

## DYNAMICS OF THE FOLLICULAR DEVELOPMENT DURING PRID TREATMENT AND QUALITY OF THE FOLLOWING SEXUAL CYCLE IN POSTPARTUM COWS

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### Abstract

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Ten postpartum cows (Bohemian Pied Cattle) were treated by progesterone intravaginal device (PRID) for 10 days. Four untreated cows served as the control group. Transrectal ultrasonographical examination and sampling of milk and peripheral blood for milk progesterone and plasma estradiol assay were performed at 3 and 4 alternating intervals from the day 510 post partum to the 2nd postpartum ovulation. Follicles persisted during PRID treatment. Dominant follicles slowly grew and ovulated on the day  $3 \pm 0.63$  after progesterone treatment in cows with follicular dominance at the term of PRID insertion and they ovulated on the day  $5.3 \pm 1.26$  in cows without follicular dominance before PRID. Concentration of the plasma estradiol ( $42.9 \pm 20.65$  pg/ml) varied and concentration of the milk progesterone ( $0.8 \pm 1.18$  ng/ml) after the initial increase decreased during PRID treatment. Two and three follicular waves occurred before the 1st postpartum ovulation and during the 1st postpartum sexual cycle in the control cows. Concentration of plasma estradiol increased in relation with growth of the dominant follicles and the particular peaks gradually increased from parturition to the 2nd ovulation. Low concentration of the milk progesterone temporarily increased during the 1st postpartum sexual cycle. We found the term of the 1st postpartum ovulation, the length of the 1st postpartum sexual cycle and the number of follicular waves during the sexual cycle in PRID treated cows and untreated cows  $29.3 \pm 3.89$  :  $23.8 \pm 5.19$  day post partum,  $19.8 \pm 2.44$  :  $19.3 \pm 1.71$  days and  $2.3 \pm 0.48$  :  $2.5 \pm 0.58$  respectively.

*Dominant follicle, follicular wave, postpartum ovulation, postpartum sexual cycle, plasma estradiol, milk progesterone*

Progestagen treatment for several days (5-20 days) is one of the most successful methods of the estrus induction during anestrus period or the estrus synchronization during sexual cycle in animals. The progestagen treatment induces estrus with higher levels of the plasma estradiol and more expressive LH peak compared to the 1st spontaneous estrus and longer the 1st sexual cycle with higher levels of the milk or plasma progesterone and lower levels of 13,14 dihydro-15-ketoprostaglandin F<sub>2</sub>alpha (PGFM) compared to the 1st spontaneous sexual cycle in postpartum cows (Troxeľ and Kesler 1984; Rutter et al. 1985; Garcia-Winder et al. 1987; Smith et al. 1987; Mee et al. 1991). Our previous work (Doležel et al. 1993b) showed slow growth of the dominant ovarian follicles and stagnation of the subordinate follicles during 10 days progesterone intravaginal device application in early postpartum cows. The dominant follicles ovulated on the day 3 and 4 after progesterone treatment in cows with morphological follicular dominance at the term of progesterone intravaginal device insertion. Ovulation occurred later in cows without morphological follicular dominance before progesterone treatment.

The purpose of the present experiment is to confirm our preliminary results and evaluation of quality of the follicular population using plasma estradiol assay.

### Materials and Methods

Fifteen postpartum cows (Bohemian Pied Cattle) were used in the experiment. The milking cows were housed on a maize silage/ grass hay/ concentrates diet. Ten cows were treated by progesterone intravaginal devices (PRID-CEVA, France) containing a total of 1.55 g progesterone and 10 mg oestradiol benzoate from day 15-20 to day 25-30 post partum. Five untreated cows represented the control group. One of the control cows was excluded before the end of the experiment for the reason of ovarian cysts.

Transrectal ultrasonographical examination (linear 5 MHz probe and scanner V 500, Aloca; video copy processor P66E, Mitsubishi) were performed at 3 and 4 day alternating intervals from day 5-10 post partum to the 2nd postpartum ovulation. Ovarian structures (follicles > 3 mm, corpora lutea) were individually identified by reference to their position and diameter in sequential image. The day after estrus was determined as the term of ovulation. If estrus was not observed the time between occurrence and disappearance of the largest follicle followed by formation of a CL was determined as the term of ovulation. The samples of milk for progesterone assay were taken in the same intervals. Blood samples for plasma estradiol assay were taken from v.jugularis to glass tubes with chelaton in the intervals of clinical examination to the 1st postpartum estrus in progesterone treated cows and to the 2nd ovulation in untreated cows. The blood samples were centrifuged and plasma and milk were frozen and stored at -20 °C until assayed. Milk progesterone was assayed by RIA (Stupnický 1975) and plasma estradiol was assayed by method described by Pichová et al.(1981) using antigen acquired by immunisation with progesterone-17-CMS-BSA.

