

Evaluation of rectal temperature in diagnosis of puerperal metritis in dairy cows

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ABSTRACT: The objective of this field trial was to evaluate the body temperature within the interval of 10 days *post partum* in cows with puerperal metritis, as confirmed by a clinical examination, in comparison with cows without clinical symptoms of this disease. In addition, the body temperature in cows having a purulent and putrid character of lochia was compared. Rectal temperature was measured daily in 92 randomly selected cows. The cows were examined clinically on day 10 ± 3 *post partum* and were divided according to the character of lochia into Group M1 (purulent lochia, $n = 29$), Group M2 (putrid lochia, $n = 28$) and Group C (normal lochia, $n = 35$). The number of cows with a fever (temperature $> 39.0^\circ\text{C}$ or $> 39.5^\circ\text{C}$) at least once during 10 days *post partum* was higher in Groups M1 and M2 compared to Group C (86.2% and 92.9% vs. 54.3%, $P < 0.01$ and $P < 0.001$, or 41.4% and 71.4% vs. 14.3%, $P < 0.05$ and $P < 0.001$). In addition, there was a higher number of cows with a temperature $> 39.5^\circ\text{C}$ in Group M2 in comparison with Group M1 ($P < 0.05$). More cows showed consistent temperatures $> 39.0^\circ\text{C}$ for three days or $> 39.5^\circ\text{C}$ for two days in Group M2 compared to Group C (42.9% vs. 8.6%, $P < 0.01$ or 25.0% vs. 2.9%, $P < 0.05$). Average daily temperatures were higher in Group M2 compared to Group C on Days 1, 3, 5 and 7 ($P < 0.05$) as well as on Days 2 and 6 ($P < 0.01$) *post partum*. The results reveal the following: higher incidence of body temperature $> 39.0^\circ\text{C}$ in cows with puerperal metritis; risk period for fever from Day 3 to Day 7 *post partum*; higher incidence of fever in cows with putrid lochia compared to cows with purulent lochia; body temperature $> 39.5^\circ\text{C}$ being a more accurate indicator of puerperal metritis than temperature $> 39.0^\circ\text{C}$. Despite that, the occurrence of fever was irregular. In conclusion, measurement of body temperature does not represent a sufficiently accurate diagnostic method for puerperal metritis although it may be considered a useful indicator for assessment of the severity of the disease.

Keywords: dairy herd; body temperature; purulent lochia; putrid lochia; fever

Because puerperal metritis represents a major cause of sub/infertility in cows and incidence of this disease is high (usually 10–40%), a systemic approach to diagnosis as well as treatment of metritis in dairy herds is desirable (Sagartz and Hardenbrook, 1971; Markusfeld, 1987; Stevenson and Call, 1988; Peeler et al., 1994; Gilbert et al., 2005; Foldi et al., 2006; Sheldon et al., 2006). Recently, measurement of body temperature has been considered a useful method in systemic diagnosis of metritis in early

postpartum cows as the disease is often accompanied by fever (Kristula et al., 2001; Zhou et al., 2001; Overton et al., 2003; Benzaquen et al., 2004; Chenault et al., 2004). In spite of introducing body temperature measurement to the monitoring system in dairy herds, there is lack of data proving the contribution of temperature measurement to the diagnosis of puerperal metritis. For this reason the objective of this field trial was to evaluate body temperatures above 39.0°C and above 39.5°C

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within 10 days *post partum* in cows suffering from puerperal metritis with purulent and putrid lochia as well as in cows without any clinical symptoms of this disease.

MATERIAL AND METHODS

Animals and examination

During September and October, 92 cows (Holstein, 0–2 parity) in 4 dairy farms (200–800 cows; 7 000 to 8 000 litres) were randomly selected immediately after parturition regardless of the course of parturition or expulsion of placenta. Three (8.6%), six (20.7%) and ten (35.7%) cows were post dystocia and two (5.7%), six (20.7%) and eight (28.6%) cows showed retained placenta in Groups C, M1 and M2 (see below), respectively. Nevertheless, evaluation of these factors was not included in this study. Rectal temperature was measured by digital thermometers (Hartmann) in selected cows each day at approximately 9 a.m. within 10 days *post partum*. Precision of the thermometers was verified by comparing temperatures (*t*-test) in a thermo-stable water bath with a standard temperature (S, 35.5–41.5°C). Temperature deviations were not significant.

