Effect of presynchronization with GnRH 7 days prior to resynchronization with CO-Synch on pregnancy wastage in lactating dairy cows

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Abstract

Increased secretion of prostaglandin $F_2\alpha$ (PGF) between d 30 and 36 of pregnancy causes luteal regression and embryonic loss. In addition, administration of gonadotropin releasing hormone (GnRH) or human chorionic gonadotropin (hCG) has been held responsible for early embryonic death when administered at pregnancy diagnosis between 29 and 42 days after insemination. The objective of this study was to determine the effect of GnRH administration at 28±3 d after artificial insemination (AI), 7 d prior to the initiation of resynchronization with CO-Synch, on pregnancy wastage rate (late embryonic and early fetal loss rate; PWR) for the previous insemination. All parity (2.38±1.45; range 1-10) lactating Holstein cows (n=1417) from a dairy farm in Washington state were enrolled. Cows that were not detected in estrus by 28±3 d (Day -7) after AI were assigned to receive either GnRH (100 µg, im; n=693) or no GnRH (control; n=724). Cows not detected in estrus during 7 d following GnRH administration were presented for pregnancy diagnosis (35±3 d after AI, Day 0) and non-pregnant cows were submitted for resynchronization with CO-Synch protocol for subsequent timed AI. The cows that were not pregnant to resynchronization were resubmitted for CO-Synch resynchronization with presynch-GnRH for a second time or to other breeding protocols. Cows were examined for pregnancy at 35 d after AI and pregnant cows were submitted to determine pregnancy status for a second time approximately at 60 d after AI.

The overall PWR was 13.9% (142/1044). The PWR for GnRH and control groups was 14.8% (75/506) and 12.5% (67/538), respectively (P=0.27).

In conclusion, the GnRH treatment 7 d prior to initiation of resynchronization with CO-Synch, when administered at 28±3 d after a previous breeding, did not increase pregnancy wastage compared to controls.

Keywords: Dairy cows, GnRH, presynchronization, resynchronization, pregnancy wastage

Introduction

Spontaneous abortion of dairy cows is an increasingly important problem that contributes substantially to low herd viability and production inefficiency. Embryonic mortality for cows confirmed pregnant between 35 to 45 days of gestation typically has ranged from 8 to 10%, with pregnancy loss often exceeding 14% in some herds.[1,2] Sreenan et al calculated that pregnancy rates of 90% and calving rates of 55% are normal for heifers and moderate yielding dairy cows, indicating an overall embryonic and fetal mortality rate of about 40%.[3] These authors concluded that few embryos are lost in the days immediately after fertilization and up to day 8 after ovulation and that about 70 to 80% of the total embryonic loss is sustained between days 8 and 16 after insemination, a further 10% between days 16 and 42 and a further 5 to 8% between Day 42 and term. It is suggested that the rate of late embryonic loss, after the fourth week of gestation, may be higher in high-producing dairy cows than in either moderate-yielding cows or in heifers. A study by Vasconcelos et al indicated that the pattern of loss might be different in high-yielding dairy cows with such cows showing a higher increment of late embryonic loss.[4,5] Vasconcelos et al reported that 20.2% of the embryos were lost between days 28 and 98 after AI in intensively managed dairy cows yielding between 11,000 and 12,000 kg of milk per lactation.[4,5]

While infectious diseases are a primary focus of pregnancy wastage prevention, infectious agents probably cause less than half of the pregnancy wastages.[6] Schallenberger et al reported that a series of increases in secretion of PGF between d 30 and 36 of pregnancy caused luteal regression and embryonic loss.[7] In addition, among many non-infectious causes, administration of GnRH or hCG after AI has been held responsible for early embryonic death when administered at pregnancy diagnosis between 29 and 42 days after insemination.[8] The objective of this study was to determine the effect of GnRH administration at 28±3 d after AI, 7 d prior to the initiation of resynchronization with CO-Synch, on PWR for the previous insemination.

Materials and methods

Animal enrollment and data collection

All parity (2.38±1.45; range 1-10) lactating Holstein cows (n=1417) from a dairy farm in Washington were enrolled from December 2009 to July, 2010. Cows were housed in free-stall barns; primiparous and multiparous cows were housed separately and milked thrice daily at 8 h intervals. Cows were fed a total mixed ration, twice daily, to meet or exceed the dietary requirements for lactating Holstein cows weighing 1200 to 1400 lb and producing 60 to 80 lbs of 3.5% fat corrected milk. Lists of all eligible cows including injection schedules, reproductive events, pregnancy examinations, health events, and milk yield data on the test date closest to the date of subsequent insemination were generated, tracked, and recorded using a commercial on-farm computer software programs (DairyComp 305, Valley Agricultural Software, Tulare, CA or DHI Plus, DHI Computing Service, Provo, UT).

Treatment

Cows that were not detected in estrus by 28±3 d (Day -7) after AI were assigned to receive either GnRH (100 µg, im; n=693 or no GnRH (control; n=724). Cows not detected in estrus during 7 d following GnRH administration were presented for pregnancy diagnosis (35±3 d after AI, Day 0) and non-pregnant cows were submitted for resynchronization with CO-Synch protocol for subsequent breeding. Briefly, cows received 100 µg GnRH, im, on Day 0 (35±3), 25 mg PGF on Day 7 (42±3), and 100 µg GnRH, im, and insemination 72 h later on Day 10 (45±3). The protocol was repeated for the cows that were not pregnant to resynchronization. It should be noted that some non-pregnant cows were submitted to other breeding protocols. Pregnant cows were submitted for pregnancy diagnosis for a second time at approximately 60 d after AI.

