BRIEF COMMUNICATION

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Human chorionic gonadotropin at parturition fails to consistently induce ovulation in sows

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Summary

Objective: Two experiments were performed to examine 1) the efficacy of human chorionic gonadotropin (hCG) in inducing ovulation in sows shortly after farrowing, and 2) the effect of hCG treatment on sow reproductive performance (wean-to-estrous interval) after weaning.

Methods: For experiment one, 69 mixed-parity sows on two commercial units in Alberta received 1000 IU hCG at various intervals within 24 hours postfarrowing. Blood samples were obtained 7–10 days later to determine progesterone (P_4) concentration as an indicator of ovulation. For experiment two, mixed-parity sows from a commercial unit in Kansas were assigned by parity to receive a vulval-mucosal injection of 1000 IU hCG (n=240), or no injection (control; n=152) within 24 hours after farrowing. Of the hCG-treated sows, 122 also received a vulval-mucosal injection of 250 µg cloprostenol (PGF) 14 days after farrowing. Pigs were weaned at 11 days of age and sows bred at their first observed estrus after weaning.

Results: For experiment one, no more than 41% of sows that received a hCG injection ovulated as indicated by plasma P_4 concentrations of more than 4 ng per mL. For experiment two, hCG- and hCG+PGF-treated sows had longer ($P < .001$) farrow-to-estrous intervals. The distribution of these intervals was biphasic. However, subsequent litter sizes did not differ among treatment groups.

Implications: These results demonstrate that the ability to induce ovulation in farrowed sows with hCG is too unpredictable to be of commercial value.

Keywords: swine, ovulation, human chorionic gonadotropin, cloprostenol

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Short lactation lengths are associated with reduced sow fertility[1,2]—e.g., longer and more variable wean-to-estrus intervals—which makes it more difficult to achieve breeding targets. For about 30 hours after farrowing, the sow's ovaries may contain potentially estrogenic follicles and her hypothalamic-pituitary axis (as measured by luteinizing hormone (LH) and follicle stimulating hormone (FSH) concentrations and pulsatility) is very active.[3–5] If the litter is weaned immediately after farrowing so that suckling inhibition is removed, in some sows these estrogenic follicles will develop immediately, triggering estrus and ovulation.[3,6,7] It may be possible to induce ovulation in lactating sows immediately post-farrowing by injecting human chorionic gonadotropin (hCG).[2,8] The hCG will serve the same physiological function as an endogenous preovulatory LH surge.[9] If ovulation could be successfully induced and normal estrous cycles followed, then the postweaning estrus could be predicted to occur about 21 days after farrowing in sows that have lactation lengths less than 16 days.

It is also possible that the ability to synchronize the postweaning estrus could be enhanced by injecting prostaglandin $F_{2\alpha}$ 14–16 days post-farrowing, which would effect the synchronous lysis of the induced corpora lutea.[2]

This report describes two experiments that were undertaken to examine the efficacy of an injection of 1000 IU hCG within 24 hours of delivery of the first piglet for the induction of ovulation in sows.

