Egg recovery from the vagina of the rabbit treated with prostaglandin $F_{2\alpha}$

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Summary. The egg recovery from the vagina was conducted 1 to 48 hours after administration of 2 or 5 mg/kg of body weight of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) in rabbits. The majority of eggs were recovered within 24 hours after treatment, especially more than 30% of the eggs were recovered by 2 hours after treatment, when a single administration of $PGF_{2\alpha}$ was made 20 to 28 hours after mating. A high recovery rate ($82.7 \pm 5.3\%$) was obtained by a subcutaneous injection of 5 mg/kg of $PGF_{2\alpha}$ 22 hours after mating. The earliest eggs were recovered from the vagina at the first vaginal washing 1 hour after treatment.

Multiple administrations of 2 or 5 mg/kg of $PGF_{2\alpha}$ 72 to 114 hours after mating were applied to recover the blastocysts. However, only a scanty number of eggs were recovered following the $PGF_{2\alpha}$ administrations. Only $28.1 \pm 16.4\%$ of the eggs were recovered from the vagina following the injections of 5 mg/kg of $PGF_{2\alpha}$ at 96, 99 and 102 hours after mating. High implantation rates were demonstrated in spite of the multiple injections of $PGF_{2\alpha}$ except in one group in which 5 mg/kg of $PGF_{2\alpha}$ were applied at 108, 111 and 114 hours after mating. This fact indicates that the treatments with $PGF_{2\alpha}$ on and after 3 days after mating have a lesser effect on the intrauterine egg transport than the early treatments 20 to 28 hours after mating.

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Introduction

Egg recovery from the vagina in rabbits following the treatments with various chemical agents have been recently reported. For instance, administration of estrogen accelerated the egg transport through the oviduct^{1~8)}, and caused expulsion of eggs into the vagina^{1~4, 7, 8)}. The egg transport in the oviduct was also disturbed by an administration of gestagen before ovulation, and some of the eggs were discharged into the vagina^{9, 10)}. The eggs located in the vaginal lumen of progestin-treated rabbits were recovered nonsurgically¹¹⁾. It has been demonstrated that an administration of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) caused a rapid egg transport through the oviduct and resulted in

an expulsion of eggs into the vagina^{12~20)}. And the eggs were recovered from the vagina by the vaginal washing method^{7, 8, 11, 19, 20)} developed to normal young as a result of transferring the eggs into the recipient does^{7, 8, 19)}. The vaginal washing method proposed by TSUTSUMI and TAKEDA²¹⁾ for egg recovery in rabbits may introduce new requisite information regarding the physiology of egg transport.

In our previous report²⁰⁾, a maximal recovery rate of eggs from the vagina (54.8%) was observed when 5 mg/kg of body weight of $PGF_{2\alpha}$ was administered at 24 hours after mating, and no eggs was recovered following a single injection of 2 mg/kg of $PGF_{2\alpha}$ at 72, 84 or 96 hours after mating. It has been considered that the endogenous progesterone levels

elevated with the lapse of time after mating may reduce the sensitivity of the oviduct and uterus to $\text{PGF}_{2\alpha}$.

The present study was designed to investigate the effect of $\text{PGF}_{2\alpha}$ administrations on the egg recovery from the vagina and on the implantations in the rabbits.

Materials and Methods

Sixty-eight adult Japanese white female rabbits were injected with 40 IU of human chorionic gonadotropin (HCG) immediately after double mating with fertile males.

First experiment: Thirty-six rabbits were divided into 9 groups depending on the time of $\text{PGF}_{2\alpha}$ administration (Table 1). Each group, consisting of 4 does, received a single subcutaneous injection of 5 mg/kg of body weight of $\text{PGF}_{2\alpha}$ at 20, 21, 22, 23, 24, 25, 26, 27 or 28 hours after mating. To determine the precise time of the appearance of eggs in the vagina, *in vivo* vaginal washings²⁰⁾ were carried out 1, 2, 3, 6, 9, 12, 24, 36 and 48 hours after treatment (Fig. 1).