A clinical examination (vaginal palpation with evaluation of manually obtained lochia and rectal palpation of uterus) was performed on day 10 ± 3 *post partum*. Vaginal examination consisted of cleaning the vulva by a paper towel, insertion of lubricated gloved hand into the vagina, insertion of finger(s) to the cervical orifice and withdrawal of lochia from vagina. The quality of lochia was considered the most important parameter for the diagnosis of puerperal metritis. Markedly a purulent character of lochia (> 50% content of puss) was considered to be a symptom of mild puerperal

metritis whereas a fetid character of lochia (putrid foul-smelling and watery red-brown exudates with necrotic debris) as a symptom of severe puerperal metritis. Results of rectal palpation were considered to be merely additional. The uterus was enlarged in all examined cows, due to increased content. Even if more distended uterus with thinner wall were often found in cows with putrid lochia in comparison with cows with purulent lochia as well as cows without symptoms of puerperal metritis these parameters were not evaluated precisely. In addition, the signs of systemic illness were observed daily simultaneously with measurement of rectal temperature. But typical signs of toxemia (reduced milk yield, dullness, diarrhoea, dehydration, inappetence or anorexia) were found only sporadically and thus these signs were not used to classify cows in this experiment. The cows were divided into experimental groups according to the findings of clinical examination – cows with purulent lochia (Group M1, *n* = 29) and cows with putrid lochia (Group M2, *n* = 28). Cows showing normal lochia formed the control group (Group C, *n* = 35).

Evaluation

Rectal temperatures above 39.0°C were considered to be a sign of fever. Occurrences of temperatures > 39.0°C and > 39.5°C were evaluated separately. The number of cows with a fever in each of the experimental groups were compared using the Chi-square (χ^2) test or Fisher's exact test. Average values of daily temperatures among experimental groups were evaluated using the Tukey-Kramer test. In addition, the Odds Ratio (*P* = 0.95) for metritis (Groups M2 as well as M2 + M1) was determined when body temperatures of greater than 39.0°C and 39.5°C occurred at least once during 10 days *post partum*.

Table 1. The number of cows in experimental groups with body temperatures above 39.0°C and 39.5°C during 10 days *post partum*

Temperature (°C)	Experimental groups		
	C (<i>n</i> = 35)	M1 (<i>n</i> = 29)	M2 (<i>n</i> = 28)
> 39.0	19 (54.3%) ^{ab}	25 (86.2%) ^a	26 (92.9%) ^b
> 39.5	5 (14.3%) ^{cd}	12 (41.4%) ^{ce}	20 (71.4%) ^{de}

C = cows with normal lochia, M1 = cows with purulent lochia, M2 = cows with putrid lochia

^a*P* < 0.01, ^b*P* < 0.001, ^c*P* < 0.05, ^d*P* < 0.001, ^e*P* < 0.05

Table 2. The number of cows in experimental groups that showed continual body temperature above 39.0°C for 3 days or above 39.5°C for 2 days during 10 days *post partum*

Temperature (°C)	Experimental groups		
	C (<i>n</i> = 35)	M1 (<i>n</i> = 29)	M2 (<i>n</i> = 28)
> 39.0	3 (8.6%) ^a	6 (20.7%)	12 (42.9%) ^a
> 39.5	1 (2.9%) ^b	2 (6.9%)	7 (25.0%) ^b

C = cows with normal lochia, M1 = cows with purulent lochia, M2 = cows with putrid lochia

^a*P* < 0.01, ^b*P* < 0.05

RESULTS

Rectal temperatures varied from 36.8°C to 41.9°C. Fevers (temperatures > 39.0°C or > 39.5°C) and normal temperatures were found in all experimental groups. The number of cows showing fever at least once during 10 days *post partum* was higher in Group M1 and M2 in comparison with Group C. In addition, there was a higher number of cows with temperatures > 39.5°C in Group M2 as compared to Group M1 (Table 1).

The temperatures > 39.0°C and > 39.5°C repeated irregularly more than three times in 3 and 0 (Group C), 5 and 1 (Group M1) and 13 and 2 (Group M2) cows, respectively. The maximum number of days with fever were 8 (>39.0°C) and 5 (>39.5°C) in one cow from Group M2. Continual fevers lasting several days were found only sporadically. The number of cows with continual temperatures > 39.0°C for three days or >39.5°C for two days was higher in Group M2 in comparison with Group C (Table 2).

