

When to suspect Q FEVER (*Coxiella burnetii* infection) in small ruminants?

In animals and humans, the infection is supposed to be mainly asymptomatic and goes unnoticed but may also cause mild to serious symptoms. Clinical signs of *Coxiella burnetii* infection in small ruminants mainly consist of abortions, which can become enzootic [1]. In humans, symptoms may vary from flu-like illness, to pneumonia, hepatitis, endocarditis, chronic fatigue syndrome and potential fatality.



ABOUT THE PATHOGEN

Coxiella burnetii is an intracellular Gram-negative bacterium, characterized by a survival mechanism (pseudospore formation) which enables it to resist durably under environmental conditions such as desiccation for several months, disinfection such as 0.5% sodium hypochlorite or UV radiation[2]. It can survive several days in moist conditions (at least 7 days in water or milk at room temperature). It can withstand exposure to 60°C for 30 minutes, but can be inactivated by pasteurisation[3]. All mammal species are considered receptive to *C. burnetii*, although ruminant species are considered its main reservoir. People professionally exposed to cattle or small ruminants (veterinarians, farmers, slaughterhouse personnel) are at risk of infection.



PURPOSE OF THIS FACTSHEET

To present the clinical signs described in small ruminants in the event of an infection with *Coxiella burnetii*.



GEORGE VALIAKOS

DVM, MSc, PhD, ASSOCIATE PROFESSOR OF BACTERIOLOGY, CO-CHAIR OF THE EU Q FEVER COMMITTEE.

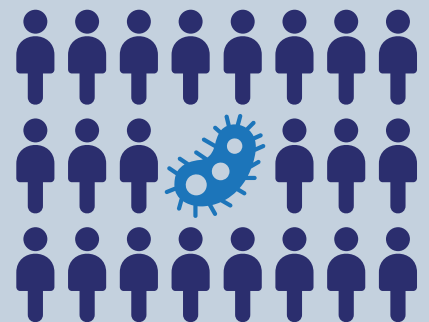
*"The level of underdiagnosis of *Coxiella burnetii* infections in small ruminants seems to be surprising. All studies worldwide demonstrate a high prevalence of this important zoonotic bacterium in livestock, creating huge concerns about the impact on the livestock productivity as well as the health of all related professionals."*



ANGEL GÓMEZ MARTÍN

DVM, PhD, RAMON Y CAJAL RESEARCHER AT THE SPANISH MINISTRY OF SCIENCE AND INNOVATION AND ADJUNCT PROFESSOR AT THE CEU CARDEÑAL HERRERA UNIVERSITY IN VALENCIA, SPAIN; PROVAGINBIO RESEARCH GROUP.

*"The great economic impact that a *Coxiella burnetii* infection causes in sheep and goats, and the risk of airborne spread to the human population from them, motivates the need to quickly and rigorously implement all the control and prevention measures that we have at our disposal as veterinarians."*



IN THE PERIOD 1990–2022,
A TOTAL OF **8,976 HUMAN
Q FEVER CASES** HAVE BEEN
REPORTED ACROSS **27**
COUNTRIES.

THE MAIN WARNING SIGNS OF A *COXIELLA BURNETII* INFECTION

LATE PREGNANCY ABORTIONS: A MAJOR CLINICAL SIGN OF INFECTION

Coxiella burnetii mainly causes **late-gestation abortions** (early gestation interruption may also be considered), premature births, neonatal death and/or the birth of weak animals. In small ruminants, series of abortions (up to abortion storm) are more common than in cattle. Abortion rates are usually higher in goats than in sheep, goats being considered more clinically sensitive ^[4,5]. Q Fever is one of the diseases to be investigated as a first step in the context of a differential diagnosis of abortions.

In healthy flocks and herds, the proportion of ewes and does visibly aborting is generally less than 2%. Abortion levels exceeding 5% or a clustering of abortions within a short time (e.g., 2 weeks) or a given location (e.g., pen or farm) suggests the need for an aggressive diagnostic investigation. An abortion rate above 2% suggests that endemic disease may be present ^[6].

Seroprevalence studies across European countries have demonstrated a high degree of exposure of small ruminants to *C. burnetii*, reaching rates as high as **50–70%** e.g., in Spain, the Netherlands, France and Portugal ^[7,8,9,10]. Recent molecular investigations of small ruminant abortions in various countries (e.g., Portugal, Spain, Greece etc.) have demonstrated the presence of the bacterium in several outbreaks in materials of late-gestation abortions, reaching approximate prevalence of **20–50%**, in many cases in mixed infections with other pathogens e.g., *Chlamydia* spp. ^[11,12,13] These results demonstrate both that the disease is possibly underdiagnosed and that its economic impact in livestock production is possibly also underestimated.

