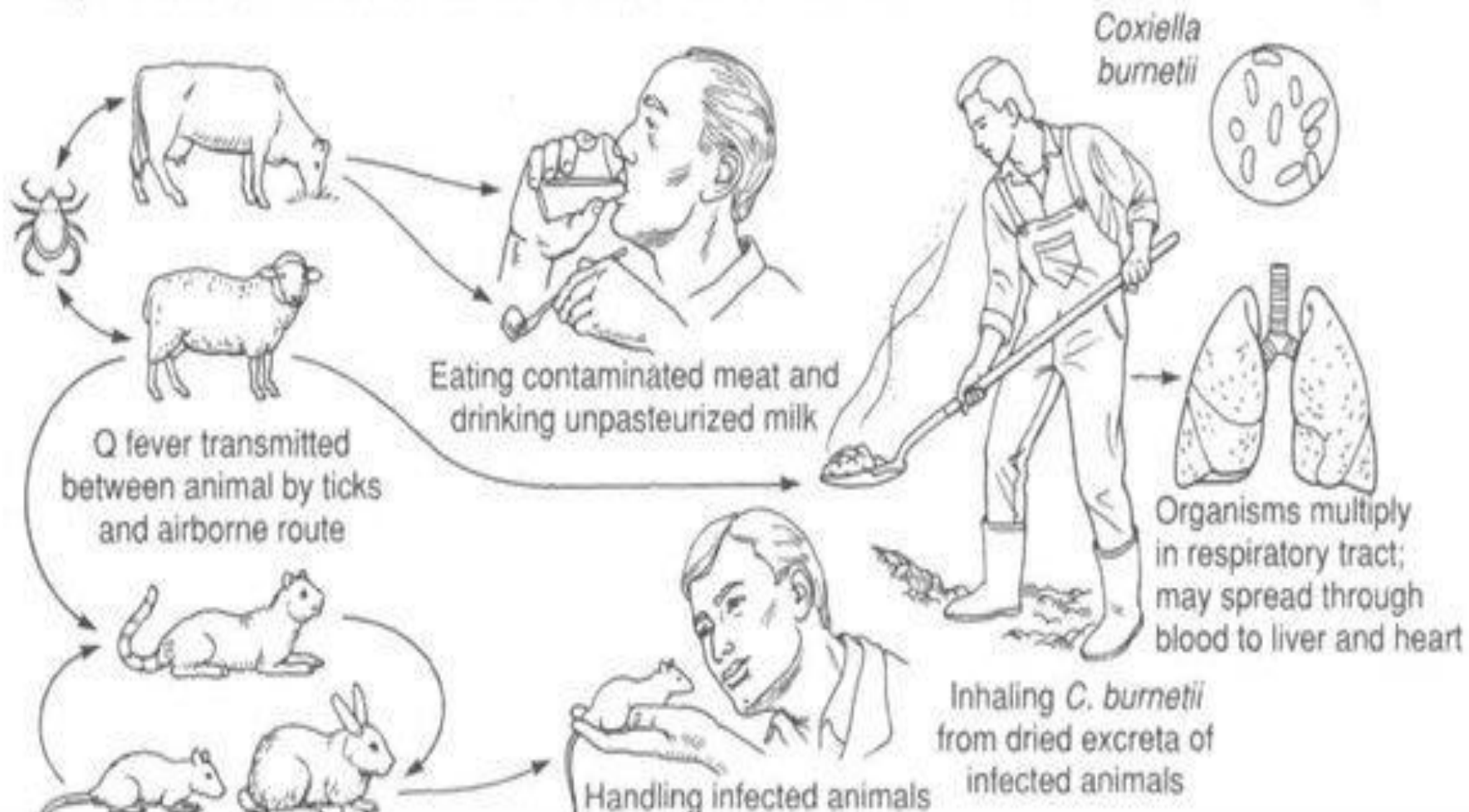
C/F:- resembles influenza or non bacterial pneumonia

