

**Republic of Iraq  
Ministry of Higher Education  
& Scientific Research  
University of Al-Qadissiya  
College of Veterinary Medicine**



## **Rickettsiosis**

A Graduation Project Submitted to the Department Council of the  
Internal and Preventive Medicine-College of Veterinary Medicine/  
University of Al-Qadisiyah in a partial fulfillment of the requirements for  
the Degree of Bachelor of Science in Veterinary Medicine and Surgery.

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

فَنَعَلَى اللَّهِ الْمَلِكُ الْحَقُّ وَلَا تَعْجَلْ بِالْقُرْآنِ مِنْ قَبْلِ أَنْ يُقْضَىٰ  
إِلَيْكَ وَحْيُهُ، وَقُلْ رَبِّ زِدْنِي عِلْمًا ﴿١١٤﴾

صَدَقَ اللَّهُ الْعَظِيمُ،

### **Certificate of Supervisor**

I certify that the project entitled ( **Rickettsiosis** ) was prepared by  
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under my supervision at the College of Veterinary Medicine / University  
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26 / 3 / 2018

# الأهداء

الى من علمني النجاح والصبر

الى من تتسابق الكلمات لتخرج معبرة عن مكنون ذاتها

من علمتني و عانت الصعاب لاصل الى ما انا فيه

و عندما تكسوني المصوم اسبح في بحر حنانها ليخفف من الامي

.... امي

الى استاذتي و المشرفة على بحثي د. ختام فايد

## Summery

Tick borne diseases in particular, are progressively more known as important in both veterinary medicine and public health. The term "Rickettsial diseases" is widely applied to a diversity of infectious diseases caused by fastidious bacteria belonging to the genera *Rickettsia*, ticks commonly play a significant role in the transmission and ecology of infectious diseases. Rickettsial diseases differ in clinical severity rate according to the virulence factors of the *Rickettsia* and host, such as male, age, and other underlying diseases. The mainly virulent rickettsiae are *R rickettsii* and *R prowazekii*, which kill a large part of the infected persons.

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## 1. Introduction

Tick borne diseases in particular, are progressively more known as important in both veterinary medicine and public health. The term "Rickettsial diseases" is widely applied to a diversity of infectious diseases caused by fastidious bacteria belonging to the genera *Rickettsia*, *Orientia*, *Ehrlichia*, and *Coxiella*. *Rickettsia* does occupy phylogenetically a location between bacteria and viruses (1). Gram-negative coccobacillary forms that proliferate within eukaryotic cells (2). A general quality of rickettsiae is that mammals and arthropods vector are natural host, (ticks, mites, fleas, and lice) and a number of mechanisms for vertical and horizontal transmission within this vector (3).

Ticks commonly play a significant role in the transmission and ecology of infectious diseases. Climatic factors (temperature, humidity and rainfall) heavily effect the ecology, maturity, behavior and survival of ticks and the transmission dynamics of the diseases they transmit (4). Mainly, rickettsia acquired by inhalation of infected airborne spray (5). In human, the epidemiology of rickettsial diseases is similar to the biology of transmit vectors. Rickettsial diseases differ in clinical severity rate according to the virulence factors of the *Rickettsia* and host, such as male, age, and other underlying diseases. The mainly virulent rickettsiae are *R rickettsii* and *R prowazekii*, which kill a large part of the infected persons Unless the disease is treated adequately early with an effective antimicrobial agent (6, 7)



## **Literature Review**

### **2-1 The Causative agent:**

#### **2-1-1 General Features**

The cells are very small (0.25  $\mu$  in diameter) in the form of rods, coccids and often Multiform microorganisms which contain typical of bacterial cell walls, no flagella, are gram-negative and Multiply within host cells via bilateral fission only. They occur single, in pairs, or in strands (8). Most type is found only in the cytoplasm of host cells, but this cause spotted fever which proliferate in the nuclei as well as in the cytoplasm. In the laboratory, they may be cultured in living tissues such as Chicken egg content or vertebrate cell cultures (9).

#### **2-1-2 Classification**

The family Rickettsiaceae is taxonomically divided into three genera:

1. Rickettsia (11 species) - Involve intracellular parasites, these are not multiply inside vacuoles and these do not parasitize on white blood cells.
2. Ehrlichia (2 species) - Involve intracellular parasites; these are not multiply inside vacuoles but do white blood cells.
3. Coxiella (1 species) - Involve intracellular parasites which prefer to grow in vacuoles the host cell.
4. Baartonella (3 species)--intracellular parasite which invade the red blood cell (10).

#### **2-1-2 Structure**

The structure of the typical rickettsia is the same to that of Gram-negative bacteria do not stain well with Gram stain, But it is characterized by taking red color when stained by the Giemsa or Gimenez stain (2). The typical cover consists of three main layers : , an outer layer, a thin electron thick solid cell wall and Internal cytoplasmic membrane The outer layer is similar to the typical membrane in its chemical composition and its triangular appearance. The cell wall is chemically like with gram-negative bacteria it is contains diaminopimelic acid and the absence of teichoic acid (11). Intracytoplasmic invaginations of the plasma membrane (mesosomes) and ribosomes are also seen. There are no separate nuclear structures (2).

