The effect of dose and route of administration of prostaglandin $F_{2\alpha}$ on the parturient response of sows

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Summary

Objective—*In two experiments, we tested the effect of dose and route of administration of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) on the farrowing response of sows.*

Design and procedure—*In experiment 1, we injected 25% of a full dose into the vaginal mucosa. In experiment 2, we injected cloprostenol perianally.*

Results—*We found that as many sows farrowed within a 48-hour period following injection into the vaginal mucosa of 25% of the recommended dose as farrowed following intramuscular (IM) injection of the full dose. Experiment 2 confirmed the efficacy of the 25% dose when injected vaginally. However, when sows were injected perianally with cloprostenol, the 50% dose proved relatively effective, but fewer farrowed within the 48-hour period when a 25% dose was used.*

Implications—*Twenty-five percent of the recommended dose of $PGF_{2\alpha}$, when administered vaginally, was equally as effective as the full recommended dose administered IM. However, no more than 65% of sows farrowed the day after a $PGF_{2\alpha}$, regardless of dose or route of administration.*

Keywords: *swine, prostaglandin $F_{2\alpha}$, administration*

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Preweaning piglet mortality rates average 10%–15% but may approach 30% in some operations.[1] Most of this piglet loss occurs during the first 3 days postpartum, with many of the deaths probably predisposed by events that occur during the first few hours of life.[1,2] The ability to predictably induce parturition in a group of sows may permit a reduction in neonatal piglet mortality by allowing the stockperson to assist sows that are having a difficult farrowing, to supervise colostrum intake, or to equalize litters by cross fostering piglets.

The only widely accepted commercially available method of inducing parturition in sows is by injecting prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) or one of its analogs. Several studies have been performed demonstrating that > 80% of sows will farrow within 36 hours of an intramuscular (IM) injection of $PGF_{2\alpha}$, administered at 112–114 days of gestation.[3–5] Although using $PGF_{2\alpha}$ to induce farrowing has proven efficacious, many producers resist using these products, in part due to their cost.

It is now established that injecting $PGF_{2\alpha}$ at half the manufacturer's recommended dose into the vaginal mucosa is as effective as an IM injection at the full recommended dose for inducing parturition in sows.[6–8] However, the minimum effective dose of $PGF_{2\alpha}$ by this route of administration remains to be determined. More recently, it has been suggested that injection into the perianal region (at about the 4- or 8-o'clock position) is as effective a route of administration as injecting vaginally.[9] The present experiments were undertaken to further examine the efficacy of different $PGF_{2\alpha}$ doses and routes of administration on the timing of parturition in sows.

Methods

Sows were cared for according to the guidelines of the Canadian Council of Animal Care.