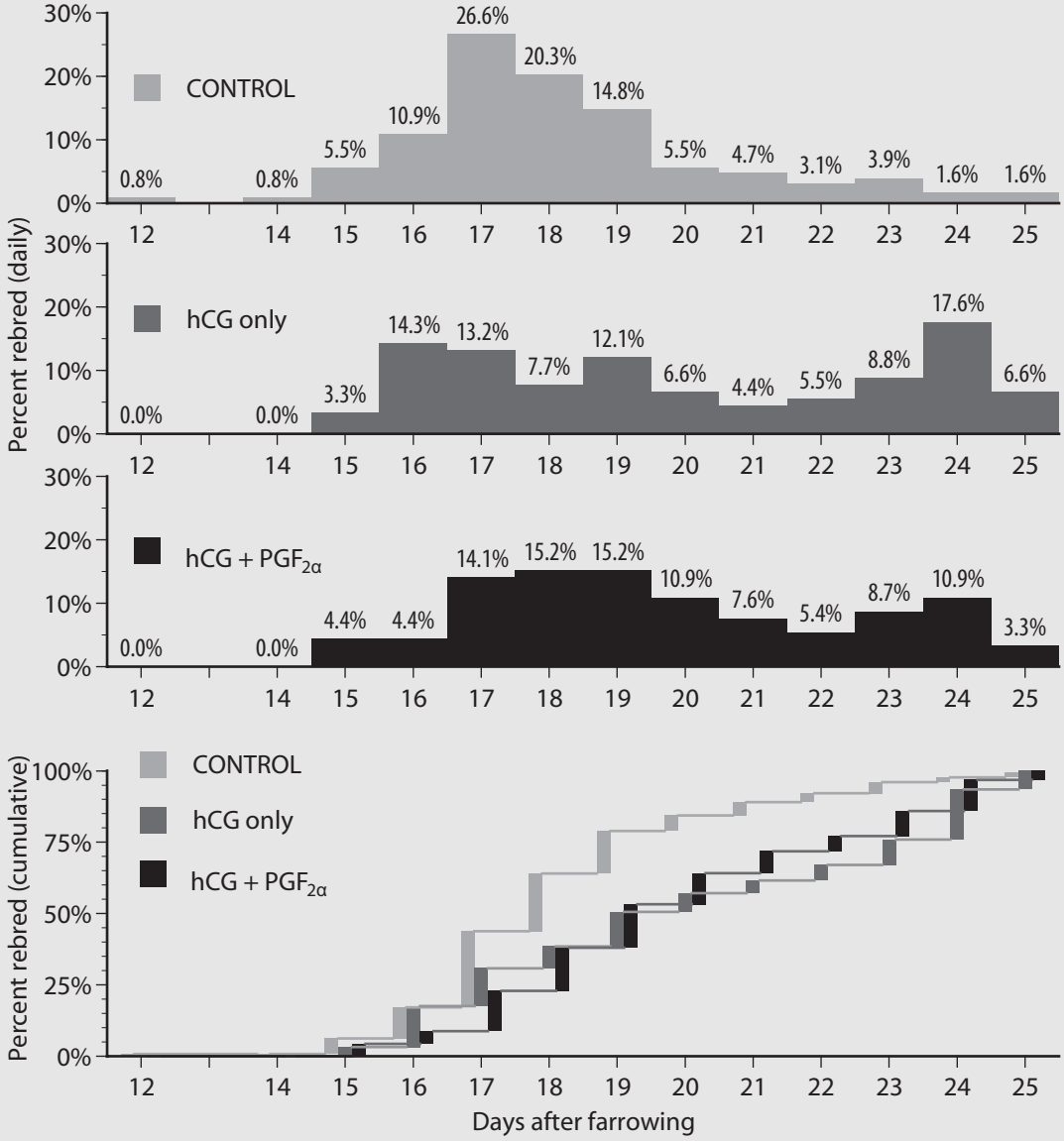
Materials and methods

Experiment one

Sixty-nine mixed-parity sows (in three different cohorts) on two commercial units in Alberta received an intramuscular injection of 1000 IU hCG (Chorulon® Intervet Canada, Ontario) at varying intervals within 24 hours of farrowing. Because it is known that sows do not ovulate naturally during lactation, no control group was included.

Ovulation status was assessed on the basis of serum progesterone (P_4) concentrations in blood samples obtained by ear vein puncture 7–10 days after hCG injection. Serum P_4 concentrations were determined by radioimmunoassay with intra- and interassay coefficients of variation <3% and sensitivity of 0.1 ng per mL. Ovulation was deemed to have occurred if serum P_4 concentrations reached > 4 ng per mL.[10-13] Serum P_4 concentrations between 2–4 ng per mL were taken to indicate some follicular luteinization but no ovulation. Progesterone concentrations of < 2 ng per mL were taken to indicate that neither ovulation nor significant luteinization occurred.

