CASE REPORT

Ultrasonography and Progesterone Determination for Luteal Cysts in Conjunction with Persistent Corpus Luteum in Dairy Cow and Treatment by hCG with Prostaglandin $F_{2\alpha}$

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Abstract

Case description — A-5-years old Holstein Fresian dairy cow had the history of anestrus behavior and non-cycling for more than 4 months. The animal was examined by ultrasonography and serum progesterone concentration determination of reproductive organ.

Clinical findings — Ultrasonography pictures found right ovarian with spherical blackish anechogenic structure as 46.5x21.4 mm and inner hypoechogenic thick wall >3 mm and a grayish echogenic area as 26.5X16.5 mm on left side of ovary with visible line of demarcation between echogenic (gray) and hyperechogenic (bright gray) area for more than 10 days. The serum progesterone concentration was 6.5-8.1 ng/ml. The clinical diagnosis was ovarian luteal cysts in conjunction with persistent corpus luteum.

Treatment and Outcome — The cow was treated with human chorionic gonadotrophin (hCG) and followed with prostaglandin $F_{2\alpha}$ on 9 days later. Nine days after hCG treatment, the results were still found, the right ovarian luteal cyst, left corpus luteum and 2.7 ng/ml of serum progesterone concentration. Three days after the $PGF_{2\alpha}$ injection, the cow showed estrus behavior with growth follicle on right and regressed corpus luteum on left side of ovary. The serum progesterone concentration was 0.1 ng/ml.

Clinical Relevant — Prostaglandin $F_{2\alpha}$ for treatment of ovarian luteal cyst in conjunction with persistent corpus luteum in dairy cow was the best effective treatment protocols.

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Introduction

The ovarian cyst is one of the important causes of infertility in dairy cattle [1]. It is the cause of economic loss, due to decreased reproductive performance [2]. Dairy cows with ovarian cysts have been shown the significant increasing of calving to conception interval by 26 to 34 days [3]. Brown et al., 1986 [4] suggested that cystic ovarian results from ovulation failure due to insufficiency of LH receptors in the ovary, not a primary LH deficiency. Cook et al. (1991) [5] reported that the lack of preovulatory LH releasing from the failure of pituitary gland related in cystic ovary. The ovarian cysts are defined as the anovulatory follicle-like structures with diameter of more than 2.5 cm and persist on one or both ovaries for 10 days or more in the absence of a corpus luteum [1, 2, 6]. Hanzen et al. (2000) [7] found that the cyst-like structure in conjunction with presence of a corpus luteum on the ovary was infrequent. Kaehn (1991) [8] showed the ultrasound picture of ovarian follicular cyst and corpus luteum, laid side by side in the same ovary of cow.

Ovarian cyst can be classified as two types, are follicular and luteal cysts, the occurrence of follicular and luteal cyst range from 30-85% and 15-70% respectively [9]. Serum progesterone concentrations of cows with follicular cysts are typically less than 0.5 ng/ml, opposite to the cows with luteal cysts have more than 0.5 ng/ml [10]. Leslie and Bosu (1983) [11] reported the plasma progesterone concentrations of cows with luteal cysts range from 3.0 to 10.4 ng/ml while the mean has been 3.6 ng/ml, was reported by Ribadu et al. (1994) [12]. The persistent follicular cyst beyond 60 days can progress to become luteal cyst through the luteinization development [10].

Ultrasonography can be used to determinate the accuracy of differences in appearance of ovarian cyst between the follicular and luteal cyst. The follicular cyst have uniformly anechogenic structure > 2.5 cm in diameter with inner hypocehogenic thin wall < 3mm, whereas the luteal cyst with spherical anechogenic structure > 2.5 cm in diameter and inner hypoechogenic thick wall of luteinized tissue > 3 mm [13]. In the anechogenic cavity of luteal cyst some time shows additional echogenic strings [14]. The determination of corpus luteum (CL) with ultrasonography was used as a corrected diagnostic technique in addition to rectal palpation. A mature corpus luteum presents as a grayish echogenic area with visible line of demarcation between CL and ovarian parenchyma. The echogenicity of corpus luteum structure will increase during corpus luteum regression period (high pixel values; high brightness of image) [12, 14, 15].

