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Increase in the occurrence of abortions associated with exposure to the Bluetongue virus serotype 8 in naïve dairy herds

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Abstract

The transplacental transmission capacity demonstrated for Bluetongue virus serotype 8 (BTV-8) in cattle probably is associated with an increased occurrence of abortions. The objectives of this study were to quantify the effect of BTV-8 exposure on the occurrence of abortions in previously naive dairy cow herds under natural infection conditions, and to determine a possible risk period during pregnancy associated with this increase. Two criteria were considered in order to estimate the occurrence of abortion: late return-to-service after a first artificial insemination (AI), and short gestations. A late return-to-service was defined as a return taking place 90 to 200 days after a first AI. These criteria were compared between cows in herds exposed during the 2007 epizootic in France and cows in herds that were not exposed. To determine the risk period during a pregnancy, variations in the occurrence of abortions were quantified according to the stage of the pregnancy during which the exposure took place. Survival analyses were used to estimate the risk of increased occurrence of abortion associated with BTV-8 exposure, adjusted by the principal factors known to influence the risk of abortion. Exposure to the BTV-8 virus under natural conditions in previously naive dairy herds notified after clinical suspicion during the 2007 epizootic was associated with an increase in the occurrence of abortions, regardless of the stage of pregnancy. The at-risk gestation period depended on the criteria used to detect abortions. The mean effect of BTV-8 exposure in the ensemble of detected outbreaks corresponded to an increase of 6.7% in late return-to-service. BTV-8 exposure during the first 3 mo of gestation was associated with a 15% increase in late return-to-service for cows with no return-to-service at 90 days, while this increase was 6% for exposure starting from the third month of gestation (in outbreaks detected in September). BTV-8 exposure from the third month of gestation was associated with a 1.9% increase of short gestations. The effect of exposure was more pronounced for outbreaks detected early in the epizootic compared with those detected later.

Keywords: Bluetongue; Abortion; Cow; Epidemiology

1. Introduction

Bluetongue virus serotype 8 (BTV-8) differs from other serotypes because of transplacental transmission capacity in cattle and sheep, which likely leads to an increased occurrence of abortions [1–3]. Until the emergence of BTV-8 in Northern Europe in 2006, the only known cases of transplacental infections with BTV were caused by modified live virus vaccine strains [4]. The infection of the conceptus by these virus strains during pregnancy in cattle and sheep was associated with an increased risk of abortion [4,5].

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While numerous studies have reported cases of abortion in cattle herds exposed to BTV-8 [6–8], only one study has sought to quantify their increase by comparing the abortion rates of seroconverted dairy cows with those of cows not infected by BTV-8 [9]. This study did not allow a significant association to be demonstrated between BTV-8 infection and the risk of abortion because of the small numbers involved (7 abortions in 80 cows infected during pregnancy). The abortion rate observed nevertheless was high compared to rates in large populations mentioned in the reference literature [10]. The demonstration of such an association and the corresponding quantification of variations in abortion rates therefore require larger samples. Among sheep, the abortion rate for ewes inseminated at the beginning of the vector activity period (July 2007 in Belgium) was 25.7% compared to 7.1% for ewes inseminated at the end of the vector activity period (October 2007) [11].

The consequences of BTV-8 infection very likely depend on the timing of infection during pregnancy. The sensitivity of conceptus in cattle and sheep to the deleterious effects of infection by BTV modified live virus vaccine strains (capable of transplacental transmission) is higher the younger the conceptus is at the moment of infection [4]. BTV-8 infections of the conceptus early in a pregnancy thus may cause a higher increase in abortion rates than infections later in the pregnancy.

To describe the impact of the disease at the herd level, it is worthwhile to know the mean effect of exposure on the performance of cows in the herd. This effect of BTV-8 exposure on abortion rates depends on the proportion of cows infected. In a study carried out in France at the end of the winter of 2007, it was shown that the within-herd prevalence rate increased when the between-herd prevalence was higher [12]. At the end of the epizootic, the within-herd prevalence varied between 0.42 and 0.99 in departments (French administrative districts) where prevalence had been estimated to be 1 (95% CI: 0.93–1.00), while it was less than 0.10 in departments with an intermediate level of between-herd prevalence (of about 0.60). Consequently, the effect of BTV-8 exposure at the herd level on the risk of abortion could vary according to the proportion of herds infected in the local geographic area.

The objectives of this study were to: (1) quantify the effect of BTV-8 exposure of previously naive herds (not infected and not vaccinated) on the occurrence of abortions in dairy cows under natural infection conditions, (2) determine the pregnancy period during which exposure to the BTV-8 virus may be associated with an increased occurrence of abortions, and (3) assess whether the effect of BTV-8 exposure increases when the proportion of infected neighboring herds increases.

2. Materials and methods

2.1. Study protocol and available data

The occurrence of abortions in cows belonging to exposed herds was compared to the occurrence of abortions in cows belonging to unexposed herds. The effect of BTV-8 exposure on the occurrence of abortions was quantified in herds exposed to BTV-8 during the 2007 epizootic in France to quantify the effect of exposure in a population of naive cows that had not been vaccinated against BTV-8. In 2006, only 6 outbreak herds had been notified in France.

The information concerning BTV-8 exposure was provided by the official surveillance system. This information was only available at the herd level. BTV-8 outbreaks were notified either in the event of detection of clinical signs by a livestock farmer or veterinarian, in the event of a positive serologic test result before the sale or transfer of animals, or in the event of either the detection of clinical signs or a positive serologic test result in sentinel herds. Only outbreaks notified following the detection of clinical signs were included in the analyses because in the other cases, the date of the serologic test does not indicate the date of exposure, which may have occurred well before the test was carried out without clinical signs having been detected. A herd was considered to be an outbreak herd if at least one animal presenting clinical signs tested positive for BTV-8. Herds reported after clinical signs in 2007 were located in 39 departments (French metropolitan territory is divided into 95 departments). The numbers of reported case herds greatly varied among these departments. Based on the proportion of herds that reported clinical signs in 2007, 19 of the 39 departments with at least one notified clinical outbreak were selected, which corresponded to most exposed departments in 2007. The selected population of clinical outbreaks corresponded to 92% of the clinical outbreaks declared in 2007.

The reproduction data were obtained on herds registered from milk controls in which artificial insemination (AI) was practiced. The data obtained were the AI, calving, and culling dates, as well as data serving to adjust factors known to influence reproductive performance: parity, milk production at each control (date of test-day, milk production, fat and protein content) and the breed of the cows and AI bulls.