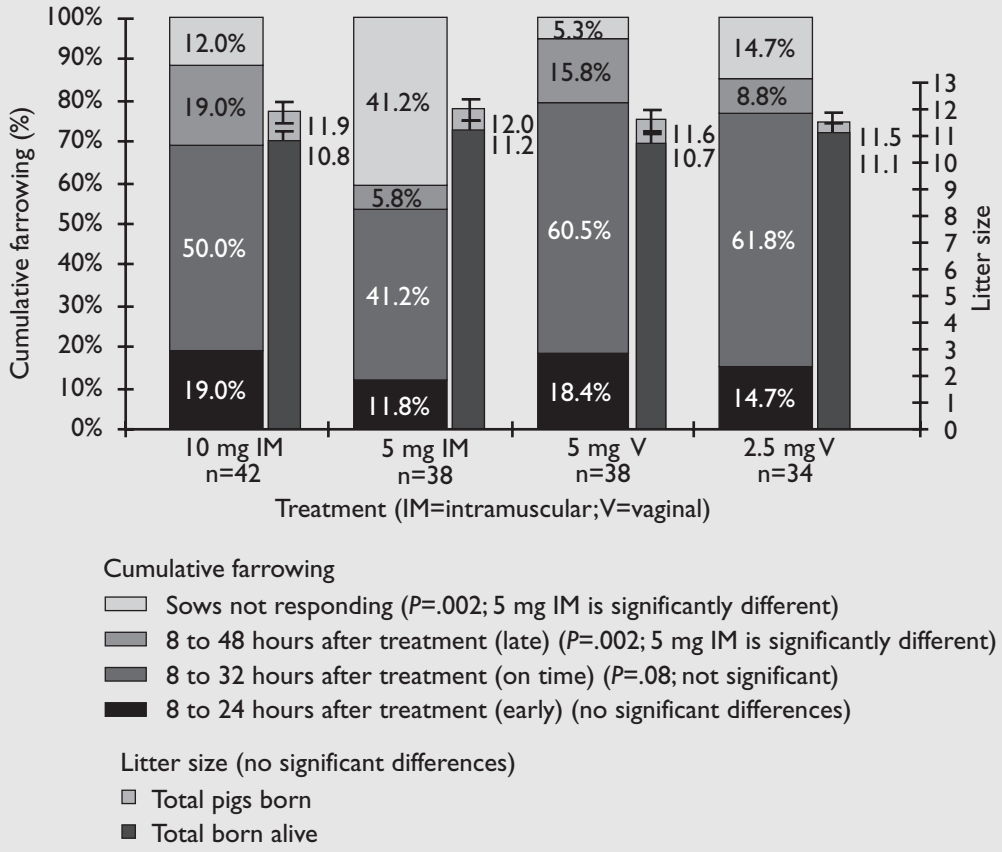
Experiment 1

Mixed-parity, Yorkshire × Landrace sows (n=148) housed at the Prairie Swine Center, Saskatchewan, were selected for induction of parturition at 112 or 113 days of gestation. The average gestation period for sows on this farm is 115 days. Parturition was induced by one of four injection treatments:

- 10 mg $PGF_{2\alpha}$ (Lutalyse®, Upjohn, Orangeville, Ontario) administered IM (n=42) (positive controls);
- 5 mg $PGF_{2\alpha}$ administered IM (n=34);
- 5 mg $PGF_{2\alpha}$ administered into the vaginal mucosa (n=38); or
- 2.5 mg $PGF_{2\alpha}$ administered into the vaginal mucosa (n=34).

Any sow that commenced farrowing before 16:00 on the day of induc-

Figure 1



Influence of intramuscular (IM) or vaginal (V) administration of different doses of prostaglandin $F_{2\alpha}$ on the timing of farrowing of sows.

tion was considered to be not responding to the exogenous $PGF_{2\alpha}$ and so was excluded from the experiment.

Sows were observed at 1- to 2-hour intervals (08:00 to 16:00) throughout the day following induction. The time that piglets were first observed was recorded. Sows farrowing overnight, before the day of observation (about 8–24 hours after $PGF_{2\alpha}$ injection) were designated as 'early.' Sows farrowing during the day of observation (about 24–32 hours after $PGF_{2\alpha}$ injection) were deemed to have farrowed 'on time.' Sows failing to farrow by the end of the working day of observation were considered either to be 'late' (i.e., farrowing approximately 32–48 hours after $PGF_{2\alpha}$ injection) or 'nonresponders' (i.e., farrowing > 48 hours after $PGF_{2\alpha}$ injection). The total number of piglets born and the number born alive were recorded.

Experiment 2

Mixed-parity sows of Large White × Landrace breeding (n=251) from a commercial herd in Alberta were used. On day 112 of gestation, sows received an injection of cloprostenol (Planate®, Coopers Agropharm Inc., Ajax, Ontario) at:

- half the manufacturer's recommended dose (88 mg) vaginally (n=62) (positive control group, based on results of experiment 1 and previous studies[6–8]);
- half the manufacturer's recommended dose (88 mg) perianally (n=62);
- a quarter of the recommended dose (44 mg) vaginally (n=64); or
- a quarter of the recommended dose (44 mg) perianally (n=63).

Farrowing responses and litter sizes were recorded as for experiment 1.

