Effective treatment of uterine disease in certified organic dairy herds

Gustavo M. Schuenemann,[a] Troy A. Brick,[b] Santiago Bas[a]
[a]Department of Veterinary Preventive Medicine and [b]Department of Veterinary Clinical Sciences, College of Veterinary Medicine, The Ohio State University, Columbus, OH

Abstract

Postpartum metritis and clinical endometritis are common uterine disorders in lactating dairy cows that negatively impact reproductive performance. For certified organic herds, implementation of preventive management practices such as proper nutrition and calving management are critical to prevent uterine diseases from occurring. Several alternative therapies such as garlic tincture, aloe vera, vitamins, and vegetable oils have been used by organic dairy producers. Despite the use of these alternative therapies to treat postpartum metritis, there is no scientific evidence available in the literature that can promote or discourage these practices. For organic (and conventional) herds, the implementation of proactive management strategies that control the risk factors for uterine diseases should be a top priority.

Keywords: Certified organic, dairy cattle, uterine diseases

Introduction

Organic food in the US, primarily produce and dairy products, reached retail sales over $21.1 billion in 2008 and for several years, organic farmers struggled to produce enough supply to meet the growing domestic demand.[1] The organic dairy industry has been growing steadily since 1990 not only in the US, but also in Europe. The dairy sector has been one of the fastest growing segments of the organic commodities, almost doubling the number of certified milk cows every year between 1997 and 2005 in the US.[1] Additionally, the retail demand for organic milk doubled and the retail milk prices were roughly double the conventional prices between 2004 and 2006.[1] The 2005 US dairy survey showed that the size (small dairy operations) and location of the farm (Northeast and Upper Midwest) increased the likelihood of organic practices as an alternative to improve farm income.[2,3] Environmental stewardship and milk price along with long term production contracts between the processors and producers have been the top reasons for converting to organic or adding a new organic dairy operation.

Management practices for certified organic dairies

Organic dairy production has gained increasing attention because of consumer concerns about food safety, animal welfare, and environmental impacts of intensive livestock operations.[4] The National Organic Program (NOP) standards for dairy and livestock require that cattle are actively grazing and at least 30% of the total dry matter intake (on a daily basis) be provided from grazing pasture for a minimum of 120 days during the growing season (NOP access to pasture [livestock], February 12, 2010). Although well managed pastures provide plentiful high quality forage, harvesting through grazing and balancing dairy rations present challenges. Additionally, the US standard prohibits the use of antibiotic drugs and synthetic hormones in certified organic dairies. If a lactating dairy cow is treated with prohibited substances (e.g., antibiotics), the organic status of the animal is lost. It is important to note that from an animal welfare point of view, no animal must suffer and veterinary care should not be withheld to preserve the organic status of an animal. The whole certified organic process relies on a number of preventive management practices such as nutrition management that ultimately assures cows' health. Postpartum uterine diseases (e.g., retained fetal membranes, metritis), respiratory diseases, and mastitis require special attention. An observational field study in Wisconsin revealed that the overall prevalence of mastitis, metritis, foot infections, and respiratory diseases was greater for conventional than organic dairy herds.[5,6]

Risk factors for metritis and endometritis

Postpartum metritis and clinical endometritis (CE) are common uterine disorders in lactating dairy cows that negatively impact reproductive performance; thus, diminishing profitability and

sustainability of dairy operations. Metritis (puerperal; usually within 14 days postpartum) is defined as the inflammation of all layers of the uterus and characterized by fetid uterine discharge with fever, anorexia, and/or decreased milk production (systemically ill).[7,8] Clinical endometritis is defined as the inflammation of the endometrial lining of the uterus characterized within 21-40 days in milk (DIM) by mucopurulent or more significant vaginal discharge (clinical diagnosis) or the presence of polymorphonuclear cells (≥5%, cytology diagnosis); usually without systemic signs of illness. Lactating dairy cows subjected to poor nutrition management (body condition score at calving of <2.75; scale 1-5) increased the risk for uterine diseases with increased levels of non-esterified fatty acids and beta-hydroxybutyrate in early postpartum cows.[12] Furthermore, retained fetal membranes, stillbirths, abortions, dystocic births and twins[12] as well as hygiene of the perineum region at calving (presence of manure and dirt around the birth canal) increased the likelihood of postpartum metritis and clinical endometrtis.[9]

Management and treatment options for clinical endometritis

Endometritis is an inflammation of the endometrial lining of the uterus without systemic signs of illness.[7] Clinical endometritis negatively impacts reproductive performance (delays time to conception and increases the risk for culling after calving) in dairy cattle; thus, diminishing profitability and sustainability.[7,10] A recent study in three herds showed that 18% of lactating dairy cows suffer from CE at 35 DIM.[12] Proactive management that targets the risk factors should be a top priority to prevent both puerperal metritis and CE. For instance, cow comfort (e.g., 30 inches of feed bunk space and 80% stocking density in relation to stalls) during the pre- and postpartum period reduced the risk for uterine diseases such as metritis and CE.

