

## Resumption of menstruation and fertility after cesarian in *Macaca fascicularis*.

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**Summary.** Cesarian is performed on 30 *Macaca fascicularis* females between day 37 and 78 of pregnancy. After cesarian, menstruation reappears within 22-53 days whatever the time of year (see fig. 1). Cycles become regular immediately after resumption of menstruation irrespective of the time elapsed before return ( $r = 0.32$ ) or age of fetus (see fig. 2). Ovulation occurs before resumption of menstruation and females are immediately fertile (see table).

These results closely duplicate those found in woman after abortion.

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### Introduction.

The postpartum in mammals is characterized by a more or less long period of ovarian inactivity, which is longer if the female suckles (Thibault and Levasseur, 1974). Within one month after birth without suckling, the ewe returns to estrus with ovulation (Mauleon and Dauzier, 1965) ; in the cow this period lasts 1 to 3 months and in the sow 2 weeks (Hafez and Jainudeen, 1974). In woman after abortion or birth without lactation, menstruation resumes within 20 to 50 days (Vorherr, 1973).

In this report we study the time elapsed before resumption of ovarian activity and fertility in the crab-eating macaque, *Macaca fascicularis*, using cesarian to interrupt pregnancy at different stages.

### Material and methods.

Thirty females imported from southeast Asia were used in this study. The conditions in which they are raised have been described (Dang, 1977). Cesarian was done aseptically between day 37 and 78 of pregnancy by median incision of the uterus. The initial anesthesia (Ketamine, Parkes-Davis Laboratory), given by intramuscular injection at a dose of 10 mg/kg, was maintained with Pentothal administered by intravenous pathway (about 0.1 g/animal).

The study consisted of 2 experiments. In the first, the females were not put with the males before resumption of menstruation ; the second group was mated between day 13 and 22, counting from the day of cesarian. From day 22 after cesarian, the animals were examined for menstruation 6 days per week by vaginal smear with a cotton swab.

In order to exactly determine the time of fertilization, females were put with the males for 24-48 hours from day 12 to day 14 of the cycle, counting from the first day of menstruation. New pregnancies were determined by uterine palpation through the rectum at day 28 postcoitum and by the presence of characteristic post-implantation menstruation. Several births confirmed the accuracy of the diagnosis.

## Results and discussion.

### *Resumption of menstruation.*

In the first experiment, menstruation reappeared rapidly no matter in what season cesarian was done, i.e. in a time lapse of 22 to 53 days (mean =  $38.0 \pm 2.6$  days). Statistical analysis shows that the period between the day of cesarian and day the menstruation resumes is slightly longer than the menstrual cycle of this primate which is  $34.5 \pm 1.3$  days (Dang, 1977).

In the second experiment where females were mated from day 13 to 22 after the day of cesarian, the mean time lapse before resumption of menstruation in non-pregnant females ( $45.2 \pm 2.8$  days) is longer than in the first experiment where subjects were not mated (see fig. 1). This difference may be because there would have been shorter time lapse in fertilized females (31-39 days), if they had not been mated.

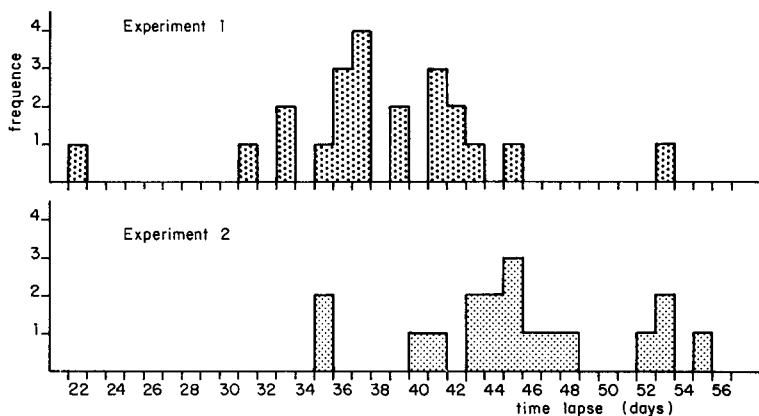


FIG. 1. — Histograms showing time lapse between cesarian and resumption of menstruation.