Fever occurred the most often from Day 3 to Day 7 *post partum*. Therefore, average daily tem-

peratures were higher in Group M2 compared to Group C on Days 1, 3, 5 and 7 (*P* < 0.05), and on Days 2 and 6 (*P* < 0.01) *post partum*. In addition, higher temperatures were found in Group M1 compared to Group C on Days 2 and 6, and in Group M2 compared to Group M1 on Day 3 (*P* < 0.05) (Figure 1).

The values of the Odds Ratio (*P* = 0.95) when fever was recorded (rectal temperature above 39.0°C and 39.5°C) for cows with putrid lochia (Group M2) or putrid and purulent lochia (Groups M2 + M1) were 1.28–27.35 or 2.44–20.99 (> 39.0°C) and 2.57–18.6 or 2.60–22.66 (> 39.5°C), respectively.

DISCUSSION

Body temperature in cows can be used in diagnosing not only pathological conditions but also some physiological conditions, such as oestrus or parturition (Noakes et al., 2001; Aoki et al., 2005). Nevertheless, diagnosis of infections/inflammations represents the most important indication for body temperature measurement. Even though fe-

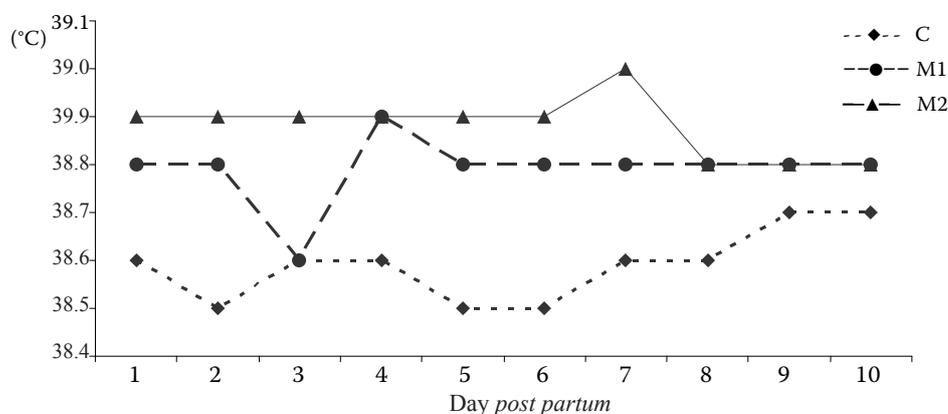


Figure 1. Average daily temperatures in experimental Groups C (cows with normal lochia, *n* = 35), M1 (cows with purulent lochia, *n* = 29) and M2 (cows with putrid lochia, *n* = 28) during 10 days *post partum*

ver represents a non-specific symptom of a pathological condition, it has been found that increased temperature within several days after parturition in cows usually accompanies puerperal metritis. Therefore regular measurement of body temperature could be part of a routine systemic monitoring in cattle farms (Montes and Pugh, 1993; Smith et al., 1998; Drillich et al., 2001). The relationships among puerperal metritis, suppression of neutrophil function and fever in cows were described by Hammon et al. (2004). But limits of increased temperatures which are useful for diagnosis of puerperal metritis are not unified. Temperatures of 39.2°C (Smith et al., 1998), 39.5°C (Drillich et al., 2001; Chenault et al., 2004) or 39.7°C (Overton et al., 2003) were described. Because a body temperature of 39.0°C is generally considered to be the maximum value for a physiological condition in cows, temperatures above this value were considered as pathological in our trial. Nevertheless, the results have shown that body temperatures above 39.5°C are more representative for diagnosis of puerperal metritis because temperatures between 39.1°C and 39.5°C were frequently found in all experimental groups. However, the body temperature is an unreliable indicator because it often varies depending on many internal and external factors, such as health, age, season of the year and the time of day. This was the reason why in our trial temperature was measured consistently according to the season (September and November) and the time of day (around 9 a.m.). It must be said, though, that age and parity of experimental animals varied (0–2 parity).

