

Early Return of Reproductive Function in Postpartum Dairy Cows by Intrauterine Infusion of Iodine(PVP-I)

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Summary

The relation between the effect on postpartal intrauterine infusion of polyvinyl pyrrolidone-iodine (PVP-I) on the early return of reproductive function and follicular development was investigated in this study, we estimated the ovarian changes and the changes in milk progesterone, serum progesterone and serum inhibin levels. A positive correlation was found between the progesterone concentration in milk and that in serum. A negative correlation was found between the blood inhibin concentration and the blood and the milk progesterone concentrations. Thus, the progesterone and the inhibin levels were reflected the ovarian changes. Infusion of PVP-I into the uterine cavity at Day 10 after parturition led to the early return of reproductive function, namely, within 30 postpartal days, in 6 of the 8 cows examined. Luteinization began following intrauterine infusion of PVP-I. This was followed by the elevation of blood progesterone level. Then, the follicle tended to develop and discharge an ovum, after the serum inhibin level was decreased. The number of days required for impregnation after delivery was 51.4 ± 9.4 in the 8 cows treated by PVP-I infusion. The interval from delivery to impregnation in these cows was significantly shortened compared to 90.0 ± 32.7 days in 60 untreated dairy cows reared under the same condition. These results demonstrate that infusion of PVP-I contributed to repair of the uterus, luteinization and early return of reproductive function in postpartum dairy cows.

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Key words : cattle, corpus luteum, inhibin, postpartum, PVP-I.

In our previous study (11), postpartum dairy cows were treated by intrauterine infused of a commercial polyvinyl pyrrolidone-I (PVP-I) preparation to investigate the ovarian changes and the changes in peripheral blood progesterone level following the treatment. Infused of PVP-I within 30 days after parturition was found effective for the

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early return of reproductive function. Infused of PVP-I within 10 days after parturition induced remarkable luteinization, increased the serum progesterone level and hastened the onset of estrus and ovulation. In our previous (10) measurement of inhibin concentration in follicle, the relation between follicular size and dominant follicle was suggested.

In this study, as a clinical application, the return of estrus after intrauterine infused of PVP-I was examined by milk test and from the ovarian changes and the changes in serum progesterone and inhibin to determine the relation between follicular development and these hormones.

Materials and Methods

Eight multiparous Holstein cows was used as experimental and 60 untreated cows as control and both groups were reared at a farm in the neighborhood of our University. In experimental group, at Day 10 after parturition, 50 ml of PVP-I (Fujita Seiyaku K.K.) were infused into the uterine cavity using an intrauterine infusion syringe described in our previous paper (10). Milk and blood were collected on the day of infusion and at intervals of 5 days until the return of estrus. The ovarian changes were observed by rectal examination. Cow-side milk test (Ovucheck) was performed on the milk samples collected. Milk was frozen and stored at -20°C . After the defattening by centrifugation,

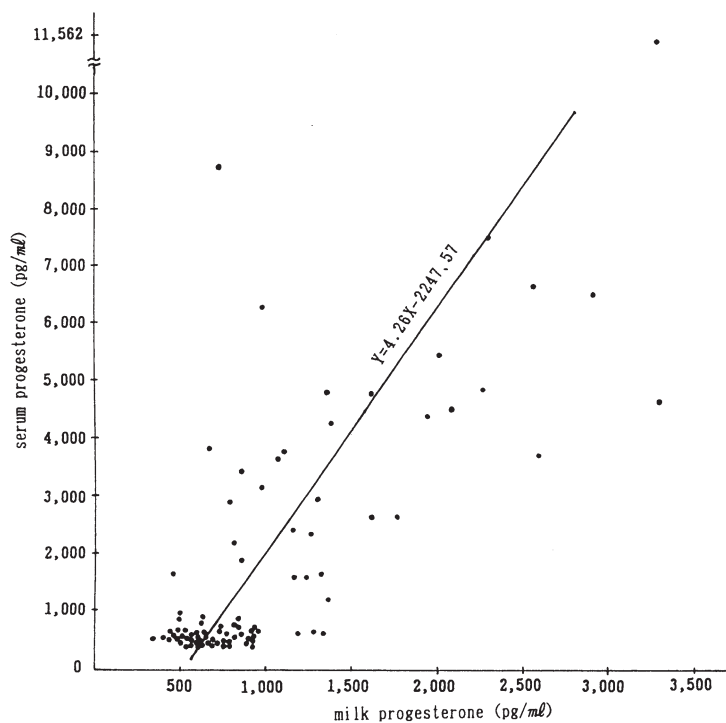


Fig. 1 Relationship between serum and serum progesterone.

