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Ultrasonography for the management of reproductive disorders in dairy cows

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Abstract: *Ultrasonography was used to confirm the diagnosis of different pathological conditions of cow's genital tract and to monitor the treatment outcome and conception rate for the improvement of reproductive disorders. A total of 54 subfertile cows with farmers' complaint for different types of reproductive problems were selected for this study. Confirmation and differential diagnosis of various reproductive problems was made by real time ultrasonography. Forty two cows received specific treatment against their reproductive disorders. The cyclic cows (n=43) were bred using frozen semen and pregnancy was confirmed by ultrasonography at Day 30-35 after breeding. The reproductive problems diagnosed, were endometritis (27.8%), metritis (7.4%), pyometra (11.1%), mucometra (3.7%), follicular cyst (9.2%), luteal cyst (1.9%), mummified fetus (1.9%), anoestrus (22.2%), repeat breeding (3.7%) and poor heat detection (11.1%). Thirty one cows out of 42, receiving appropriate treatments, showed cylicity with overall 73.8% effectiveness of the treatment (83.3%; poor heat detection, 60.0%; endometritis, 100.0%; metritis, 66.7%; pyometra, 100.0%; mucometra, 60.0%; follicular cysts, 100.0%; luteal cysts and 75.0%; anoestrus). Among 43 bred cows, 37 became pregnant giving an overall 86.0 % conception rate (100.0%; poor heat detection, 84.6%; endometritis, 75.0%; metritis, 100.0%; pyometra, 50.0%; mucometra, 100.0%; follicular and luteal cysts, 88.9%; anoestrus and 50.0%; repeat breeders). Ultrasonography can be used for improved diagnosis and management of reproductive disorders, to monitor treatment outcome thereafter and pregnancy success in dairy cows.*

Keywords: *Dairy cows, GnRH, PGF2α, ovarian disorders, Ultrasonography*

I. Introduction

The goal of reproduction management is to have cows become pregnant at a biologically optimal time and at an economically profitable interval after calving [17]. The main constraints of cattle reproduction is prolonged postpartum intervals to conception and low conception rate, which are the results of inefficiencies in the management of nutrition, estrus and AI services [16]. Early identification of non-pregnant dairy cows and heifers post breeding can improve reproductive efficiency and pregnancy rate by decreasing the interval between AI services and increasing AI service rate [4]. Thus, new technologies to identify non-pregnant dairy cows and heifers early after AI may play a key role in management strategies to improve reproductive efficiency and profitability.

Rectal palpation could be an accurate method for diagnosing pregnancy but is a poor method for resolving ovarian follicular distinction [14]. In contrast, ultrasonic imaging is a highly accurate and a rapid method for assessing ovarian structures as well as detecting cyclicity [6]. Hormonal examination to know the cyclicity is accurate but expensive and slow, moreover, it needs a specialized laboratory and the test can not be performed on farm [5]. But there is ultrasound machine to be used in veterinary practice, which is easily transportable to farms. In the bovine practice, ultrasonography has become an important diagnostic tool for evaluating the female reproductive system, where it is possible to view the entire reproductive system in a non-invasive manner [2]. Interest in ultrasonography among veterinarians and animal scientists began to grow in the early eighties, following reports on the usefulness of the technique in studying the reproductive organs of the cow [13]. Ultrasonography can be used efficiently for diagnosing reproductive disorders and the response to treatment thereafter [10]. The aims of the treatment of reproductive diseases are to reverse inflammatory changes that impair fertility, whilst enhancing uterine and ovarian defense and repair. The non-invasive nature of ultrasonography makes it an excellent clinical and research tool in the bovine reproduction [2].

The use of transrectal ultrasonography to evaluate reproduction in cows has enhanced our understanding of the ovarian and uterine processes during the estrus cycle, different pathologic sates and pregnancy in order to improve reproductive performance and genetic phenomenon. Even though the application of ultrasound in diagnosis and treatment of reproductive diseases in smallholder dairy farms has proved effective, the use of ultrasound as a management tool in Bangladesh is not widely distributed. Therefore, the present study was conducted to record different pathological conditions of the genital tract of dairy cows for

more accurate diagnosis, to determine their proportions and to monitor treatment outcome for the improvement of their fertility in terms of conception rate.

