Prevalence of Q fever in a rural practice

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Abstract

Background Q fever is a world-wide condition caused by the rickettsia Coxiella burnetii. It appears more prevalent in agrarian communities and may have serious sequelae.

Methods A descriptive, cross-sectional, observational study using a randomly selected group of the adult working practice population in a rural practice in West Wales was devised. An immunofluorescence test, which identified past infection, was used to look for associations between C. burnetii seropositivity and farm-related or social activities, and to compare the findings with those of other studies. An attempt was made to establish a clinical profile for the illness Q fever.

Results Twenty-one subjects were found to be seropositive to C. burnetii. No definite consistent clinical features were identified. Farming was undoubtedly a risk factor for the disease, maybe with other related factors also important. There was a possibility that alcohol had a protective effect. No sinister sequelae were described.

Conclusions Q fever occurs more frequently in farmers than in non-farmers, but was less common than previously thought. Is Q fever accurately described in medical textbooks? A case is made for a more co-operative approach between primary carers and epidemiologists in the study of illnesses in populations.

Keywords: Q fever, farm, rickettsia, zoonosis

Introduction

Q fever is a tick-borne illness caused by the rickettsia Coxiella burnetii. This is an intracellular parasite which is pathogenic in man and maintained in nature in a cycle involving an insect vector and animal host. Infection occurs by inhalation of dried tick infected by C. burnetii, or contact with animal excretions or from contaminated milk. C. burnetii is extremely hardy, and Q fever is considered an important and world-wide condition; there is evidence from several European countries, Asia, Africa and North America that Q fever is far more common in rural than in urban populations.

A survey carried out opportunistically on nearly 1300 blood samples in this practice 12 years ago showed seropositivity of approximately 10 per cent in an established agrarian group. It has since been recognized that the complement fixation test then used had relatively low sensitivity and could miss up to two-thirds of cases of non-recent infection. It was thus conceivable that a substantial proportion of the farming population of the practice had, at one time, been exposed to Q fever. The most recent paper published the results of a survey carried out in Hereford and Preston, which suggested that Q fever was three times more common in farming than in non-farming populations and reported a seropositivity to C. burnetii of 27 per cent in a dairy farming population. It is the advent of the ‘gold standard’ immunofluorescence test that has made it possible to recognize previous Q fever infection.

The classical textbook description of the illness is of a long incubation of 14–26 days, followed by the abrupt onset of fever, headache, temperature, malaise, myalgia and anorexia. The headache is usually severe, and in a few days a dry hacking cough can accompany the development of an atypical pneumonia. Most people get over the acute illness within about two weeks, but in about 20 per cent of cases the course is protracted for a month or more. Though mortality is uncommon, Palmer and Young estimated that approximately one-third of cases develop a chronic hepatitis, leading to a prolonged illness and one in ten of recognized cases can develop an endocarditis. The objectives of this study were to measure the prevalence of C. burnetii seropositivity in the working population of a rural practice and to look for any associations with animal- or farm-related activity, attempting to replicate the results of the Hereford and Preston study and testing the validity of these results in the working population of the practice. A secondary objective was an attempt to establish a clinical profile for the illness Q fever. There was also the suggestion that subclinical forms of farm illnesses could be missed in a stoical farming population. Were we failing to diagnose Q fever?

Methods

A simple cross-sectional, observational study was designed,
with the information systematically gathered. Prevalence and not incidence was measured, and subsequently estimates of relative risks were calculated.

The 'working' population, or more specifically, those born in the years 1920–1976 inclusive, formed the population to be sampled. To give a power of 90 per cent, a sample size of 282 was calculated, using EpilInfo Version 6.0 and the predictions based on the Hereford and Preston study. The ratio of unexposed (non-farmers) to exposed (those with farm associations), calculated from previous informal studies, was 2:1. Farmers were defined as those who were currently, or had been in the past, actively involved in farming on a part- or full-time basis.

The practice computer system (Exeter Waverley GP Computer System) was interrogated to define this group and 6172 patients were identified. Consequently, using SPSS for Windows, subjects were randomly identified from the sampling frame.

Exclusions were subjects with a terminal or severely incapacitating illness, and a psychosis or other mental handicap. No patient was being investigated for the possibility of having C. burnetii at the time of the study. Because of the fluidity in any practice list, a sample size of 320 patients was randomly selected. Of these, 28 had either left the practice or fulfilled exclusion criteria. Twenty patients were not contactable or were known to be working away, and there were seven refusers. Thus, 265 contacts were made, an overall response rate of 91 per cent. Of these, 92 (34.7 per cent), were farmers, 134 were female and 131 male.

