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Echography Characteristics of Abnormal Ovaries in Infertile Dairy Cows

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Abstract: The object of this study was to describe the echography characteristics of different abnormal ovaries and estimate their effect on dairy cow sterility. The ovaries of 74 infertile dairy cows were checked with transrectal real-time ultrasound (7.0 MHz) and echography characters of abnormal ovaries were described. Thereinto, ovarian abnormality occurred about 60% and the other 40% case hadn't obvious echogenic change. Hypoplasia showed a little area within parenchyma anecho or poor echo which could discriminate it with any other ovarian abnormality. Even though appeared a little echo area, atrophic ovary had much little high echo dot. Although, quiescent ovary was also very little, it had some small follicles which couldn't develop. Ultrasound image showed large liquid anecho area of large ovaries in cystic ovarian follicle and corpora lutea cases. Anecho area of cystic ovarian follicle had echo of cumulus oophorous and its wall smooth. Corpus luteum appeared much little poor echo dot in crude fluid-filled anecho area and some of them had anecho cavity. Ovaritis showed an enlarged echo area much hyper or strong echo spot distributed inside. The edge of ovary connected tightly with circumjacent tissues reflecting hyper-echo. Few little follicles appeared but no dominant follicle and luteum were scanned.

Key words: Dairy cow, echography, ovary, sterility, luteum, China

INTRODUCTION

Dairy cows should calve one time every year to maximize economic efficiency but their reproductive function had declined obviously in the past twenty years (Roche *et al*., 2000; Lucy, 2001). Resumption of dairy cow ovarian activity plays an important role in subsequent fertility in face to this goal (Darwash *et al*., 1997; Smith and Wallace, 1998). Although, most postpartum follicular development occurs normally in a wave-like manner in normal cycling cattle (Rajamahendran and Taylor, 1990; Savio *et al*., 1990), recent studies have revealed that postpartum anovulatory anestrus in dairy cows is due to the failure of a dominant follicle to ovulate (Roche *et al*., 2000). Cystic ovarian follicle, corpus luteum and luteal cyst, ovarian atrophy and ovarian hypoplasia were the most common ovarian dysfunctions (Lopez-Diaz and Bosu, 1992; Laporte *et al*., 1994; Opsomer *et al*., 1998).

Currently, diagnosis of ovarian pathologies in cattle most frequently occurs during routing postpartum rectal palpation conducted by a bovine practitioner but differentiation between follicular and luteal cysts via rectal palpation is difficult, even for experienced practitioners (Farin *et al*., 1992). By contrast, ultrasonic imaging is a highly accurate and rapid method of assessing ovarian structures (Griffin and Ginther, 1992). Under most circumstances because practical application of ultrasound for routine reproductive management on a dairy farm refers to a single signal conducted at a given point in time, the physiological status of a follicle (e.g., dominant, subordinate, growing, regressing) or corpus luteum cannot be determined during a single ultrasound examination and serial ultrasound examinations are needed (Fricke, 2002).

Moreover, little attention has been paid to the echography characteristics and their differentiation among ovarian atrophy, hypoplasia and ovaritis. This study aims to image and characterize the ultrasonography of cystic ovarian follicle, corpus luteum, cystic luteal, atrophic and hypoplasia ovaries and ovaritis in dairy cows with transrectal ultrasound scanning thrice every 10 days.

MATERIALS AND METHODS

Infertile cows: Dairy cattle without estrus or gestation more than three months postpartum were categorized as infertile dairy cows (Cartmill *et al*., 2001). About 74 infertile dairy cows (Holstein) fed at Yangtze Dairy Cow Farm (Wuhan, China) were collected from April, 2004-June, 2006.

Clinical signs of infertile cows were noted down and analyzed and ovaries palpation was often necessary. The infertile cows in this study appeared very different clinical signs according to their ovarian pathological changes.

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Ultrsonographic examination: Their ovaries were scanned thrice in the interval of 10 days with a real-time B-mode ultrasound equipped with 5.0 MHz (frequency conversed from 3.5-7.0 MHz) micro convex array intrarectal transducer (CHISON-600VET, Chison Medical Ultrasound Inc., Wuxi, Jiangsu, China). To get accurate image, practitioner should touch and let transducer some centimeters away from ovary.

Optimum images were selected from the memorizer. Ovary, follicle, corpus and lutea in ultrasound image were sized with electronic calipers (vertical and horizontal measures) and their echo characteristics were described and compare. Each abnormality ovarian group and their morbility were calculated.