Student's t-test was used for statistical evaluation.

### Results

None of the experimental cows was bearing corpus luteum (CL) during PRID treatment. Dominant follicles slowly grew during progesterone (pg) treatment and they ovulated on the day  $3.0 \pm 0.63$  (2-4) after PRID removal in cows with morphological follicular dominance before PRID insertion (n=6). Dominant follicle that occurred during pg treatment ovulated on the day  $5.3 \pm 1.26$  (5-7) after PRID removal in cows without morphological follicular dominance before PRID insertion (n=4). Number and size of the subordinate follicles

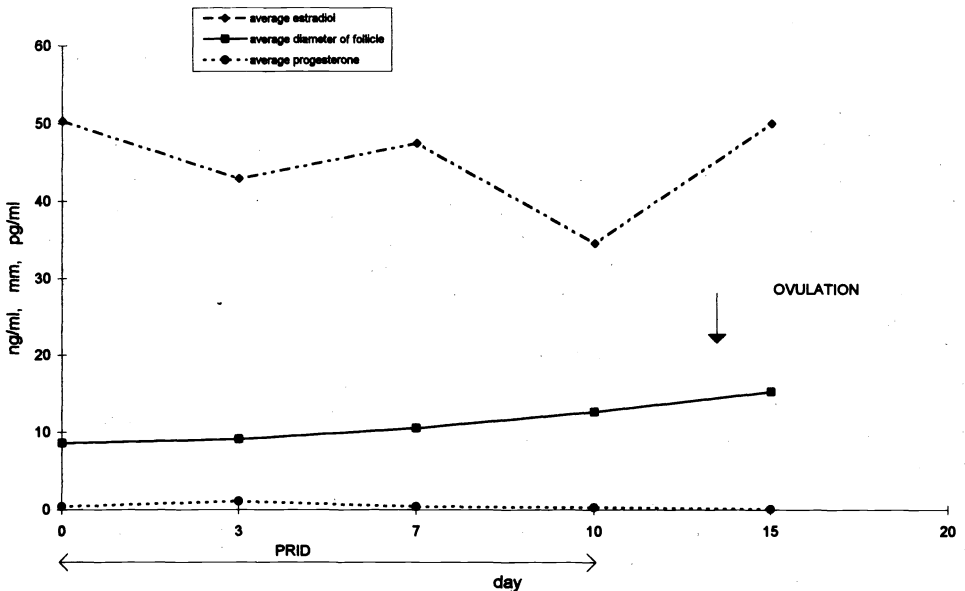


Fig. 1. Size of dominant follicles and concentrations of plasma estradiol and milk progesterone during PRID in cows.