Figure 1



Effect of 1000 IU hCG with or without PGF (Estrumate®) on farrowing-to-estrus interval

Experiment two

Mixed-parity sows from a commercial unit in Kansas with 11-day lactations and twice-weekly weaning were assigned by parity and randomly within each room to one of three treatments:

- a hCG group that received a vulval-mucosal injection of 1000 IU hCG (Chorulon® Intervet) within 24 hours of farrowing (n=118);
- a hCG+PGF group that received a hCG injection as above, plus a subsequent vulval-mucosal injection of 250 µg cloprostenol (PGF; Estrumate® Bayer, USA) at 14 days after farrowing (n=122); or
- a control group that received no injections (n=152).

Sows not bred by 14 days after weaning were transported to another facility until bred or culled. Data were recovered only for those sows that conceived and subsequently farrowed to the first postweaning service. Only sows exhibiting estrus by 25 days after weaning were included in the data analysis, with all other sows designated as "anestrus." This minimized the potential for including sows in the study whose first estrus was missed and were then bred at their second postweaning estrus.

Data recorded were:

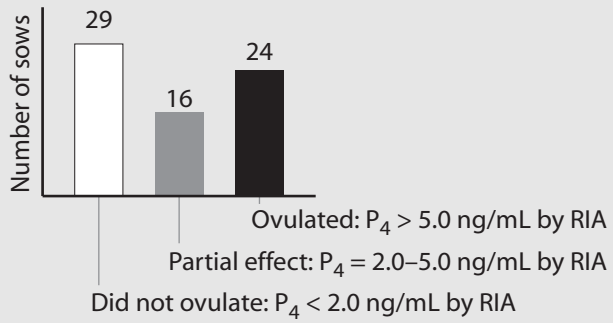
- lactation length,
- wean-to-estrus interval, and
- subsequent litter size (total born and total born alive).

Statistical analysis

Data from experiment one were not statistically analyzed.

Data from experiment two were subjected to ANOVA using GLM procedures of SAS® (Statistical Analysis System Institute, Cary, North Carolina). The model included terms for treatment, parity, and their

Figure 2



Serum progesterone (P_4) values for sows in Experiment One

interaction. Data for percent of sows successfully rebred by 25 days after weaning were subjected to χ^2 analysis.

Results

Experiment one

No more than 41% of sows ovulated (Figure 2) in response to an injection of hCG after farrowing in any of the three cohorts.

Experiment two

Parity had no effect on the ovulatory response to hCG injection.

Lactation lengths were not different among treatments (starting mean ± standard deviation 11.1 ± 1.3 for the hCG group, 11.1 ± 1.0 for the hCG + PGF group, and 11.0 ±1.1 for the controls). Treatment with hCG or hCG+PGF was associated with longer ($P < .001$) farrow-to-estrus and wean-to-estrus intervals (Figure 1). However, treatment had no effect ($P > .05$) on the percentage of sows that were successfully rebred (i.e., conceived and farrowed) by 25 days after weaning (i.e., 89.5% control sows, 84.4% for hCG sows, and 92.4% for hCG+PGF-treated sows), or on subsequent litter size (means ± SEM 9.9 ±0.3 for control sows, 10.0 ±0.4 for hCG sows, and 9.9 ±0.3 for hCG+PGF sows).

Discussion

The distribution of wean-to-estrus intervals for hCG-treated sows was a biphasic response, with returns clustering at 16–19 days and at 21–24 days postfarrowing (Figure 1). The response of the earlier-responding hCG-treated sows was similar to the monophasic response of the control sows (concentrating at 17–19 days after farrowing [Figure 1]); the later response time is consistent with an hCG-induced ovulation at farrowing, with a normal subsequent estrous cycle.

The data from experiment two are consistent with those from experiment one. The failure to recover data from nonfarrowing sows precluded analysis of possible treatment effects on farrowing rate.

Taken together, the results of experiments one and two indicate that hCG treatment is capable of inducing ovulation and estrous cycles in some sows in the immediate postpartum period. Although the reason that some sows ovulate and others do not was not addressed in this study, other studies have indicated that the exact timing of hCG treatment may be important.[2]

Implication

Although injecting sows with 1000 IU hCG during the first 24 hours after farrowing can induce ovulation and estrous cyclicity in sows, the response is far too limited and unpredictable to be of commercial application.

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