The pregnancy wastage was determined by cows that were diagnosed as pregnant at 35 days after insemination and subsequently observed to be non-pregnant at 60 d after AI. The PWR was calculated as number of cows pregnant 35 days after insemination and not pregnant at 60 days after insemination divided by total number of cows pregnant at 35 days after insemination.

Statistical analysis

Multivariate logistic model (PROC LOGISTIC, SAS Version 9.1 for Windows, SAS Institute, Cary, NC) was used to examine the effect of treatments on PWR. The variables included in the model were treatment (GnRH vs. no GnRH), parity (1, 2 and 2+), and appropriate interaction. The 'P' value at 0.05 was considered significant.

Results

Accounting for parity (P<0.001), the PWR between GnRH and control groups was not different (P>0.1). The pregnancy/AI (P/AI) at 35 days after insemination was 66.0% (935/1417). The PWR at 60 days after insemination was 13.8% (129/935) for the previous breeding. The PWR was not different between GnRH and control groups (GnRH: 15.2% [69/453] vs. control: 12.4% [60/482]; P=0.36).

There were 482 cows (GnRH: n=217; control: n=265) that were submitted for a second breeding. Out of those, 293 cows were eligible for resynchronized timed AI. The P/AI for resynchronized timed artificial insemination was 37.2% (109/293). The PWR was 11.9% (13/109) for resynchronized timed artificial insemination. The PWR for resynchronized breeding was not different between GnRH and control groups (GnRH: 11.3% [6/53] vs. control: 12.5% [7/56]; P=0.29).

The overall PWR was 13.9% (142/1044). The PWR for GnRH and control groups was 14.8% (75/506) and 12.5% (67/538), respectively (P=0.27). No parity by treatment interaction (P>0.1) was recorded.

Discussion

The reason for the administration of GnRH prior to the initiation of resynchronization is to improve the synchrony of follicular wave emergence and thereby conception rates. In addition, it may reduce pregnancy wastage by inducing accessory corpora lutea and increasing progesterone concentrations in pregnant cows. However, administration of GnRH has been held responsible for early embryonic death when administered after insemination. Chebel et al demonstrated that initiation of the Ovsynch/TAI protocol with the administration of 100 µg of GnRH prior to pregnancy diagnosis did not affect pre-enrollment pregnancy rates and pregnancy loss during the first 42 days of gestation.[9] Stevenson et al administered hCG, GnRH or saline at pregnancy diagnosis between 29 and 42 days after insemination and observed the pregnancy status for four weeks.[8] They observed 15.4% total pregnancy losses. The pregnancy loss varied from 11.3% in controls to 22.3% in hCG-treated females. However, no significant treatment effect on pregnancy loss was detected. Moreira et al studied the effect of bovine somatotropin and resynchronization with GnRH on pregnancy rates of lactating dairy cows.[10] The authors suggested that resynchronization of cows with initiation of the Ovsynch protocol on day 20 after the initial AI decreases embryo survival to the prior AI. Treatment with GnRH is followed by a rapid secretion of luteinizing hormone, and is also associated with a transitory increase in plasma estradiol.[11] These events may stimulate the secretion of PGF, which could result in luteolysis and terminate pregnancy. Thus it appeared reasonable to test the effect of GnRH on pregnancies from previous insemination when administered as a strategy for resynchronization.

In this study, administration of GnRH at 28±3 d after AI did not increase pregnancy wastage in lactating dairy cows compared to cows that were not treated. Treatment with GnRH during the early embryonic period,[12-15] and at pregnancy diagnosis[8,16] clearly increases the number of additional corpora lutea. However it has failed to reduce fetal loss in any of the studies performed. Similarly, using GnRH on day 21 or 23 of gestation as a resynchronization strategy, was found to have no effect on subsequent pregnancy losses in cows that were pregnant at the time of treatment.[17,18]

It seems there are inconsistencies in the effect of GnRH administration and embryonic survival.[19,20] Even though the GnRH administration is able to induce accessory corpora lutea, progesterone concentrations remained similar in cows that developed accessory corpora lutea compared to cows that did not. The reason might possibly be the higher rate of liver catabolism in high-producing animals. Thus, GnRH administration is not beneficial in reducing early embryonic loss in those animals. El-Zarkouny and Stevenson also showed similar results with progesterone-releasing vaginal inserts.[21] Dairy cows of unknown pregnancy status received a progesterone-releasing insert or no insert from d 13 to d 21 after AI to resynchronize estrus in non-pregnant cows. This treatment had no effect on established pregnancies.

In this study, parity affected the pregnancy wastage but there was no treatment by parity interaction. The overall pregnancy wastage rates have been found to be similar in heifers, beef cows and low- to moderate-producing dairy cows; however, the embryo survival rate is lower in high-producing dairy cows. It is unlikely that this is an age- or parity-related phenomenon but it may be due to the direct and indirect effects of milk production.

There are several non-infectious factors that may affect early embryonic survival such as genetic causes, parity, plasma concentrations of progesterone after AI, energy balance after calving and at the time of insemination, dry-matter and protein intake, milk production, and twinning.[22,23] In order for progesterone supplementation to effectively increase embryo survival, treatment would have to be targeted rather than treatment of all cows.[17] The targets should be high-producing cows, cows bred during peak milk production, and in herds with the history of high early embryonic death due to non-infectious causes, and cows with loss of body condition.[20,21,24-28]

In conclusion, the GnRH treatment 7 d prior to initiation of resynchronization with CO-Synch, when administered at 28±3 d after a previous breeding, did not increase PWR compared to controls.

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