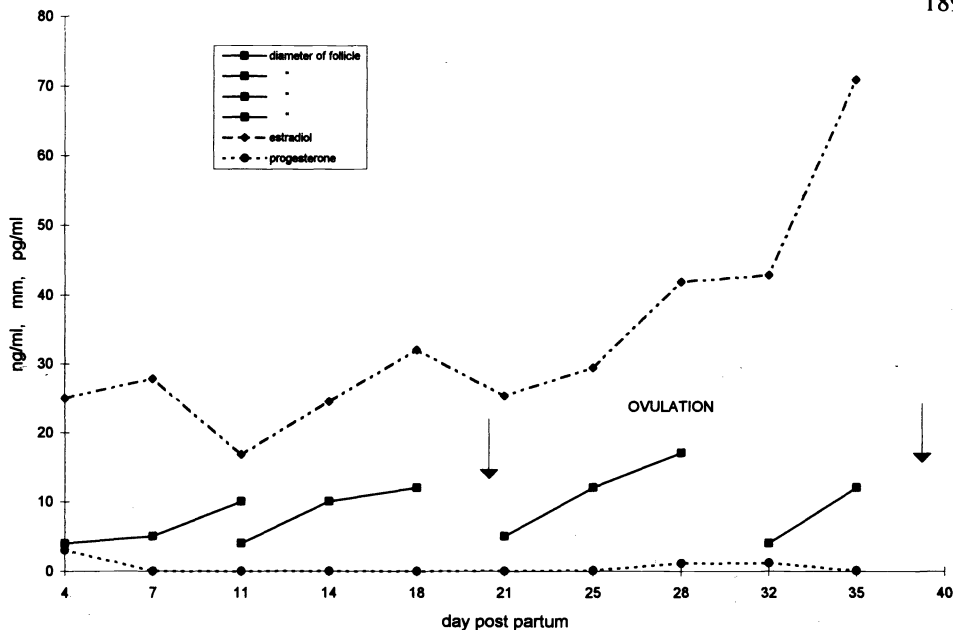


Fig. 2. Size of dominant follicles and concentrations of plasma estradiol and milk progesterone in control cow 1.

stagnated. Concentration of the plasma estradiol ( $42.9 \pm 20.65$  pg/ml) varied during pg treatment and concentration of the milk progesterone ( $0.8 \pm 1.18$  ng/ml) after the initial increase decreased (Fig. 1).

### Discussion

Our results confirm the knowledge about the persistence of dominant follicles and inhibition of ovulation during exogenous progesterone (pg) administration (Robertson et al. 1989; Sirois and Fortune 1990; Doležal et al. 1993b). Persistence of the dominant follicle and stagnation of the subordinate follicles is evidence of the morphological as well as functional follicular dominance (Ireland and Roche 1987; Fortune 1993). Precondition of the exogenous progesterone effect is the absence of endogenous progesterone since cyclicity of the follicular waves continues in the presence of corpus luteum (Taylor et al. 1993). Duchens et al. (1994) describe dependence of the follicular development on the dose of exogenous progesterone. Likewise Lucy et al. (1990) state negative effect of the corpus luteum on PRID induction or synchronization of estrus.

Table 1

Term of the 1st postpartum ovulation (day pp) and length of the 1st sexual cycle (days) with the number of the follicular waves in treated (PRID) and untreated cows

	PRID	Control
1st ovulation	$29.3 \pm 3.89$	$23.8 \pm 5.19$ a
1st sexual cycle	$19.8 \pm 2.44$	$19.3 \pm 1.71$
follicular waves	$2.3 \pm 0.48$	$2.5 \pm 0.58$

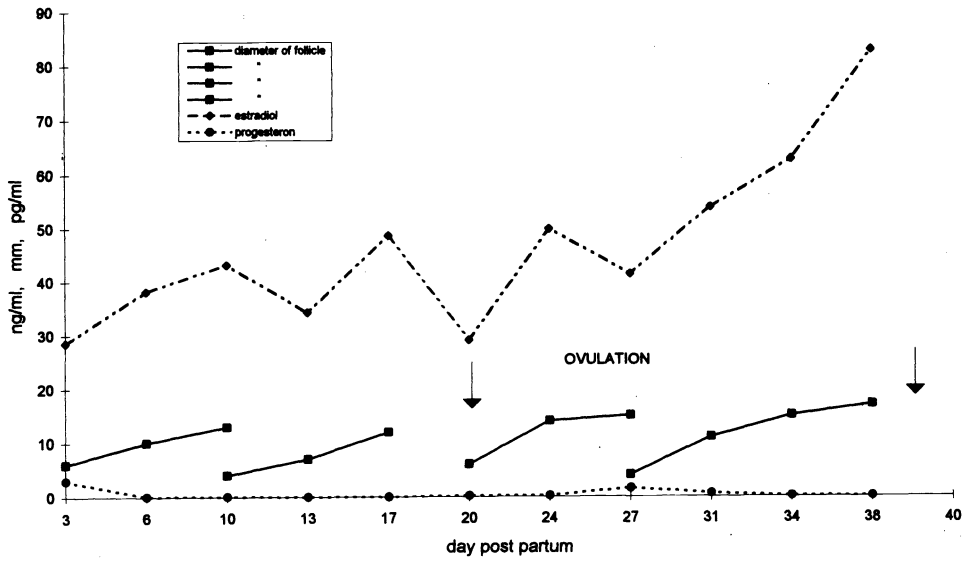


Fig. 3. Size of dominant follicles and concentrations of plasma estradiol and milk progesterone in control cow 2.

