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COMMUNICATION

Needleless Implant Delivery of Gonadotropin-Releasing Hormone Enhances the Calving Rate of Beef Cows Synchronized with Norgestomet and Estradiol Valerate*

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ABSTRACT

One-hundred and six beef cows were included in a study to determine if gonadotropin-releasing hormone (GnRH) administered via needleless implants would enhance calving rate like conventional GnRH administration. All cows were synchronized with the norgestomet and estradiol valerate estrus synchronization procedure and then randomly assigned to one of three groups: no GnRH, GnRH via conventional implants, and GnRH via needleless implants. GnRH was administered 30 hr after norgestomet implant removal. Although needleless implants were administered while cows were restrained, they may be administered remotely. GnRH administered by both methods equally enhanced ($p < 0.05$) calving rate and the needleless implant caused minimal response by the cows. Therefore, remote administration of GnRH may accomplish therapeutic efficacy and reduce the time, labor, stress, and risk of injury associated with providing conventional animal therapy.

*Mention of trade names or companies does not imply endorsement or warranty by the Department of Animal Sciences or the authors.

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INTRODUCTION

Although several estrus synchronization procedures have been developed, most require that the synchronized females be bred over several days at estrus (12). The only procedures that enable artificial insemination (AI) at a single predetermined time utilize a norgestomet implant and an injection of a luteolytic or an antiluteotropin compound (9,12). Pregnancy rates of cattle synchronized with these types of products, however, have been variable because of asynchronized ovulations and short luteal phases (10).

It was previously demonstrated that the administration of gonadotropin-releasing hormone (GnRH) 30 hr after norgestomet implant removal enhanced timed AI pregnancy rates (6,13,14). Use of GnRH at this time, however, requires additional chute processing and animal handling. In addition to requiring significant time, processing the cows also causes stress and increases the chance of injury (11); and stress during the interval between implant removal and estrus has been demonstrated to decrease fertility (5,10).

Because it would be highly advantageous to administer GnRH without chute processing, a new method of remote drug delivery was evaluated. The objective of this experiment was to determine if GnRH administered 30 hr after norgestomet implant removal via the remote drug delivery system would effectively enhance calving rate, as does GnRH administered via conventional implants.

MATERIALS AND METHODS

One-hundred and six cross-bred beef cows suckling calves were used. All cows were administered Syncro-Mate B® (SMB—Rhone Merieux, Inc., Athens, GA). The SMB procedure consists of an intramuscular injection of norgestomet (3.0 mg) and estradiol valerate (5.0 mg) in sesame oil and benzyl alcohol, and a hydron implant containing 6.0 mg of norgestomet (9). The implant was subcutaneously implanted on the convex surface of the ear. At the end of 9 days the norgestomet implants were removed and cows were randomly assigned to one of three groups. Cows assigned to group 1 (n = 38) received no further treatments. Cows assigned to groups 2 (n = 33) and 3 (n = 35) were administered 250 μg of GnRH 30 hr after norgestomet implant removal. Although the GnRH formulation was the same for implants administered to cows in groups 2 and 3, the method of administration differed. The cows in group 2 were processed in a chute and administered the GnRH via an subcutaneous ear implant. For group 3, the GnRH formulation was placed in a needleless implant (Fig. 1) and administered intramuscularly via a compressed-air delivery system (11) while cows were in the chute. After administration of the needleless implants, the penetration sites were inspected to ensure administration. Approximately 48 hr after norgestomet implant removal, all cows were inseminated by a single inseminator. The semen was from multiple bulls of known fertility. Service sire selection was made before the timed AI and before the cows were randomly allotted to treatment groups. Five days after AI all cows were exposed to bulls for the remainder of the 63-day breeding season. Calving rates were based on calving dates the following spring. Chi-square analysis was used to determined difference among groups (1).

RESULTS AND DISCUSSION

GnRH, regardless of method of administration, enhanced calving rate ($p < 0.05$; Table 1). Calving rate of the cows administered GnRH via conventional implantation (61%) was not different ($p > 0.10$) from calving rate (60%) of cows administered GnRH via needleless implantation (Table 1). This improvement in calving rate was similar to previous reports and has been observed in all studies conducted, regardless of method of GnRH administration (Table 2). The increase in calving rate was greater in the studies with lower calving rates in the non-GnRH-treated females (Table 2).

