BRIEF COMMUNICATION

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The relationship between estrogen pretreatment and route of administration of cloprostenol on progesterone concentrations and farrowing in sows

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Summary

Objective: To test the effect of preinduction estradiol treatment and route of cloprostenol (PGF) administration on the farrowing and endocrine responses of sows.

Methods: Sows were allocated in a 2 x 2 factorial arrangement to receive 3 mg estradiol at 112 days versus no injection, and to subsequently receive 175 µg PGF either intramuscularly or perianally on day 113 of gestation. Sows were blood sampled at the time of PGF injection, and at 12, 18, and 24 hours after PGF injection and at farrowing. Plasma samples were assayed for progesterone.

Results: There was no effect of estradiol pretreatment or route of administration of PGF on farrowing responses. Blood samples were successfully collected from nine of 10 sows with an interval between PGF injection and farrowing of >= 48 hours. Progesterone profiles indicated that in five of these nine sows, PGF failed to cause luteolysis. However, the other four sows had clear evidence of PGF-induced luteolysis but still had a prolonged interval between PGF injection and farrowing.

Implications: Estradiol pretreatment does not improve the predictability of farrowing in response to PGF. Further, luteolysis does not occur in all sows after PGF injection and not all sows farrow promptly after luteolysis.

Keywords: swine, cloprostenol, estradiol, farrowing

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Preweaning piglet mortality rates are often 10%-15% of pigs born alive, but may approach 30% in some operations.[1] Most of this piglet loss occurs during the first 3 days postpartum. Many of the deaths are probably predisposed by events that occur during the first few hours of life, such as chilling or failure to obtain sufficient colostrum in the immediate postpartum period.[1,2] If parturition in a group of sows could be predictably induced, it would facilitate supervision of the farrowing process and ultimately reduce neonatal piglet mortality.[3] The only widely accepted commercially available method to induce parturition in sows is to administer prostaglandin F_{2a} or one of its analogues (PGF). Several investigators have observed that > 80% of sows farrow within 36 hours of an intramuscular injection of PGF when it is administered at 112-114 days of gestation.[4,5,6] However, in a commercial setting, fewer than 60% of PGF-treated sows are likely to farrow during an 8-hour working day.[3,7] Therefore, although using PGF to induce farrowing has proven efficacious, many producers do not use these products because individual farrowing responses cannot be adequately predicted.

The predictability of initiating farrowing can be improved by administering oxytocin 24 hours after PGF injection, but this practice is contraindicated because it is associated with obstetrical problems.[8,9] From field observations, it has been suggested that PGF dosages higher than those recommended by the manufacturer may improve the farrowing response[10] and some researchers do use a higher dose.[9] On the other hand, lower-than-recommended doses are also effective if administered perianally.[7] It has also been suggested that estradiol treatment before PGF injection may advance the onset of farrowing,[11] and so may have a useful role in improving the predictability of farrowing after PGF injection. Eckerle, et al.,[12] have demonstrated that after PGF-induced luteolysis, serum progesterone concentrations were reduced by about 50% at 12 hours after PGF injection. However, a better understanding of the sows endocrine response to PGF injection is required to maximize the predictability of the farrowing response.

The purpose of the present investigation was to evaluate the effect of estradiol pretreatment and different routes of PGF administration on the farrowing response of sows and associated blood progesterone concentrations.

Materials and methods

Study design

Mixed-parity Yorkshire x Landrace sows (n=105) were assigned in a 2 x 2 factorial arrangement to receive:

() an IM injection of 3 mg estradiol (E) in corn oil, or
() no injection (C)

at 07:00 on day 112 of gestation and to receive a subsequent injection of 175 µg cloprostenol (PGF, Planate(R), Schering-Plough, Pointe-Claire, Quebec) either

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() IM or
() perianally (PA)

on day 113 of gestation. Thus, the four treatments included in this study were

() EIM (n=23),
() CIM (n=29),
() EPA (n=25) and
() CPA (n=28).

The estradiol dose was the same as that used in previous studies to allow comparison.[11,12] We have observed that a half-dose of PGF administered perianally was effective for inducing parturition.[7] Therefore, we reasoned that the full dose by this route would be equivalent to a higher-than-recommended dose administered intramuscularly.

Farrowing response

From the time of PGF injection, sows were monitored continuously for the delivery of piglets. Farrowing response was measured as

() time interval from the injection of PGF to the delivery of the first piglet,
() duration of farrowing, and
() litter size born (alive and dead).

Progesterone concentration

A blood sample was obtained by ear vein puncture from each sow at the time of PGF injection, at 12, 18, and 24 hours after PGF injection, and at farrowing. Blood samples were assayed for progesterone concentration using a commercial kit (Intermedico, Markham, Ontario) with intra-assay coefficients of variation (CV) of 5.1% and inter-assay CV of 15.9%. Luteolysis was considered to have occurred in response to PGF injection if plasma progesterone was reduced by 50% by 24 hours after PGF injection.

