Q Fever

Revision Dates

Case Definition	July 2012
Reporting Requirements	May 2018
Remainder of the Guideline (i.e., Etiology to References sections inclusive)	December 2005

Case Definition

Confirmed Case

Acute clinical illness[1] with laboratory confirmation of infection:

- Detection of *Coxiella burnetii* nucleic acid (e.g., PCR) in an appropriate clinical specimen (e.g., blood, biopsy tissue, CSF)[2]

OR

- Seroconversion or significant (i.e., fourfold or greater) change in antibody titre to *C. burnetii* phase II or phase I antigen in paired serum specimens ideally taken 3 – 6 weeks apart

OR

- Detection of *C. burnetii* antigen by immunostaining in an appropriate clinical specimen (e.g., blood)[B]

OR

- Isolation of *C. burnetii* from an appropriate clinical specimen (e.g., blood)[B].

**The following probable case definition is provided as a guideline to assist with case finding and public health management, and should not be reported to AH.*

Probable Case

Acute clinical illness[A] with one of the following:

- A single supportive IFA IgG or IgM titre of ≥ 1:256 to phase II antigen[3,4]

OR

- Detection of *C. burnetii* in tissues by electron microscopy

OR

- Epidemiologically linked to a confirmed case.

Reporting Requirements

[1] Acute clinical illness: Fever usually accompanied by rigors, myalgia, malaise and retrobulbar headache. Severe disease can include acute hepatitis, pneumonia and meningoencephalitis. Asymptomatic infections may also occur.
Chronic infection: Potentially fatal endocarditis may evolve months to years after acute infection, particularly in persons with underlying valvular disease. A chronic fatigue-like syndrome has been reported in some Q fever patients.
[2] Refer to the National Microbiology Laboratory (NML) Guide to Services for current specimen collection and submission information.
[3] Some acute cases may also have elevated phase I antibodies.
[4] It is recommended that a convalescent specimen be collected at least three weeks after the initial specimen if clinically indicated to either rule out or confirm infection.

1. **Physicians, Health Practitioners and others**
   Physicians, health practitioners and others shall notify the Medical Officer of Health (MOH) (or designate) of the zone, of all confirmed and probable cases in the prescribed form by mail, fax or electronic transfer within 48 hours (two business days).

2. **Laboratories**
   All laboratories shall report all positive laboratory results by mail, fax or electronic transfer within 48 hours (two business days) to the:
   - Chief Medical Officer of Health (CMOH) (or designate), and
   - MOH (or designate) of the zone.

3. **Alberta Health Services and First Nations Inuit Health Branch**
   - The MOH (or designate) of the zone where the case currently resides shall forward the initial Notifiable Disease Report (NDR) of all confirmed cases to the CMOH (or designate) within two weeks of notification and the final NDR (amendment) within four weeks of notification.
   - For out-of-province and out-of-country reports, the following information should be forwarded to the CMOH (or designate) by phone, fax or electronic transfer within 48 hours (two business days):
     - name,
     - date of birth,
     - out-of-province health care number,
     - out-of-province address and phone number,
     - positive laboratory report, and
     - other clinical / epidemiological information.

4. **Additional Reporting Requirements**
   - Animal health issues associated with the source of human Q fever disease should be reported to Alberta Agriculture and Rural Development by the CMOH.

Etiology (1)

Q fever is caused by *Coxiella burnetii*, a rickettsial pathogen. It reaches very high concentrations in animal tissues, especially the placenta. There are two distinct antigenic phases. Phase I is found in nature and Phase II is found after multiple laboratory passages in eggs or cell cultures.

Six different strains of *C. burnetii* have been identified: Hamilton, Vacca, Rasche, Biotzere, Corazon, and Dod. The European strains are different from the North American strains.

The infectious form of *C. burnetii* is highly resistant to heat, desiccation (drying), and chemicals. It can persist for long periods of time in the environment e.g., dust up to four months, wool for 12 – 16 months at 4°C – 6°C in the spore stage.

Unlike other rickettsiae, *C. burnetii* enters the cell by a passive mechanism. The organism is extremely infectious for humans. It has been suggested that a single viable organism is enough to cause an infection.

Clinical Presentation

Q fever is a zoonotic infection. It is typically an acute febrile illness although up to 60% of initial infections are asymptomatic or present as “fever of unknown origin”. The infection is self limited, lasting 1 – 4 weeks and then gradually resolving. The disease may also present in a chronic form occurring years after an acute infection.