Second experiment: Thirty-two does were divided into 8 groups, each group consisting of 4 animals, according to dose and time of $\text{PGF}_{2\alpha}$ administration (Table 2). Each rabbit received multiple subcutaneous injections of 2 or 5 mg/kg of $\text{PGF}_{2\alpha}$ 72 to 114 hours after mating to recover the blastocysts. The vaginal washings were carried out in each rabbit after the first injection of $\text{PGF}_{2\alpha}$ in a similar schedule as indicated in the first experiment (Fig. 2).

The animals were laparotomized 9 days after mating, and the numbers of corpora lutea and sites of implantation were recorded.

Results

Number of eggs recovered after treatment:

Fig. 1. Number of eggs recovered from the vagina in each hour following 5 mg/kg of $\text{PGF}_{2\alpha}$ treatment in the first experiment. Each group including four does.
● means an egg recovered.

A single administration of 5 mg/kg of $\text{PGF}_{2\alpha}$ at 22 hours after mating showed a high recovery rate of vaginal eggs based on the number of corpora lutea (about 83%, range 64.3~90.0%). There were no statistical differences in the recovery rates among groups in the first experiment, although the recovery rates were relatively low in the groups which were treated with $\text{PGF}_{2\alpha}$ at 20 or 28 hours after mating. The earliest eggs were recovered from the vagina only 1 hour following the treatment in most of the groups (Fig. 1), and 22.2 to 70.0% of eggs were recovered during the first 3 hours after the treatment; namely,

Fig. 2. Number of eggs recovered from the vagina in each hour following $\text{PGF}_{2\alpha}$ treatments in the second experiment. Each group including four does.

● means an egg recovered.

↓ means $\text{PGF}_{2\alpha}$ injection.

48% for the treatment at 20 hours after mating, 47% for 21 hours, 36% for 22 hours, 43% for 23 hours, 70% for 24 hours, 54% for 25 hours, 22% for 26 hours, 59% for 27 hours and 60% for 28 hours, respectively. No difference was observed statistically in the implantation rates among the groups, although the treatment at 22 hours after mating showed the lowest implantation rate (1.8%, range 0.0~7.1%). The implantation rates were on a similar level (19.2~23.2%) within the groups in which $\text{PGF}_{2\alpha}$ were given at 20, 23, 24, 26 or 27 hours after mating. The rates of eggs missed, which was calculated on the number of corpora lutea, showed similar figures except for the groups treated at 27 and 28 hours after mating. The rate of eggs missed was highest in the group of 28 hour-treatment

(41.1%) and the rate was lowest (6.4%) in the group of 27 hour-treatment (Table 1).

Multiple administrations of 2 or 5 mg/kg of $\text{PGF}_{2\alpha}$ in the second experiment led to unsatisfactory results. The number and the recovery rates of eggs from the vagina were remarkably low in both treatments of 2 and 5 mg/kg (Table 2, Fig. 2), and a few eggs were sporadically recovered during the experimental period (Fig. 2). However, the earliest eggs were recovered in the first vaginal washing 1 hour after the treatments in a half of 8 groups, also. A maximal egg recovery rate in the second experiment was 28% (range 0.0~75.0%) in a group treated with 5 mg/kg of $\text{PGF}_{2\alpha}$ 96, 99 and 102 hours after mating (Table 2), the rate was remarkably low in comparison with the results of the first experiment treated with a single dosage (Table 1). The animals, in which no eggs were recovered from the vagina, were included in all groups of the second experiment. Especially when 2 and 5 mg/kg of $\text{PGF}_{2\alpha}$ were given 72, 75 and 78 hours after mating and 84, 87 and 90 hours after mating, eggs were recovered from only one doe, respectively. Although groups given 5 mg/kg of $\text{PGF}_{2\alpha}$ 96, 99 and 102 hours after mating and 108, 111 and 114 hours after mating showed low implantation rates of eggs (21.9% and 5.0%, respectively), more than 50% of eggs implanted in other groups.