Gonadotrophin releasing hormone (GnRH) analogue or human chorionic gonadotrophin (hCG) have been widely used to treat follicular cyst. They are equally effective responsibility

treatment, in other hand for treatment of luteal cyst can be used prostaglandin $F_{2\alpha}$ [1]. Peter (2004) [16] reported that $PGF_{2\alpha}$ causes regression of luteal tissue and occurring of estrus respond within 8 days after treatment. Treatment of persistence corpus luteum is usually used with $PGF_{2\alpha}$ administration, due to its most effective and shortest period to induce estrus respond [17].

The objective of this report determined the type of ovarian cyst such as luteal cyst, in conjunction with persistent corpus luteum in dairy cow by ultrasonography and serum progesterone concentration for choosing of optimal treatment protocols.

Case history

A 5 years old Holstein Fresian dairy cow was kept in experimental animal farm of Division of Animal Production Technology and Fisheries, Faculty of Agricultural Technology, King Mongkut's Institute of Technology Ladkrabang, with history of anestrus behavior and non-cycling for more than 4 months. It was examined by the veterinarians of Mahanakorn University of Technology. Physical examination was done for clinical investigation of cow, found normally temperature, heart rate, respiratory rate rumen contraction rate and good out-looking condition.

Animal housing and nutrition management

The cow with body condition score 3 (5-scales) [18] was housed indoor in individual stall barn with an open-air run. The animal was allowed to graze natural grass in field near the stall barn in the morning. It was given concentrated diets with not less than 16% protein each evening. Water and mineral lick were available ad libidum. A general management schedule of hoof trimming and deworming was followed every 6 months.

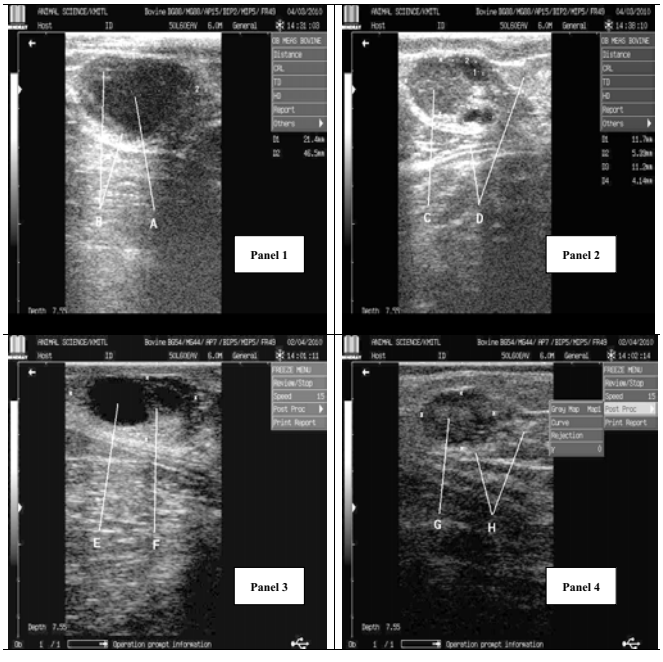
Clinical finding and diagnosis

After external physical examination, the animal was used the rectal palpation and ultrasonography (Ultrasound machine brand; Mindray; Version DP-6600 Vet) for examination of reproductive organ. Blood sample was collected 10 ml from jugular vein for complete blood count (CBC) test and serum progesterone concentration determination. Serum was pipetted and stored at -20°C until assayed using micro-luminescence-radioimmunoassay (Progesterone MLRIA of Abbott Laboratories's method, USA, 2007; sensitivity < 0.1 ng/ml from Bangkok RIA Diagnostic Corporation Limited, Bangkok). By rectal palpation examination showed the flaccid uterus, the fluctuation cyst structure as bigger than 30 mm in diameter on right hand side of

