Comparison of Two Different Protocols for Induction of Parturition in Heifers with or without Estradiol Benzoate

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Abstract: Objectives of this study were to investigate the efficacy of dexamethasone in combination with estradiol benzoate in controlled induction of parturition in heifers, especially in the subjects of retained fetal membranes and dystocia caused by fetal oversize. A total number of 100 Holstein-Friesian heifers aged 24-25 months, mean weight 450 kg and body condition score of 3-4 from a dairy herd located in the suburb of Tabriz with similar nutrition and management systems were allocated at random into two groups. Group A (Control, n = 50) heifers, after passing the minimum 270 d of pregnancy were injected with 30 mg dexamethasone IM. Group B (Treatment, n = 50) heifers with the same period of pregnancy received 30 mg dexamethasone plus 20 mg estradiol benzoate IM on the same days of pregnancy. The overall durations of initial treatments to induction of parturition were (41.50 ± 2.65) h in group A and (37.50 ± 1.27) h in group B. In group A, more dystocia cases were observed than in group B. After parturition, group A showed a higher percentage of retention of fetal membranes as well as the calf mortality and dystocia compared to group B. The differences between two groups were statistically significant ($P < 0.05$). In conclusion, our results indicate that induction of parturition by estradiol benzoate and dexamethasone together will be more effective than dexamethasone alone because of the less retention of fetal membranes, easy calving and shorter time from induction to parturition.

Key words: Dexamethasone, estradiol benzoate, heifer, parturition, retained fetal membranes.

1. Introduction

Induction of parturition is an important program for timing of parturition in cattle [1]. This program has many benefits for timing of parturition in dairy cows [2]. Advantages of planned parturition over spontaneous delivery may include saving time for observing and attending the parturition and preventing complications such as dystocia [3]. The procedure can help owners and veterinarians to detect and treat dystocia, reducing prenatal calf mortality [4]. In dairy herds, parturition time may be induced 10-15 days earlier than natural time of parturition to prevent excessive udder edema and fetal over sizes. Long-acting corticosteroids used for induction of parturition have gained widespread acceptance with dairy producers in New Zealand and Australia for

seasonal purposes [5]. Therefore, induction of parturition is a very important tool for prevention of calf and cow mortality caused by dystocia. Several regimens have been used to induce parturition in dairy cattle, including intravaginal misoprostol [6], ergometrin [7], dexamethasone or prostaglandins in combination with estradiol and oxytocin in cows [8], but significant reduction in the rate of retained fetal membranes has not been seen. Increases in fetal cortisol and estrogen production are the key events during the complex signal cascade leading to the initiation of parturition in cattle and the timely release of the placenta [9]. The purpose of this study was to evaluate the efficacy of dexamethasone in combination with estradiol benzoate in induction of parturition of heifers in Tabriz dairy herds, especially in the subjects of retained fetal membranes and dystocia caused by fetal oversize.

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2. Materials and Methods

2.1 Hormonal Drugs

Dexamethasone (Vetacoid, 50 mL vial, 1 mL containing: 2 mg dexamethasone sodium phosphate) and estradiol benzoate (Vetastrol, 10 mL vial, 1 mL containing 2 mg estradiol mono-benzoate) were purchased from Abureihan Company (Tehran, Iran).

2.2 Location and Animals

This study was carried out in a dairy herd with 520 head cow located in the suburb of Tabriz, Iran (38° 07' N and 46° 29' E) from January 2014 to November 2016.

Temperature during the experiment ranged from 0 to 30 °C with annual rainfall in this region ranges from 226 to 250 mm.

The Holstein-Friesian heifers were kept under the same nutrition (TMR) and management systems and fed by corn silage, hay, soybean and complementary minerals. All heifers were housed in open shed barns, and artificially inseminated with an imported semen package from the USA.

According to heifers' artificial insemination dates, after passing minimum 270 days of pregnancy for preventing dystocia caused by fetal oversize, animals subjected to induced parturition. Thereafter, a total number of 100 heifers with 23-24 months old, mean weight 450 kg and body condition score of 3-4 (based on a 1 to 5 score) were selected and allocated at random into two groups. Group A (Control, n = 50) heifers, were received 30 mg dexamethasone by IM (intramuscularly). Group B (Treatment, n = 50) heifers with the same period of pregnancy received 30 mg dexamethasone plus 20 mg estradiol benzoate IM. Heifers with unwanted conditions like vaginal prolapse, laminitis, chronic diseases such as diarrhea and blotting were omitted from the groups and replaced by other animals.

2.3 Data Collection

The number of heifers which responded to the

treatment (%), the period of time between treatment and animal response (h), type of calving (dystocia if giving birth take place by the veterinary interaction or normal delivery without external interaction), calf viability and the rate of placental retention (%) were recorded. Induction was successful if calving would be occurred during 72 hours after administering these hormones. Placentas were considered retained if they were not released by 24 hours post parturition.

