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Research Article

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## Investigation the Efficiency Ceftiofur Hydrochloride in Prevention of Uterine Postpartum Infections and Improvement the Fertility Parameters in Holstein Dairy Cows Affected by Retained Fetal Membrane and Dystocia

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### ABSTRACT

**Objective:** Ceftiofur, a third-generation cephalosporin, is used as a usual antimicrobial drug in veterinary medicine. Positive efficiency of ceftiofur for treatment of retained fetal membrane (RFM) and acute puerperal metritis has been previously reported. Thus, this study was conducted to evaluate the efficiency of ceftiofur hydrochloride (CH) in prevention of uterine postpartum infections and improvement the fertility parameters in Holstein dairy cows. **Methods:** After parturition, 300 dairy cows affected with dystocia and RFM, from a single dairy herd, were randomly assigned into 2 groups (n=150). Group1 (control) was not treated but other group (CH) was subcutaneously treated with 2.2 mg/kg CH for 5 days. **Results:** CH could significantly reduce rate of uterine infections compared with control groups ( $P<0.01$ ). Open days and first service rate were significantly lower in CH group compared with control group ( $P<0.01$ ). It can be concluded that uterine infections and metritis are inevitable part of dairy cow transitional period. Injection of CH had beneficial effects on reduction the infections and thus it can be advised use of CH to reduce infections and increasing fertility rate in dairy cows affected with RFM and dystocia, before other control program.

### Introduction

Dairy cow industry is faced with major problems, such as infection of reproductive system because of parturition. It is estimated by 20% or more of fresh dairy calves to be involving with these infections which cause metritis. Metritis and endometritis are known as major puerperal uterine infections in high-producing dairy cows (Galvao et al., 2009). It is known a reverse correlation among uterine infections and reproductive performance (Gilbert et al., 2005). Pathogens often create uterine infections which can finally create infertility (Sheldon et al., 2006). Dystocia, the twins, retained fetal membrane (RFM) and still birth have been increased outbreak of metritis up to

50%. Some bacteria including *Escherichia coli*, *Arcanobacterium pyogenes*, *Fusobacterium necrophorum* and *Prevotella melaninogenica* have been caused postpartum uterine diseases in cows (Sheldon and Dobson, 2004). Antibiotics, intrauterine or systemic treatment with antibiotics, have been applied to decrease the effect of uterine infection on fertility (Galvao et al., 2009). Although antibiotic therapy is known as usual treatment, but it has much limitations including negative interactions of the antibiotic drug and the uterine environment, irritation of the endometrium by the antibiotic drug itself or the carrier substance, and a defaulted efficacy of the antibiotics in the inflamed tissue

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(Paisley et al., 1986). In the past decades, systemic application of broad spectrum antibiotics were suggested (Smith et al., 1998; Drillich et al., 2006a; Galvao et al., 2009). On the other hand, applying efficient antibiotics for treating and preventing infectious has been advised due to the variety of pathogens (Lima et al., 2014).

Ceftiofur, a third-generation cephalosporin, is used as antimicrobial drugs in veterinary medicine (Hornish and Kotarski, 2002; Olfati et al., 2016). Ceftiofur is known to have efficiency against almost all gram-positive and gram-negative pathogens (Salmon et al., 1996; Haggett and Wilson, 2008). Ceftiofur is a safe drug because it is hydrolyzed to desfuroylceftiofur acetamide and eliminated by renal system through protein binding (Brown et al., 1991). Appropriate efficacy of ceftiofur for treatment of RFM (Drillich et al., 2006a, b) and acute puerperal metritis (APM; Drillich et al., 2001) has been previously reported. Galvao et al., (2009) showed that intrauterine infusion of CH positively influenced uterine health in dairy cows but it could not reduce the incidence of subclinical endometritis or improve reproductive performance. Thus the present study was conducted to assess the efficiency of (CH) in prevention of uterine postpartum infections and improve the fertility parameters in Holstein dairy cows.

## Material and Methods

This research study was done between January 2015 till April 2016 at the Shirin Asal Dairy Farm, Tabriz-Iran. After parturition, 300 dairy cows affected with dystocia and RFM, from a singly dairy herd, were randomly assigned into 2 groups (n=150). These cows were selected among 2400 parturition during two years. Group 1 (control) was not treated but other group (CH) was subcutaneously treated with 2.2mg/kg CH for 5 days. The both groups were considered  $35 \pm 3$  days before parturition and  $56 \pm 3$  days after parturition. Characteristics and information of cows including lactation and disorders were registered. The different methods were used to investigate including ultrasonography control of uterus, uterus involution, cervix dimension, discharge type, uterus lavage, Giemsa staining and cytology. Ultrasonography was done by using easyscan® system. Examination of cervix dimension was done by rectal palpation and ultrasonography. Fifty ml normal saline was infused into

uterus by Foley catheter and sterile syringe after observe the echogenic scans and suspecting to infections. Vulva was then wiped by disposable napkin. To collection fluids, uterus was gently massaged by 10 seconds and liquids were aspirated without any more efforts. All samples were transferred into sterile tube and centrifuged at 700 rpm for 6 minutes and then one drop of sedimentation content was dropped on slides and dried at room temperature to Giemsa-wright staining. Clinician and laboratory technician, without having information about survey, screened slides for two times by microscope with x 400 magnification. Cells were considered as follows, large mononuclear cells as macrophage and small mononuclear cells as monocyte were considered. Observations of epithelial cell under microscope were counted as true sampling. The fertility parameters were registered including open days, days to first service (DFS), pregnancy rate and conception rate in the next lactations.