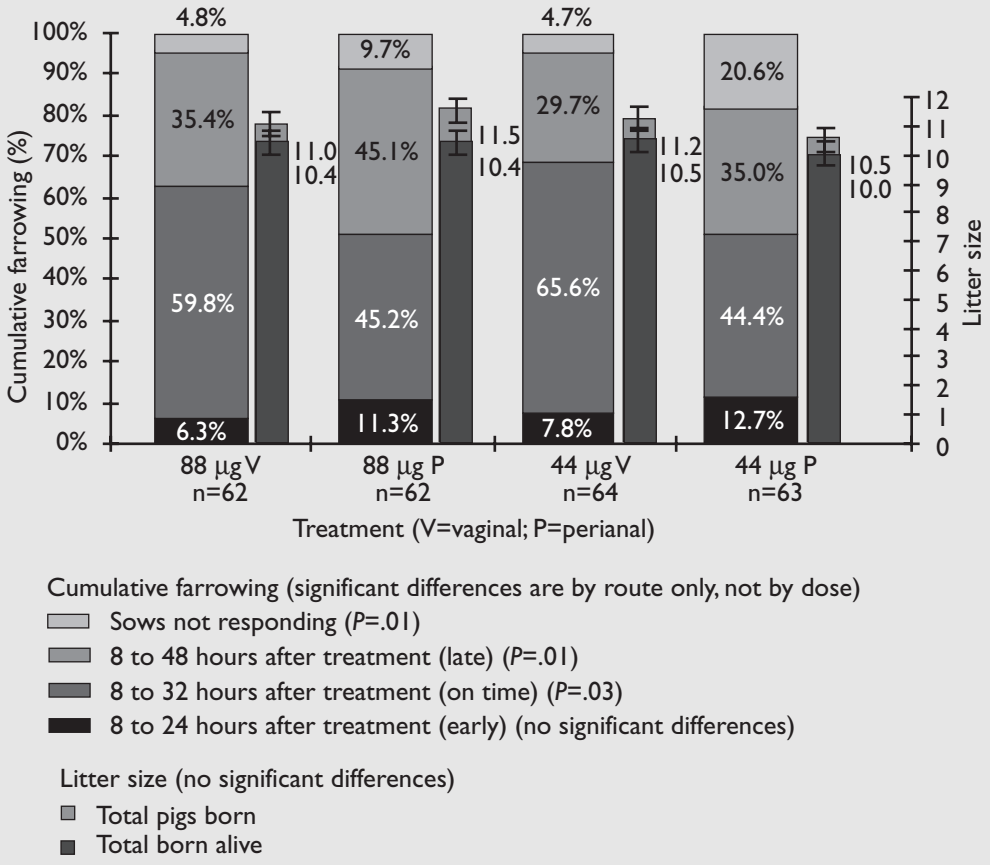
Statistical analysis

The number of sows farrowing during three cumulative time periods (8–24 hours, 8–36 hours, and 8–48 hours) and sows not responding were analyzed and results expressed on a percent basis. Experiment 1 was analyzed as a one-way model with four treatments (10 or 5 mg $PGF_{2\alpha}$ IM and 5 or 2.5 mg $PGF_{2\alpha}$ vaginally) using the CATMOD procedure of SAS (Statistical Analysis Systems Institute Inc., Cary, North Carolina). Experiment 2 was analyzed as a 2 × 2 factorial with two levels for route of administration (vaginal and perianal) and two levels for dose (88 and 44 mg), using the CATMOD procedure of SAS. Litter-size data from each experiment were analyzed using analysis of variance procedures.

Results

In experiment 1, there were no significant differences among treatments for percentage of sows farrowing 'early' (8–24 hours), suggesting that many of these early farrowing sows had probably initiated par-

Figure 2



Influence of vaginal (V) or perianal (P) administration of different doses of cloprostenol on the timing of farrowing of sows.

turition close to the time of $PGF_{2\alpha}$ injection (Figure 1). When the percentage of sows farrowing 'early' and farrowing 'on time' were combined, sows receiving 5 or 2.5 mg $PGF_{2\alpha}$ vaginally had similar values whereas those receiving 5 mg IM tended to have a lower percentage of farrowing compared to all other treatments (P=.08). At 48 hours, fewer (P=.002) of the sows receiving 5 mg $PGF_{2\alpha}$ IM had farrowed compared to the other treatments. The highest farrowing percentage was obtained in the 5-mg vaginal injection treatment. For sows in experiment 1, barn staff perceived a reduction in restless behavior when sows received 2.5 mg Lutalyse® vaginally, compared to sows receiving 10 mg IM (data not shown).

