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Comparison of two monitoring and treatment strategies for cows with acute puerperal metritis

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ABSTRACT

The objective of this study was to compare two strategies for screening and subsequent treatment of acute puerperal metritis (APM) in dairy cows. Therefore, we conducted a study on 79 cows with APM (cows with an enlarged uterus with fetid watery red-brown vaginal discharge and fever >39.5 °C) and 114 healthy control cows. Cows with APM were divided into two groups (treated, N = 67 cows; not treated, N = 12 cows). The treated animals were further subdivided into two groups (treated between Day 1 and 4 post partum, N =12 and treated between Day 5 and 10, N = 55). Serum haptoglobin concentrations, milk yield, cure rate, prevalence of endometritis, and cervical diameter on days in milk (DIM) 21 to 27 were compared between the groups. Cows were defined as cured when their rectal temperature was <39.5 °C 4 days after treatment and fever did not rebound over 39.4 °C until the end of the screening period which was DIM 10. The results of this study did not show any significant differences in cure rates, milk yield, or serum haptoglobin concentrations on DIM 2, 5, and 10 and subsequent uterine health (DIM 21–27). Considering this study as a proof of concept study, we conclude that there might not be a negative effect after a screening and treatment protocol beginning at DIM 5 and leaving early APM cows untreated. This hypothesis needs to be confirmed by a larger field study. Furthermore, antimicrobial therapy could be avoided in 12 of 55 cows (21.8%) in group 2 because of the protocol implementing treatments after DIM 5. These cows did not show signs of APM during the following 5 days. Therefore, these animals were considered as self-recovered leading to a cure rate of at least 21.8% (12 of 55 cows).

1. Introduction

Acute puerperal metritis (APM) is an acute systemic illness caused by infection of the uterus, occurring within 21 days after parturition [1]. A case of APM is diagnosed based on an abnormally enlarged uterus accompanied by fetid watery red-brown vaginal discharge (VD), fever (>39.5 °C) and signs of systemic illness (i.e., decreased milk yield, decreased dry matter intake, elevated heart rate, and dehydration) [1]. In studies applying these criteria the prevalence of APM in dairy cows ranged from 15.3% to 69% [2–4].

Reduced milk yield, increased culling rate, and treatment costs in cases of APM result in substantial economic losses. The total costs per case of APM have been calculated to approximate US $329 to US $386 [5]. The prevalence rates and the reported costs underscore the importance of this disease. Also considering the life-threatening character of APM [6] strategies for effective prevention, accurate and early diagnosis, and efficacious treatment of APM are of great importance.

Recently the systemic use of antimicrobial agents was proven to be an effective treatment strategy and thus recommended by several authors [7–9]. Most frequently used drugs for treatment of APM are penicillin, oxytetracycline, ampicillin, and ceftiofur [7,10].

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The use of antimicrobial agents is inherently associated with selective pressure for the emergence of resistant bacteria, which stresses the importance of their prudent use [11]. More recently, several reports have noted serious concerns regarding resistance in zoonotic pathogens in cattle [12–14]. Ceftiofur, a third-generation cephalosporin has been demonstrated to be an efficacious treatment for APM in several research trials [6,15,16]. Advantages include demonstrated efficacy and a 0 day withdrawal period for milk [17]. However, third-generation cephalosporins are valued for treating serious infections in human medicine. Therefore, the use of ceftiofur in dairy cows could be a potential threat to the ability to cure life-threatening infections in humans [18].

For an early detection of APM a daily measurement of rectal body temperature during the first 4 to 13 days in milk (DIM) was recommended [6,19]. Thresholds to define fever in dairy cows range from 39.4 °C [19] to 39.7 °C [9]. In the early postpartum period an increased body temperature most likely indicates a uterine infection [20].

Using rectal temperature as a diagnostic criterion, frequencies of both type I (fever when the animal is actually healthy) and type II errors (no fever when the animal is actually sick) occur [9,21,22], although a high repeatability of rectal temperature measurements has been demonstrated [23]. Furthermore, two recent studies reported that body temperature of fresh cows in the first days after parturition can significantly increase physiologically under hot weather conditions [24,25]. Because of these limitations, diagnosing fever alone is less reliable than including an examination for abnormal uterine discharge because pyrexia is not consistently associated with pathogenic bacteria in the uterine lumen [9].

