Effects of $PGF_{2\alpha}$-analogue Administration During the Luteal Phase on the Next Estrous Cycle in the Bitch

Toshihiko TSUTSUI, Eiichi KAWAKAMI, Hiromitsu ORIMA[1)], and Akira OGASA
Department of Reproduction, [1)]Department of Radiology, Nippon Veterinary and Zootechnical College, 1–7–1 Kyonan-cho, Musashino-shi, Tokyo 180, Japan
(Received 19 November 1988/Accepted 9 March 1989)

Jpn. J. Vet. Sci. 51(4): 809–811, 1989

KEY WORDS: bitch, estrous cycle, prostaglandin $F_{2\alpha}$-analogue.

The authors have reported that early parturition alone was induced by the administration of $PGF_{2\alpha}$ during the final stage of gestation in pregnant bitches. $PGF_{2\alpha}$ displayed no other conspicuous effect on pregnant bitches, unless a particularly large dose was administered. However, the next estrus occurred earlier than expected in these animals [3]. Oettle *et al.* [1] have reported that such shortening of the estrous cycle occurs in bitches even when $PGF_{2\alpha}$ is administered during the luteal phase. It has also been reported by Vickery and McRae [5] and Vickery *et al.* [6] that the next estrus in a bitch occurs earlier when a $PGF_{2\alpha}$-analogue is administered during gestation to induce abortion. The authors have demonstrated that it is possible to cause luteal regression and induce abortion in bitches by administering a $PGF_{2\alpha}$-analogue (16–3-chlorophenoxy - ω - tetranor - trans - Δ^2 - $PGF_{2\alpha}$ methylester; $PGF_{2\alpha}$-A) either at the luteal phase or during gestation [4].

The object of this study was to observe the effects of $PGF_{2\alpha}$-A administration to bitches at various stages of the luteal phase on the estrous cycle which is expressed as the period in days between the beginnings, of vulvar bleeding in the reproductive cycle, as well as on reproduction. The bitches used in this experiment were thirty, 1 to 5 year-old beagles bred in the author's colony. They were used for 41 trials and were kept in a semi-closed room under natural lighting with 4–5 bitches per kennel (wooden cage with a wire netting, 150×65×60 cm). These bitches were divided into 4 groups according to the timing of administration. The timing of administration was determined by estimating corpora lutea (CL) function on the basis of peripheral blood progesterone (P) levels as reported earlier by the authors [4], and the stage of the CL of the animals were judged as follows: (A) functional CL, 25 days post-ovulation; (B) start of regression, 35 days post-ovulation; (C) regression in progess, 50 days post-ovulation; and (D) completely regressed, 60 days post-ovulation. The above four categories each consisted of 9–11 bitches. The bitches were then injected intramuscularly with a single 200 μg dose of $PGF_{2\alpha}$-A. Ovulation in these bitches was asserted to have occurred on the third day of estrus, as reported previously by the authors [2]. The previous estrous cycle of the 16 bitches which were not permitted to mate before $PGF_{2\alpha}$-A administration served as the control for comparing estrous cycle reduction. The conception rate and litter size of 19 bitches mated in the estrous cycle before administration were also used as controls for comparison.

Student's t test was used for the statistical analysis of estrous cycle and litter size data obtained from this experiment.

The results of the estrous cycle of each group before and after $PGF_{2\alpha}$-A administration are shown in Table 1. The estrous cycle in the controls lasted 157.5±19.7 days (mean ± SD; range: 113–196 days). When compared with the estrous cycles in the other groups, significant decreases were found in groups A, B and C. However, the estrous cycle in group D lasted 164.6±22.0 days, having no difference with the controls. No significant difference was found between the cycles of groups A, B or C. Duration of the post-treatment estrous cycle in each of the 12 bitches in these 3 groups, in which the estrous cycle had been clarified are compared in Table 2. Here the decrease of the estrous cycle in days was 41.1±18.1. The period in days from administration to the next estrus was also compared among the four groups (Table 1). Although no significant difference was found among groups A, B and C, significant difference was found between groups A and D ($P<0.05$), B and D ($P<0.05$), and C and D ($P<0.01$). Results with respect to reproduction were expressed as a 94.4% conception rate and a litter size of 6.1±2.0 in the 19 bitches used as controls. For the 12 bitches in