The needleless implant penetrated the skin in all the treated cows. A slit, smaller than the diameter of the

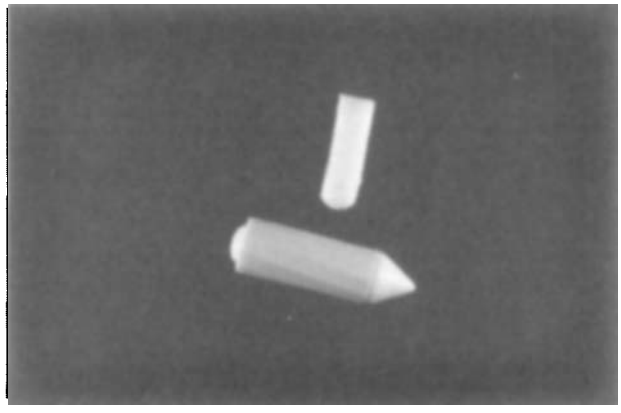

Figure 1. Needleless implant used to administer GnRH to cows.

Table 1

Effect of Gonadotropin-Releasing Hormone[a] Administered Via Needleless Implants on the Calving Rate of Postpartum Beef Cows Synchronized with Norgestomet and Estradiol Valerate[b]

Treatment Group	Calving Rate[c]
Control	14/38 (37%)[x]
GnRH	
Conventional implant	20/33 (61%)[y]
Needleless implant	21/35 (60%)[y]

[a]Gonadotropin-releasing hormone was administered 30 hr after norgestomet implant removal.
[b]Each cow was administered a norgestomet implant for 9 days. At the time of implantation each cow also received an intramuscular injection of 5 mg estradiol valerate and 3 mg norgestomet (Syncro-Mate B).
[c]Values with different superscripts differ ($p < 0.05$).

implant, and a few drops of blood were present after administration. One of three behavioral reactions was displayed by the cows upon treatment. Some of the cows reacted with a kick, others turned their head to look curiously, and others had no reaction as they appeared more concerned by the restraint. Kesler et al. (11) monitored cortisol concentrations in heifers treated similarly and reported that the small elevation observed was similar to the cortisol response after intramuscular injection. Deer treated remotely, however, had no elevation in cortisol concentrations (11).

Although a remote delivery system was used, since this was the first use of this system in cows, it was used while in the cows were restrained in order to ensure penetration. Therefore, advantages of remote delivery were not realized. However, these data demonstrate that the needleless implant is efficacious in delivering GnRH for this therapeutic condition. Therefore, the benefits of GnRH 30 hr after norgestomet implant removal could be realized with significantly less effort and risk. There are several ways in which this system could be implemented. One method is to move cattle slowly down a narrow passage and treat them as they pass. Alternatively, after providing feed to the cattle, one may walk behind them, treating the cows as they are consuming their feed.

As reported in Table 2, the stress of venipuncture and transport at the time of GnRH treatment decreased calving rate. Therefore, some of the improvement ob-

Table 2

Summary of Pregnancy Rates of Stressed Females and Females Administered GnRH 30 hr After Norgestomet Implant Removal

Study	Control	Stress/GnRH	Diminution/Enhancement (%)
Stressed			
Hixon et al. (5)			
Venipuncture	19/48 (40%)	8/38 (21%)	-48
Kesler and Favero (10)			
Transport	6/10 (60%)	2/12 (17%)	-72
GnRH treated:			
Troxel et al. (13)			
Implanted	9/33 (27%)	19/32 (59%)	+119
Injected	18/100 (18%)	34/74 (46%)	+156
Hoffman et al. (6)			
Injected	50/104 (48%)	69/106 (65%)	+35
Valle et al. (14).			
Injected	56/182 (31%)[a]	75/171 (44%)	+42
Implanted	56/182 (31%)[a]	76/180 (42%)	+36
Present Study			
Implanted	14/38 (37%)[b]	20/33 (61%)	+65
Needleless	14/38 (37%)[b]	21/35 (60%)	+62
Combined	147/457 (32%)	314/631 (50%)	

[a]Data repeated for illustration purposes.
[b]Data repeated for illustration purposes.

served in calving rate may be due to overcoming handling-induced stress as the decreased calving rate caused by stress is due to a suppression of the preovulatory luteinizing hormone surge. However, the calving rate (50%) summarized in the studies using GnRH 30 hr after norgestomet implant removal is higher than the calving rate (40%) summarized by Kesler and Favero (10) of 1202 non-GnRH-treated females.

The needleless implants have also been successfully used for other therapeutic conditions in deer (2,3,4,7), cattle (8), goats (11), and horses (15). Because of the benefits associated with administering compounds via remote delivery of needleless implants, this system may have many practical uses in domestic and wild animals.

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