

Mid-Cycle Estrus in Bovines: Major Aberration to Farm and Dairy Industry

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ABSTRACT

A successful conception in dairy cows and buffaloes was determined by effective and correct time estrus detection and successful artificial insemination or natural service. All the cows and buffaloes presented to the dispensaries and referral centres with the history of estrus for artificial insemination were not in true estrus and not fit for artificial insemination, because they were in mid-cycle estrus. It is one of the recent threats for dairy farm and dairy industry in term of economic loss due to failure of getting pregnant. The present communication elaborate the mid-cycle estrus in dairy cows and buffaloes and strategies to combat it.

INTRODUCTION

In recent days reproductive management of dairy cattle and buffalo become difficult due to repeat breeding condition which resulted in increased inter-calving interval and

number of services per conception. Most commonly silent estrus, subestrus, irregular estrous cycle length and anestrus were the major constraints in cow and buffalo

reproductive management (Madan, 1990). For overcoming these problems accurate estrus detection could be the vital factor in deciding the conception rate and improper identification of true estrus was the major limit to the reproductive efficiency of the dairy cow (Madkar *et al.* 2002). The estrous cycle is a rhythmic process ranging from 18 to 24 days with an average of 21 days in dairy cattle and buffalo. Anything deviated from the foresaid range is being considered as aberration (Senger, 2005). Within an estrous cycle various numbers of (two/three/four) follicular waves could occur without much alteration in the length of the cycle. Most of the time cows were inseminated apart from the actual or true estrus at field and this might lead to failure of conception which ultimately end up in repeat breeding condition.

Mid-cycle estrus (MCE)

Mid-cycle estrus (MCE) is defined as exhibition of signs of estrus (edematous vulva, scanty cervico-vaginal mucus, mounting on other animal and frequent bellowing) during the mid-luteal phase of the estrous cycle and MCE being reported as an aberration of estrus cycle in the dairy cows and buffaloes (Sood *et al.*, 2009). This MCE event confused the farmer and veterinarian in the field conditions which culminate increase in number of artificial insemination per conception and repeat breeding resulted in economic loss to the farmer and milk industry. The present article represents the causes and characteristics of mid cycle estrus in dairy cows and buffaloes and its hormonal management.

CAUSES

Transitional decreased level of progesterone concentration which was sufficient to maintain pregnancy but negative feedback to LH pulse cannot be maintained which in turn causes the gradual maturation of ovarian dominant follicle. Ovarian follicle secrete estrogen

which was responsible for expression of estrus signs in estrus period (Noakes, 2001 and Sah, 2002). Animals exhibiting mid cycle estrus behaviour had higher estrogen secretion from dominant follicle and due to lower production of P₄ from corpus luteum (CL) or luteal deficiency causes the overriding of estrogen and animal exhibits the signs of estrus during mid-luteal phase (Gupta *et al.*, 2023).

Distinct rise in estrogen was observed in luteal phase from the large sized follicle in follicular wave, often its activity is being suppressed by the P₄ from the mature CL of diestrus (Sood *et al.*, 2009). Similarly during early gestation period there was appearance of estrus signs due to increased follicular activity is often called as gestational/post-conception heat (Chauhan *et al.*, 1976). Dominant follicle which was present in the mid-cycle due to supra basal level (>1 ng/ml) of progesterone was sufficient to prevent ovulation by inhibiting the estrogen induced LH surge (Duchens *et al.*, 1994). It may be the reason AI during mid-cycle heat would lead to failure of conception. Different characters of true estrus and mid-cycle estrus was depicted in Table 1.

DIAGNOSIS:

1. Based on history

Cow or buffalo inseminated 10-12 days earlier during the standing estrus at the field level. Most of the time cow is inseminated apart from the actual or true estrus in field and this may lead to failure of conception which ultimately end up in repeat breeding condition (Kumaresan *et al.*, 2001). Sometime cows inseminated at the mid-cycle estrus may lead to early embryonic mortality if animal got pregnant in the standing estrus insemination in the previous cycle.

2. Rectal examination

Rectal examination of the mid-cycle estrus cows revealed a tonic uterus and relaxed

cervix as observed in standing true estrus of the cycle. Often the cows are being addressed by the farmers for artificial insemination with history of behavioral signs of estrus exhibited by the cow. It's very challenging in differentiating the whether cow is in true estrus and mid-cycle estrus based on the routine clinical and reproductive examinations (Satheshkumar, 2018).

3. Trans-rectal ultrasonographic examination

A real-time B-mode ultrasound scanner equipped with a 7.5-MHz rectal probe is required to observe follicles and corpus luteum in the ovaries. Dominant follicle appears as anechoic whereas corpus luteum appears as hypoechoic mass (homogenous) on ultrasonographic examination. At the time of true estrus regressing CL (average diameter of 9-12 mm and less) and dominant follicle (average of 9-10 mm and above) could be observed in the ovaries, whereas presence of large CL with an average diameter of 13-15 mm and above and dominant follicle with an average of 9 mm and above could be noted during mid-cycle estrus.