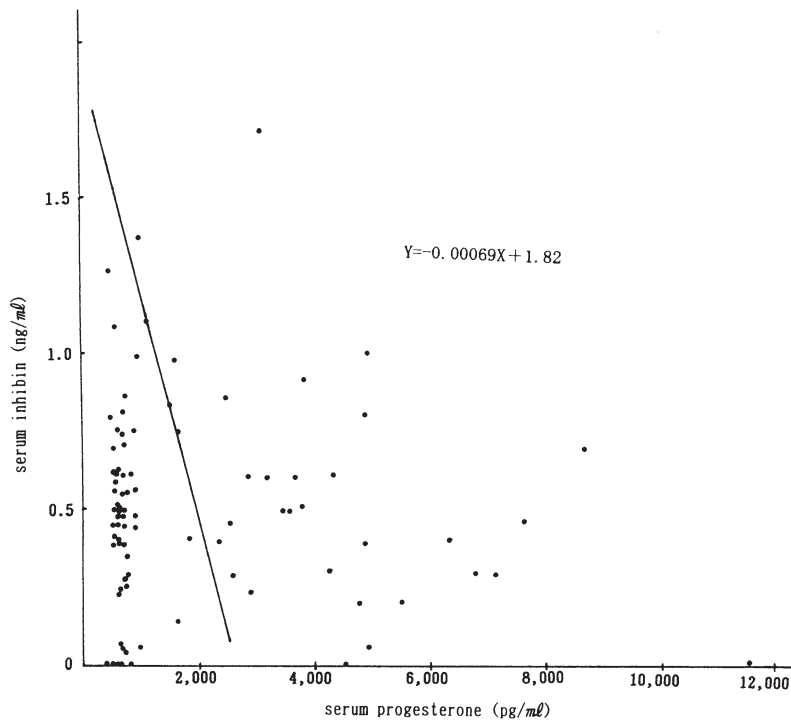


Fig. 2 Relationship between serum and serum progesterone.

the concentration of progesterone in milk was estimated from the chromatic response to the test (9). Serum progesterone and inhibin were quantified by RIA as previously described (10). The control group was untreated intact cows, serum and milk progesterone and serum inhibin levels were also measured by same procedure to comparing with the experimental group.

Results

In treated cows, the relation between the progesterone concentration in milk and blood is shown in Fig.1. A positive correlation ($Y=4.26X-2247.57$) was found between the milk progesterone and serum progesterone levels. A negative correlation ($Y=-0.00069+1.82$) was found between blood inhibin and serum progesterone (Fig.2).

Figures 3 and 4 show the ovarian changes and the changes in serum inhibin, serum progesterone and milk progesterone in 2 of the cows which, after intrauterine infusion of PVP-I at Day 10 after parturition, developed estrus and ovulation within 60 postpartal days. In Cows A and B, the development of follicle and the formation of corpus luteum began to appear from considerably early after parturition. The normal appearance of the uterine horn and uterine body were found to restore approximately 35 days after parturition. The progesterone levels in serum and milk precisely reflected the activity of