II. Materials And Methods

2.1. Selection of subfertile cow: A total of 54 subfertile dairy cows were selected randomly for diagnosis and treatment of reproductive disorders. Farmers' complaints and ultrasonography were used to determine the subfertile cows. Farmers' complaints about the clinical cases were recorded and clinical signs of sub-fertile cows were noted down in TABLE 1 and 4, respectively.

2.2. Transrectal ultrasonography: Ultrasonography was performed by using a portable real-time B-mode transrectal ultrasound scanner (Pharvision Micro V10- 3.5MHz, Piemedical,USA). Ovaries of individual cows were scanned twice at an interval of 10 days for confirmative diagnosis. Size of the ovary, follicles, CL and structures of uterus (before and after treatment) were examined and measured by using electronic calipers (vertical and horizontal measures) and their echo characteristics were described and compared (TABLE 4). Presence of CL, follicle or cysts in ovaries and conditions of uterus (either tonus or atonic and genital discharges) were examined on the day of diagnosis and then after treatment. Diagnosis was made on the basis of echogenicity of the images. Cows were classified into cyclic and non-cyclic cows based on the presence of a CL at least in one of the ovaries.

2.3. Treatment: After diagnosis based on history, clinical examination and ultrasonographic findings, the animals were treated following the protocol developed by [17] (TABLE 2).

2.4. Breeding of treated cows: A total of 43 cows out of 54, diagnosed with reproductive disorders were bred after giving proper treatment and management using frozen semen from fertile bull (TABLE 6).

2.5. Pregnancy diagnosis: The treated animals were examined for pregnancy diagnosis at day 30-35 after breeding by using ultrasound scanner. The pregnancy was confirmed by the presence of a visible fetus on viewing screen of the ultrasound machine which was irregularly shaped non-echogenic structures in the lumen of uterus.

2.6. Statistical analysis: The data were entered into Microsoft Excel worksheet 2007 and descriptive statistics were performed to determine the proportions of reproductive disorders in cows. Conception rate was defined as the number of cows diagnosed pregnant on day 30-35 post ovulation divided by the number of cows inseminated multiplied by 100. Effects of treatment on conception rate were determined by the following formulae:

For pyometra, mucometra, anoestrus and poor heat detection, a case was considered cured when a cow showed estrus. In these cases-

$$\text{(1). Cure rate (\%)} = \frac{\text{Number of cows showed estrus after treatment}}{\text{Number of cows treated}} \times 100$$

For endometritis, metritis, ovarian cysts and repeat breeder cows, a case was considered cured when she became pregnant. In these cases-

$$\text{(2). Cure rate (\%)} = \frac{\text{Number of cows became pregnant after breeding}}{\text{Number of cows affected}} \times 100.$$

III. Results

3.1. Proportions of reproductive disorders in cows: Out of 54 clinical cases investigated, fifteen cows (27.8%; 15/54) were suffering from endometritis, whereas 7.4% (4/54), 11.1% (6/54) and 3.7% (2/54) were suffering from metritis, pyometra, and mucometra, respectively. Follicular and luteal cysts were found in 9.2% (5/54) and 1.9% (1/54) cows respectively, mummified fetus was recorded in 1.9% (1/54) cows, twelve cows out of 54 were suffering from anoestrus (22.2%; 12/54), two cows (3.7%, 2/54) had repeat breeding problems and poor heat detection was diagnosed in 11.1% (6/54) cows. A summary of the proportions of the diagnosed cases and ultrasonographic findings are shown in TABLE 3 and 4, respectively.

3.2. Reproductive performance of affected cows after treatment: In total, 6 cows were identified as normally cycling but farmers considered these cases anoestrus. These were diagnosed as cases of poor heat detection.

Five cows out of these six responded to treatment in terms of becoming in heat giving 83.3% (5/6) effectiveness of the treatment. The success of the treatment was 60.0% (3/50 in case of endometritis while the efficacy of treatment was 100.0% in case of metritis. 66.7% (4/6) and 100.0% (2/2) cows became completely cured after treatment against pyometra and mucometra, respectively. The effectiveness of the treatment were 60.0% (3/5) and 100.0% for the cows with follicular cysts and luteal cysts, respectively. Nine anoestrus cows out of 12 showed prominent estrus signs after treatment resulting 75.0% (9/12) efficacy of the treatment. But the cows with mummified fetus did not respond to the applied treatment. However, out of 42, after treatment 31 cases showed estrus resulting an overall 73.8% success of the given treatment and were bred accordingly (TABLE 5).