Each subject was invited to attend the practice premises to complete a questionnaire and give a blood specimen, which was locally spun down and frozen, before despatch to the Bristol Public Health Laboratory, where the immunofluorescence tests were performed. A titre level of 1/32 was regarded as significant. The questionnaire was fundamentally the one used to study cattle farming associations with C. burnetii in Hereford and Preston, with some augmentation to include questions about depression, cardiovascular, gastro-intestinal and respiratory illness, and smoking and drinking habits. The aim was to examine the clinical spectrum of the disease in a rural practice, in particular looking for an association between C. burnetii and serious illness or lifestyle.

Vaccination history was included, to give information which could be validated against the practice patient record. Validity was maintained, as well as by almost daily informal contact, by regular monthly review, when the interrogators, data entry clerk and the first author met to discuss any problems. Every tenth record was checked by the first author.

Apart from around 3000 people living in the central market town and a few hundred living in 'the industrial fringe', the majority of the 9000 patients of the practice lived in scattered rural villages and holdings over an area of 400 square miles. The farms varied from lush dairy land to rough mountain pasture.

### Results

Twenty-one sera gave seropositivity to C. burnetii in dilutions greater than 1/32, IgG phase 2 antibodies to Q fever, using the indirect immunofluorescent antibody test. This meant a seroprevalence of 7.9 per cent overall, 15.1 per cent in farmers and 4.2 per cent in non-farmers. This was approximately half the predicted number of positives. The odds ratio of C. burnetii seropositivity of farmers to non-farmers was 4.18 [95 per cent confidence interval (CI) 1.62–10.76, p value 0.01].

Every tenth of the vaccination and immunization responses was matched with the practice computer record and subject responses were more than 70 per cent accurate.

Were there any associations with C. burnetii seropositivity?

Table 1 showed that, in a univariate analysis, there was a highly statistically significant difference in C. burnetii seropositivity between the groups, farmed/not farmed (p 0.01, odds ratio 4.18, 95 per cent CI did not include one). Drinking unpasteurized milk and mechanized milking, activities related of course to farming, also had significant p values.

There was no statistical association of C. burnetii seropositivity with any other agrarian-related activity (including feeding animals, keeping cows or sheep), or with area of living, outdoor leisure activities, age or sex. There was also no difference in seropositivity between full-time and part-time

<table>
<thead>
<tr>
<th>Factor</th>
<th>% Positive no contact</th>
<th>% Positive contact</th>
<th>Odds ratio</th>
<th>p value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever farmed</td>
<td>4.20</td>
<td>15.05</td>
<td>4.18</td>
<td>0.01</td>
<td>1.62, 10.76</td>
</tr>
<tr>
<td>Drink unpasteurized milk</td>
<td>6.39</td>
<td>15.22</td>
<td>2.6</td>
<td>0.05</td>
<td>1, 6.93</td>
</tr>
<tr>
<td>Mechanized milking</td>
<td>6.88</td>
<td>22.22</td>
<td>3.35</td>
<td>0.04</td>
<td>1, 14.75</td>
</tr>
</tbody>
</table>

### Table 2 C. burnetii seropositivity with factor

<table>
<thead>
<tr>
<th>Factor</th>
<th>p value</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer</td>
<td>0.002</td>
<td>4.18</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.025</td>
<td>0.37</td>
</tr>
</tbody>
</table>
farmers (OR 0.37, 95 per cent CI 0.067, 2.08; \( p \), calculated from Fisher's exact test, 0.22). However, alcohol consumption seemed to have some protective effect (with a \( p \) value of 0.025; OR 0.37, 95 per cent CI 0.15, 0.91).

To determine whether the factors associated with \( C. \) burnetii seropositivity were associated independently or because of the influence of a surrogate factor such as farming, a multiple logistic regression analysis was carried out, using the forward likelihood ratio facility in SPSS for Windows. As well as farming-related activities, alcohol consumption, as compared with teetotalism, was included, and the results are shown in Table 2.

It was now apparent that being a farmer remained the most important risk factor and that the activities of mechanized milking and drinking unpasteurized milk were surrogate to farming. It was also seen that there was a high statistical association between non-alcohol consumption and \( C. \) burnetii seropositivity. In fact, 11 of the 83 teetotal subjects were \( C. \) burnetii seropositive. Also, only one of the remaining ten subjects who were \( C. \) burnetii seropositive admitted to drinking more than ten units of alcohol per week.

