Q Fever Outbreak at a Cosmetics Supply Factory

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Q fever is a zoonotic disease that is most commonly associated with outbreaks in slaughterhouses. We describe an outbreak of 4 cases occurring in a factory that processes ovine fetal products for the cosmetics industry. It is important that industries typically not associated with risk of Q fever are made aware of potential health risks that workers might be exposed to so further outbreaks might be prevented.

Q fever is caused by the intracellular, gram-negative bacteria *Coxiella burnetii*. The reservoirs for the bacteria are both wild and domestic animals. Q fever is usually an occupational disease of slaughterhouse workers and farmers. Transmission occurs via inhalation of a contaminated aerosol. *C. burnetii* concentrates in the placenta of infected animals, and exposing oneself to the products of conception in animals with *C. burnetii* infection is regarded as a high-risk activity. The organism is tolerant to environmental extremes, including desiccation, extremes of pH, chemical disinfectants, and freezing temperatures [1, 2].

In Australia, Q fever is a notifiable infection, with 550 cases reported in 2003. Of these cases, 502 were from New South Wales and Queensland [3]. Q fever is not considered to be endemic in Victoria, but outbreaks have occurred in slaughterhouses when consignments of livestock have been brought from other states [3].

The symptoms of acute Q fever are protean, with asymptomatic seroconversion occurring in up to 60% of cases [4]. There is geographic variation in the clinical features; in Australia, a nonspecific febrile illness is the most common presentation [5]. Headache, pneumonia, and hepatitis are common in other regions of the world [1]. A post–Q fever fatigue syndrome has been suggested on the basis of follow-up studies of Australian slaughterhouse workers [6] and patients involved in an outbreak in the United Kingdom that showed rates of up to 20% [7]. Less commonly, Q fever can be a chronic infection, causing endocarditis, osteomyelitis, or infection of vascular prostheses.

An effective vaccine for Q fever is available, and slaughterhouse workers and farmers are routinely immunized [8]. In this series, we describe an outbreak of Q fever among employees in an industry not traditionally regarded as high risk.

Case series. The outbreak occurred in a small factory with 8 employees in regional Victoria. It manufactured a range of products, including powdered sheep placenta and fetal tissue for the cosmetics industry. The powder is used in anti-aging products both in Australia and other countries. The factory had been supplying this powdered product for several years without incident. The size of the factory is 14,000 m^2; its 15 rooms are divided into 4 manufacturing areas separated by air locks. Milling of the fetal products and placenta occurred in a processing room in 1 of the areas.

Before February 2005, the milling process involved the delivery of frozen blocks of products of conception, comprised of sheep uteruses, fetuses, placentas, and amniotic fluid, from slaughterhouses around Australia and New Zealand. The frozen blocks were shaved; the shavings were boiled and then spread out and dried before being ground into powder.

In February 2005, a customer requested that the factory supply amniotic fluid as a separate product, and this resulted in a change in the processing method. The frozen blocks were now thawed to allow the amniotic fluid to be drained off before the remaining tissue was minced, boiled, and dried as previously described.

A case of Q fever was defined as an appropriate clinical syndrome accompanied by seroconversion to *C. burnetii* infection or a positive PCR result. Serological tests were assessed at the Australian Rickettsial Reference Laboratory (Geelong, Australia) with an indirect immunofluorescence assay. A significant finding was defined as a titer of antibodies to phase II (anti–phase II) IgM >1:50 or a 4-fold increase in titer between acute and follow-up serological test results [1]. *C. burnetii* has antigenic variations. Phase II antigen is the avirulent form of *C. burnetii* and phase II antibodies are the first to be detected in acute Q fever. Phase I antigen is the virulent, replicating form of *C. burnetii* and phase I antibodies are associated with chronic infection [1].

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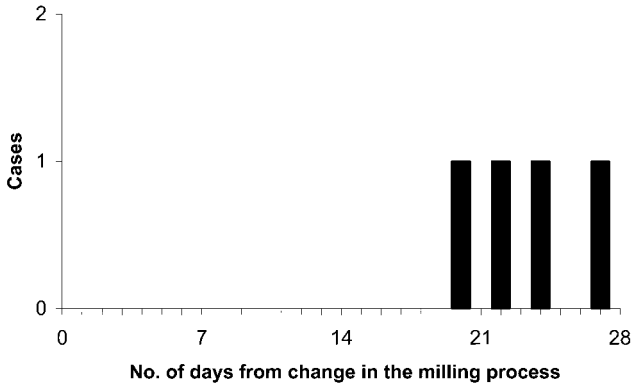

Figure 1. Number of days from the change in how animal product was processed at the cosmetics supply factory to the outbreak of 4 cases of Q fever that occurred among employees. Each black bar represents 1 case of Q fever.

Because cases of Q fever are of public health significance, ethics approval was not sought for this study. The investigation was conducted with the consent of the employer and employees of the factory and was pursuant to the guidelines of the Department of Human Services, State Government of Victoria, Australia.

Results. Four cases of acute Q fever were identified; all occurred within 30 days of the change in processing method at the factory (figure 1). The health department was not notified of any other cases of acute Q fever from the same administrative region during the outbreak period or within 4 weeks before and after the outbreak. Details of the serological testing of the case patients in this series are recorded in table 1.

