

Short Report: Throat Swab Samples for Diagnosis of Q Fever

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Abstract. Oropharyngeal swabs collected from patients with Q fever from France and from febrile patients from Senegal were tested by molecular assays for *Coxiella burnetii*. One positive result (0.08%) occurred for only one patient with acute Q fever. Throat swabs cannot replace blood serum samples as diagnostic tools for Q fever.

Q fever is a worldwide zoonosis and many human infections are caused by *Coxiella burnetii*.¹ Atypical pneumonia is one of the most commonly recognized forms of acute Q fever. Most cases are clinically asymptomatic or mild, characterized by a nonproductive cough, fever, and minimal auscultatory abnormalities, but some case-patients have acute respiratory distress.¹ Laboratory diagnosis of Q fever is primarily based on serologic testing for phase I and phase II antigens.^{1,2}

Over the past decade, polymerase chain reactions (PCRs) for detection of *C. burnetii* DNA have been commonly used to test patients for acute infection before appearance of antibodies and to test clinical samples for Q fever endocarditis.¹ In recent studies, throat swabs and sputum have been proposed as potentially useful tools for *C. burnetii* genotyping and the detection of Q fever.^{3–5}

The objective of our study was to determine the usefulness of oropharyngeal and nasopharyngeal swabs as diagnostic tools for Q fever. We analyzed a large number of throat swab samples from patients with Q fever in France and from febrile patients in areas of high Q fever incidence in Senegal.⁶

Oropharyngeal and nasopharyngeal swab samples were obtained from patients with suspected Q fever and from outpatients with Q fever at an infectious disease consulting hospital (Hopital La Timone, Marseille, France). In addition, throat swab samples were obtained from health centers distributed throughout rural Senegal from patients with fever. The national ethics committee of Senegal and the local ethics committee of Mediterranean University, Marseille, France, approved this study.

Patients were classified as definitely having Q fever if serologic or PCR results for *C. burnetii* were positive.⁷ Q fever was suspected in patients coming in contact with newborn animals, placentas, or wool that was contaminated with parturient fluids from infected animals.¹ A four-fold decrease in the phase I IgG and IgA titers and disappearance of phase II IgM was considered as indicating a past infection.⁸ Swabs from Senegal were transferred to Marseille frozen at –80°C on dry ice in sterile conditions.

DNA was extracted from swabs by using a QIAamp Tissue Kit (QIAGEN, Hilden, Germany). Extracted DNA was handled under sterile conditions to avoid cross-contamination at –20°C until assayed by PCR. To detect *C. burnetii*, DNA was used as a template in a described quantitative PCR (qPCR) specific for the IS1111 spacer region and the less sensitive IS30A spacer region.⁹ Results were considered positive when

confirmed by both spacers. Two sets of negative controls (DNA from non-infected swab specimens and sterile water) and a positive control (DNA extracted from the supernatant of a culture of *C. burnetii* L929) were included in each run. The quality of DNA handling and extraction of samples was verified by qPCR for the housekeeping gene encoding beta-actin.¹⁰ Results were considered negative when qPCR for *C. burnetii* was negative for both spacers and the cycle threshold values of the beta-actin gene were ≤ 30.

We tested 602 swabs collected from 198 patients in France (Table 1). A total of 43 swabs obtained from 43 patients with suspected Q fever, 171 swabs from 44 patients with acute Q fever, 234 swabs from 54 patients with Q fever endocarditis, 2 swabs from a pregnant woman with Q fever, and 152 from 56 patients with past Q fever infection were included. Two (4.6%) patients suspected for Q fever were positive for *C. burnetii* by serologic analysis.

For 31 patients with acute Q fever and 27 patients with Q fever endocarditis, a swab sample was collected before the beginning of doxycycline therapy, whereas the pregnant woman was already receiving treatment at the time the swab samples were collected. Among the patients who were not receiving antibiotic therapy, 22 patients with acute Q fever and 14 patients with Q fever endocarditis had respiratory symptoms, including cough, influenza-like symptoms, or radiographic results compatible with atypical pneumonia at the time of sample collection.

Only one throat swab was positive for *C. burnetii*. This sample was from a 49-year-old woman with fever, atypical pneumonia, non-productive cough, and hepatitis, and who reported excessive use of alcohol. The PCR analysis of a throat swab was positive for *C. burnetii*, and serologic analysis confirmed acute Q fever (IgM titer = 1:50). The PCR analysis of a blood sample taken the same day was also positive for *C. burnetii*. In addition, in Senegal, we collected 667 swabs from 667 febrile patients, and all were negative for *C. burnetii*.

In this study on throat swabs, we used molecular assays for the detection of *C. burnetii* in patients with Q fever, and a positive result was obtained for only one patient with acute Q fever. Our qPCR for the detection of *C. burnetii* was sensitive and versatile and has been evaluated,^{6,9,11} and the quality of DNA extraction was verified for all samples.¹⁰ Our qPCR specific for the IS1111 spacer region could detect 10² bacteria/mL.⁹

In addition, as a part of a study on the prevalence of Q fever in western Africa, we tested swab samples from febrile persons from areas with high Q fever incidence in Senegal.^{6,11} High incidence rates of Q fever among febrile patients were reported in the villages of Dielmo and Ndiop (73 cases/100,000 and 223 cases/100,000 person-years, respectively).

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TABLE 1
Throat swabs tested for Q fever*

Variable	No. swabs tested (no. patients)	No. swabs collected before treatment (no. positive)	No. swabs collected before treatment from patients with respiratory symptoms (no. positive)	No. swabs collected during/after treatment
Acute Q fever	171 (44)	31 (1)	22 (1)	140
Q fever endocarditis	234 (54)	27	14	205
Pregnant with Q fever	2 (1)	0	0	2
Past Q fever infection	152 (56)	0	0	152
Q fever suspicion	43 (43)	43	NP	0
Febrile patients from Senegal	667 (667)	667	NP	0
Total	1,269 (865)	768	NP	501

*NP = not provided.

These values were much higher than the annual incidence reported in France (2.5 cases/100,000 person-years).^{6,12}

Throat swabs are the traditionally preferred sample collection method for the detection of *Mycoplasma pneumoniae* pneumonia.¹³ However, throat swabs were proposed to be also useful for the detection of other atypical agents of pneumonia, including *C. burnetii*.⁵ In a study based on a nested PCR specific for the *com1* gene encoding a 27-kD outer membrane protein of *C. burnetii* in Japan, most patients with acute Q fever had a throat swab or sputum positive for *C. burnetii*, and the authors proposed that serum and respiratory samples should be preferable for the PCR-based screening of patients with acute Q fever.⁵ However, suicide PCR cannot be used as a routine tool for the diagnosis of Q fever because it is performed with single-use primers specific for single-use gene fragments and has not been confirmed in laboratory studies with positive controls to rule out contamination.¹⁴ Moreover, in the Netherlands, patient throat swabs have been commonly used as samples for *C. burnetii* genotyping.^{3,4} However, based on the low number of positive results obtained from our series of Q fever patients, we do not believe that throat swabs can replace blood serum samples as diagnostic tools for Q fever.⁷

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