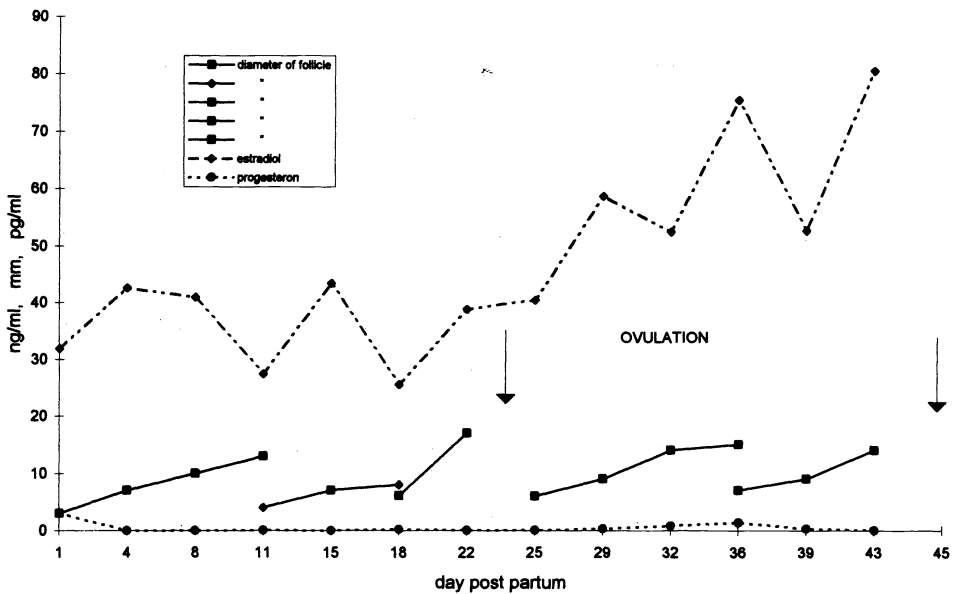


Fig. 4. Size of dominant follicles and concentrations of plasma estradiol and milk progesterone in control cow 3.

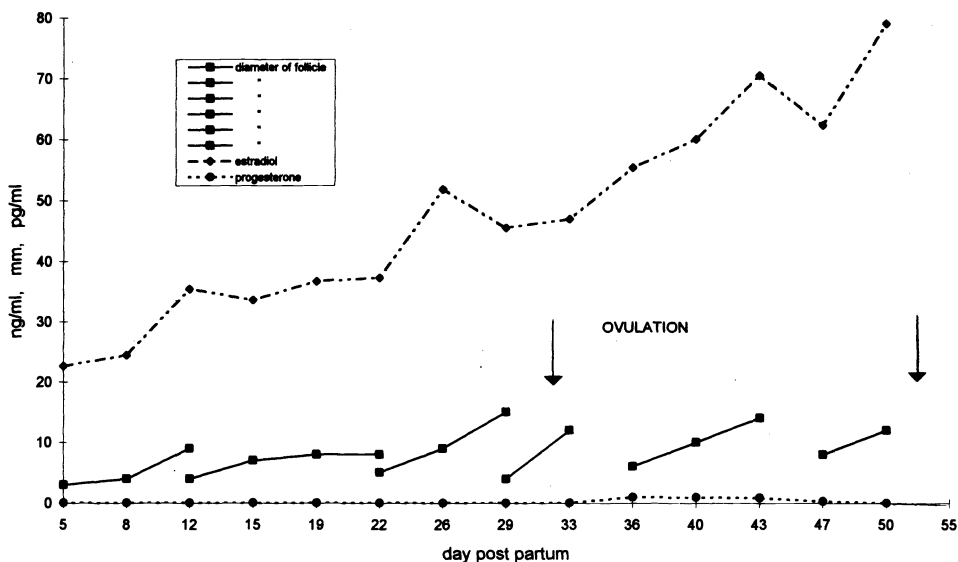


Fig. 5. Size of dominant follicles and concentrations of plasma estradiol and milk progesterone in control cow 4.