3.3. Effects of treatment on the conception of cows after breeding: Out of forty three cows bred thirty seven became pregnant after breeding with frozen semen; hence the overall conception rate was 86.0 % (37/43) (TABLE 6). Success of breeding was 100.0% (5/5) in case of poor heat detection while 84.6% (11/13) and 75.0% (3/4) for endometritis and metritis problems, respectively. Pregnancy success in the cows which received treatment for pyometra and mucometra were 100.0%(4/4) and 50.0%(1/2), respectively, after breeding. 100.0% cows conceived which were bred after treatment against follicular and luteal cysts. Conception rates for cows receiving treatment for anoestrus and repeats breeding problems and were 88.9% (8/9) and 50.0% (1/2), respectively, after breeding.

TABLE 1: Farmers' complaints about the cases of reproductive disorders in cows

Serial No.	Farmers complaints	Number of cases
1	Did not show estrus by ≥ 60 days postpartum	24
2	Came to heat regularly but did not conceive	17
3	Wanted to know the pregnancy status	2
4	Irregular estrus cycle but did not conceive	6
5	Fever, inappetance and the cow was presumably pregnant	1
6	Vaginal discharges but not cycling	4
Total	54	

TABLE 2: Treatments given to cows with reproductive disorders diagnosed

Serial No.	Diagnosis	Treatment used	No. of animals
1	Poor heat detection	Advice to monitor heat carefully +AI following estrus	6
2	Endometritis	Intrauterine infusion with oxytetracycline + PGF2α if CL was present+ AI on observed estrus	15
3	Metritis	Intrauterine penicillin + AI on observed estrus	4
4	Pyometra	PGF2α + heat monitoring+ AI on observed estrus	6
5	Mucometra	GnRH+ PGF2α+heat monitoring + AI on observed estrus	2
6	Follicular cyst	GnRH+ PGF2α+GnRH at the time of AI	5
7	Luteal cyst	PGF2α + 2 times AI at 12 hour interval on the same estrus	1
8	Mummified fetus	PGF2α	1
9	Anoestrus	Nutritional supplementation/ GnRH+ PGF2α +AI+ GnRH	12
10	Repeat breeder	GnRH at the time of AI	2

TABLE 3: Proportions of reproductive disorders in cows

Reproductive Disorders	No. of cows examined	%
Poor heat detection	6	11.1
Endometritis	15	27.8
Metritis	4	7.4
Pyometra	6	11.1
Mucometra	2	3.7
Follicular cyst	5	9.2
Luteal cyst	1	1.9
Mummified fetus	1	1.9
Anoestrus	12	22.2
Repeat breeding	2	3.7
Total	54	100.0