In the event of clinical signs of the APSW Complex (Abortions, Premature births, Stillbirths, Weak offspring), Q Fever should always be suspected.



OTHER DESCRIBED OR SUSPECTED SIGNS

In small ruminants, clinical signs of *C. burnetii* infection other than those of the APSW Complex are rarely reported and insufficiently documented. One report from the Netherlands describes that some of the aborting goats developed metritis. Also, perinatal mortality in seemingly healthy born kids was higher ^[14].

Another study shows that high *C. burnetii* shedder goats (mean Ct value of 23,9) have a reduced milk

yield (about 17%) in comparison with low shedder goats (loss of 0,53 L/day for a daily production of 3.03 L/day) ^[15]. Further studies would be of interest, to measure the impact of *C. burnetii* infection on the frequency of metritis or even infertility.

NOTE: In goats, reproductive failures in the same female at consecutive kidding seasons has been described in the literature, but seems to be a rare event ^[16].



DID YOU KNOW? In the period 1990–2022, studies investigating 81 large human Q Fever outbreaks with 8,976 total cases across 27 countries have been published in international scientific journals. Almost half of these outbreaks (40/81) were directly related to exposure to sheep and goats and/or their products! ^[17]

IN SMALL RUMINANTS, THE FOLLOWING SUSPICION CRITERIA APPLY

Clinical signs of the APSW Complex are the main warning signs in small ruminants^[18]. Apart from routine sampling in abortion processes (aborted fetuses materials, placenta, vaginal swabs for PCR, blood for serology), bulk tank milk for PCR can be used to indicate active circulation of the pathogen^[10]. For detailed sampling strategy and interpretation of results, please refer to the relevant factsheets (“Which samples should be taken in case of abortion in small ruminants suspected of Q Fever?” and “Guideline for the interpretation of Q Fever positive results on bulk milk tank”).

CRITERIA FOR SUSPECTING Q FEVER IN SMALL RUMINANTS

 IMPORTANCE IN SMALL RUMINANTS	APSW COMPLEX				RETAINED PLACENTA	FERTILITY ISSUES (RETURN TO ESTRUS)	ENDOMETRITIS	MASTITIS
	ABORTION	PREMATURE DELIVERY	STILLBIRTHS	WEAK OFFSPRING				
	+	+	+	+	?	?	?	?

Legend: + Supported by evidence; ? Unknown.