Developmental stages of eggs recovered:

In the first experiment, 246 eggs were recovered from the vagina following a single dose of $\text{PGF}_{2\alpha}$ 20 to 28 hours after mating. Most eggs were morphologically normal and fertilized (92.3%), and the proportion of 2-cell eggs against the total number of fertilized eggs were 32%, and 36% for 4-cell eggs, 21.5% for 8-cell to 32-cell eggs. A few degenerating eggs and empty zona pellucida were also re-

Table 1. Egg recovery from the vagina and implantation of eggs following 5 mg/kg of PGF_{2α} treatment

Time ^{a)} of treatment	No. of rabbits	No. of corpora lutea Mean±S. E. (range)	No. and rate of egg recovery (range, %)	No. and rate of implantation of eggs (range, %)	No. and rate of eggs missed (range, %)
20	4	44 11.0± 0.7 (9~13)	23 52.0±10.2 (18.2~61.5)	9 21.0±15.7 (0.0~72.7)	12 27.0± 5.5 (9.1~38.5)
21	4	46 11.5± 0.4 (11~13)	32 72.0±16.7 (15.4~100.0)	2 4.6 ^{b)} (0.0~18.2)	12 23.4±16.8 (0.0~84.6)
22	4	41 10.3± 1.1 (9~14)	33 82.7± 5.3 (64.3~90.0)	1 1.8 ^{b)} (0.0~7.1)	7 15.5± 4.0 (10.0~28.6)
23	4	50 12.5± 1.5 (9~16)	28 57.1± 4.2 (46.7~70.0)	9 19.2± 7.3 (0.0~33.3)	13 22.2± 4.8 (11.1~37.5)
24	4	47 11.8± 1.1 (9~14)	30 63.8± 2.8 (60.0~71.4)	10 21.5± 4.8 (10.0~33.3)	7 14.6± 5.3 (0.0~30.0)
25	4	41 10.3± 0.7 (8~12)	26 62.6± 7.5 (45.5~80.0)	6 13.6 ^{b)} (0.0~54.5)	9 23.8± 8.9 (0.0~50.0)
26	4	43 10.8± 0.5 (9~12)	27 62.6± 3.3 (55.6~72.7)	8 20.2± 6.2 (0.0~44.4)	8 17.2± 7.8 (0.0~45.5)
27	4	36 9.0± 1.5 (6~14)	27 70.4± 8.6 (50.0~88.9)	6 23.2±11.7 (0.0~50.0)	3 6.4±3.7 ^{c)} (0.0~14.3)
28	4	37 9.3± 0.2 (9~10)	20 53.3± 8.6 (33.3~80.0)	2 5.6 ^{b)} (0.0~22.2)	15 41.1±10.2 ^{d)} (20.0~66.6)

^{a)}: Hours after mating.^{b)}: Figure showed in one doe.^{c), d)}: Significant differences were noted between c and d ($p<0.05$).**Table 2.** Egg recovery from the vagina and implantation of eggs following multiple injection of 2 or 5 mg/kg PGF_{2α}

Time ^{a)} of treatment	Doses of PGF _{2α} (mg/kg)	No. of rabbits	No. of corpora lutea (range)	No. and rate of egg recovery (range, %)	No. and rate of implantations (range, %)	No. and rate of eggs missed (range, %)
72, 75, 78	2×3	4	48 12.0±1.2 (10~14)	3 5.4 ^{b)} (0.0~21.4)	34 72.9± 8.5 (50.0~90.0)	11 21.8± 4.4 (10.0~21.4)
	5×3	4	57 14.3±4.7 (13~15)	9 16.1 ^{b)} (0.0~64.3)	36 63.2±20.2 ^{d)} (7.1~64.3)	12 19.3± 9.1 ^{f)} (0.7~40.0)
84, 87, 90	2×3	4	37 9.3±1.4 (6~13)	2 5.6 ^{b)} (0.0~22.2)	21 51.4±18.4 (11.1~100.0)	14 43.1±18.5 (0.0~88.9)
	5×3	4	34 8.5±1.3 (6~12)	3 12.5 ^{b)} (0.0~50.0)	24 70.0±17.1 ^{d)} (33.3~100.0)	7 22.9±13.7 ^{f)} (0.0~62.5)
96, 99, 102	2×3	4	43 10.8±0.3 (10~11)	2 4.8± 2.8 (0.0~10.0)	28 64.1±17.4 (20.0~100.0)	13 31.2±16.3 (0.0~70.0)
	5×3	4	32 8.0 ^{e)} (8.0)	9 28.1±16.4 (0.0~75.0)	7 21.9±10.7 (0.0~50.0)	16 50.0±15.3 (5.0~87.5)
108, 111, 114	2×3	4	41 10.3±0.5 (9~11)	5 12.9± 8.0 (0.0~33.3)	21 51.9±19.2 (0.0~90.9)	15 35.2±19.0 (0.0~81.8)
	5×3	4	37 9.3±0.5 (8~11)	7 20.0±15.8 (0.0~50.0)	2 5.0 ^{b), e)} (0.0~20.0)	28 75.0±14.4 ^{g)} (50.0~100.0)