Average concentration of the plasma estradiol decreased and varied during pg treatment in our experiment. This condition may be due to its relation to stagnation of the follicular development. Garcia-Winder et al. (1987) and Mee et al. (1991) state higher secretion of estradiol in the preovulatory follicles in cows after pg treatment compared to untreated cows. Likewise we found an increase of plasma estradiol and growth of the dominant follicle after removal of intravaginal progesterone device. Nevertheless levels of plasma estradiol during and just after pg treatment were comparable with levels of estradiol before the 1st spontaneous postpartum ovulation but they were lower in comparison with the 1st spontaneous postpartum sexual cycle. White et al. (1985) and Smith (1986) state the relationship between the quality of the preovulatory follicular development and the quality of the following corpus luteum.

In spite of the average concentration of milk progesterone during pg treatment were lower than it is described by Fortune (1993) and Macmillan and Peterson (1993) they were significantly higher compared to the previous values in the same cows and the values in control cows during the same postpartum period.

The average length of the sexual cycle with the number of follicular waves after pg treatment in our experiment almost reach the characteristic values for normal sexual cycle in cows. However there were some differences between cows with and without follicular dominance at the term of PRID insertion. The former had a longer sexual cycle with a higher number of follicular waves ( $21.2 \pm 0.41$  days,  $2.5 \pm 0.55$  waves) compared to the latter ( $17.8 \pm 2.87$  days,  $2.0 \pm 0.00$  waves). Even when the length of the 1st spontaneous postpartum sexual cycle is influenced by the term of the previous ovulation it is generally shorter than following sexual cycles (Morrow et al. 1966; Edgerton and Hafs 1973; Schams

et al. 1978; D u b y et al. 1985; R u t t e r and R a n d e l 1985). In our experiment the 1st spontaneous postpartum sexual cycle in control cows (except one cow) was comparable to the sexual cycle after pg treatment. The term of the 1st spontaneous ovulation was probably the cause of the similarity of the 1st sexual cycle in control cows to the sexual cycle after PRID treatment as well as to the characteristic values for the later sexual cycles in cows. In the previous work (D o l e ž e l et al. 1993a) we observed a shorter 1st spontaneous sexual cycle with a lower number of the follicular waves after the ovulation which occurred before day 20 post partum as compared to the cows that ovulated later.

### **Dynamika folikulárního vývoje během ošetření PRID a kvalita následujícího pohlavního cyklu u krav v poporodním období**

Deset krav plemene Český strakatý skot v poporodním období bylo ošetřeno intravaginálními progesteronovými tělísky (PRID) po dobu 10 dnů. Čtyři neošetřené krávy tvořily kontrolní skupinu. Ve 3 a 4 denních intervalech od 5.-10. dne po porodu do 2. poporodní ovulace bylo u krav prováděno transrektální ultrazvukové vyšetření a odběry mléka i periferní krve ke stanovení progesteronu v mléce a estradiolu v krevní plazmě. Během ošetření PRID ovariální folikuly perzistovaly. U krav s folikulární dominancí patrnou v termínu zavedení PRID dominantní folikuly pomalu rostly a ovulovaly v den  $3,0 \pm 0,63$  po ošetření progesteronem. U krav bez folikulární dominance před ošetřením PRID folikuly ovulovaly v den  $5,3 \pm 1,26$  po ošetření. Během ošetření PRID koncentrace plazmatického estradiolu ( $42,9 \pm 20,65$  pg/ml) kolísala a koncentrace progesteronu v mléce ( $0,8 \pm 1,18$  ng/ml) po počátečním zvýšení se snižovala. U kontrolních krav proběhly 2 a 3 folikulární vlny před 1. poporodní ovulací i během 1. poporodního pohlavního cyklu. Koncentrace plazmatického estradiolu u těchto krav se zvyšovala současně s růstem dominantních folikulů a jednotlivé maximální hodnoty se postupně zvyšovaly od porodu do 2. poporodní ovulace. Nízká koncentrace progesteronu v mléce dočasně se zvýšila během 1. poporodního pohlavního cyklu. U ošetřených krav v porovnání s neošetřenými jsme zjistili hodnoty termínu 1. poporodní ovulace (den po porodu), délky 1. pohlavního cyklu (dny) a počtu folikulárních vln během tohoto pohlavního cyklu  $29,3 \pm 3,89$ ;  $23,8 \pm 5,19$ ,  $19,8 \pm 2,44$ ;  $19,3 \pm 1,71$  a  $2,3 \pm 0,48$ ;  $2,5 \pm 0,58$ .

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