ELSEVIER

Animal Reproduction Science 102 (2007) 111–121

ANIMAL REPRODUCTION SCIENCE

www.elsevier.com/locate/anireprosci

The prevalence of chlamydiae of bulls from six bull studs in Germany

Johannes Kauffold[a,*], Klaus Henning[b], Rüdiger Bachmann[a], Helmut Hotzel[c], Falk Melzer[c]

[a] *Large Animal Clinic for Theriogenology and Ambulatory Services, Faculty of Veterinary Medicine, University of Leipzig, An den Tierkliniken 29, 04103 Leipzig, Germany*

[b] *Friedrich-Loeffler-Institut (Federal Research Institute for Animal Health), Institute of Epidemiology, Seestraße 55, 16868 Wusterhausen, Germany*

[c] *Friedrich-Loeffler-Institut (Federal Research Institute for Animal Health), Institute of Bacterial Infections and Zoonoses, Naumburger Straße 96 a, 07743 Jena, Germany*

Received 3 July 2006; received in revised form 22 September 2006; accepted 17 October 2006
Available online 7 November 2006

Abstract

Although there are indications for venereal transmission of chlamydiae in cattle, epidemiological data on the presence of these bacteria in bulls and bull semen in particular is still incomplete. We investigated semen ($n = 120$), preputial washing samples ($n = 121$) and faeces ($n = 122$) of bulls from six bull studs located within five Federal States of Germany for the presence of chlamydiae using *omp*1-PCR and partial *omp*1 sequencing. Blood serum was examined for chlamydial antibodies using an indirect ELISA ($n = 122$). Chlamydiae were found in 11 (9.2%), 13 (10.7%) and 22 (18.0%) of the semen, preputial washing and faecal samples, respectively. Among individual chlamydial species identified, *Chlamydophila* (*Cp.*) *psittaci* predominated in semen and preputial washing samples, and *Cp. pecorum* in faeces. *Cp. abortus* was the third frequently observed species. Chlamydial antibodies were detected in a total of 62 (50.8%) bulls. Bull studs differed in regard to the number of bulls found chlamydia-positive in faeces and serologically positive. No correlation was observed between serological data and PCR of semen, preputial washing samples or faeces. Standard ejaculate parameters did not differ between bulls that were chlamydia-positive and -negative in semen. In conclusion, detection of chlamydiae in semen of bulls suggests a potential for venereal transmission. Chlamydiae appear to be widespread within the bull population in Germany. Serological testing failed to identify bulls shedding chlamydiae in their semen.

Keywords: Bull; Chlamydiae; Semen; Preputial washing sample; Faeces; Chlamydial antibodies

* Corresponding author. Tel.: +49 3419738364; fax: +49 3419738398.
E-mail address: kauffold@vetmed.uni-leipzig.de (J. Kauffold).

0378-4320/$ – see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.anireprosci.2006.10.013

1. Introduction

Bovine chlamydioses have been associated with a wide range of diseases including enteritis (Ronsholt, 1978; Kurbanove, 1980; Reggiardo et al., 1989), pneumonia (Ronsholt, 1978; Reggiardo et al., 1989), conjunctivitis (Ognianov et al., 1978), mastitis (Ronsholt and Basse, 1981; Kaltenboeck et al., 1991), polyarthritis (Storz et al., 1966a,b) and encephalomyelitis (Piercy et al., 1999). Additionally, a number of reproductive problems such as abortion (Griffiths et al., 1995; Ogina et al., 1996; Cavirani et al., 2001; Pospischil et al., 2002), vaginal discharge (Wittenbrink, 1991; Wittenbrink et al., 1994), vaginitis (Wittenbrink, 1991; DeGraves et al., 2003), endometritis (Wittenbrink et al., 1993a, 1994; Veznik et al., 1996a), salpingitis (Longbottom, 2004), hypofertility (Kaltenboeck et al., 2005), and repeat breeding (Wittenbrink et al., 1994) have been reported to be associated with chlamydial infection. Poor management conditions, such as crowding during rearing (Jee et al., 2004), and metabolic diseases, such as ketosis (Wehrend et al., 2005), have been found to have a facilitating effect on genital chlamydiosis suggesting that it is a multifactorial disease complex (Wehrend et al., 2005). Chlamydiae have been isolated from aborted bovine fetuses (Ogina et al., 1996), fetal membranes (Griffiths et al., 1995), vaginal discharge (Wittenbrink et al., 1994) and cervical swabs (Veznik et al., 1996b; Wehrend et al., 2005), as well as detected in vaginal cytobrushs (DeGraves et al., 2003) and *post-mortem* uterine specimens (Wittenbrink et al., 1988). Serological testing revealed a high prevalence of chlamydiae within the female cattle population in different European countries (Stepanek et al., 1983; Cavirani et al., 2001; Wehrend et al., 2005), with females coming from herds with reproductive problems being more frequently chlamydia-positive (Cavirani et al., 2001). Cumulative evidence indicates a detrimental role of chlamydiae on female reproduction in cattle, but the route of infection of the female genital tract is still not fully determined. Recent research conducted with calves and maiden heifers indicates that infection of the female genital tract occurs early in life during the juvenile phase due to extragenital transmission (DeGraves et al., 2003, 2004; Jee et al., 2004). However, in a number of mammalian species, genital/sexual transmission of chlamydiae is evident. In humans *Chlamydia* (*C.*) *trachomatis* was shown to be transmitted to women through semen during intercourse (Paavonen and Eggert-Kruse, 1999; Vigil et al., 2002; Debattista et al., 2003; Gonzales et al., 2004). In several laboratory animal species and primates, artificial inoculation of the lower genital tract led to ascending infection of the uterus and oviducts (Khamesipour et al., 1994; Van Voorhis et al., 1997; Rank et al., 2000). In sheep, there is limited evidence to suggest that *Chlamydophila* (*Cp.*) *abortus* is venereally transmitted to ewes (Longbottom and Coulter, 2003). Boar semen has been found harbouring chlamydiae (Kauffold et al., 2006; Teankum et al., 2006) suggesting it may be a vector for sexual genital chlamydial infection of sows. Moreover, when female pigs were artificially genitally inoculated with a human pathogenic strain of *C. trachomatis*, they developed severe genital pathology (Vanrompay et al., 2005). In the bull, there are a few studies reporting the presence of chlamydiae in semen (Storz et al., 1976; Travnicek et al., 1980; Domeika et al., 1994; Veznik et al., 1996a). In a Czech (Veznik et al., 1996a) and a Swedish study (Domeika et al., 1994), in which 42 and 47 bulls, respectively, were tested for chlamydiae in semen by either immunfluorescence or PCR, 14.3% and 29.8% were found positive. Chlamydiae have been isolated from the epididymis of a bull suffering seminal vesiculitis syndrome (Storz et al., 1968) and from the epididymis, testes and accessory sex glands of bulls following artificial parenteral inoculation with the bovine strain of *C. psittaci* (Storz et al., 1976). Additionally, cows which were genitally infected with chlamydiae developed vaginitis and/or endometritis (Wittenbrink et al., 1993a; DeGraves et al., 2004). Comprehensive data thus suggest that chlamydiae might be transmitted venereally in cattle and semen might be involved as a vector. The aim of this study was