Table 1. Effect of $PGF_{2\alpha}$-A administration on next estrus

Group	Time of admin. (Days after ovulation)	No.of bitches	Estrous cycle (Mean±SD)		Days from admin. to next estrus (Mean±SD)
			Pre-treatment (Control)	Post-treatment	
A	25	10	157.5 ±19.7 n=16	112.6±17.9[a)]	85.0±19.7[b)]
B	35	11		124.6±20.6[a)]	86.2±24.2[b)]
C	50	9		124.0±14.9[a)]	73.9±14.8[b)]
D	60	11		164.6±22.0	106.5±21.0

a) Significantly reduced as compared to the control ($P<0.01$).
b) Significantly different from group D (A, $P<0.05$: B, $P<0.05$: C, $P<0.01$).

Table 2. Effect of $PGF_{2\alpha}$-A administration on the recurrence of estrus

Group	Bitch No.	Estrous cycle		
		Pre-treatment (A)	Post-treatment (B)	A-B
A	44	181	106	75
	156	138	96	42
	176	158	105	53
B	119	148	99	49
	123	150	108	42
	139	152	147	5
	146	196	142	54
	163	168	130	38
	200	164	110	54
C	72	158	131	27
	113	145	116	29
	170	163	138	25
Mean		160.1	119.0	41.1
SD		16.1	17.7	18.1

groups A, B and C after $PGF_{2\alpha}$-A administration the rate of conception was 91.7% and the litter size was 6.3±1.3, showing no difference with the controls.

From these results, it is evident that the recurrence of estrus is reduced by about 40 days when a single 200 μg dose of $PGF_{2\alpha}$-A is administered to bitches in the luteal phase. Furthermore, reproduction results were found to be normal. This is thought to be due to an increase in gonadotropin secretion activity in response to an effect of $PGF_{2\alpha}$-A administration on the hypothalamo-hypophysial system. In the present experiment the shortening of the estrous cycle was observed in response to administration during the functional CL phase (groups A, B, C), although not during the regressive phase (D group). These phenomena could be interpreted as the result of to consider a sudden decrease in plasma P levels caused by $PGF_{2\alpha}$-A administration which have an effect on the hypothalamo-hypophysial system.

ACKNOWLEDGEMENTS. The authors wish to thank the Ono Pharmaceutical Co., Ltd. for supplying the prostaglandin $F_{2\alpha}$ analogue (ONO-1052) used in this experiment.

REFERENCES

1. Oettle, E. E., Botha, E., and Painter, I. 1985. *Theriogenology* 23: 409–414.
2. Tsutsui, T. 1973. *Jpn. J. Anim. Reprod.* 18: 137–142.
3. Tsutsui, T., Takatani, H., Hirose, O., and Yamauchi, M. 1982. *Jpn. J. Vet. Sci.* 44: 403–410.
4. Tsutsui, T., Kawakami, E., Orima, H., Yamauchi, M, Okubo, T., and Stabenfeldt, G. H. 1989. *Jpn. J. Vet. Sci.* 51: 496–504.
5. Vickery, B. H. and McRae, G. I. 1980. *Biol. Reprod.* 22: 438–442.
6. Vickery, B. H., McRae, G. I., Kent, J. S., and Tomlinson, R. V. 1980. *Prostaglandins Med.* 5: 93–100.

要　　約

犬の黄体期における $PGF_{2\alpha}$-*analogue* 投与が次回発情までの日数におよぼす影響(短報)：筒井敏彦・河上栄一・織間博光[1]・小笠　晃（日本獣医畜産大学獣医臨床繁殖学数室，[1]獣医放射線学教室)――犬の黄体期に $PGF_{2\alpha}$-*analogue* を投与した場合の性周期の短縮効果および繁殖成績について検討した．実験犬はビーグル種で，1～5才の30頭41例を投与時期によって4群に区別し，$PGF_{2\alpha}$-*analogue* を筋肉内に1回投与した．その結果，排卵後25，35および50日投与群では60日投与群および投与前（コントロール）に比較して約40日短縮し（$P<0.01$），この発情期における繁殖期成績は正常であることが分った．