

Seroepidemiology of *Coxiella burnetii* infection and its frequency as a cause of community-acquired pneumonia in Canada

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The present study tested acute and convalescent serum samples from 788 patients hospitalized for community-acquired pneumonia in seven Canadian provinces for antibodies to *Coxiella burnetii*. One hundred nine patients (13.8%) had antibodies to this microorganism, and seven patients had acute Q fever. Serological evidence of infection with *C burnetii* was present in patients from all seven provinces. Three of the seven cases of acute Q fever were from Manitoba, suggesting that there may be unrecognized cases of Q fever in this province. In addition, a case of acute Q fever in Newfoundland, where there had previously been no reported cases, was noted, although subsequently, an outbreak of Q fever on goat farms has been reported.

Key Words: Canada; *Coxiella burnetii*; Fever; Seroepidemiology

La séroépidémiologie de l'infection à *Coxiella burnetii* et sa fréquence comme cause de pneumonie non nosocomiale au Canada

RÉSUMÉ : La présente étude a permis d'évaluer des spécimens sériques de 788 patients hospitalisés par suite d'une pneumonie non nosocomiale dans sept provinces canadiennes, afin de déceler les anticorps du *Coxiella burnetii*. Cent neuf patients (13,8 %) présentaient des anticorps à ce microorganisme, et sept patients affichaient une coxiellose aiguë. Des signes sérologiques d'infection à *C burnetii* étaient présents chez des patients des sept provinces. Trois des sept cas de coxiellose aiguë provenaient du Manitoba, ce qui laisse supposer la présence éventuelle de cas non dépistés de coxiellose dans cette province. De plus, un cas de coxiellose aiguë a été déclaré à Terre-Neuve, où on n'avait fait état d'aucun cas auparavant. Cependant, une flambée de coxiellose a été observée par la suite dans des élevages de caprins.

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Q fever has been endemic in Nova Scotia since the late 1970s and early 1980s (1,2). Cases of Q fever have also been identified in Prince Edward Island, New Brunswick, Quebec and Ontario. Indeed, from 1980 to 1987, 328 cases of Q fever were reported in Canada (3). In addition to the above provinces, nine cases were reported in Alberta, one in British Columbia and none in Manitoba, Saskatchewan or Newfoundland (3). We recently carried out a prospective study of community-acquired pneumonia at 15 centres in eight Canadian provinces. This study gave us an opportunity to update our knowledge about the seroprevalence of *Coxiella burnetii* in Canada.

PATIENTS AND METHODS

The present study was a prospective cohort study conducted from January 11, 1996 to October 31, 1997 at 15 centres in eight Canadian provinces. Eight hundred fifty patients who had acute onset of one or more symptoms, signs suggestive of pneumonia and radiographic evidence of pneumonia, and who provided informed consent were enrolled. An acute phase serum sample was collected at the time of enrolment into the study, and a convalescent phase blood sample was obtained four to six weeks later.

Antibodies to *C burnetii*

Antibodies to *C burnetii* phase I and phase II antigens were determined using a microimmunofluorescence assay (4). Tests were carried out by the procedure of Philip et al (5) with purified *C burnetii* whole cell antigens from the Nine Mile strain at a concentration of 200 µg/mL. Each antigen was fixed onto slides, and serum dilutions were applied before being overlaid and incubated with fluorescein isothiocyanate rabbit antihuman polyvalent antisera (Dako Immunoglobulins, Denmark). The end point was the highest dilution showing whole cell fluorescence. A titre of 1:8 or greater was considered to be seropositive, while a fourfold rise in antibody titre between acute and convalescent samples was considered diagnostic of acute Q fever. Convalescent serum samples from patients with known Q fever and those who had been seronegative on repeated testing were included as positive and negative controls with each run.

TABLE 1
Number and percentage of patients from each province who were seropositive for *Coxiella burnetii*, and the number who had Q fever

Province	Number tested	Percentage seropositive	Number of cases of Q fever
Newfoundland	66	15.2	1
Nova Scotia	145	12.2	1
Quebec	140	17.8	1
Ontario	193	10.8	1
Manitoba	128	13.3	3
Alberta	139	8.6	0
British Columbia	9	44.5	0

RESULTS

Only three patients were enrolled from the Saskatchewan site; therefore, these results are not presented. Table 1 presents the seropositivity results by province. Of the 788 patients with serum samples available for testing, 109 patients (13.8%) had an antibody titre of 1:8 or greater to *C burnetii*. Seven patients had acute Q fever. Three of the seven patients were located in the province of Manitoba. Table 2 gives the distribution of the antibody titres to *C burnetii* phase I and phase II antigens.

DISCUSSION

In a study of blood donors carried out in 1982, we found that 11.8% of 977 people from Nova Scotia had antibodies to *C burnetii* phase II antigen, while 14.6% of the 219 residents of Prince Edward Island who were tested had such antibodies (6). In a study of 503 Manitoba blood donors carried out in 1986, 15.9% had antibodies to *C burnetii* compared with 4.2% of 966 New Brunswick blood donors studied in the same year (7). The rate of seropositivity to *C burnetii* among Manitoba blood donors in 1986 is remarkably similar to the 13.3% that we found among 128 Manitobans with community-acquired pneumonia during the present study. Despite evidence of *C burnetii* infection in the seven provinces in our study, Q fever has not been diagnosed in the past few years in the prairie provinces. It is noteworthy, then, that there were three cases of acute Q fever in Manitoba. Our study was not designed to elicit the usual risk factors for Q fever, such as contact with cattle, sheep or goats (3). We also identified a case of acute Q fever in Newfoundland. No cases of Q fever had been reported from Newfoundland before this. However, during the spring of 1999, an outbreak of Q fever involving 66 persons occurred on the farms of a goat cooperative in Bonavista, Newfoundland (8).

Q fever is a zoonosis, and direct or indirect contact with animals is important in the epidemiology of Q fever. Cattle, sheep and goats are the primary reservoirs of Q fever for humans, although in Nova Scotia, contact with infected parturient cats was the main reservoir for this infection (9). *C burnetii* localizes to the uterus and mammary glands of

TABLE 2
Number and percentage of 788 patients who had the indicated antibody titres to phase I and phase II *Coxiella burnetii* antigens

Antibody titre	Phase II (n)	Phase II (%)	Phase I (n)	Phase I (%)
<1:8	675	85.6	768	97.4
1:8	22	2.7	7	0.88
1:16	30	3.8	9	1.1
1:32	32	4.0	1	0.01
1:64	22	3.8	1	0.01
1:128	3	0.38	2	0.02
1:256	4	0.50	0	0

infected animals (10). Infected cows can shed *C burnetii* in milk for up to 32 months (11).

The principal manifestations of acute Q fever are a non-specific febrile illness, pneumonia and hepatitis (12). In the Newfoundland outbreak, 40 of 60 affected persons (66.7%) had a nonspecific febrile illness (8), while in Nova Scotia, pneumonia was the major manifestation of Q fever (9). It is, therefore, possible that in some provinces where there is serological evidence of Q fever but little

clinical evidence, most of these infections may be nonspecific febrile illnesses.

CONCLUSIONS

There is serological evidence of *C burnetii* infection in all of the provinces that we studied. Our study and the recent outbreak discussed above indicate that there is a new focus of Q fever in Newfoundland, and our data suggest that *C burnetii* is a cause of pneumonia in Manitoba.

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