RESULTS AND DISCUSSION

Diagnosis with ultrasound examination: Most of the 74 spontaneous cases appeared abnormal echographic structures of ovarian. Thereinto, ovarian hypoplasia occurred 21.6% (16/74), ovarian quiescence 18.9% (14/74), ovarian atrophy 5.4% (4/74), cystic ovarian follicle 10.8% (8/74), corpus luteum 5.4% (4/74) and ovaritis 1 case and no obvious echogenic change of ovary was observed in the other 28 cases (39.2%). Their clinical signs were nearly able to discriminate. All 8 cases of cystic follicles occurred at one ovary. Most cases without obvious echogenic structural change had uterus pathologic signs such as metritis and endometritis. Many ovarian echogenic changes occurred with clinical signs of uterus and appearing syndrome. Different clinical signs, respectively appeared according to their ovarian and uterus changes. Cow with ovarian hypoplasia never had estrus and inefficiently been treated with estrogens, small ovaries was found with transrectal palpation. These cows were fat and stout.

Family survey usually showed twins and especially paroecious twins. Good dairy practitioners known that these calve should be culled but in past decade, dairy industry developed so fast that delict made culled cows distribute into many farms. Although, delivered before cows with ovarian atrophy appeared anestrus and inefficiency treated with estrogens and small ovaries discovered with transrectal palpation at both sides. Their body condition was similar with that of cow with ovarian hypoplasia. Some of them with dystrophy or other diseases should have relative symptom and age was also a main factor.

Ovarian quiescence occurred in cows which showed the signs of anestrus. Although, appeared estrus with estrogens treatment sometime, animals failed to ovulation and gestation. The factors causing ovarian quiescence are complex, uterus diseases and endocrine disorder maybe the most important. Ovaries were felt as normal size with transrectal palpation but there wasn't large follicle. Cows with cystic ovarian follicle appeared normal or even continual estrus and insemination failed every time. Most of them had uterus inflammation and some of them had mastitis. Although, large follicle could be touch with transrectal palpation there wasn't ovum ovulated and these cystic follicles exist long. Many dairy cows with corpus luteum showed anestrus, half or both side ovaries enlarged and large ves protruded with transrectal palpation. These large ves existed >21 days and their shape, size and site didn't change. Ovaritis rarely reported in dairy cow. Although, one case was discovered, visible clinical symptom wasn't acquired beside sterility. Swelling ovary could be palpated transrectal.

Differences of ultrsonographic morphology among abnormal ovaries in dairy cows: Ultrasound changes were shown as Fig. 1-6. Inactive ovary mainly includes ovarian atrophy, ovarian hypoplasia and ovarian inactive. All pathologic echograms didn't change obviously in all thrice scanning. Differences between images in each abnormality group were analyzed below. Comparing hypoplasia with atrophic ovaries, the first showed a little area within parenchyma anecho or poor echo. With this character, ultrasound could discriminate any other ovarian abnormality.

Even though appeared a little echo area, atrophic ovary had much little high echo dot. Although, inactive ovary was also very little it had some small follicles which couldn't develop. Cystic ovaries mainly include cystic follicle and corpora lutea. Twelve cystic (white arrow). No follicle and luteum were shown ovaries cases were checked out and all of them were unilateral in

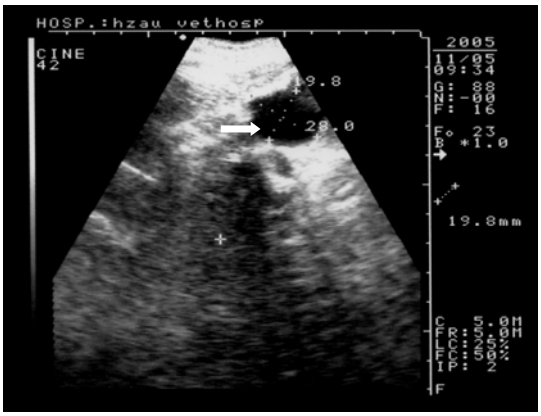

Fig. 1: Ultrasonography of ovarian hypoplasia. Left ovarian ultrasonography obtained with 7.0 MHz intrarectal transducer. Ovary diameter was 10.9 mm and it appeared as an ellipse poor echo area. No follicle and luteum were shown

Fig. 2: Ultrasonography of ovarian atrophy. Left ovarian ultrasonography obtained with 5.0 MHz intrarectal transducer. Ovarian size was 23.6×31.5 mm, no follicle and luteum appeared but ovarian fibrosis showed echogenic dots. No follicle and luteum were shown