For clinical cases, administration of prostaglandin $F_2\alpha$ analog (PG)[12-14] and antimicrobial agents such as ceftiofur hydrochloride and penicillin[7,15,16] are frequently used to treat these cows in conventional herds. Antimicrobial therapy for cows with clinical signs of uterine disease is recommended in certified organic herds, but the organic status is lost and the animal must exit the herd. Therefore, the use of alternative therapies such as garlic tincture, aloe vera, vitamins, and vegetable oils have been used by organic dairy producers.[5,17] Despite the use of these alternative therapies to treat uterine diseases (e.g., metritis), there is no scientific evidence available in the literature that can promote or discourage these practices. Recently, a field trial showed that homeopathic remedies (Lachesis compositum [Lachesis], Carduus compositum [Carduus], and Traumeel LT [Traumeel]) were not effective to prevent CE (based on clinical and fertility outcomes).[18] The use of lytic enzyme preparations from *Bacillus subtilis* (Lysosubtilin) was assessed as alternative treatment for cows with postpartum endometritis compared to neofur or uterosan.[19] Lysosubtilin (2×10^6 IU) was dissolved in 100 mL of distilled water and administered intrauterinarily twice per week until recovery in cows with CE as opposed to cows treated with neofur or uterosan. This field trail showed that cows treated with a lytic enzyme preparation (Lysosubtilin) had improved therapeutic outcomes (clinical cure), reduced calving-to-conception interval, and improved conception risk compared to cows treated with neufur or uterosan.

The use of intra-abdominal hypertonic glucose (20%) was previously reported to control acute peritonitis in rabbits.[20] Furthermore, an *in vitro* study has shown that mannose (a sugar monomer) inhibits the adhesion of bacteria to the epithelial cells of the equine endometrium.[21] This suggests that the use of 50% dextrose in water (a hypertonic solution), that targets the uterine environment rather than the bacterial pathogen itself, may be a viable and effective strategy for organic lactating dairy cows diagnosed with CE. Recently, we investigated the use of intrauterine dextrose (200 mL; 50% dextrose in water) in a randomized clinical trail under field conditions.[22] Lactating dairy cows (n=760) from two conventional herds were screened using vaginoscopy for CE at 26±3 DIM and scored using a 0-3 scale.[8,23] Cows scored as 2 or 3 were stratified by parity and randomly allocated into one of three treatment groups: 1) control (n=83), 2) subcutaneous administration of ceftiofur crystalline free acid (CCFA, n=75; 6.6 mg/kg; Excede®; Pfizer Animal Health, New York, NY), or 3) intrauterine infusion (equine infusion pipettes) of 200 mL 50% dextrose (n=79; Vedco, Saint Joseph, MO). In this study, all cows (with or without CE) were presynchronized with two injections of PG given 14 days apart (starting at 26±3 DIM) followed by

Ovsynch (OV; gonadotropin releasing hormone [GnRH]-7 d-PG-56 h-GnRH 16 h-timed-artificial insemination [AI]) 12 days later. This study showed that cows that received intrauterine dextrose had improved clinical cure compared to control groups. Also, pregnancy per AI (PAI) in dextrose treated cows (29.8%) tended to differ (P=0.1) from cows in the control (21.1%) or CCFA treated groups (19.7%); whereas PAI in dextrose cows was not different from cows without CE (39.1%).[22] It is important to note that intrauterine infusion is a procedure that requires proper training and strict aseptic precautions to prevent further uterine damage.

Final remarks

Postpartum metritis and CE are common uterine disorders in lactating dairy cows that negatively impact reproductive performance; thus, diminishing profitability and sustainability of dairy operations. For certified organic herds (as well as conventional herds), implementation of preventive management practices such as proper nutrition and calving management are key to prevent uterine diseases from occurring. For clinical cases, the use of intrauterine dextrose showed promising clinical and fertility results. However, further investigation is needed with certified organic herds to confirm and determine the underlying mechanisms for these findings.

Acknowledgements

The authors wish to thank the collaborating dairy farms for assisting and providing the animals used in the endometritis study. Also appreciation is extended to Dr. J. Daniels and Dr. C. Pinto (Department of Veterinary Clinical Sciences) for their input and bacteriology analysis. The effectiveness of the intrauterine dextrose administration on cows diagnosed with clinical endometritis was supported in part by the USDA-NIFA Animal Health (formula fund).