Statistical analysis

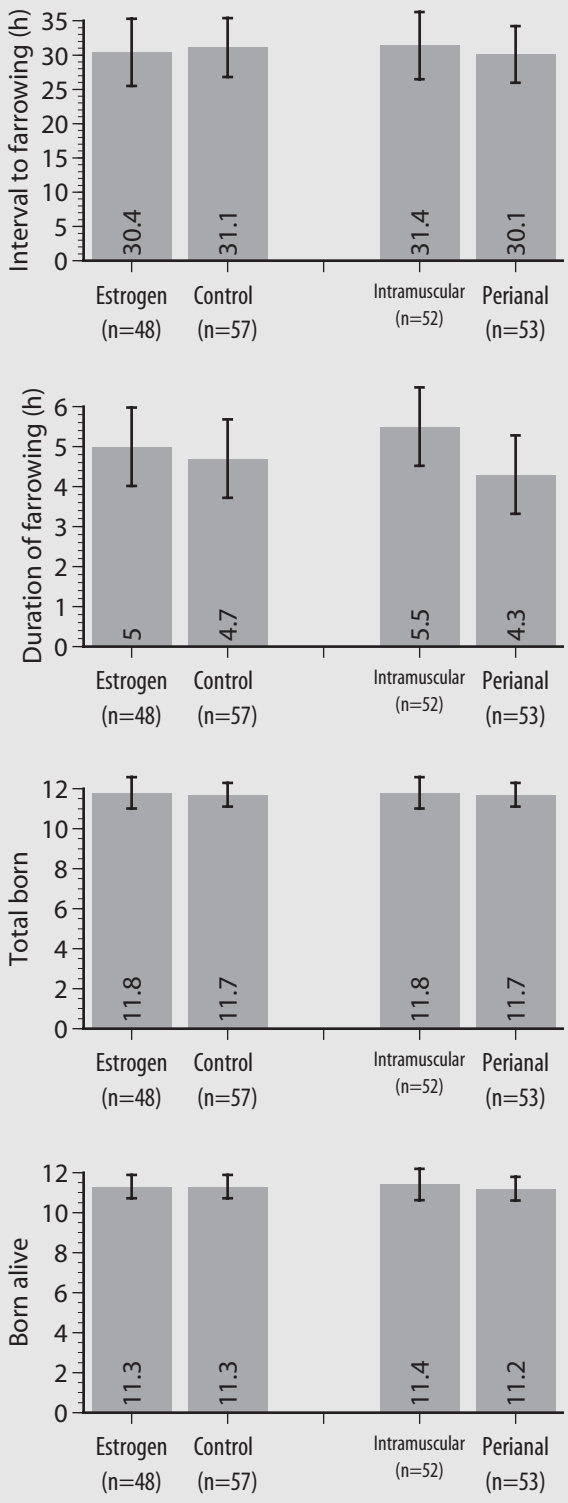
Treatment effects on the interval between PGF injection and delivery of the first piglet, the duration of farrowing, and litter size were analysed by two-way ANOVA using SAS (SAS; Cary, North Carolina).

Results

No significant interactions between estrogen treatment and route of PGF administration were detected for any variable, so results are presented as main effects only.

There was no effect of either estrogen pretreatment or route of PGF administration on the timing and duration of parturition in sows or on total or liveborn pigs (Figure 1). Ten sows experienced PGF-to-farrowing intervals of >= 48 hours. Of these sows, nine were successfully blood sampled. Plasma progesterone concentrations indicated that PGF failed to induce luteolysis in five sows. However, in the other four sows, PGF-induced luteolysis was evident.

FIgure 1



Influence of estrogen pretreatment and route of injection of cloprostenol on farrowing responses of sows (least-square means +/-95%CI)

Discussion

The peripartum period is associated with high concentrations of circulating estrogens. These high estrogen concentrations facilitate myometrial activity via induction of relaxin and oxytocin receptors.[13,14] Therefore, estrogen treatment could prime the uterus to respond to hormonal signals that follow luteolysis. However, based on the present results, endogenous estrogen was not limiting in our sows. The lack of treatment effects is further evidenced by the frequency distribution of PGF-to-farrowing intervals, which was very similar to that observed by others.[9]

The present study does not fully determine why some sows fail to farrow in response to PGF. Although we expected that luteolysis would not occur in some sows--and our data confirmed this--our study did not provide an explanation for why luteolysis does not occur in these sows. However, it has been observed that administering a second PGF injection 6 hours after the first increased the proportion of sows that farrowed promptly.[16] This suggests that the luteal and/or uterine response to the single luteolytic signal was inadequate to induce the cascade of endocrine events required for terminal luteolysis and that the second injection served to reinforce the luteolytic signal. However, it was intriguing to note evidence of luteolysis in sows in the present study that experienced prolonged PGF-to-farrowing intervals. This suggests that in some sows, either the uterus was not able to fully respond to luteolysis-driven endocrine events or that a nonterminal luteolysis occurred and that progesterone production subsequently recovered before the sow began to deliver piglets.

Implications

() Neither estradiol pretreatment nor perianal injection will improve farrowing predictability in response to PGF.

() Terminal luteolysis does not occur in all sows after PGF injection.

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