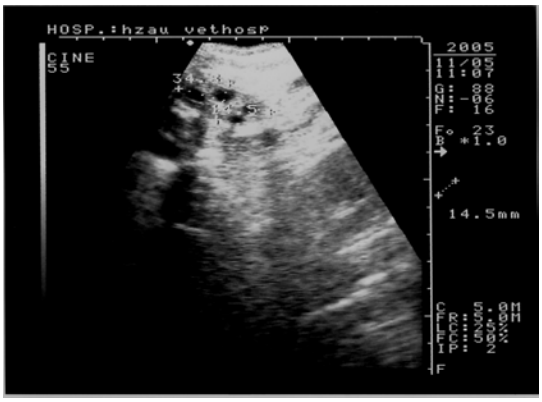

Fig. 3: Ultrasonography of inactive ovary. Right ovarian ultrasonography obtained with 5.0 MHz intrarectal transducer. Ovarian size was 14.5×34.3 mm. Some small follicles distributed but no one developed

this test. They were usually difficult to distinguish clinically beside estrus examination. Ultrasound image showed large liquid anecho area within large ovaries in both kinds of cases. Anecho area of cystic follicle had oocyte suspended by a specialized pedicle of granulose cells called cumulus oophorous and cystic wall was smooth. Corpus luteum filled with granules, appeared much little poor echo area and some of them had fluid-filled cavity. Both cystic follicle and corpus luteum hadn't ovum occulted. Just one case of ovaritis was Imaged out. Ultrsonography showed enlarged ovary much hyper-echo or strong echo spots distributed in side.

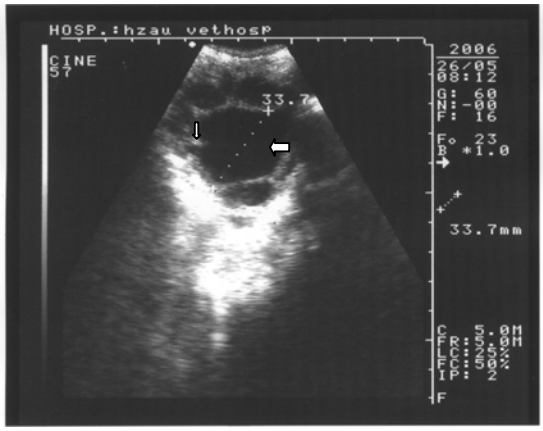

Fig. 4: Ultrasonography of systic ovarian follicle. Right ovarian ultrasonography obtained with 5.0 MHz intrarectal transducer. A 33.7 mm cystic follicle was showed with white arrow and oocyte was suspended within the antrum by cumulus oophorous (small arrow) the other follicles were small

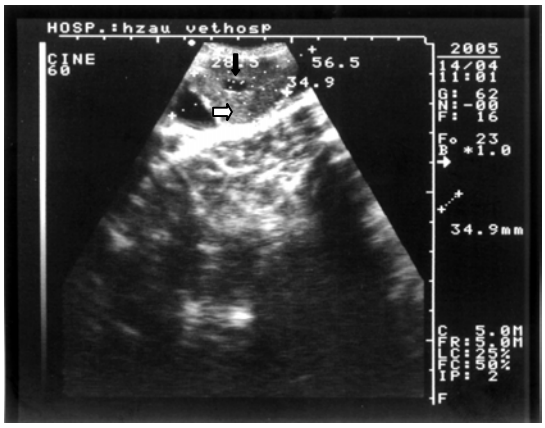

Fig. 5: Ultrasonography of corpus luteum with cavity. Right ovarian ultrasonography obtained with 5.0 MHz intrarectal transducer. A diameter 34.9 mm corpus luteum (white arrow) filled with granules but contained 8×3 mm fluid-filled cavities (black arrow) appeared on echogram

The edge of ovary connected tightly with circumjacent tissues reflecting hyper-echo. Few little follicles appeared but no dominant follicle and luteum were scanned.