Several studies examined the diagnostic value of acute phase proteins as indicators for APM [10,26]. Serum haptoglobin (Hp) concentrations between 1.06 g/L and 1.9 g/L have been shown to indicate an acute infectious process in dairy cows. Because serum Hp concentrations increased 2 days before clinical signs (VD and body temperature ≥39.5 °C) of APM were diagnosed [27] and were related to the bacterial contamination of the uterus [28] they can support the diagnosis of APM [9,27].

Recent studies investigating treatments of APM measured body temperature for 3 to 14 days postpartum and used body temperature as part of the treatment decision. None of the studies, however, reported the relationship between the frequencies of temperature measurements and type I errors [29]. Therefore, the objectives of this study were to compare two strategies of monitoring fresh cows for APM differing in their screening intensity. Subsequently we compared two treatment strategies and an untreated group of cows with APM.

2. Materials and methods

2.1. Experimental animals and design

The study was conducted on a commercial dairy farm, in Sachsen-Anhalt, Germany between October and December 2011, housing 1200 Holstein dairy cows with an average 305-day milk production of 10,147 kg (3.98% fat and 3.33% protein). Cows were managed according to the guidelines set by the International Cooperation on Harmonisation of Technical Requirements for Registration of Veterinary Medicinal Products [30].

Lactating cows were housed in a free-stall barn with cubicles equipped with rubber mats and slotted floors. Early-postpartum cows were fed a total mixed ration consisting of 34.1% corn silage, 20.5% grass silage, 4.2% barley straw, and 41.2% concentrate mineral mix on a dry matter basis distributed with a conveyer belt system up to 10 times per day. Cows were milked three times a day (at 6 AM, 2 PM, and 10 PM). Milk yield was recorded daily using the parlor software (Fullexpert Software 3.02, Lemmer Fullwood, Lohmar, Germany).

Cows entered the experiment 1 day after calving at 7 AM. Cows that received anti-inflammatory drugs or antimicrobial drugs for purposes not related to the study (e.g., acute mastitis) or suffered from inflammatory diseases other than APM were excluded from the trial (N = 28).

Cows were randomly allocated to one of two groups according to the last digit of their ear tag. Cows with an odd number (1, 3, 5, 7, 9) were allocated to group 1 and cows with an even number (0, 2, 4, 6, 8) were allocated to group 2 (Fig. 1). All cows underwent a general clinical examination including rectal temperature and VD daily between 8 AM and 11 AM. All examinations were performed by one of three investigators. To standardize the definition of disease, a scoring system was used (0 = no discharge; 1 = normal lochial secretion, not smelly, viscous, or reddish brown; 2 = fetid, watery, and reddish-brown VD). Every Wednesday, the diagnostic procedures were performed by all three investigators jointly in order to assure a homogenous diagnostic classification. Cows having fetid, reddish-brown, watery vulvar discharge in combination with a rectal temperature ≥39.5 °C (fever) were diagnosed as having APM. Cows that did not expel their fetal membranes within 24 hours postpartum were defined as having retained fetal membranes (RFM). In group 1, cows suffering from APM (together with a rectal temperature ≥39.5 °C and fetid discharge) received a systemic antimicrobial treatment of 6.6 mg per kg of body weight (BW) ceftiofur crystalline-free acid (Naxcel, Pfizer Limited, Kent, UK) on the day of diagnosis (independent of DIM; N = 28). Cows with APM in group 2 did not receive any treatment before DIM 5 (N = 50) even if they would have been diagnosed as suffering from APM before DIM 5. Therefore, it was possible, that cows diagnosed with APM at DIM 1 to 4 in group 2 (no treatment before DIM 5) self-recovered before DIM 5 and consequently did not meet our inclusion criterion (fever and abnormal VD) for an antimicrobial treatment thereafter (i.e., DIM 5–10). Therefore, these cows did not receive antimicrobial treatment (no treatment at the day of diagnosis of APM or later [NoTx@D], N = 12). If APM was diagnosed between DIM 5 to 10, cows were treated (treatment at DIM 5 to 10; Tx@D5 to 10). Retrospectively, cows were categorized into two classes according to the time of treatment (i.e., treatment at DIM 1–4 [Tx@D1 to 4] vs. Tx@D5 to 10) as shown in Figure 1. Considering the life-threatening character of APM [5] all cows diagnosed with APM after DIM 4 were treated. Cows were defined as cured when their rectal temperature was <39.5 °C 4 days after