^{a)}: Hours after mating.^{b)}: Figure showed in one doe.^{c)}: Each doe had 8 corpora lutea equally.^{d), e)}: Significant differences were noted between d and e ($p<0.05$).^{f), g)}: Significant differences were noted between f and g ($p<0.05$).

Table 3. Developmental stages of eggs recovered from the vagina following the $\text{PGF}_{2\alpha}$ treatment in the first experiment

Morphology of eggs	Time of PGF _{2α} (hours after mating)									Total
	20	21	22	23	24	25	26	27	28	
Undivided ^{a)}	11	5	5							21
Unfertilized		1		1		5	1			8
2-cell	2	9	9	13	15	6	4	12	2	72
4-cell	4	8	14	6	9	11	9	9	11	81
8-cell	4	1	1	3	4	1	5	4	5	28
16-cell		2	1	3		3	4	2	1	16
32-cell		5					3		1	9
Degenerating	2			2						4
Empty zona pellucida		1	3			2		1		7

^{a)}: The mono-cell egg having 2 polar bodies was classified as undivided eggs.

Table 4. Developmental stages of eggs recovered from the vagina following the $\text{PGF}_{2\alpha}$ treatments in the second experiment

Morphology of eggs	Time of PGF _{2α} (hours after mating) and doses (mg/kg)								Total
	72, 75, 78		84, 87, 90		96, 99, 102		108, 111, 114		
	2×3	5×3	2×3	5×3	2×3	5×3	2×3	5×3	
Morula		8							8
Blastocyst		1	2	3	2	2 ^{a)}	5	6	21
Degenerating									
morula	4								4
blastocyst						7		1	8

^{a)}: Two blastocysts revealed expanding to about 289 and 387 micra in diameters.

covered (4.5%). Twenty-one undivided eggs were recovered after an injection of $\text{PGF}_{2\alpha}$ 20 to 22 hours after mating, these eggs were considered as the fertilized eggs because having 2 polar bodies (Table 3). All eggs recovered in the second experiment were in the morula or blastocyst stages (Table 4). Twelve eggs (29%) were degenerated and others were morphologically normal. Two expanding blastocysts, about 289 and 387 micra in diameter, respectively, were recovered one hour after $\text{PGF}_{2\alpha}$ treatment of 5 mg/kg 96 hours after mating (Table 4).

Discussion

In our previous report²⁰⁾ we have demon-

strated that 48.4% and 54.8% of eggs were recovered from the vagina in rabbits, when 2 or 5 mg/kg of body weight of $\text{PGF}_{2\alpha}$ were injected 24 hours after mating and the vaginal washing was started 3 hours after the treatment. But no eggs was recovered when 2 mg/kg was administered at 72, 84 or 96 hours after mating, although a few eggs were recovered following 5 mg/kg treatment. The present study clearly showed that an expulsion of eggs into the vagina occurred within 1 hour after $\text{PGF}_{2\alpha}$ treatment and high recovery rates of eggs were observed following a single administration of 5 mg/kg of $\text{PGF}_{2\alpha}$ 20 to 28 hours after mating. The present study also demonstrated that the majority of eggs were

recovered within 24 hours after treatment, especially more than 30% of the eggs were recovered 2 hours after treatment in total (Table 1, Fig. 1). In our preliminary experiment concerning about the retention of eggs in the vagina of $\text{PGF}_{2\alpha}$ -treated rabbits, when known number of surrogates of the eggs were deposited into the proximal part of the vagina 24 hours after mating following an injection of 5 mg/kg of $\text{PGF}_{2\alpha}$ immediately after deposition, the recovery rate of the surrogates from the vagina 1, 3 and 6 hours later were 42%, 25% and 6%, respectively. Thus, the expulsion of eggs into the vagina was remarkable within a few hours after $\text{PGF}_{2\alpha}$ treatment.