In experiment 2, there were no significant interactions between dose and route of administration or main effect of dose at any cumulative time period (8–24, 8–32, 8–48 hours; P>.3 for interaction and dose effects). There was no significant effect of route of administration on the percentage of sows farrowing up to approximately 24 hours after $PGF_{2\alpha}$ injection (Figure 2). However, by 32 hours fewer perianally injected sows had farrowed (P=.03). This effect of route of administration was even greater (P<.01) at 48 hours and seemed to be particularly evident in the sows receiving the lowest dose of $PGF_{2\alpha}$ perianally (Figure 2). There were no route or dose effects on litter size.

Discussion

The present data confirm the observation of Friendship, et al.,[6] in that a half dose of $PGF_{2\alpha}$ administered vaginally was as effective for inducing farrowing as the full recommended dose injected IM. Furthermore, it was noted that the administration of one-quarter dose vaginally was also as efficacious for inducing parturition in sows as was a half dose vaginally or a full dose IM. The minimal dose of $PGF_{2\alpha}$ injected vaginally that will consistently induce farrowing was not determined. However, the present data suggest that it is 25%, or less, of the full recommended IM dose.

The present results further indicate that administering $PGF_{2\alpha}$ in the perianal region may give a near-comparable induction response to other routes of administration but that the dose administered should not be less than half of the recommended IM dose. What is not quantified in these studies is the herd persons' reaction to the different routes of administration. Concerns were raised by barn staff about the sows' reaction to injection by the vaginal route and operators voiced a preference for the perianal injection site.

The results of the present studies are presented as cumulative farrowing percentages over a 48-hour time period and clearly indicate the efficacy of prostaglandin for inducing farrowing. However, it is impor-

tant to note that only approximately 50%–60% of sows farrowed during the following working day regardless of dose or route of administration. Therefore, if the objective of inducing farrowing is to allow barn staff to supervise piglet delivery to improve neonatal survival, many sows will escape supervision. Although it has been shown that an injection of oxytocin approximately 24 hours after $PGF_{2\alpha}$ will promote a more prompt and synchronous onset of farrowing, such a procedure also often necessitates increased manual assistance.[10–12] Therefore, we recommend that oxytocin not be used as a routine part of farrowing induction but be reserved for addressing prolonged farrowings after delivery has commenced. This highlights a significant shortcoming in current induction techniques in that without the use of oxytocin, the use of prostaglandin is poorly predictive in terms of individual sow responses, and it strongly indicates a need for further research.

The reason for the efficacy of the lower $PGF_{2\alpha}$ dose administered vaginally, and to a lesser extent perianally, for inducing parturition was not addressed. However, it is possible that injection into the vaginal mucosa resulted in a higher local ovarian $PGF_{2\alpha}$ concentration, because the venous drainage of the reproductive tract is greatly interconnected.[13] Therefore, a vaginal mucosal injection would likely result in a relatively high $PGF_{2\alpha}$ concentration in the uterine vein and thus, by countercurrent cycling, also in the ovarian artery. To what extent, if any, this applies to the perianal route of administration is not known. The present data further document that the half dose, when administered IM, was relatively inefficient for inducing parturition in sows.

Implications

- Twenty-five percent of the recommended dose of $PGF_{2\alpha}$, when administered vaginally, was equally as effective as the full recommended dose administered IM. The minimum effective dose of $PGF_{2\alpha}$ for successful induction of farrowing remains to be determined.
- Using vaginal routes of administration of $PGF_{2\alpha}$ can reduce the cost of inducing parturition in sows. This would allow more producers the opportunity to use $PGF_{2\alpha}$ to exert control over parturition, with the potential for improvement in piglet survival.
- No more than 65% of sows farrowed the day after a $PGF_{2\alpha}$, regardless of dose or route of administration.

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