## Statistical Analysis

The data were analyzed by using SPSS 21 version software. Qualitative and independence indices were analyzed by t-test method, while, comparison of the both groups was done by non-parametric wilcoxon method because of dependency. Qualitative parameters were analyzed by U man Whitney methods.

## Results

Results showed 79, 74 and 25 cows infected in first, second and the both examinations, respectively, in control group. Results also indicated 23, 20 and 6 cows infected in first, second and the both examinations, respectively, in CH group. These differences were significant ( $P < 0.01$ ). The data for cervix dimensions were  $5.18 \pm 1$  and  $11.3 \pm 1.8$  for CH and control groups, respectively. These differences were significant ( $P < 0.001$ ; Table 1). DFS (day of first insemination after parturition) was  $100.62 \pm 31$  and  $140.9 \pm 47$  days for CH and control groups, respectively, which these differences were significant ( $P < 0.001$ ; Table 1). The data for open days were  $256.06 \pm 43.00$  and  $109.00 \pm 34.00$  for CH and control groups, respectively. These differences were significant ( $P < 0.001$ ; Table 1).

**Table 1:** Fertility parameters in CH and control groups

Parameters	CH group	Control	P
DFS	$100.62 \pm 31^b$	$140.9 \pm 47.00^a$	0.001
Cervix dimension	$5.18 \pm 1.00^b$	$11.13 \pm 1.80^a$	0.001
Open days	$109.00 \pm 34.00^b$	$256.06 \pm 43.00^a$	0.001

R-spearman test applied to exploration of relation test between first and second examination showed significant relation between them, i.e. infection of uterus not only influences postpartum health future of fertility even after one probable estrous cycle but it also affects between

investigations. Insemination rate in the CH group was 1.8 and conception rate was %55, while it was 2.8 and %35 in the control group, respectively ( $P < 0.05$ ). Pregnancy rate was also counted in the control and CH group and this fertility index was %18.5 and %33 respectively.

**Table 2:** Differentiating of cows according to the parturition and rate of infection

CH group	1stlac.	2ndlac.	3rdlac.	4thlac.	5thlac.	6thlac.	7thlac.
Infectious	11	9	5	3	7	1	1
Non.infectious	35	31	24	12	6	3	2
Total	46	40	29	15	13	4	3
Control group	1stlac.	2ndlac.	3rdlac.	4thlac.	5thlac.	6thlac.	7thlac.
Infectious	30	31	24	24	12	4	1
Non.infectious	8	6	4	3	1	1	1
Total	38	37	28	27	13	5	2

## Discussion

This study was conducted to evaluate the efficiency of CH in prevention of metritis and improvement the fertility in the dairy cows affected by dystocia and RFM before outbreak of uterine infections. Our results showed that administration of CH could significantly decrease infections and also improve fertility parameters. Administration of antibiotics for treatment of puerperal uterine infections is widely accepted in cows (Brown et al., 2000; Okker et al., 2002; Drillich et al., 2006a). Ceftiofur is known to have efficiency against almost all gram-positive and gram-negative pathogens (Salmon et al., 1996; Haggett and Wilson, 2008). Ceftiofur is known to have suitable efficiency for treatment of RFM (Drillich et al., 2006a, b) and acute puerperal metritis (Drillich et al., 2001; Olfati and Moradi kor, 2016). Galvao et al., (2009) reported that intrauterine infusion of CH positively affected uterine health in dairy cows but it could not reduce the incidence of subclinical endometritis or improve reproductive performance. It is known a reverse correlation among uterine infections and reproductive performance (Gilbert et al., 2005). Thus, health uterus can help to improvement the fertility rate and increase the fertility. According to past studies and pharmacokinetics of CH, it can reach to proper concentration in the uterus. A study has been done by okker et al. (2002) who reported similar findings to our results. The same researcher reported to be better CH compared with oxytetracyclin. In the present study, the patterns of uterus involution were different and it was according to the study which had been done by Galvao et al., (2009). In this study pattern of involution in the cows with vaginal infectious discharge was clear. Involution of infected uterus by chronic release of PGF $2\alpha$  from endometrium had been justified by Drillich et al., (2006).

## Conclusion

In conclusion, CH significantly lowered infection rate and improved fertility parameters compared with control group. Thus, it can be advised early administration of CH by practitioners in the cows with metritis or vaginal discharge and it can be a useful and available guideline before preparing long time preventing programs results.

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