TABLE 4: Ultrasonographic findings and diagnosis of reproductive disorders

Farmers complaints	Stages of cycle at the time of examination	Ultrasonographic findings	Diagnosis	No. of animals
Did not show estrus by Day 60 postpartum	Not in estrus at the time of examination	Greyish edematous endometrium with irregular, greyish-black structure with echogenic spots on ovary (CL).	Poor heat detection	6
		Uterus distended and have thickened uterine wall. The viscous fluid inside the lumen contained diffused, echogenic particles floating in it. Presence of greyish-black structure with echogenic spots in the ovary (CL).	Pyometra	6
		No echogenic area (CL) was imaged in the ovarian stroma and small follicles (nonechogenic structures) (5-7 mm diameter) was visible on the ovarian surface. Less dark endometrium with low echogenicity was found.	Anoestrus	12
Came to heat regularly but did not conceive	Were in estrus at the time of examination	Moderate amount of anechogenic fluid in lumen alongwith 'snowy' echogenic particles. Uterine wall was thickened. Large nonechogenic structures (follicle, 9-12 mm) found on ovary.	Endometritis	10
		Dark edematous endometrium with nonechogenic structures on ovary (follicle, 10-11 mm).	Repeat breeder	2
	Not in estrus at the time of examination	Large amount of anechogenic fluid in lumen alongwith 'snowy' echogenic particles. Greyish-black structure with echogenic spots (CL) on ovary.	Endometritis	5
Wanted to know the pregnancy status	Were in estrus at the time of examination	Uterus was thin walled which was visible as white streak and appears to be filled with echogenic particles in the enormous anechoic fluid present inside it. No greyish-black structure with echogenic spots (CL) was found.	Mucometra	2
Irregular estrus cycle but did not conceive	Were in estrus at the time of examination	Imaged as thin walled (≤3mm) non-echogenic structures visible over the surface of the ovary. Size was ≥25 mm. No greyish-black structure with echogenic spots was found and uterus was dark.	Follicular cyst	5
	Not in estrus at the time of examination	Anechoic central cavity bordered by a distinct wall (>3 mm) of luteinized tissue imaged over the ovarian surface. Size >25 mm.	Luteal cyst	1
Fever, inappetance and the cow was presumably Pregnant	Not in estrus at the time of examination	Uterine fluids were not evident in contrast to the snowy appearance of the lumen of uterus. Uterine wall was thickened. Fetal parts were rarely identified and mostly appeared as a poorly defined echogenic mass.	Mummified fetus	1
Vaginal discharges but not cycling	Not in estrus at the time of examination	Uterine wall was thickened and uterine body was distended. Enormous amount of anechoic fluid was present in the lumen along with echogenic particles. Greyish-black structure with echogenic spots (CL) in one ovary, in another ovary, no significant structures (NSS) was found.	Metritis	4

TABLE 5: Effects of treatment on resumption of estrous cycle

Reproductive Disorders	No. of cows treated	No. of cows in estrus	% of cows in heat estrus
Poor heat detection	6	5	83.3
Endometritis	5	3	60.0
Metritis	4	4	100.0
Pyometra	6	4	66.7
Mucometra	2	2	100.0
Follicular cyst	5	3	60.0
Luteal cyst	1	1	100.0
Mummified fetus	1	0	0
Anoestrus	12	9	75.0
	Total: 42	Total: 31	Overall: 73.8

TABLE 6: Pregnancy rate of cows of different disorders after treatment and breeding

Reproductive disorders	No. of cows bred	No. of Cows pregnant	% of pregnant cows (Conception rate)
Poor heat detection	5	5	100.0
Endometritis	13	11	84.6
Metritis	4	3	75.0
Pyometra	4	4	100.0
Mucometra	2	1	50.0
Follicular cyst	3	3	100.0
Luteal cyst	1	1	100.0
Anoestrus	9	8	88.9
Repeat breeding	2	1	50.0
	Total : 43	Total : 37	Overall: 86.0

IV. Discussion

An overwhelming proportion of animals that farmers considered as anoestrus cows had CL when examined by ultrasonography. These animals were in fact cycling but the farmers failed to detect them in estrus. This indicates poor heat detection in six cows (11.1%) out of 54. When the estrus signs of these cows were monitored carefully and bred at each observed estrus, they responded to treatment and conceived. Five cows out of these six responded to treatment in terms of becoming in heat giving 83.3% (5/6) effectiveness of the treatment and five became pregnant giving 100.0% conception rate (5/5).In a previous study, Kamal *et al* [6] reported that 11.0% cows had CL at the time of examination but farmers presented those animals as not seen in estrus. Poor follicular growth, no CL, inactive ovaries, poor body condition led most of the cows to become anoestrus as evidenced in this study. All these had negative effects on conception rate and also reported earlier by Shamsuddin and Aryal, [15]. Twelve cows were suffering from anoestrus (22.2%; 12/54) whereas two cows (3.7%; 2/54) had repeat breeding problems. Incidence of anoestrus in dairy herds over multiple years varied from 11 to 92% [20] and also 18.5% [6]. Repeat breeding in cows in various countries ranged from 10.0 to 18.0% [8]. Nine anoestrus cows out of 12 showed prominent estrus signs after treatment and the treatment efficacy was 75.0%. Conception rates were 88.9% (8/9) and 50.0% (1/2), respectively for cows receiving treatment against anoestrus and repeat breeding problems. Conception rates 66.7 to 80.0% were also reported for anoestrus and repeat breeder cows in several independent previous studies [18, 21].