Ultrasonography depending on these echo information reflected from acoustic interface and attenuated while propagating through a material (Dukhin *et al*., 2005). Ultrasound technique has been

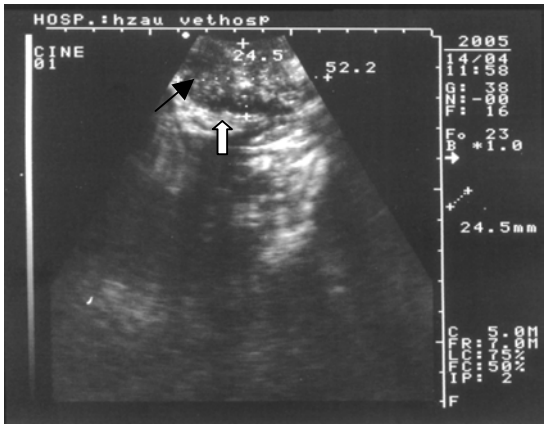

Fig. 6: Ultrasonography of ovaritis. Right ovarian ultrasonography obtained with 7.0 MHz intrarectal transducer. A 52.2×24.5 mm size ovary filled with much hyper-echo spots and few little follicles (little black arrow) and no dominant follicle and luteum appeared. The ovarian edge connected with circumjacent tissues was untidy and hyper-echogenic (white arrow)

applied to the study of bovine follicular dynamics nearly for 20 years which was thought as a breakthrough method (Pierson and Ginther, 1987). New research information generated through ultrasonic imaging has clarified the nature of complex reproductive processes in cattle including ovarian follicular dynamics, corpus luteum function and fetal development (Vassena *et al*., 2003; Pierson and Girther, 1988; Mann and Lamming, 2001).

Bols *et al*. (2004) thought both mechanical sector and linear array transducer ultrasound systems can be effectively used for oocyte retrieval in the cow. Fricke (2002) thought that although ultrasonic imaging could distinguish anatomical attributes of a structure, it offered little information recognizing physiological or endocrine status such as plasma hormone concentrations and this diagnostic limitation of ultrasonic imaging would become especially serious when incorrect therapy or reproductive intervention was recommended. With this reason, a thorough understanding of ovarian physiology and the mechanisms for which hormonal programs succeed or fail is critical for correct interpretation of ultrasonic imaging information. Completely reproductive diagnosis should need hormone analysis but clinical checks sometimes need us quickly providing likelihood diagnostic conclusion.

With this request, transrectal ultrasonograpy which could clearly image the ovarian pathological changes of dairy cows might be the optimum choice. Ovarian inactive had little inactive follicles which had developed little in later 3 weeks in this test because ovary developed dynamically, transrectal ultrasonography should be carried out repeatedly in clinical examination. Abnormal ovary was considered as the most important factor affecting the reproductive efficiency of dairy cows (Darwash *et al*., 1997; Smith and Wallace, 1998). Different pathological ovarian changes of dairy cow had distinctly echo characteristics in the study. Kastelic *et al*. (1990) and Singh *et al*. (1997) reported that ovarian cysts containing luteinized tissue should not be confused with a normal corpus luteum containing a fluid-filled cavity. Corpora lutea appear as distinctly echogenic areas within the ovarian stroma. Many corpora lutea appear as a solid tissue masses but may also contain fluid-filled cavities and the cavities range from <2 to >10 mm in diameter. Pierson and Girther (1988) detailed abnormal ovarian structures and their description were similar to ours.

Corpora lutea appear as distinctly echogenic areas within the ovarian stroma. About 79% corpora lutea appear as a solid tissue masses but may also contain fluid-filled cavities ranging from <2 to >10 mm in diameter at some time during the estrus cycle and early pregnancy (Kastelic *et al*., 1990; Singh *et al*., 1997). Different ovarian pathological changes resided in infertile cows.

In the cow herd of this study, about 63.5% (47/74) infertile cases had ovarian pathological changes and some of them changed at one ovary. Most cases without obvious echogenic structural change had uterus pathologic signs. Although, researchers do not know which one of uterus diseases and ovary diseases occurred first in these cases, ovary diseases usually recrudesce with abnormal uterus such as hysteritis, endometritis and uteri abscess. Actually, confirming the primary affection is difficult in veterinary clinical practice. Williams *et al*. (2007) demonstrated that cattle with high numbers of uterine pathogens on day 7 postpartum, the diameter of the first postpartum dominant follicle was smaller and plasma oestradiol concentrations were lower.

Thus, contamination of the uterus with recognized uterine pathogens is associated with ovarian dysfunction during the postpartum period. Furthermore, infection results in an increase in the production of inflammatory mediators. Uterine pathogenic bacteria such as *E. coli* stimulate prostaglandin E2 secretion by endometrial cell cultures and tissue exudation *in vitro* which may affect corpus luteum function (Herath *et al*., 2006). Inflammatory exudation and even pus occurred by infection could destroy endometrium and inhibit fecundation. Persistent inflammation induces endocrine maladjustment, ovary dysfunction and even systemic diseases (Mann and Lamming, 2001).

CONCLUSION

The results of the study shows that ultrasound could differentiate ovarian pathological change.

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