Effect of propranolol on the onset and duration of parturition in sows

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The ability to predictably induce parturition in a group of sows may permit a reduction in neonatal piglet mortality by allowing the stockperson, for example, to assist sows having a difficult farrowing or to equalize litters by the cross-fostering of piglets. The administration of prostaglandin $F_{2\alpha}$ (PGF), or its analogues, has long been known to be effective for the induction of parturition in sows (1), but a considerable range in the interval between treatment and parturition can still be expected.

Various additional treatments have been applied in attempts to improve the promptness of parturition following PGF. The injection of oxytocin approximately 24 h after the injection of PGF has been shown to reduce the variation in the time to parturition (2). However, while oxytocin causes a more synchronous onset of parturition, it often disrupts the process of parturition, necessitating manual assistance (3,4). The administration of relaxin has also proven efficacious for synchronizing farrowing (5), but relaxin is not commercially available. The injection of estradiol at the time of PGF administration failed to influence the onset or duration of parturition (6).

Recently, the injection of carazolol, a beta-adrenergic blocking agent, in sows was shown to result in a prompt onset of labor and an acceleration of the parturition process (7,8). The mechanism whereby beta-adrenergic blockade influences the process of parturition remains to be determined. However, it has been suggested by Holtz *et al* (8) that the advancement of labor is due to the binding of myometrial beta-adrenergic receptors, thereby inhibiting the tocolytic effect of endogenous epinephrine released in response to the pain and discomfort of parturition.

Carazolol is not available in Canada, but propranolol also blocks both beta-1 and beta-2 adrenergic receptors. Therefore, a pilot study was undertaken to determine the efficacy of propranolol for improving the predictability of PGF-induced parturition in sows.

Forty-seven, Yorkshire × Landrace, mixed parity sows at the Prairie Swine Centre were selected for induction of farrowing. The average gestation period for sows on this farm is 115 d. All sows received an IM injection of 10 mg of a PGF analogue (Lutalyse, Upjohn, Orangeville, Ontario) at 0800 on day 113 of gestation. Four sows farrowed during the night of day 113 and were removed from the experiment. At 0800 on day 114, 32 of the remaining sows received a second IM injection consisting of 10 IU oxytocin (rogar/STB Inc., London, Ontario) ($n = 9$), 1.5 mg of propranolol hydrochloride (Inderal, Ayerst Laboratories, Montreal, Quebec) ($n = 10$), or 3.0 mg propranolol ($n = 13$). Eleven received no injection and served as controls.

Sows were observed every 15 min for the presence of piglets. The times of the second injection and the birth of the first and last pigs were recorded. Farrowing house policy on this farm dictated that, once one piglet has been born, manual intervention may be performed when a subsequent piglet has not been born within 60 min. The need for any intervention was recorded. The mean interval between piglet births was calculated as duration of farrowing divided by the number of pigs born. Data were collected only from sows commencing to farrow by 8 h after the second injection. Sows were cared for according to the guidelines of the Canadian Council of Animal Care.

Data for time to first piglet born and the mean interval between births was subjected to an analysis of variance using the Number Cruncher Statistical System (NCSS, N.J. Hintze, Kaysville, Utah). Differences between means of each treatment were examined by *t*-test (NCSS).

Of the 43 sows assigned to treatment, 13 failed to farrow by 8 h after the second injection. The sows not responding to treatment were 4 that received 3.0 mg propranolol, 5 that received 1.5 mg propranolol, 2 that received oxytocin, and 2 that were controls. The effects of the injection regime on farrowing in the remaining 30 sows are shown in Table 1. The injection of oxytocin 24 h after PGF did not increase the proportion of sows that farrowed within the experimental period. However, the administration of oxytocin was associated with a more prompt onset of piglet delivery ($P < 0.03$) but a prolonged mean interval between piglets ($P < 0.03$). This latter effect was due primarily to 3 sows that required assistance, confirming earlier reports of adverse effects of oxytocin on the smooth progress of parturition (3,4) and lending support to the recommendation of Holtz *et al* (8) that oxytocin be omitted from routine farrowing induction regimes.

No adverse effects to the administration of propranolol were observed. The injection of propranolol at either dose failed to significantly influence either the timing of onset or the duration of parturition (Table 1). This is in contrast to data generated when carazolol, also a beta-adrenergic blocker, was injected (7,8). The apparent lack of effect of propranolol was likely a reflection of its shorter biological half-life compared to that of carazolol (8). However, since few sows were employed in the present study and the parameters measured are inherently very variable, the conclusion that propranolol was without effect in farrowing sows must be interpreted with caution. There was no effect of treatment on the incidence of stillbirths (Table 1).

We conclude from the present data that the use of oxytocin in the prefarrowing management of sows should be

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Table 1. Effect of oxytocin and propranolol on the timing and duration of parturition in sows ($s_{\bar{x}}$)

	Control	Oxytocin	Propranolol (1.5 mg)	Propranolol (3.0 mg)
Number of sows	9	7	5	9
Parity	3.6 ± 1.1	4.2 ± 1.1	3.2 ± 0.5	3.6 ± 0.4
Time to first pig (min)	169.3 ± 17.3[a]	51.3 ± 12.4[b]	125.4 ± 24.7[a]	141.7 ± 24.6[a]
Time between pigs (min)	12.6 ± 1.4[a]	30.2 ± 5.7[b]	14.4 ± 2.0[a]	17.2 ± 2.9[ab]
Total pigs born	12.5 ± 0.6	10.0 ± 0.9	12.6 ± 1.0	10.9 ± 0.6
Pigs born alive (%)	98.4	94.0	92.1	98.2

[a,b]Means followed by different superscripts differ, $P < 0.03$

avoided. Also, the use of a relatively short-acting beta-blocker will not promote a more rapid onset or a shorter duration of parturition in sows. CVJ

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