REFERENCES

- Bauer, B.U.; Knittler, M.R.; Andrack, J.; Berens, C.; Campe, A.; Christiansen, B.; Fosmore, A.M.; Fischer, S.F.; Ganter, M.; Körner, S.; et al. Interdisciplinary Studies on Coxiella Burnetii: From Molecular to Cellular, to Host, to One Health Research. *International Journal of Medical Microbiology* 2023, 313, 151590. doi:10.1016/j.ijmm.2023.151590.
- Maurin M, Raoult D. Q Fever. *Clin Microbiol Rev*. 1999 Oct;12(4):518-53.
- EFSA. 2024. Story map on Q Fever, available online: <https://storymaps.arcgis.com/stories/7f9d9bc1e4ee4b838eaa0d2576ee0c0>.
- Dijkstra, F.; Van Der Hoek, W.; Wijers, N.; Schimmer, B.; Rietveld, A.; Wijkmans, C.J.; Vellema, P.; Schneeberger, P.M. The 2007–2010 Q Fever Epidemic in the Netherlands: Characteristics of Notified Acute Q Fever Patients and the Association with Dairy Goat Farming. *FEMS Immunol Med Microbiol* 2012, 64, 3–12. doi:10.1111/j.1574-695X.2011.00876.x.
- Brom, R.V.D.; Engelen, E. van; Roest, H.J.J.; Hoek, W. van D.; Vellema, P. Coxiella Burnetii Infections in Sheep or Goats: An Opinionated Review. *Veterinary Microbiology* 2015, 181, 119–129. doi:10.1016/j.vetmic.2015.07.011.
- Menzies, P.I. Control of Important Causes of Infectious Abortion in Sheep and Goats. *Veterinary Clinics of North America: Food Animal Practice* 2011, 27, 81–93. doi:10.1016/j.cvfa.2010.10.011.
- Ruiz-Fons, F.; Astobiza, I.; Barandika, J.F.; Hurtada, A.; Axtxaerandio, R.; Juste, R.A.; García-Pérez, A.L. Seroepidemiological Study of Q Fever in Domestic Ruminants in Semi-Extensive Grazing Systems. *BMC Vet Res* 2010, 6, 3. doi:10.1186/1746-6148-6-3.
- Schimmer, B.; Lenferink, A.; Schneeberger, P.; Aangenend, H.; Vellema, P.; Hautvast, J.; Van Duynhoven, Y. Seroprevalence and Risk Factors for Coxiella Burnetii (Q Fever) Seropositivity in Dairy Goat Farmers' Households in The Netherlands, 2009–2010. *PLoS ONE* 2012, 7, e42364. doi:10.1371/journal.pone.0042364.
- Gache, K.; Rousset, E.; Perrin, J.B.; De Cremoux, R.; Hosteing, S.; Jourdain, E.; Guatteo, R.; Nicolle, P.; Touratier, A.; Calavas, D.; et al. Estimation of the Frequency of Q Fever in Sheep, Goat and Cattle Herds in France: Results of a 3-Year Study of the Seroprevalence of Q Fever and Excretion Level of Coxiella Burnetii in Abortive Episodes. *Epidemiol. Infect.* 2017, 145, 3131–3142. doi:10.1017/S0950268817002308.
- Anastácio, S.; Carolino, N.; Sidl-Boumedine, K.; Da Silva, G.J. Q Fever Dairy Herd Status Determination Based on Serological and Molecular Analysis of Bulk Tank Milk. *Transbound Emerg Dis* 2016, 63, e293–e300. doi:10.1111/tbed.12275.
- Santos, S.; Azenha, D.; Oliveira, C.; Almeida, A. Coxiella Burnetii and Chlamydia Spp. Coinfection in Small Ruminant Abortion in Portugal. *Small Ruminant Research* 2022, 207, 106616. doi:10.1016/j.smallrumres.2022.106616.
- Gouviás, I.; Lysitsas, M.; Batsidas, A.; Malefaki, S.; Bitchava, D.; Tsara, A.; Nickovic, E.; Bouzalas, I.; Mallisiova, E.; Guatteo, R.; et al. Molecular Investigation of Small Ruminant Abortions Using a 10-Plex HRM-qPCR Technique: A Novel Approach in Routine Diagnostics. *Microorganisms* 2024, 12, 1675. doi:10.3390/microorganisms12081675.
- Ramo, M. de LA.; Benito, A.A.; Quilez, J.; Monteagudo, L.V.; Baselga, C.; Tejedor, M.T. Coxiella Burnetii and Co-infections with Other Major Pathogens Causing Abortion in Small Ruminant Flocks in the Iberian Peninsula. *Animals (Basel)* 2022, 12, 3454. doi:10.3390/ani12243454.
- Wouda, W.; Dercksen, D.P. [Abortion and stillbirth among dairy goats as a consequence of Coxiella burnetii]. *Tijdschr Diergeneeskd* 2007, 132, 908–911.
- Canevari, J.T. The prevalence of Coxiella burnetii shedding in dairy goats at the time of parturition in an endemically infected enterprise and associated milk yield losses. *BMC Vet Res* 2018 Nov 20141353. doi:10.1186/s12917-018-1667-X 14.
- Berri, M.; Rousset, E.; Champion, J.L.; Russo, P.; Rodolakis, A. Goats May Experience Reproductive Failures and Shed Coxiella Burnetii at Two Successive Parturitions after a Q Fever Infection. *Research in Veterinary Science* 2007, 83, 47–52. doi:10.1016/j.rvsc.2006.11.001.
- Tan, T.; Heller, J.; Firestone, S.; Stevenson, M.; Wiethoelter, A. A Systematic Review of Global Q Fever Outbreaks. *One Health* 2024, 18, 100667. doi:10.1016/j.onehlt.2023.100667.
- Agerholm, J.S. Coxiella Burnetii Associated Reproductive Disorders in Domestic Animals—a Critical Review. *Acta Vet Scand* 2013, 55, 13. doi:10.1186/1751-0147-55-13.



EUROPEAN Q FEVER COMMITTEE

The Q FEVER COMMITTEE, co-chaired by Professors Raphaël Guatteo and George Valiakos, was created in July 2024 with the support of Ceva Santé Animale.

Discover who we are, our mission, and the latest expertise on Q Fever – Simply scan the QR code or visit the link below.

WWW.EUQFEVERCOMMITTEE.COM