Kristula et al. (2001) recorded that cows experiencing no clinical problems at calving or during early *post partum* had an average rectal temperature below 38.9°C each day throughout the first 10 days *post partum*. In accordance with these authors, we found during the same period average daily temperatures to be between 38.5°C and 38.7°C in control cows. Daily average temperatures of 38.9°C or higher were found in cows with purulent lochia only on Day 4, while these temperatures persisted from Day 1 to Day 7 *post partum* in cows with putrid lochia. These findings verify the results of Kristula et al. (2001) and Benzaquen et al. (2004), which showed the highest occurrence of fever in cows with puerperal metritis between Day 3 and 6 *post partum*.

Even though fetid or purulent characters of lochia are usually considered as unambiguous clinical symptoms of puerperal metritis (Zilaitis et al.,

2004; Drillich et al., 2002; Drillich, 2006) opinions on the pathological character of purulent lochia are not uniform. Some authors state that pathological character depends on the content of pus (Dohmen et al., 1995; LeBlanc et al., 2002a; Williams et al., 2005). The most important factors influencing the character of pathological lochia are represented by the progress of uterine involution and quantity and spectrum of bacterial contamination in the uterus. Because these factors tend to change in relation with the postpartum period and development of inflammation (Paisley et al. 1986; Huszenicza et al., 1999; Sheldon and Dobson, 2004; Foldi et al. 2006) in our trial the pathological character of lochia could have changed in the course of observation. Sheldon et al. (2006) state that putrid lochia can change to having a purulent character as early as a few days *post partum*. Even though uncertainties may occur in classification of the character of puerperal metritis on day 10 ± 3 *post partum* we considered this term suitable, as more serious diagnostic mistakes can be made at earlier stages of examination. Development of clinical signs can be delayed and thus some cases of puerperal metritis may remain undiagnosed when clinical examination is performed very early post partum. Kulcsar et al. (2005) described the occurrence of clinical signs of toxic puerperal metritis up to day 3–4 *post partum* but not before day 6 in milder cases of this disease.

We evaluated body temperatures in cows with putrid and purulent lochia (regardless of puss content) separately. Fever occurred more often in cows having putrid lochia. These results show more frequent toxemia in cows with putrid lochia compared to cows with purulent lochia. External symptoms of toxemia such as lassitude, anorexia, drop in milk yield and dehydration are not sufficiently accurate because they are present only in some cases (Nakao et al., 1992; Hirvonen et al., 1999; Huszenicza et al., 1999; LeBlanc et al., 2002b; Kim and Kang, 2003; Maizon et al., 2004; Gilbert et al., 2005; Sheldon et al., 2006). In accordance with the literature mentioned, in our trial these symptoms were found only sporadically.

In our study, despite a higher number of cows in Group M2 and M1 showing temperatures above 39.0°C and 39.5°C compared with Group C, nearly one third of cows suffering from puerperal metritis (28.6%) did not show any fever. Also Benzaquen et al. (2004) found, on the basis of *post partum* monitoring of daily rectal temperatures, that over

half of the cows with metritis did not show any fever during the first week *post partum*. Similarly, Sheldon et al. (2004, 2006) stated that pyrexia is not consistently associated with puerperal metritis even though it correlates with the presence of uterine pathogens and the fact that febrile animals have higher concentrations of acute phase protein.

Monitoring postpartum cows with the aim of diagnosing metritis should be focused specifically on cows after dystocia and/or retained placenta because positive correlations between these pathological conditions and puerperal metritis have been confirmed (Bretzlaff et al., 1982; Dohmen et al., 2000; Tefera et al., 2001; Butler et al., 2002; Drillich et al., 2003; Garcia et al., 2003). Relationships among dystocia, metritis and fever in postpartum dairy cows have been described by Kristula et al. (2001) and Benzaquen et al. (2004).

The results of our trial have shown a higher incidence of body temperature $> 39.0^{\circ}\text{C}$ in cows with puerperal metritis, the risk period for fever occurrence being from Day 3 to Day 7 *post partum*, fever in cows with putrid lochia occurring with higher incidence compared to cows with purulent lochia, and, finally, body temperature $> 39.5^{\circ}\text{C}$ representing a more accurate indicator of puerperal metritis than temperature $> 39.0^{\circ}\text{C}$. Nevertheless, occurrence of fever did not follow any pattern. We can conclude that measurement of body temperature does not represent a sufficiently accurate diagnostic method for puerperal metritis but is a useful method for assessment of the severity of the disease.

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