It has been reported that the subcutaneous injection of $\text{PGF}_{2\alpha}$ in rabbits increased the frequency and amplitude of oviductal contraction for 1 to 1.5 hours²²⁾ or for 3.4 hours²³⁾. In the present study, eggs were continuously recovered from the vagina up to 36 hours after the treatment, although the egg recovery rate was remarkably high at the second hour after the treatment. This indicates that the egg transport accelerated by $\text{PGF}_{2\alpha}$ is kept for long time over the effective period of $\text{PGF}_{2\alpha}$ on oviductal contractility.

Multiple injections of 2 or 5 mg/kg of $\text{PGF}_{2\alpha}$ 72 to 114 hours after mating on the recovery of the intrauterine blastocysts were examined in the second experiment, because only a few eggs were recovered by a single injection of 2 or 5 mg/kg of $\text{PGF}_{2\alpha}$ at 72, 84 or 96 hours after mating in the previous experiment²⁰⁾. A slight improvement in the recovery rate was observed in the present study, although the time of the vaginal washing was altered. However, the rate of eggs recovered from the vagina in the second experiment was remarkably low compared with that observed in the first experiment. This may be caused by

a progestational condition which eliminates the effect of $\text{PGF}_{2\alpha}$ on uterine contractions. It has been reported that the sensitivity of muscles to $\text{PGF}_{2\alpha}$ is influenced by endocrine conditions^{24, 25)}, and that the concentration of PGF in the oviduct is decreased by progesterone treatment²⁶⁾ and the response of oviducts of $\text{PGF}_{2\alpha}$ is decreased by progesterone²⁵⁾. Also, it has been indicated that the uterine response to $\text{PGF}_{2\alpha}$ in progesterone-treated rabbits was significantly reduced²⁷⁾. Thus, the endogenous progesterone level increased with the lapse of time after mating²⁸⁾ may depress the sensitivity of the oviduct and uterus to $\text{PGF}_{2\alpha}$, and this may cause a reduction of the number of the eggs expelled into the vagina. It seems, however, that the expulsion of intrauterine eggs into the vagina via cervix after $\text{PGF}_{2\alpha}$ injections is not only depending on the enhanced uterine contractions induced by $\text{PGF}_{2\alpha}$ but also may be related to the size of the blastocysts, because of the low recovery rate of blastocysts in the second experiment. It is speculated that the expansion of blastocysts may cause to prevent physically the transport of the blastocysts into the vagina through the cervix. There are no reports concerning the egg transport through the cervix, although the histological structures of the nonpregnant²⁹⁾ and the pregnant rabbit³⁰⁾ were demonstrated. In the present study, two expanding blastocysts (289 and 387 micra in diameter) were recovered from the vagina 1 hour after treatment in the case of 5 mg/kg administered 96 hours after mating (Table 4). This may indicate that the cervical cannal was relaxed in some degree to allow the passage of the blastocysts after $\text{PGF}_{2\alpha}$ treatment, and the size of the blastocysts may be the limit for the egg transport through the cervix because more largely expanding blastocysts have never been