Individuals at risk : food handlers, veterinarians

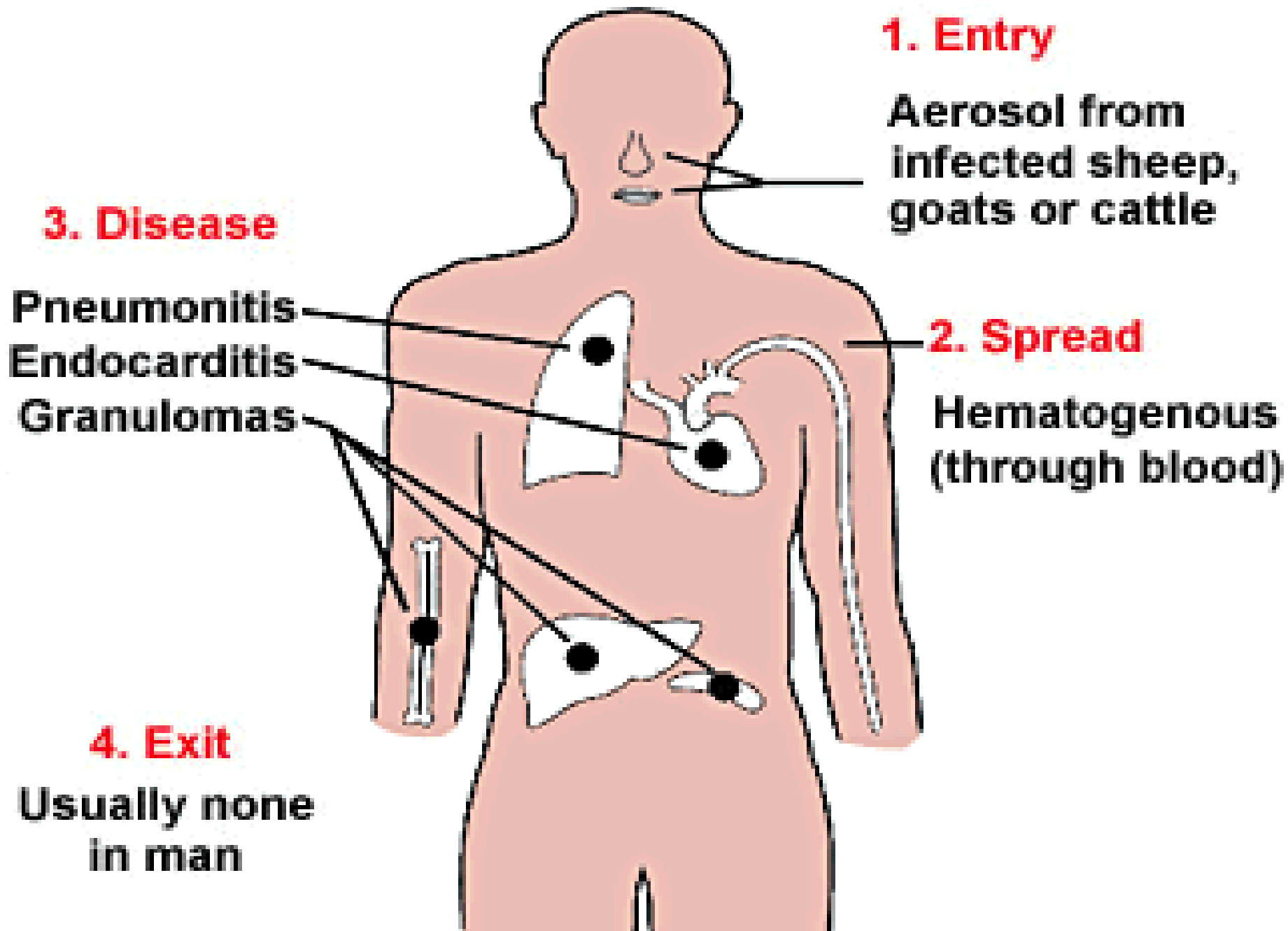
Infective endocarditis occasionally in chronic Q fever

## Q Fever (Query Fever) Q is for "query" because when described, its etiology was unknown 219

**DEFINITION:** An acute infectious disease caused by the rickettsial organism *Coxiella burnetii*. It infects a variety of animals, but unlike other rickettsial diseases it is not transmitted to humans through an insect vector.







- **Acute :**
- **disease begins with fever and influenza-like symptoms. Pneumonia occurs in about half of cases. Hepatitis is frequent enough that the combination of pneumonia and hepatitis should suggest Q fever.**

- **Chronic:**
- characterized by life threatening **endocarditis** may occur in patients with abnormal valves. It is associated with a rise in antibody titre to phase I *C. burnetii* and negative blood cultures

- **Diagnosis:**
- is mainly by serologic detection of a rising antibody titre to phase I or II *C. burnetii*. Indirect immunofluorescence is considered the best method
- PCR is useful in diagnosing culture negative endocarditis. Other methods as in rickettsia may be used.

# Treatment

- Once infected, humans can have life-long immunity

Acute Q fever treated with:

Doxycycline (100 – 200 mg/day)

Chloramphenicol (Adult : 50 – 100 mg/kg/day

Child : 25 – 50mg/kg/day)

Erythromycin (Adult : 1-2 g/day up to 4gm/day

Child : 30 -50 mg/day up to 1g/day)

Timethoprim/sulfamethoxazole (160/800 mg)

## **Fluoroquinolones:-**

Ciprofloxacin, Gemifloxacin,

Levofloxacin, Moxifloxacin

Norfloxacin, Ofloxacin

# Chronic Q fever

- Chronic Q fever is difficult to treat, therefore a prolonged antimicrobial regimen is recommended.
- The most current recommendation for endocarditis is combination treatment with **doxycycline and hydroxychloroquine** for at **least 18 months** to eradicate any remaining *C burnetii* and prevent relapses.
- An alternative option is combination of **doxycycline and a fluoroquinolone for at least 3-4 years.**

- **Treatment:**
- **Doxycycline is used for treatment of acute infection.**
- **Combined, prolonged treatment of doxycycline with ciprofloxacin or rifampicin is essential in endocarditis**



## Control measures

Treatment:- tetracycline (DOC) ,prolong for 18 months.

Preventive measures:-

- Pasteurization/boiling of milk

- Providing sanitary cattle sheds

- Adequate disinfection and disposal of products.

Personal prophylaxis :-

- Coxiella vaccination to occupationally exposed workers.



- **A formalin-killed whole cell, phase I *C. burnetii* vaccine is available for those occupationally at risk.**

**PRESCRIPTION ONLY MEDICINE  
KEEP OUT OF REACH OF CHILDREN**

**Q-vax<sup>®</sup>** SKIN TEST

**Vial**

**0.5 mL**

**Inactivated *C. burnetii* for  
Pre-Q-Vax<sup>®</sup> Vaccination Screening**

**Suspension for intradermal injection**

**After dilution each 0.1 mL dose  
of product contains 16.7 ng of  
*Coxiella burnetii* inactivated Phase I**

**AUST R 100518**

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