**Discussion**

There was a considerably increased risk of \( C. \) burnetii seropositivity in the farming as opposed to the non-farming populations (OR 4.19, 95 per cent CI 1.62, 10.76; \( p \) 0.01), compared with the Hereford and Preston study of relative risk (RR) 2.51 (95 per cent CI 1.81, 3.47; \( p < 0.01 \)) between working or living on a 'mainly dairy' farm and controls. In the studies using the immunofluorescence test, which identified past infection, animal contact and/or rurality were identified as risk factors for Q fever. However, none of these studies was randomized. In this study, there was no firm evidence that any increased contact with farm animals or products had any real effect on risk, or that there was any difference in \( C. \) burnetii seropositivity between full-time and part-time farmers (OR 0.37, 95 per cent CI 0.067, 2.08; \( p \), calculated from Fisher's exact test, 0.22). It had to be acknowledged that the number of positives was small.

Medical textbooks describe \( C. \) burnetii as an illness associated with pneumonia, hepatitis and endocarditis. Whereas the subjects demonstrated good recall of immunization status and of other clinical illness, there was no recall of any symptoms associated with seropositivity to \( C. \) burnetii. Although it is possible that those with a more serious form of the illness had died, there have been no recorded \( C. \) burnetii deaths in the practice during the last ten years. An advantage of a practice-based study is that it is possible to scrutinize the medical records of subjects. Those with positive \( C. \) burnetii titres revealed no evidence of any protracted viral type illness in the majority of cases. This inability to establish a recorded history of a severe illness in the majority of patients with \( C. \) burnetii seropositivity suggests the possibility of a subclinical form of the condition. Thus, whereas it is again acknowledged that the number of seropositives is small, no real clinical profile of the disease or its sequelae could be demonstrated from this study, based on a random sample of a practice working population. Indeed, there was a strong suggestion that the current perception of \( C. \) burnetii frequency and of its clinical profile was, at best, incomplete. The Hereford and Preston paper\(^1\) concluded: 'Exposure to \( C. \) burnetii is common in UK farm workers and their families. Disease, however, appears to be mild or subclinical. It is possible that the severity of \( C. \) burnetii has been overestimated from cases identified by clinicians or ascertained by public health agencies ... and that the clinical spectrum may be wider than currently thought.' This conclusion seems to have been reinforced. The *Manual of public health*\(^1\) reports that \( C. \) burnetii has a 'considerable variation in severity and duration: infections may be inapparent or nonspecific', but goes on to say that 'abnormal liver function tests are common'. The same publication also states that incidence is greater than that reported, is endemic in areas where animal reservoirs are present, and occurs occasionally in dairy workers and farmers. This study suggests that the incidence of the illness is small and that farmers dealing with cattle are considerably more at risk of infection by \( C. \) burnetii than other farming groups.

It was a surprise to discover that alcohol consumption seemed to have some protective role in \( C. \) burnetii (OR 0.37, 95 per cent CI 0.15, 0.91; \( p \) value 0.025). This possibly merits further study.

**Conclusion**

The fact that farming populations are considerably more at risk of \( C. \) burnetii infection than their non-farming counterparts was reaffirmed. Increased risk because of degree of exposure to animals and other agrarian-related activities was not proven.

\( C. \) burnetii was less endemic in this area than had been anticipated. One can only speculate as to the reasons for this, but it may be important that the area has an established home-bred stock and is a net exporter of beef and lamb. Alcohol remained enigmatically a factor associated with lower prevalence of \( C. \) burnetii seropositivity.

The small number of \( C. \) burnetii positives made it difficult to accurately describe a clinical profile for Q fever, but there remained a strong suspicion that medical textbooks written by specialists may not always give a true spectrum of this condition. The value of primary care data in providing pointers for more rigidly structured public health studies should not be underestimated, and a case is made for a co-operative approach for population studies of clinical illness.

**Acknowledgements**

We are indebted to our colleagues in the practice for their support when carrying out this study, to the patients who agreed to participate, and to Mrs Delyth Cater for the data entry. The
support of Dr Ted Coles, Director of Medical Computing at UWCM, Dr Daniel Rh. Thomas, Professor Stephen Palmer, and Dr Roland Salmon of PHLS Cardiff and Dr Mike Simmons of PHLS Carmarthen has been much appreciated, and I am indebted to Dr Frank Dunstan, DepL of Medical Statistics, UWCM, for his advice and guidance. The publication was part of a dissertation for the degree of Master in Public Health.

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Accepted on 9 April 1997