# An overview of Q fever

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## ABSTRACT

Q fever, caused by *Coxiella burnetii*, is a significant zoonotic disease with global implications. The bacterium is highly resilient and can survive in harsh environmental conditions, making it a widespread concern in both human and animal populations. Transmission primarily occurs through aerosolized particles, but other routes, such as ingestion of contaminated milk and tick bites, also contribute to its spread. The clinical manifestations of Q fever can range from mild flu-like symptoms to severe complications, particularly in individuals with predisposing conditions, such as heart valve defects or immunosuppression. While the mortality rate is generally low when treated, untreated infections can be fatal. Vaccination and proper preventive measures, especially for individuals working in high-risk environments, have proven effective in controlling the spread of Q fever. Early diagnosis and treatment with antibiotics, such as doxycycline, remain critical to preventing the progression to chronic disease.

**Keywords:** Q fever, *Coxiella burnetii*, Zoonotic disease, Transmission routes, Prevention and treatment

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**Introduction**

Q fever is a zoonotic disease that is mainly transmitted to humans through the inhalation of contaminated aerosol particles. Another route of transmission to humans is the consumption of contaminated milk from farm animals [1]. The causative agent for the transmission of Q fever is *Coxiella burnetii*, which is gram negative small intracellular bacterium. Its shape is a pleomorphic rod, which is 0.4-1.0µm in length and 0.2-0.4µm in width. *Coxiella* was named after Herald R. Cox, who first isolates this bacterium in the lab of united states. There is only one strain of this species, *C. burnetii*, which have the ability to survive harsh conditions of the environment. This bacterium is prevalent throughout the world. Reservoir hosts are mainly farm animals and pets rarely. The disease is of a very broad spectrum, starting from mild or no symptoms to very severe ailment. If remains untreated, death will be the outcome. History of Q fever goes back to 1935, and it was then described as a febrile ailment in working persons of abattoir in Australia. The 'Q' in the name of disease stood for Queensland, a state of Australia, where the disease was first described. 18 outbreaks were reported in Q fever from 1999-2004 in 12 different countries. These outbreaks involved 289 people, 6 outbreaks involved sheep, 3 involved goats. 1 out of 3 outbreaks involving goats are related to exposure to wild animals. There is an extensive list of the reservoir hosts of *Coxiella burnetii* including birds, arthropods (mainly ticks) and mammals. There are around 40 known species of ticks which carry the organism, and they replicate in the gut cells of ticks [2].

**Characteristics of *C. burnetii***

*Coxiella burnetii* belongs to the family *Rickettsiaceae*, which falls in the Proteobacteria group. The outer membrane of *C. burnetii* is just similar to the membrane of the other gram-negative bacteria. The size of this bacterium is 0.4-1.0µm in length and 0.2-0.4µm in width. In eukaryotic cells, it can multiply in a large number in a short period of time. The estimated time in which bacterium doubles in its number is 20-45 hours. But this bacterium does not have the ability to grow in an axenic medium. The size of the cell is either small or larger, the small one is very compact, and rodlike with a center of dense electrons. While the larger size of the cell is less dense than the small one. This large variant of the cell is the metabolically active form of *C. burnetii*. The chromosome of these bacteria is very small (upto 5Mbp) and is circular in shape. The plasmid carries about 2% of the genomic information and its size falls between 32-51 kb [3].

**Routes of Transmission**

There are multiple routes of the transmission of Q fever, some of the transmission routes are listed below:

1. Through aerosol route
2. Through oral route
3. Through percutaneous route
4. Person to person transmission (rare)
5. Through sexual route

In aerosol route of transmission, the contaminated particles of the *Coxiella burnetii* are transmitted to humans and cause infection. People at risk are those who have close contact with the contaminated farm animals. In oral route of the transmission, causative agent is transmitted to humans through raw milk or mastitic milk. It could be transmitted through the products which are made with contaminated milk like cheese and butter. Ticks transmit the disease through percutaneous routes to domesticated animals. Transmission of Q fever is very rare from person to person, occasionally it transmits from the patient to hospital staff or performing autopsies [4].

**Clinical Manifestations of Q fever**

Clinical sign and symptoms depend on the acute or chronic stage of the infection. However, the incubation period ranges from 9-28 days. The acute stage of the infection is often asymptomatic but, in some cases, it starts with the influenza like symptoms which is followed by fever, chill, malaise, headache, sweat, and anorexia. The acute phase of Q fever remains for 1-3 weeks, and the temperature may rise up to 40° C. The respiratory symptoms appear 4-5 days after the onset of the disease. These manifestations are most commonly seen in older and debilitated animals. However, meningoencephalitis and encephalitis are the rare manifestations of Q fever. A post infection fatigue syndrome may appear in almost 20% of the case reports of acute Q fever. The chronic stage of the infection lasts from a few weeks to years after the initial infection. Patients with the history of cardiac valvular defects, arterial aneurysms, or vascular grafts are at a higher risk of getting chronic Q fever. Also, heat stress, immunosuppression and pregnancy are predisposing factors of chronic Q fever [5]. Mortality caused by Q fever is very low (1%) in untreated patients, but it is always fatal when the infection goes untreated.

**Prevention and Treatment strategies**

Vaccines are available commercially for Q fever that plays very important role in the in prevention of the disease. In Australia, Vaccines are used widely to prevent the animals from Q fever and this strategy is very effective. However, vaccination is done for the people who are at the greater i.e., slaughterhouse workers, dairy farm workers, herders, farmers, wool sorters, and rendering-plant workers. For treatment of Q fever, doxycycline is the drug of choice in case of acute stage of the infection. Doxycycline is given until the patient recovers (for 5 days in case of mild ailments and for 10 days in case of high-risk children). However, research indicates that doxycycline can be given to the children for a short period of time (5-10 days). In case of pregnant animals, trimethoprim/sulfamethoxazole can be given but not beyond the 32 weeks of gestation. However, alternative strategies like botanical compounds can be tested and used against disease [6].

**Conclusion**

Q fever, caused by *Coxiella burnetii*, is a significant zoonotic disease with global implications. The bacterium is highly resilient and can survive in harsh environmental conditions, making it a widespread concern in both human and animal populations. Transmission primarily occurs through aerosolized particles, but other routes, such as ingestion of contaminated milk and tick bites, also contribute to its spread. The clinical manifestations of Q fever can range from mild flu-like symptoms to severe complications, particularly in individuals with predisposing conditions, such as heart valve defects or immunosuppression. While the mortality rate is generally low when treated, untreated infections can be fatal. Vaccination and proper preventive measures, especially for individuals working in high-risk environments, have proven effective in controlling the spread of Q fever. Early diagnosis and treatment with antibiotics, such as doxycycline, remain critical to preventing the progression to chronic disease. Ongoing research and public health initiatives are essential for mitigating the risks of Q fever, ensuring the safety of both human and animal populations.

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