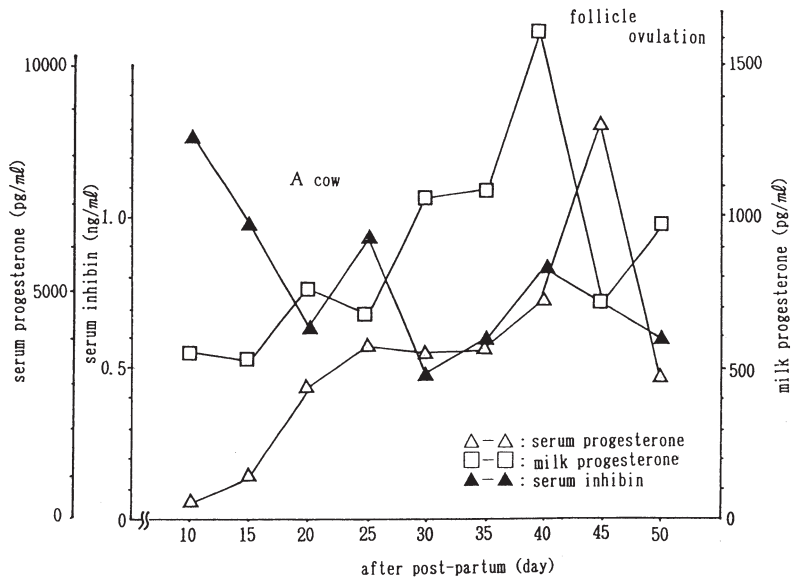


Fig. 3 Changes of serum and milk progesterone and serum inhibin levels in A cow after infusion of iodine solution into the uterus at 10th day of post-partm.

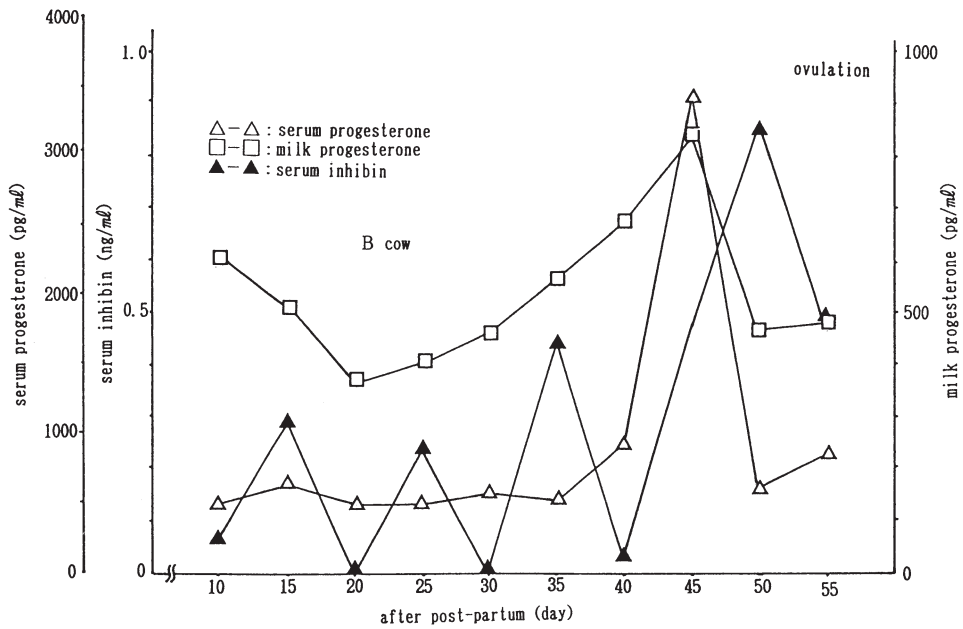


Fig. 4 Changes of serum and milk progesterone and serum inhibin levels in B cow after infusion of iodine solution into the uterus at 10th day of post-partm.

Table 1. Effect of PVP-I infusion on estrus with ovulation and conception (M±S.D.)

Treatment	n	First estrus(day)	First conception(day)
No treatment	60	—	90.0±32.7
PVP-I	8	40.0±3.5(6/8)	54.1±9.4*

* P<0.05 ; vs No-treatment

the corpus luteum. Blood inhibin was found to decrease with the development of follicle and to increase with the development of corpus luteum.

In untreated control cows, the follicular development and the formation of corpus luteum was began to appear from considerably after parturition. In this group, some cows developed the follicle, but ovulation did not occur. Subsequently, before ovulation serum progesterone was not arise in high levels compared to that of treated A and B cows.

Intrauterine infusion of iodine at Day 10 after parturition was effective for the early return of reproductive function in approximately 40 postpartal days in 6 of the 8 cows examined. The interval between delivery and first artificial insemination could be significantly shortened in the 8 cows (54.1 ±9.4 days) treated by PVP-I infusion, compared to that in 60 untreated cows (90.0±32.7 days, Table 1).