References

1. Dimitri C, Oberholtzer L: Marketing U.S. organic foods: recent trends from farms to consumers. 2009 EIB-58. Economic Research Service/USDA. (http://www.ers.usda.gov/Publications/EIB58/EIB58.pdf; accessed on January 25, 2010).
2. McBride W, Greene C: A comparison of conventional and organic milk production systems in the US. Selected paper at the American Agricultural Economics Association Annual Meeting, July 29-August 1, 2007, Portland, OR. (http://ageconsearch.umn.edu/handle/9680/; accessed on January 25, 2010).
3. USDA-NASS 2008: Farms, land in farms, and livestock operations 2007 summary. (http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1259; accessed on February 15, 2010).
4. Sundrum A: Organic livestock farming, a critical review. Livest Prod Sci 2001;67:207-215.
5. Pol M, Ruegg PL: Treatment practices and quantification of antimicrobial drug usage in conventional and organic dairy farms in Wisconsin. J Dairy Sci 2007;90:249-261.
6. Ruegg PL: Management of mastitis on organic and conventional dairy farms. J Anim Sci 2009;87:43-55.
7. LeBlanc SJ, Duffield TF, Leslie KE, et al: Defining and diagnosing postpartum clinical endometritis and its impact on reproductive performance in dairy cows. J Dairy Sci 2002;85:2223-2236.
8. Sheldon IM, Lewis GS, LeBlanc S, et al: Defining postpartum uterine disease in cattle. Theriogenology 2006;65:1516-1530.
9. Schuenemann GM, Nieto I, Bas S, et al: Dairy calving management: effect of perineal hygiene scores on metritis [abstract]. J Dairy Sci 2011.
10. Gilbert RO, Shin ST, Guard CL, et al: Prevalence of endometritis and its effects on reproductive performance of dairy cows. Theriogenology 2005;64:1879-1888.
11. Heuwieser W, Tenhagen BA, Tischer M, et al: Effect of three programmes for the treatment of endometritis on the reproductive performance of a dairy herd. Vet Rec 2000;146:338-341.
12. Dubuc J, Duffield TF, Leslie KE, et al: Risk factors for postpartum uterine diseases in dairy cows. J Dairy Sci 2010;93:5764-5771.
13. Kasimanickam R, Duffield TF, Foster RA, et al: The effect of a single administration of cephapirin or cloprostenol on the reproductive performance of dairy cows with subclinical endometritis. Theriogenology 2005;63:818-830.
14. Galvão KN, Frajblat M, Brittin SB, et al: Effect of prostaglandin F2 alpha on subclinical endometritis and fertility in dairy cows. J Dairy Sci 2009;92:4906-4913.
15. McDougall S: Effect of intrauterine antibiotic treatment on reproductive performance of dairy cows following periparturient disease. N Z Vet J 2001;49:150-158.

16. Okker H, Schmitt EJ, Vos PL, et al: Pharmacokinetics of ceftiofur in plasma and uterine secretions and tissues after subcutaneous postpartum administration in lactating dairy cows. J Vet Pharmacol Ther 2002;25:33-38.
17. NODPA 2009: Northeast Organic Dairy Producers Alliance. NODPA News. Volume 9, Issue 1. p 1-39 (http://www.nodpa.com/january_2009_final_low-res.pdf; accessed on February 10, 2010).
18. Arlt S, Padberg W, Drillich M, et al: Efficacy of homeopathic remedies as prophylaxis of bovine endometritis. J Dairy Sci 2009; 92:4945-4953.
19. Biziulevichius GA, Lukauskas K: In vivo studies on lysosubtilin: 2. Efficacy for treatment of post-partum endometritis in cows. Vet Res 1998;29:47-58.
20. Narat JK: Experimental study upon the use of intra-abdominal injections of hypertonic glucose solution in the treatment of peritonitis. Ann Surg 1923;78:357-363.
21. King SS, Young DA, Nequin LG, et al: Use of specific sugars to inhibit bacterial adherence to equine endometrium in vitro. Am J Vet Res 2000;61:446-449.
22. Brick TA, Bas S, Daniels JB, et al: Impact of intrauterine dextrose therapy on conception of lactating dairy cows with clinical endometritis [abstract]. J Dairy Sci 2011.
23. Williams EJ, Fischer DP, Pfeiffer DU, et al: Clinical evaluation of postpartum vaginal mucus reflects uterine bacterial infection and the immune response in cattle. Theriogenology 2005;63:102-117.