The index case patient was a 29-year-old, previously healthy man who presented at the hospital with a 5-day history of fever, rigor, and frontal headache. He was employed at the factory and worked in the processing room. On examination, he was febrile, with a temperature of 40°C, and tachycardic, with no focal findings. Initial investigation revealed a mild thrombocytopenia with a platelet count 123×10^9 cells/L, a normal WBC count of 8.9×10^9 cells/L, an aspartate aminotransferase level of 61 U/L, and an alanine transaminase level of 48 U/L, reflecting a mild transaminitis. Findings of a chest radiograph were normal. Acute Q fever was diagnosed by PCR during the patient's hospitalization and subsequently confirmed by seroconversion to Q fever phase II antibody. His illness was complicated by a splenic rupture, which one of us has reported elsewhere [9]. The patient was treated with oral doxycycline without surgical intervention and required 50 days of sick leave before returning to work.

The second patient was a 21-year-old, previously healthy man who worked at the factory in the same room as the index case patient. He presented at the hospital with sweats, fever, and headache. On examination, there was neck stiffness. The findings of lumbar puncture revealed normal CSF parameters, and the findings of a chest radiograph were normal. He had a normal WBC count but mild thrombocytopenia, with a platelet count of 113×10^9 cells/L. His liver function tests revealed an alkaline phosphatase level of 129 U/L, an aspartate aminotransferase level of 75 U/L, and an alanine transaminase level of 89 U/L. He was treated with doxycycline, had good clinical response, and returned to work after 17 days of sick leave. Seroconversion to Q fever phase II antibody was subsequently confirmed.

Patient 3, a 40-year-old woman, and patient 4, a 33-year-old woman, did not require hospital admission. Both worked in the processing room. They presented to their local health clinics with fever and flu-like symptoms. Liver function test results for patient 4 revealed an alanine transaminase level of 66 U/L. Both patients were treated empirically with doxycycline with a good clinical response. Patient 3 required 17 days of sick leave, and patient 4 required 20 days. Seroconversion to Q fever phase II antibody was subsequently confirmed.

The remaining 4 employees of the factory did not work in the processing room. They underwent skin testing and sero-

Table 1. Serological test results for factory workers with Q fever.

		Test results at baseline			Test results at follow-up	
Patient	Day[a]	Phase I antibodies	Phase II antibodies	Day[a]	Phase I antibodies (titer)	Phase II antibodies (titer)
1	1	Negative	Negative	22	IgM (1:400); total Ig (1:400)	IgM (1:400); total Ig (1:1600)
2	6	Negative	Negative	28	IgM (1:200); total Ig (1:200)	IgM (1:400); total Ig (1:800)
3	3	Negative	Negative	13	IgM-negative	IgM (1:200); total Ig (1:200)
4	2	Negative	Negative	21	IgM (1:50); total Ig (1:100)	IgM (1:400); total Ig (>1:3200)

NOTE. A negative test result is defined as a titer <1:25.

[a] Days from date of onset of illness of patient 1.

logical examination performed by the local public health physician. None had evidence of previous Q fever exposure, and all were then vaccinated.

Discussion. This is the first report of a Q fever outbreak associated with animal products in the cosmetics industry. Outbreaks of Q fever are well recognized in both urban and rural settings worldwide, mostly in association with animal slaughtering facilities [10]. This outbreak further suggests that the degree of infectiousness of frozen animal product is low, but is much higher once thawed. It is unusual that all 4 exposed persons had symptomatic illness and there were no subclinical cases. The high attack rate of acute disease may reflect a high infective inoculum in this setting.

An effective vaccine for Q fever was approved for the general market in Australia in 1989. Prevaccination screening with both skin testing and serological examination is essential, because severe, local complications can occur if the vaccine is given to those previously exposed to Q fever. Current recommendations in Australia are for routine vaccination in laboratory personnel who handle veterinary specimens; slaughterhouse workers and contract workers in slaughterhouses; truck drivers who transport livestock; veterinarians; sheep shearers; sheep, cattle and dairy farmers; persons who cull and process kangaroos or wild goats; and tanning and hide workers [11].

Historically, the morbidity associated with Q fever has been significant in Australia, with an estimated economic cost of AU$1 million (US$740,000), and 1700 person-weeks of work time were lost annually during 1991–1994 [12]. This was attributed to poor uptake of vaccine in occupational groups at risk. Since 2001, the National Q Fever Management program has targeted slaughterhouse workers and farmers, providing resources for screening and vaccination.

Although registered slaughterhouses are easily identified in Australia, other niche businesses that process animal products may not be aware of the risk of Q fever. In this case series, the employer went to considerable effort to establish his occupational health and safety responsibilities, but was not advised by the suppliers of the placental products of the risk of Q fever and need for vaccination.

Since the outbreak, standard Q fever prevention policies have been implemented at the factory. This includes pre-employment screening of all potential employees, including contract workers. We are not aware of any further cases of Q fever at the factory since this case cluster was reported. We propose that animal products should be labeled with a material safety data sheet that details the origin of the product and risk of Q fever so that preventative measures may be taken for workers in industries typically not included in the at-risk group.

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Potential conflicts of interest. All authors: no conflicts.

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