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*Chlamydomphila abortus* is a ubiquitous organism that causes ovine enzootic abortion (OEA), a major form of infectious abortion in sheep and goats, worldwide. In addition to these animals, it causes abortion in other ruminant and less frequently non-ruminant animals. Humans are also susceptible to *C. abortus*. Contracting infection with this organism via contact with aborting animals or abortion products may lead to serious consequences in pregnant women (Aitken & Longbottom, 2007; Aljumaah & Hussein, 2012).

The serological prevalence of *C. abortus* in dromedary camels was estimated to be 7.6% in Tunisia (Burgmeister et al., 1975), 11.1% in Egypt (Schmatz et al., 1978), 12.25% in Libya (Elzlitne & Elhafi, 2016), 19.4% in Saudi Arabia (Hussein et al., 2008), 19.6% in the UAE (Zaher et al., 2017), and 30% in Iraq (Al-Rubaye et al., 2018). It was also noted that the seroprevalence of camel chlamydiosis was generally higher in adult versus young and in female versus male camels (Al Khalifa et al., 2018; Elzlitne & Elhafi, 2016; Hussein et al., 2008; Osman et al., 2016). In Chad, Giraud et al. (cited by Wernery & Kaaden, 2002) reported chlamydiosis in two out of nine camels.

## 14.1 Etiology

*Chlamydomphila abortus* (formerly *Chlamydia psittaci* serotype 1) is an obligate intracellular, non-motile, gram-negative bacterium that causes abortion and fetal death in mammals, including humans. It was previously classified as *Chlamydia psittaci* but has later been recognized as a distinct species on the basis of DNA–DNA hybridization and differences in pathogenicity. In common with other Chlamydiaceae, it possesses a unique biphasic developmental cycle comprising elementary and reticulate bodies. The elementary bodies represent the infectious form of *chlamydia* that binds to host cell receptors and initiates infection while the reticulate bodies are non-infectious intracellular inclusions which comprise

metabolically active replicating forms of *chlamydia* (reviewed by Essig & Longbottom, 2015).

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## 14.2 Clinical Picture

*C. abortus* infection usually remains silent until the affected animal aborts late in gestation or gives birth to a weak or dead fetus. This applies to camels as it does to other animals. Wernery and Wernery (1990) suggested that although chlamydiosis was a major cause of abortion in sheep, goats, and cows, it does not seem to affect pregnancy in camels since no increase in abortion rate was observed in infected camel herds and no *chlamydia* was found in uterine swabs from these animals. However, Ali et al. (2012) incriminated *C. abortus* as an important cause of ovarian hydrobursitis in female dromedaries which might lead to conception failure, while Osman et al. (2016) directly associated chlamydiosis with abortion and calf mortality in female Maghrabian camels in Egypt; these authors were able to demonstrate chlamydial antibodies in vaginal swabs of camels with history of abortion or stillbirth. In the following year, Zaher et al. (2017) reported that chlamydiosis greatly affected hematobiochemical parameters as well as reproductive performance of dromedary camels in the UAE, resulting in reproductive failure manifested by abortion and/or repeat breeding. Infected camels may also play an important role in the transmission of chlamydiosis to other species of animals (Essig & Longbottom, 2015).

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## 14.3 Pathogenesis

There is no specific information on the pathogenesis of *C. abortus* in camels. However, studies on sheep and goats indicate that infection is primarily acquired through contact with abortion products, dam's vaginal discharge, and aborted or stillborn fetuses. The same may be true for camels. Following infection in sheep, the organism enters the blood stream and may rarely cause interstitial pneumonia or focal hepatitis. Several weeks or months later, the infection reaches the pregnant uterus, placenta, and fetus. Newly introduced and primigravid ewes are the most vulnerable. The incubation period is about 2–3 months. If the infection occurred during early pregnancy, it may cause late abortion, stillbirth, or birth of weak lambs and retention of fetal membranes. If the infection is acquired during late pregnancy, abortion will occur in the next pregnancy. Abortion is probably the result of multiple factors such as tissue destruction by *C. abortus*, vasculitis, thrombosis, and fetal inflammatory response. An aborted animal will not abort again but may become a carrier of the organism for an extended period of time and may shed the organism in its feces and other discharges.

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## 14.4 Diagnosis

Chlamydial organisms may be seen in stained smears of the placenta and in vaginal swabs from freshly aborted dams. They can also be isolated from the placenta or fetal organs, products of abortion, uterine discharge, and vaginal fluids. Isolation of the organism is only possible in living cells, such as chicken embryo or tissue culture. Chlamydial DNA can be detected using PCR or microarray methods. The CFT was previously one of the most commonly used serological tests for detecting chlamydiosis antibodies but is now largely replaced by more specific and more sensitive tests. The PCR is currently considered to be the method of choice in many laboratories which have the required facilities. Commonly used serological tests are ELISA and FAT. These include competitive ELISA tests using monoclonal antibody technology (Anderson et al., 1995; Jones et al., 1997) and indirect ELISA tests based on recombinant DNA technology (Sachse et al., 2009; Salti-Montesanto et al., 1997).

Western blot analysis, indirect micro-immunofluorescence and immunohistochemistry have also been used to detect *C. abortus* antigens and to distinguish between *C. abortus* and *C. pecorum* but are too laborious to be used as routine tests.

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## 14.5 Zoonotic Potential

Transmission of different chlamydial agents from animals and birds to humans is well known. In the case of *C. abortus*, a significant risk of contracting infection is encountered by farm workers, especially women, handling cases of ovine enzootic abortion.

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## 14.6 Treatment and Control

Several antibiotics are effective against *C. abortus*, the most commonly used of which are oxytetracyclines. Other antibiotics such as chloramphenicol, tylosin, macrolides, and quinolones are also effective. Two live vaccines and one inactivated vaccine were developed for controlling infection in sheep and South American camelids. No information is available on their use in old world camelids. Infected animals should be isolated and farm workers should take necessary measures to protect themselves. Pregnant women should avoid contact with pregnant animals during parturition.

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