The length of this menstruation (3-6 days) corresponds to that of the normal cycle (Dang, 1974).

Thirteen females underwent 2 or 3 successive cesarians at different times during

pregnancy and time elapsed before resumption of menstruation was the same. There is no correlation ( $r = 0.16$ ) between age of fetus taken and time lapse before return to menstruation during the period under consideration (37-78 days) (see fig. 2).

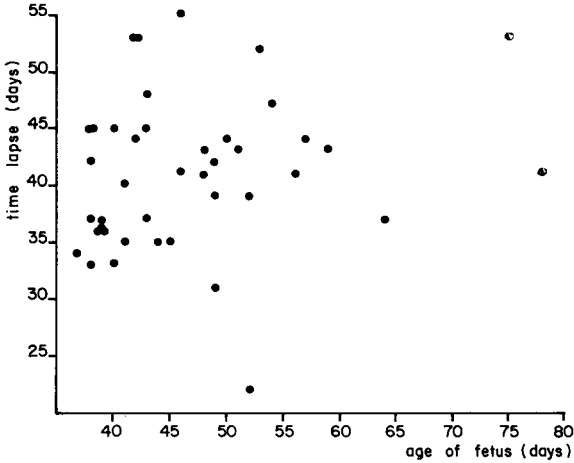


FIG. 2. — Absence of correlation between age of fetus taken and time elapsed before menstruation resumes.

When mating was not followed by new pregnancy, the length of the two following cycles ( $32.6 \pm 2.8$  days ;  $35.5 \pm 4.8$  days) was the same as in the normal cycle. Moreover, the time elapsed before return to menstruation does not affect the length of the cycle coming after ( $r = 0.32$ ).

#### *Post-cesarian fertility.*

The table opposite shows that the female is fertile immediately after cesarian before menstruation reappears, at least when operated on at day 37 to 47 of pregnancy.

#### *Pregnancy.*

In these females, post-implantation menstruation appears after  $19.1 \pm 3.6$  days, counting from the 18th day of mating. This period is similar to that seen in the same females after fertilization during the normal cycle ( $18.5 \pm 4.3$  days ; see table).

The ovulation in these females thus seems to occur 18 to 22 days after cesarian. This first follicular phase after cesarian is thus 5-8 days longer than that of the normal menstrual cycle. This confirms the time lapse between the cesarian and first menstruation ( $38.0 \pm 2.6$  as against  $34.5 \pm 1.3$  days).

Conception rate in females fertilized before resumption of menstruation (8/26) is at least equal to that obtained during the two following menstrual cycles (6/30 and 4/20, respectively) during which females are mated only at days 13 and 14 of the cycle.

TABLE  
Fertility after cesarian

Age of fetus (days)	Days of mating after cesarian	Pregnancy	Time elapsed before post implantation menstruations (days)	
			after cesarian	during normal cycle (mating at day 13-14)
37	14-20	yes	18	17
38	13-18	no	—	—
38	14-20	yes	21	19
38	14-20	no	—	—
39	14-20	yes	13	15
40	14-22	yes	19	—
41	14-19	no	—	—
41	14-21	no	—	—
42	14-21	no	—	—
42	14-21	no	—	—
42	14-21	no	—	—
43	14-20	no	—	—
43	14-21	no	—	—
44	14-21	yes	25	26
45	13-22	yes	15	15
45	15-16	no	—	—
46	14-21	no	—	—
47	13-18	yes	17	—
47	17-20	yes	25	19
48	14-20	no	—	—
50	14-20	no	—	—
51	14-20	no	—	—
53	18-19	no	—	—
54	14-21	no	—	—
57	14-20	no	—	—
78	14-20	no	—	—
		8/26	19,1 ± 3,6	18,5 ± 4,3

In woman, the resumption of menstruation after abortion or birth, when there is no lactation, occurs within 20 to 50 days, and the length of the menstrual cycle after return is already normal. In about 60 p. 100 of cases, ovulation precedes resumption of menstruation (Vorherr, 1973). This is also true in the macaque.

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