ovary, lacuna structure of corpus luteum as smaller than 3 cm on left hand side of ovary. With ultrasonography determination found that the right ovarian cyst with spherical blackish anechogenic structure as 46.5x21.4 mm in diameter and inner hypoechogenic thick wall > 3 mm (**Figure 1**, Panel 1) and a grayish echogenic area as 26.5X16.5 mm on left side of ovary with visible line of demarcation between echogenic (gray) and hyperechogenic (bright gray) area (**Figure 1**, Panel 2). The value of complete blood count (CBC) normally presented all of parameters. The serum progesterone concentration was 6.5 ng/ml.

Four weeks later, the cow was determined again by rectal palpation, ultrasonography and serum progesterone concentration. The clinical findings were similar with the first determination and the serum progesterone concentration was 8.1 ng/ml. The cow was still anestrus behavior. The results of twice determination were interpreted for clinical diagnosis, that the cow was right side ovarian luteal cysts in conjunction with persistent corpus luteum on left side of ovary.

Figure 1. Ultrasonography Determination Pictures



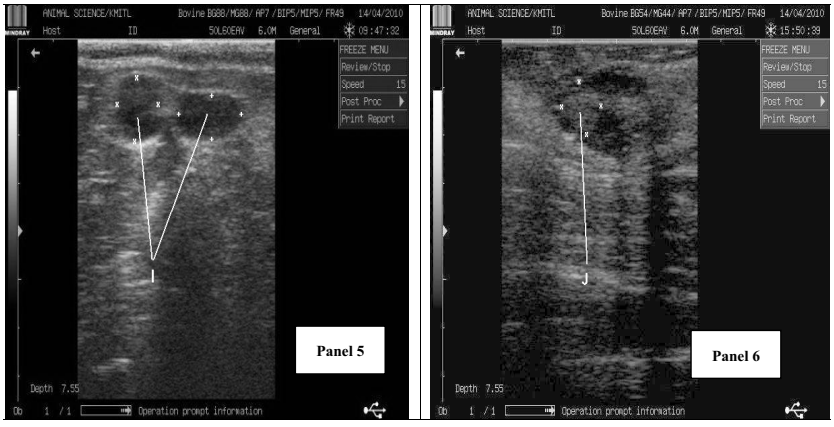
Panel 1: the right ovarian cyst with spherical blackish anechogenic structure as 46.5x21.4 mm in diameter (A) and inner hypoechogenic thick wall > 3 mm (B)

Panel 2: a grayish echogenic area as 26.5X16.5 mm corpus luteum on left side of ovary (C) with visible line of demarcation between echogenic (gray) and hyperechogenic (bright gray) area of ovary parenchyma (D)

Panel 3: the right ovarian luteal cyst with spherical anechogenic structure as 45.9x20.8 mm (E) and additional echogenic strings in the anechogenic cavity (F)

Panel 4: the grayish echogenic area as 26.1X16.9 mm of left corpus luteum (G) with hyperechogenic (bright gray) area of ovary parenchyma (H)

Figure 1. Ultrasonography Determination Pictures (Continued)



Panel 5: uniformly anechogenic structure of 2 growth follicle about 14.2X12.4 mm (left side) and 18.3X 9.7 mm (right side) on right hand side of ovary (I)

Panel 6: the bright grayish hyperechogenicity of corpus luteum regression structure 12.4X8.4 mm (J) on left side of ovary