recovered from the vagina when 5 mg/kg of $\text{PGF}_{2\alpha}$ was given 108, 111 and 114 hours after mating. According to ADAMS³¹⁾, the correct timing of the entry of eggs into the uterus is vitally important for their further survival, and if eggs prematurely enter into the uterus, the eggs are quickly transported through the uterus and are expelled into the vagina. ADAMS³²⁾ also confirmed that in estrous rabbits, eggs transferred to the uterus were immediately expelled into the vagina and that the percentages of eggs recovered from the uterus fell from 69% to 0% after 0.5 to 4 hours after transfer. It was reported that unfertilized eggs in pseudopregnant rabbit appeared in the vagina more than 90 hours after sterile mating, and that the mean diameters of these eggs were 335~362 micra²¹⁾. This indicates that the cervical cannal may relaxed in some degree and that eggs in unsufficient diameters may pass through the cervix to the vagina. HODGSON and PAUERSTEIN³³⁾ reported that some eggs were found in the uterus and vagina of normal rabbit 48 hours after mating and HCG administration. Thus, it assumed that the treatment of $\text{PGF}_{2\alpha}$ around 24 hours after mating causes the expulsion of eggs into the vagina.

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References

- 1) CHANG, M. C.: *Endocrinology* 79, 939, 1966.
- 2) CHANG, M. C.: *Nature* 212, 1048, 1966.
- 3) CHANG, M. C. & R. YANAGIMACHI: *Fertil. Steril.* 16, 281, 1965.
- 4) CHANG, M. C. & M. J. K. HARPER: *Endocrinology* 78, 860, 1966.
- 5) GREENWALD, G. S.: *J. exp. Zool.* 135, 461, 1957.
- 6) GREENWALD, G. S.: *Fertil. Steril.* 10, 155, 1959.
- 7) TSUTSUMI, Y., T. TAKEDA, K. YAMAMOTO & Y. TANABE: *J. Reprod. Fertil.* 48, 393, 1976.
- 8) TAKEDA, T., K. YAMAMOTO, Y. TANABE & Y. TSUTSUMI: *Memoris Facul. Agr. Hokkaido Univ.* 10, 231, 1977.
- 9) CHANG, M. C.: *Endocrinology* 81, 1251, 1967.
- 10) PAUERSTEIN, C. J., B. D. FREMMING & J. E. MARTIN: *Gynec. Invest.* 1, 257, 1970.
- 11) TAKEDA, T., H. SUZUKI, S. MATSUI, Y. TERAMI & Y. TSUTSUMI: *Japan. J. Anim. Reprod.* 24, 184, 1978.
- 12) ELLINGER, J. V. & K. T. KIRTON: *Biol. Reprod.* 7, 106, 1972 (abstr.).
- 13) ELLINGER, J. V. & K. T. KIRTON: *Biol. Reprod.* 11, 93, 1974.
- 14) CHANG, M. C. & D. M. HUNT: *Nature* 236, 120, 1972.
- 15) CHANG, M. C., D. M. HUNT & C. POLGE: *Adv. Biosci.* 9, 805, 1973.
- 16) CHANG, M. C., S. K. SAKSENA & D. M. HUNT: *Prostaglandins* 5, 341, 1974.
- 17) AREF, I., E. S. E. HAFEZ & G. A. R. KAMAR: *Fertil. Steril* 24, 671, 1973.
- 18) AREF, I. & E. S. E. HAFEZ: In *Ovum Transport and Fertility Regulation* (HARPER, M. J. K., C. J. PAUERSTEIN, C. E. ADAMS, E. M. COUTINHO, H. B. CROXATTO & D. N. PATON eds.) p. 320, Copenhagen, Scriptor, 1976.
- 19) TAKEDA, T., Y. TSUTSUMI, Y. TANABE & K. YAMAMOTO: *Fertil. Steril.* 28, 759, 1977.
- 20) TAKEDA, T., Y. TSUTSUMI, S. HARA & M. IDA: *Fertil. Steril.* 30, 79, 1978.
- 21) TSUTSUMI, Y. & T. TAKEDA: *Jap. J. Zootech. Sci.* 47, 509, 1976.
- 22) SPILMAN, C. H. & M. J. K. HARPER: *Biol. Reprod.* 7, 106, 1972 (abstr.).
- 23) SPILMAN, C. H. & M. J. K. HARPER: *Biol. Reprod.* 9, 36, 1973.
- 24) HORTON, E. W., I. H. M. MAIN & C. J. THOMPSON: *J. Physiol. (Lond.)* 180, 514, 1965.
- 25) SPILMAN, C. H.: *Prostaglandins* 7, 465, 1974.
- 26) SAKSENA, S. K. & M. J. K. HARPER: *Biol Reprod.* 13, 68, 1975.
- 27) PORTER, D. G. & H. R. BEHRMAN: *Nature* 232, 627, 1971.
- 28) HILLIARD, J. & L. W. M. EATON Jr.: *Endocrinology* 89, 522, 1971.
- 29) SUZUKI, H., T. TAKEDA & Y. TSUTSUMI: *Jap. J. Zootech. Sci.* 49, 614, 1978.
- 30) TYLER, K. R.: *J. Reprod. Fertil.* 49, 341, 1977.
- 31) ADAMS, C. E.: In *Ciba Foundation Symposium; Preimplantation Stages of Pregnancy* (WOLSTENHOLME, G. E. W. & M. O'CONNOR eds.) p. 345, J. & A. Churchill, London, 1965.