Acute Q fever is most often characterized by fever, chills, weakness, headache, anorexia, fatigue, and myalgia, however, most often individuals initially present with influenza-like symptoms. Other signs and symptoms will depend on the organs involved. Respiratory symptoms appear 4 – 5 days after the initial onset of illness as a dry cough. Pneumonia with cough and chest pain occurs in about 20 – 40% of cases. Hepatitis is another common manifestation and can be found in 40 – 60% of cases. Jaundice is rare. The case-fatality rate in untreated acute cases is most often less than 1% and is negligible in treated cases except in persons who develop endocarditis. In contrast to other rickettsial infections, a rash is rarely present in Q fever.

Chronic Q fever occurs in about 1% of acutely infected individuals. It often presents as endocarditis in persons with underlying heart disease or prosthetic valves, vascular aneurysms or vascular grafts. Valve replacements are often required following infection.

Q fever is rarely fatal, however, chronic Q fever may be fatal if untreated. When appropriate long-term therapy is implemented, mortality among individuals with endocarditis is decreased to approximately 10%. Q fever during pregnancy is associated with abortion, premature birth, and low birth weight infants.

Diagnosis

Q fever is often difficult to diagnose. Diagnosis is usually established by demonstrating a seroconversion to *Coxiella* antigens in conjunction with clinical history.

Coxiella burnetii exists in two antigenic phases called phase I and II:

- In acute illness, antibodies to phase II antigens of *C. burnetii* is usually higher than phase I and can be detected in the second week of illness.
- In chronic illness, antibodies to phase I antigens are higher than antibodies to phase II antigens.
- Antibodies to both phases can persist for months or years after initial infection so it is important that acute and convalescent testing be done to determine the infection is recent.

Diagnosis is made by the demonstration of a rise in acute and convalescent sera by direct immunofluorescent antibody testing, microagglutination, complement fixation or ELISA tests. Recovery of the organism from blood is diagnostic but it poses a hazard to laboratory workers. The organism may be identified in tissue (liver, heart valve) by immunostains and electron microscopy.

Epidemiology

Reservoir

The most common reservoir is domestic farm animals (cattle, sheep, goats) most of which have subclinical infections. When infected, these animals shed the organism in urine, feces, milk, and especially in birth products. The placenta of an infected sheep may contain over a million organisms per gram of tissue. *C. burnetii* has also been identified in arthropods, fish, birds, rodents, and marsupials. In addition, some wild and domestic bird species are sources of transmission. The organism has been isolated from ticks. Tick vectors are thought not to cause infection in humans but may be important in maintaining animal and bird reservoirs.

Transmission

Humans are most often infected through the process of inhaling contaminated aerosols. Organisms are shed in high numbers during the birthing process (in amniotic fluid and the placenta). Humans may inhale dust contaminated by these materials. These airborne particles can be carried downwind one kilometre or more. This contributes to the sporadic cases.

Infection may also occur from direct exposure to infected animals or tissues or through exposure to contaminated materials such as wool, straw or even laundry. This is quite different from the other rickettsial infections which are transmitted via tick bite.

Raw milk from infected cows is known to contain organisms and may be responsible for some cases of Q fever, but it has not been proven to transmit the organism. There are reported cases of intrauterine infections and direct transmission by blood transfusion.

Incubation Period

The incubation period is dependent on the size of the infectious dose but it is typically 20 days with a range of 14 – 39 days. Acute Q fever can develop years after an initial infection.

Period of Communicability

Person to person transmission rarely, if ever, occurs.

Host Susceptibility

Q fever is usually an occupational disease affecting individuals who have direct contact with infected animals and infected animal products. People at highest risk are those working with animals especially veterinarians, farmers, sheep and dairy workers, as well as lab and research workers. Antibody response develops to both phases of Q fever in animals and humans. Immunity following recovery from clinical illness is most likely lifelong.

Occurrence

General (1,2)

Originally known as Query Fever, this infection was first identified in 1935 in Queensland, Australia during the investigation of a febrile illness that affected workers of a meat plant. Q fever occurs worldwide and varies in frequency and presentation from country to country. It has been reported in 51 countries. The infection is endemic in areas where animal reservoirs

exist. Epidemics have been reported among individuals working in meatpacking and rendering plants, laboratories, stockyards, and researchers (working with pregnant ewes).

The mortality rate with acute infection has been reported as high as 2.4% but is generally less than 1%. Males are affected more than females and adults more than children. Seasonal trends occur in farming communities with predictable frequency. It typically coincides with lambing season (early spring).

In 2002, a cluster of cases was reported in the Newport Dock area of South Wales. The source of the infection was not identified but airborne transmission of *Coxiella* spores was suspected. In the US, frequency is difficult to ascertain. The Centers for Disease Control and Prevention (Atlanta) reported 26 cases in 2001 and 61 cases in 2002. Dairy and slaughterhouse workers were most at risk.