2.4 Statistical Analysis

Independent sample t-test and Chi-square were used (by using SPSS software version 22, Inc., Chicago, IL, USA) for analysis of data in the present study. Statistical differences were considered significant when $P < 0.05$ and trends are discussed when $P < 0.01$.

3. Results

The gestation period of heifers in our farm and in normal situations are ranged from 278 to 282 days. In the present study, the overall period between injections of hormones to induction of parturition in heifers was (41.50 ± 2.65) hours in group A and (37.50 ± 1.27) hours in group B (Figs. 1 and 2). Eight of 50 heifers (16%) in group A did not respond to induction of parturition by 72 hours after hormone administration and were omitted from the trial (Table 1). Sixteen out of 42 heifers in group A had dystocia at the time of parturition (38%). All heifers in group B had successful parturition and only 9 heifers showed difficulty in calving. Thirty three heifers (78%) from group A and 32 heifers (64%) from the group B showed retention of fetal membranes after parturition (Table 2). The rate of calf mortality in this study was one calf in group A and no mortality in group B. In the group B, a heifer after parturition showed signs of uterine prolapse which immediately with the prompt veterinary interaction prevented from progressing of uterine prolapse. Collected data were analyzed by using SPSS software version 22. In the cases of overall time among

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Fig. 1 Mean time of parturition after injection of dexamethasone in the group A (h).

Fig. 2 Mean time of parturition after injection of dexamethasone and estradiol benzoate in the group B (h).

Table 1 Rates of responsiveness and time required for parturition after treatments in heifers (hours).

Group	N	Time parturition (h)	Number of heifers that responded to the treatment
A (Dexamethasone)	50	41.5 ± 2.65	42 (84%)
B (Dexamethasone + Estradiol Benzoate)	50	37.5 ± 1.27	50 (100%)

Table 2 The rates of dystocia and retention of fetal membranes in two groups.

Group	N	Rate of dystocia	Rate of retained fetal membranes
A (Dexamethasone)	42	16 heifers (38%)	33 heifers (78%)
B (Dexamethasone + Estradiol Benzoate)	50	9 heifers (18%)	32 heifers (64%)

treatment to induction of parturition (independent sample t-test), responsiveness to induction protocol, retention of fetal membranes and dystocia (Chi-square), the differences between two groups were statistically significant ($P < 0.05$). In other cases such as fetal mortality or postpartum complications the differences statistically were not significant.

4. Discussion

It has been suggested that cows induced with corticoids may calve without sufficient estrogen concentrations to finish a normal placental delivery [10-12]. However, the use of estrogens in various induction regimes to mimic normal hormonal events at parturition has yielded conflicting results [13-16]. The effect of corticoids and cloprostenol to induction of parturition is reported in cows [17-19].

The higher occurrence of post-parturient problems in cows induced with corticosteroids alone has been widely reported. Hartmann et al. [20] reported that performing protracted induction of parturition by administration of dexamethasone twice daily between day 268th and 273rd of gestation results in increased placental maturation, but does not influence the incidence of placental retention in cows. Average incidence of fetal membranes retention for normal dairy cows range from 4%-18% [21]. In present study the overall incidence of retention of placenta in the group A (Dexamethasone) was reported significantly higher (78%) than the group B (Dexamethasone + Estradiol benzoate) (64%) and the overall incidence of fetal membrane retention in two groups was higher than that reported in the study of Rabidas et al. [22] which reported 50% placental retention in buffaloes that underwent induction program. The higher incidence of retained fetal membranes in present study may be due to shorter pregnancy length (270 d)

resulting in incomplete maturation of fetal membranes (Table 2). Higher incidences of retained fetal membranes in cows after induction of parturition with PGF2 α have been recorded [17, 23]. Increased occurrence of retained placenta in group A might be due to lack of estradiol and insufficient maturation of placentas for completing the detachment processes.

The rate of calf mortality in this study was acceptable (one calf in group A and no mortality in group B). Higher calf mortality rate (11.77%) in buffaloes after induction of parturition with dexamethasone alone or in combination with PGF2 α has been reported [24]. More live fetuses were found in treatment group B (100%) in comparison to group A (2.3%). The incidence of calf mortality in group A appears to be due to insufficient relaxation of pelvic ligaments caused by estradiol deficiency. However, calf mortality may be reduced by good management and using expert workers.

In conclusion, our results indicated that induction of parturition by estradiol benzoate and dexamethasone together will be more effective than dexamethasone alone because of the less retention of fetal membranes, easy calving and shorter time from induction to parturition.

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