- 32) ADAMS, C. E.: *Adv. Biosci.* 4, 149, 1969.
 33) HODGSON, B. J. & C. J. PAUERSTEIN: *Biol. Re-*

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Prostaglandin $F_{2\alpha}$ 投与家兎腔からの採卵

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不妊性交配後 90 時間目以降の家兎腔から未受精卵子が回収され²¹⁾, estrogen^{7,8)} 及び $PGF_{2\alpha}$ 処理家兎¹⁰⁾ の腔から得られた卵子の一部が生存性を有することが知られた。 $PGF_{2\alpha}$ 投与が家兎卵子の移動を促進することはよく知られているが¹²⁻²⁰⁾, 前報²⁰⁾で交配後 24 時間目に $PGF_{2\alpha}$ を生体重 1 kg あたり 2 mg または 5 mg 投与した時の腔からの採卵率は投与後 75 時間目までにそれぞれ 48.4%, 54.8% に達したが, 交配後 72 時間目以後の処理では 2 mg/kg の場合全く卵子は採取されず, 5 mg/kg 投与で少数の卵子が採取されたにすぎなかった。本研究では交配後 20 時間目から 28 時間目の家兎に $PGF_{2\alpha}$ を 1 回投与し, その後の腔からの採卵率と着床率を検討するとともに, 交配後 72 時間目から 108 時間目の家兎について 3 回の反復投与を行い, 腔からの採卵率の改善を試みた。実験 1 では 36 羽の雌家兎を投与時間により 9 群に分け, 交配後 20 時間目から 28 時間目にかけて 5 mg/kg の $PGF_{2\alpha}$ を 1 回注射した (表 1)。実験 2 では 32 羽の家兎を投与時間と投与量により 8 群に分け, 交配後 72 時間目から 108 時間目にかけて投与を開始し, その後 3 時間ごとに 2 回反復投与した (図 2, 表 2)。

実験 1 では交配後 22 時間目に 5 mg/kg の $PGF_{2\alpha}$ を投与した群が最も採卵数が多く, 82.7% の採卵率が得られた。また, 21 時間目での投与では 72.0%, 27 時間目の投与でも 70.4% と高い採卵率が示された (表 1)。 $PGF_{2\alpha}$ 投与後 3 時間以内の卵子採取率をみると, 採取卵子のうち 22~70%がこの時間帯に回収されている (図 1)。一方, これらのグループにおける着床率はいずれも低く, 最高 23.2%, 最低 1.8%であった。

実験 2 では 2 mg/kg または 5 mg/kg を反復投与したが, 腔からの採卵率は低く, 交配後 96, 99, 102 時間目に各 5 mg/kg を投与した家兎群で 28.1% の採卵率を得たにとどまった (表 2)。その反面, 着床率は交配後 96, 99, 102 時間目に 5 mg/kg を投与したグループで 21.9%, また交配後 108, 111, 114 時間目に 5 mg/kg を投与したグループが 5.0% と低かったほかは 50% 以上の着床率を示した。

以上の結果から, 交配後 24 時間日前後での $PGF_{2\alpha}$ 投与は腔からの卵子採取にきわめて有効であったが, 卵子が子宮内に進入した後での $PGF_{2\alpha}$ 投与では, 総投与量を増加しても腔からの採卵効果は少ないことが確認された。