Endometritis was the most frequently diagnosed pathological conditions and most of the farmers presented these cows as repeat breeder animals. The presence of anechoic fluid in cases of endometritis along with snowy echogenic particles observed during this study was similar to previous reports [10]. Fifteen cows among 54 (27.8%) were suffering from endometritis. These animals had apparently normal cervical and vaginal discharges. Kamal *et al* [6] reported 3.0% prevalence of endometritis in cows while Ali and Timimi [1] found 13.9% endometritis in cows. Metritis was diagnosed in four cows (7.4%; 4/54) which corroborated with previous report of Kumar and Purohit [10] and also with Ali and Timimi [1] who reported 8.3% metritis in cows. The ultrasonographic features of metritis were in part similar to endometritis; however, there was enormous amount of anechoic fluid in the distended uterus along with echogenic particles falling in line with features reported by others [11]. The successes of the treatment were 60.0% (3/5) and 100.0% (4/4) against endometritis and metritis, respectively. In case of endometritis, 84.6% (11/13) cows conceived and got pregnant after breeding which was 75.0% (3/4) for the cows with metritis problem. This result is closely similar to the findings of Shamsuddin *et al* [18] who reported 78.5% (11/14) conception rate after treating the uterine infections like metritis and endometrtis. In cases of pyometra, ultrasonographically, high volumes of echogenic pus, presence of cotyledons inside the uterus and CL on the ovary were observed in this study which is similar to the findings of Sheldon *et al* [19]. Most of these cases were in fact presented as anoestrus cows. Subsequent to therapy, the uterine diameter, fluid accumulation and echogenic particles got reduced which was also recorded by Kumar and Purohit [10]. In cases of mucometra, in accordance with present study, a consistent ultrasonographic finding was thin walled uterus filled with anechoic fluid [3]. Among the diagnosed cases, 11.1% (6/54) cows were found suffering from pyometra and 3.7% (2/54) from mucometra. After proper treatment and management 66.7% (4/6) and 100.0% (2/2) cows with pyometra and mucometra, respectively, cured and resulted pregnancy in 100.0% (4/4) and 50.0% (1/2) cows, respectively. Kumar *et al* [9] found 62.50% and 50.00% conception rate, respectively for uterine infection with thin and thick cervical mucous.

The ultrasonographic features of cysts were simple fluid filled (anechoic) thin walled structures 25 mm (follicular cysts) round to ovoid in shape. The diameters of ovarian cysts varied from 30 mm to 48 mm. Luteal cysts were characterized by the presence of a distinct hypoechoic wall (3 mm), which was used to differentiate luteal cysts from follicular cysts. These are in agreement with findings published elsewhere [12]. Six ovarian

cysts (follicular cysts; 9.2% and luteal cysts; 1.9%) were diagnosed in this study. A higher incidence of follicular cysts and lower incidence of luteal cysts had been recorded elsewhere [10]. Treatment of ovarian cysts with GnRH and PGF2α resulted in re-establishment of normal estrous cycles within 12 days. The effectiveness of the treatment were 60.0% (3/5) and 100.0% for the cows with follicular cysts and luteal cysts, respectively. When these cyclic cows were bred following estrus with single dose of GnRH, 100.0% cows became pregnant. Khurshid and Anjum [7] reported that administration of GnRH and PGF2α resulted 80.0% conception rate in cows with cystic ovarian diseases. The response to the treatment was good as evident by the ultrasonographic disappearance of both the type of cysts within 12-40 days of treatment, which confirmed previous reports [22]. But the cows with mummified fetus did not respond to the applied treatment.

V. Conclusion

Ultrasonography can be performed at individual and farm level to diagnose different reproductive tract disorders and also to determine the proportions of different reproductive disorders in dairy cows. Furthermore, treatment outcome for the improvement of fertility and conception rate could be monitored by the application of ultasonography. Thus, ultrsonography is becoming the first choice for sustainable improvement in the reproductive management program of dairy farms.

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