## **2-2 Pathogenicity**

3 In their arthropod vectors, Rickettsia proliferate in the epithelial layer of the intestinal canal and are excreted with stool, but sometimes there are found in the salivary glands in the arthropods. It is transmitted to the human by saliva arthropods during biting (12).

4In the mammalian host, there is mainly a lining in the small blood vessels, especially in the heart, brain cells and skin. Hyperplasia of the endothelial cells and the formation of a thrombosis leading to the blockage of blood flow, with the exit of red blood cells to adjacent tissues. Inflammatory cells also collect around the affected parts of the blood vessels. This inflammation is responsible for some of the most prominent clinical manifestations, such as peripheral trauma, skin ulcers and stupefaction. The cause of death is due to endothelial cell damage, which causes plasma outflow, shock, and decreased blood volume (13). Rickettsial illnesses, caused by organisms within the genus of rickettsiae, are recognized and can be divided into the following 3 biogroups: (2, 11)

a. Spotted fever bio-group (15 rickettsioses)

- Rocky Mountain spotted fever (RMSF), caused by *Rickettsia rickettsia* (14).

- Rickettsial pox, caused by *Rickettsia akari*, (6).

- Boutonneuse fever (ie, , Marseilles fever, , African tick typhus, Israeli spotted fever Mediterranean spotted fever, Indian tick typhus, Kenya tick-bite fever) (13, 15).

- a. African tick fever is similar, but it is more shy. It differs from other similar rickettsioses in that it produces a painful lymphadenopathy , nuchal myalgia , multiple eschars, and, occasionally, a sparse vesicular rash (2, 16).

- b. Typhus group

These similar diseases differ only from epidemiological aspects. *Rickettsia prowazeki* and *Rickettsia typhi* are similar to those found in the total , but are distinct antigen. Typhus transmitted through the epidemic , Brill-Zinsser disease (ie, relapsing louse-borne typhus), and murine (endemic or flea-borne) typhus (14).

- c. Scrub typhus bio-group (Tsutsugamushi disease).

The rickettsial agents of scrub typhus have a single taxonomic name: *Orientia tsutsugamushi*. These organisms represent a heterogeneous group that differs markedly from the types of *Rickettsia* from Fever and the group of typhus. (17).

## **2-3 Clinical signs:**

People: A large range of purposes and these symptoms lead to possible death. The disease is rarely diagnosed or without signs. Some people develop fever, rashes and muscle pain (due to damage to the vascular cells), but the skin rash

is not always seen by *Rickettsia* (18). Multiple-organ disease leads to high mortality if not treated. Infections with *R. parkeri* are less severe than *R. rickettsii* and are often present with *R. typhi* or *R. felis* (19, 20).

Canines: Dogs exposed to *R. rickettsii* can rapidly develop into severe illness, although most injuries are symptoms or are mild. Dogs can develop clinical signs similar to humans. The most common clinical signs are topical edema, inactivity, fever, rash, swollen lymph nodes, loss of appetite (21).

Other animals: Most other animals only have short-term infections with no associated disease. These animals as well as others that don't become ill develop antibodies that can be detected by serologic testing (22).

#### **2-4 Clinical pathological, gross, and histopathological findings:**

Thrombocytopenia is common. Leukopenia followed by a leukocytosis and mild anemia may develop. Petechiae and ecchymoses are common due to damage to endothelial cells (23).

#### **2-4 Diagnosis**

No rapid laboratory tests are available to diagnose rickettsial diseases timely in the course of illness, and serologic assays usually take 10-12 days to become positive. Research is indicating that swabs of eschars may be used for molecular detection of rickettsial infections (24, 25).

#### **2-5 Treatment**

Doxycycline has been used in the treatment of rickettsial infection (26).

#### **2-6. Prevention and control:**

Because *Rickettsia* spp. is vector-borne, limiting exposure to vectors is necessary to prevent transmission. Transmission doesn't occur from animal to animal, but can occur through blood inoculation of wounds. Habitat

modification to limit ticks in areas where animal frequent. Some birds are known hosts for certain tick species, and while they may not be competent hosts of the rickettsial pathogens, they can aid in distribution of vectors (27, 28).

## **2-7. Importance**

*Rickettsia prowazekii* is a prokaryotic organism that is primarily maintained in human populations, and spreads between people via human body lice. Infected people develop an acute, mild to severe illness that is sometimes complicated by neurological signs, shock, gangrene of the fingers and toes, and other serious signs. Approximately 10-30% of untreated clinical cases are fatal, with even higher mortality rates in debilitated populations and the elderly (29). People who recover can continue to harbor the organism inapparently. It may re-emerge years later and cause a similar, though generally milder, illness called Brill-Zinsser disease. At one time, *R. prowazekii* regularly caused extensive outbreaks, killing thousands or even millions of people. This gave rise to the most common name for the disease, epidemic typhus. Epidemic typhus no longer occurs in developed countries, except as a sporadic illness in people who have acquired it while traveling, or who have carried the organism for years without clinical signs (30). In North America, *R. prowazekii* is also maintained in southern flying squirrels (*Glaucomys volans*), resulting in sporadic zoonotic cases. However, serious outbreaks still occur in some resource-poor countries, especially where people are in close contact under conditions of poor hygiene. Epidemics have the potential to emerge anywhere social conditions disintegrate and human body lice spread unchecked (31).

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