Canada (3)
Q fever is not nationally notifiable. Anecdotal reporting has been published with the most recent report of Q fever from Newfoundland in the spring of 1999. Abortions in goats were associated with an illness in goat workers at a farm in rural Newfoundland. A serologic survey of 66 individuals indicated recent infection in 37% of these workers. Independent risk factors included contact with goat placenta, smoking tobacco, and eating cheese from pasteurized goat milk. No previous cases of Q fever had been reported in Newfoundland.

Alberta (4)
From 1993 to 2001, a total of 11 cases of Q fever have been reported in Alberta; eight males and three females. Six cases were reported in 2002; four males and two females. From 1993 to 2004, more than half of the reported cases occurred in 25 – 59 year olds. The majority of cases indicated an unknown source of infection, the remainder report contact with animals on farms in Alberta (goats and sheep). Three cases were reported in 2003 and four cases in 2004.

Key Investigation

Single Case/Household Cluster

- Determine possible source of exposure including living close by a farm or livestock operation.
- Determine occupational risks. High-risk occupations include:
  - laboratory workers,
  - stockyard workers,
  - person employed in meat packing and rendering plants,
  - veterinarians, and
  - farmers.
- Identify recent contact with sheep, cattle or goats on farms or in research facilities.
- Identify recent contact with parturient animals including cats.
- Determine recent consumption of raw milk or dairy products.
- Determine direct or indirect association with a laboratory that handles *C. burnetii.*
- Identify immune and pregnancy status.
- Identify individuals who may have been exposed to the same source.

Control

Management of a Case

- Routine practices for infection prevention and control.
- Symptomatic treatment.
- Disinfect articles freshly soiled by sputum and blood using 0.05% hypochlorite, 5% peroxide or a 1:100 solution of Lysol.

Treatment of a Case

- Most individuals recover without antimicrobial therapy.
- In acute cases, where antimicrobials are required, they should be started promptly and continued.
- When symptoms are apparent, tetracycline (doxycycline) is the drug of choice. It may speed up recovery. Tetracyclines should not be administered to children less than eight years of age unless the benefit is greater than the risk of dental staining from the drug.
- The course of antibiotics may have to be repeated if relapse occurs.
- Chloramphenicol and fluoroquinolones are alternatives, however, fluoroquinolones are not approved for use in persons less than 18 years of age
- Chronic Q fever endocarditis is more difficult to effectively treat and may require the use of multiple drugs. Two different treatment protocols may be used:
    - doxycycline in combination with quinolones for at least four years, or
    - doxycycline with hydroxyl-chloroquine for 18 months to three years.
  - Relapses may occur after the discontinuation of treatment.
  - The infected heart valve may need to be surgically replaced in some patients.

Management of Contacts

- The infection is not passed person to person.
- There may be individuals who have been exposed to the same source.

Preventive Measures

- Educate workers in high risk occupations about the sources of infection and the need for adequate disinfection and disposal of animal products of conception.
- Identify infections in domesticated animal populations.
- Educate individuals who handle parturient animals about proper hygiene.
  - Birthing should take place in indoor facilities.
  - Properly dispose of placenta, birth products, fetal membranes, and aborted material.
- Maintain surveillance of workers involved in research involving pregnant sheep.
  - Baseline serum followed by periodic evaluations.
  - Advise those persons at risk (those with valvular heart disease, women of childbearing age, immunosuppressed individuals) about the risk of serious illness.
  - Animals should be assessed for Q fever.
  - Appropriate bagging and washing of clothing to prevent infection in laundry workers.
- Restrict access to areas (barns, laboratories) with potentially infected animals.
- Educate farmers to erect sheep holding facilities:
  - away from populated areas, and
  - implement measures to prevent air flow to occupied areas.
- Consume only pasteurized milk and dairy products from cows, goats, and sheep.
- Currently, no vaccine is commercially available in Canada, however, research is being done in Australia and the US.

References

(1) Public Health Agency of Canada. *Infectious substances: Coxiella burnetii*. Office of Laboratory Security. Material Safety Data Sheet. November 1999. http://www.phac-aspc.gc.ca/msds-ftss/index.html

(2) Public Health Agency of Canada. *Q Fever – United Kingdom.* Infectious Diseases News Brief. November 2002. http://www.phac-aspc.gc.ca/bid-bmi/dsd-dsm/nb-ab/2002/nb4402_e.html

(3) Public Health Agency of Canada. *Caprine-Associated Q-Fever in Newfoundland.* Ottawa: CCDR 2000;26-03. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/00vol26/dr2603e.html

(4) Alberta Health, Disease Control & Prevention. *Communicable Disease Reporting System*. October 2003.