4. Hormone assay:

Estimation of P₄ hormone gives idea about estrus. Progesterone concentration measured to be less than 1 ng/ml (basal level) in true estrus, but it would be more than 1 ng/ml (supra basal level) in mid-cycle estrus.

I. Non-hormonal approach

Skip the appeared mid-cycle estrus (mature CL & dominant follicle) and observe the heat signs after 8-10 days and inseminate the animal in true estrus (regressing CL & dominant follicle)

II. Hormonal approach

1. Prostaglandins based protocol

a. Single PG (SPG) protocol

Administration of 500 mcg of cloprostenol sodium on the day of diagnosis of mid-cycle estrus resulted in lysis of mature CL and subsequent estrus signs after 48-72 hrs of PGF₂ alpha injection and ovulation of dominant follicle and perform fixed time artificial insemination

b. Double PG (DPG) protocol:

Administration of 500 mcg of cloprostenol sodium (1st dose) on the day of diagnosis of mid-cycle estrus and second dose of 500 mcg of cloprostenol sodium after 11 days, and perform fixed time artificial insemination after 48-72 hrs of PGF₂ alpha injection.

2. GnRH analogous:

Recently scientists had reported that emergence of mid-cycle estrus might be due to weak corpus luteum or luteal insufficiency (Awasthi *et al.*, 2005 and Dar *et al.*, 2017). For overcoming the mid-cycle estrus due to luteal insufficiency, day 6 GnRH therapy (follicular wave synchronization & accessory CL formation) might be useful under field condition.

Administration of Buserelin acetate (10mcg) on day 6 of estrous cycle after AI resulted in ovulation of dominant follicle (from follicular wave I) which is present on the day 6 of cycle culminate to formation of accessory CL, which produce progesterone required for embryo survival in the case of early embryonic mortality in luteal insufficiency cases. At the same time induced ovulation (by day 6 GnRH) created a permissive environment for emergence of new cohort of follicles by Day 8 Vs Day 9/10 in non-treated animal. The DF of this earlier emerged synchronized follicular wave II started regressing much earlier on Day 13 Vs Day 16 in non-treated animal, which might be due to the suppressive effect of high P₄ (>10.0 ng/ml) secreted during the mid-luteal

phase by both CL and accessory CL in GnRH administered animal. This protocol prevent the dominant follicle to show estrus due to higher concentration of P₄ in circulation.

The fertility tended to be higher in cows with three-follicular wave pattern than two-follicular wave per cycle. The concept of altering follicular development to three-wave pattern could be used to augment fertility of crossbred cows at the same time prevent the mid-cycle estrus also.

Table 1: Differentiable characters of true estrus and mid-cycle estrus in cows and buffaloes

S.No	TRUE ESTRUS (TE)	MID-CYCLE ESTRUS (MCE)
Qualitative parameters		
1	Typical characteristics signs of estrus appears (Edema of the vulval lips, standing to be mounted, trying to mount on other animals, reddening of the vestibular mucus membrane, cervico-vaginal mucus, frequent bellowing & urination)	Characteristic signs of estrus appears but all the signs were not appreciable
2	Relaxation of external os of cervix-prominent and tonic uterine horns	Relaxation of external os of cervix-less prominent but tonic uterine horns noticed
3	Relaxation of internal os of cervix-prominent	Relaxation of internal os of cervix-very less prominent
4	Ease of passing of artificial insemination gun	Difficulty in passing the artificial insemination gun
Quantitative parameters		
1	Copious amount of cervico-vaginal mucus present	Scanty cervico-vaginal mucus present
2	Inter-estrous interval: 18-21days	Inter-estrous interval:7-12 days
3	Presence of regressing CL with an average diameter of 9-12 mm and less	Presence of mature CL with an average diameter of 13-15 mm and above
4	Presence of dominant follicle with an average	Presence of dominant follicle

	of 9-10 mm and above	with an average of 9 mm and above (corresponding to the size of the follicle in TE)
5	Ovulation occur 12-14 hrs after the end of estrus	Ovulation doesn't takes place due to P ₄ dominance
6	Progesterone concentration measured to be less than 1 ng/ml (Basal level)	Progesterone concentration measured to be more than 1 ng/ml (supra basal level)
Other parameters		
1	Occur in follicular phase of the estrous cycle	Occur in luteal (mid-luteal) phase of the estrous cycle
2	True estrus appears most probably on third follicular wave of the estrous cycle	True estrus appears on first/second follicular wave of the estrous cycle

CONCLUSION:

Mid-cycle estrus event confused the farmer and veterinarian in the field conditions which culminate increase in number of artificial insemination per conception and repeat breeding resulted in economic loss to the farmer and milk industry. Hormonal approach was the permanent solution for the MCE diagnosed cows and buffaloes.

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