Discussion

A positive correlation was found between the progesterone level in milk and blood. This agreed with the result previously obtained (9). A negative correlation was found between the inhibin concentration in blood and the progesterone concentration in serum. Inhibin reaches the pituitary gland via blood and inhibits the secretion of FSH or LH. Basically, inhibin produced by follicular granulocytes is inversely related to FSH at any time during the luteal stage (6). Therefore, there is a positive correlation between the follicular size up to 20 mm in diameter and inhibin concentration. Inhibin concentration is variant in correlation to follicular and luteal development and regression. Inhibin concentration is, therefore, decreased during the follicular phase and is increased during the luteal phase.

The serum progesterone, milk progesterone and inhibin levels following postpartal intrauterine injection of PVP-I were found to reflect the ovarian activity cows A and B. From this pattern of hormone behavior, luteinization was apparent, because the blood progesterone, milk progesterone and serum inhibin levels were elevated following postpartal intrauterine infusion of PVP-I. Since first ovulation did not occur at Day 10 after parturition, in all animals it was found to have developed corpus luteum without excep-

tion. On the other hand, the untreated cows (control) corpus luteum was existed and ovulation did not occur Day 50 after parturition.

Breuel et al. (2) reported that an estrus behavior was manifested in 87 % of the postpartum cows, an estrus sign appeared in 100 % and ovulation occurred in 97 % within 10 days after weaning. They examined the changes in FSH and LH before and after ovulation and the morphology of discharged ova, and found that estrus, ovulation and conception were more frequent in cows which had well-developed corpus luteum, namely, adequate luteal function, before ovulation. This seems to indicate that adequate development of corpus luteum is indispensable for the impregnation of postpartum cows. This is consistent with the finding of Breuel et al. (1) that postpartum cows received transfer of a fertilized ovum were not impregnated without administration of exogenous progesterone. It has been reported that ovular deformity and embryonic death were increased in rats, if the oviduct or uterus was exposed to progesterone for a long time before ovulation (3). Early embryonic death is increased, if the increased level of progesterone persists for a long time during the period of follicular development in postpartum estrus cows (2, 10, 19). These indicate that for the survival and development of ova, appropriate concentration of steroid is needed before, during and after estrus. Butcher (4) suggested that the rate of pregnancy was increased, if the corpus luteum existed for a short duration. So, it was presumed that luteinization by infusion of PVP-I at Day 10 after parturition exerts a profound influence on ovulation and conception.

In view of the above, the development of corpus luteum before the onset of estrus is considered to be an important key for the prevention of early embryonic death.

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PVP-I 注入による後分娩乳牛の 早期生殖機能の回復

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後分娩乳牛の子宮内に PVP-I を注入することによる, 後分娩の生殖機能早期回復促進効果と卵胞の発育との関係を検討するために, 牛乳および血清中のプロジェステロン, 血清中のインヒビンおよび卵巣所見を調べた。その結果, 牛乳中のプロジェステロン値と血清中のプロジェステロン値との間には正の相関が見られた。一方, 血清中のインヒビンは血中および牛乳中のプロジェステロンと負に相関し, いずれも卵巣の変化をよく反映していた。分娩後10日に PVP-I を子宮内に注射すると 8 頭のうち 6 頭が分娩後30日以内に生殖機能を回復した。即ち, PVP-I を子宮内に注入することにより黄体化が始まり, 血中のプロジェステロンが上昇し, 血清中のインヒビンが減少した後, 卵胞が発育, 排卵する傾向が見られた。これら PVP-I 注入群 8 頭の分娩後の受胎日の平均は 54.1 ± 9.4 日で, PVP-I 注入によって有意に分娩後の受胎日が短縮された。一方, 対照の乳牛には, 黄体・卵胞の発育がみられたが, 排卵はみられず, 60頭の分娩後の受胎日の平均は 90.0 ± 32.7 日であった。これらのことから, PVP-I 注入により分娩後の子宮修復ならびに黄体形成が促進され, 生殖機能が早期に回復することが判明した。