Treatment and results

The cow was administrated intramuscular single dose with 3,000 IU human chorionic gonadotrophin (hCG) on day of second determination and followed intramuscular single dose of 500 μg Cloprostenol ($PGF_{2\alpha}$) on 9 days later which similar treatment protocol with Dinsmore et al. (1989) [19]. Nine days after hCG treatment in the cow were the results found, the right ovarian luteal cyst with spherical anechogenic structure as 45.9x20.8 and additional echogenic strings in the anechogenic cavity (**Figure 1**, Panel 3), the grayish echogenic area as 26.1X16.9 mm of left corpus luteum (**Figure 1**, Panel 4) and 2.7 ng/ml of serum progesterone concentration. Three days after the followed $PGF_{2\alpha}$ injection, the cow showed estrus behavior with uniformly anechogenic structure of mature 2 growth follicle about 14.2X12.4 mm and 18.3X9.7 mm on right hand side of ovary (**Figure 1**, Panel 5) and the bright grayish hyperechogenicity of corpus luteum regression structure as 12.4X8.4 mm on other side of ovary (**Figure 1**, Panel 6). The serum progesterone concentration was 0.1 ng/ml in this time.

Discussion

The cause of anestrus and non-cycling of this dairy cow is ovarian luteal cyst in conjunction with persistent corpus luteum, because with ultrasonography determination can find the structure of luteal cyst as spherical blackish anechogenic structure as 46.5x21.4 mm and inner hypoechogenic thick wall of luteal tissue > 3 mm on right hand side for more than 10 days, is similar to previous report of Farin et al. (1992) [13] and a grayish echogenic area as 26.5X16.5 mm of CL on left side of ovary with visible line of demarcation between echogenic of CL and hyperechogenic of ovary parenchyma area according to Ribadu et al. 1994 [12]; Pieterse, 1989 [14]. However the high level of serum progesterone concentration (6.5 ng/ml) of this cow is confirm to ovarian luteal cyst disease [11]. This cow with ovarian luteal cyst in conjunction with CL is rare case similar to report of Hanzen et al. (2000) [7], because the ovarian cysts are found frequently on one or both ovaries in the absence of a corpus luteum [1, 2, 6]. The clinical finding of this case is progressed from the persistent follicular cyst beyond 60 days to become luteal cyst through the luteinization development according to Carroll et al. (1990) [10], due to its non-treatment ovarian cyst longer than 4 months for waiting of spontaneous recovery. Thus it may be better to start treatment the ovarian cyst immediately rather than waiting for spontaneous recovery, due to its much shorter period in inducing estrus and can begin to replete breeding again. The $PGF_{2\alpha}$ causes regression of luteal tissue and the most effective treatment for ovarian luteal cyst and CL [16]. But the veterinarians chose to use human chorionic gonadotrophin (hCG) for treatment of luteal cyst in this cow due to examine its effective respect to treatment response and post-treatment fertility. The treatment result on day 9 was unsatisfied, the luteal cyst was still persisted with a little bit decreasing size. The cow showed infertility of anestrus behavior that it related to the higher than 0.5 ng/ml (2.7 ng/ml) of serum progesterone concentration [10]. It was proved that the hCG administrated for treatment ovarian luteal cyst of this case in 9 days, was not success, the luteal cyst was not recovery according to Nanda et al., (1988) [20]. The veterinarians chose synthetic analogue of $PGF_{2\alpha}$ (Cloprostenol) treatment on day 9 following after hCG treatment that it was similar with the protocol of Dinsmore et al. (1989) [19]. The treatment results presented the recovery ovarian luteal cyst, the CL regression, dominant follicles in 3 days. The estrus behavior of cow was re-established on day 3 after treatment of luteal cyst disease and persistant CL with $PGF_{2\alpha}$. The prostaglandin $F_{2\alpha}$ effectively regress luteal cyst and CL better than hCG, its cause lysis of luteal cyst and luteal tissue of CL within 3 days with resulting in normal estrus and fertility according to Dobson et al., (1977) [21].

Conclusion

In conclusion, the ovarian luteal cyst in conjunction with persistent corpus luteum could be very well differentiated from ovarian follicular cyst in the absence of a corpus luteum by using of ultrasonography and serum progesterone concentration determination and the choosing of prostaglandin $F_{2\alpha}$ for treatment of ovarian luteal cyst in conjunction with persistent corpus luteum in dairy cow was the optimal treatment protocols.

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