ORIGINAL RESEARCH

The Effect of PGF2α-Induction of Estrus on Pregnancy Rates in Mares

Elizabeth S. Metcalf, MS, DVM, Dipl ACT,[a] and Micah M. Thompson, BS[b]

ABSTRACT

In mares, the onset of estrus is routinely induced after a luteolytic dose of a prostaglandin F2alpha analogue. Mares in diestrus with a mature, functional corpus luteum will respond by coming into estrus 3 to 4 days after induction[1]. Shortening the interestrous interval in mares has an important economic impact on the equine breeding industry. Because the breeding season of the mare is short, timing of insemination and appropriate coordination of endocrine events is critical to pregnancy success and ultimate foaling rates. Several recent studies have reported that the use of prostaglandin analogues is associated with lower pregnancy rates. In this study the induction of estrus with cloprostonol (125-250 ug IM) did not affect pregnancy rates in mares that have ovulatory cycles (n = 461).

Keywords: Prostaglandin; Mares; Pregnancy; Estrus

INTRODUCTION

There are many instances in which shortening the interestrous interval and "appointment breeding" are beneficial to breeders. First, mares that fail to become pregnant may immediately return to estrus after prostaglandin F2alpha (PGF2α) administration, as opposed to waiting until the mare naturally returns to estrus after a longer period. Second, embryo donors have the potential to produce more embryos in a given season if estrus is induced immediately after an embryo flush. Third, foaling mares that are "short-cycled" after foal heat may demonstrate higher foaling rates if they are successfully bred before the 30-day heat. Finally, in the absence of ultrasound examination and/or careful observation of signs of behavioral estrus, mare owners are often unaware of the stage of the mare's estrous cycle; they seek the most economical and efficient means of using reproductive expertise to successfully synchronize their mares. Therefore, with the expectation that the mare has a mature corpus luteum (CL), veterinarians will often instruct mare owners to administer a prostaglandin injection to their mare 2 to 3 days before the mare entering a breeding facility so that the mare will be in early estrus upon arrival. This "appointment breeding" represents a valuable economic incentive to the mare owner.

However, recent research has suggested that administration of PGF2α during diestrus to "short-cycle" mares may be associated with lower pregnancy rates.[2,3] Lindeberg et al[2] reported that mares treated with PGf2α or PGF2α and hCG during the period of "CL sensitivity" had lower pregnancy rates than untreated controls. Similarly, Nielsen et al[3] found that estrus induction after PGF2α administration had a significant negative influence on pregnancy rate after insemination with frozen-thawed semen.

The objective of this retrospective analysis is to determine whether the use of PGF2α to shorten the interestrous interval affects pregnancy rates in mares.

MATERIALS AND METHODS

Breeding records were reviewed from 461 ovulatory heat cycles in multiple breeds of mares presented to a private practice for breeding. The mares were examined during the northern hemisphere physiological breeding season (March–August) over a 2-year period. The treatment group of mares (n = 231) received an injection of cloprostenol (Estrumate[R] Schering-Plough Animal Health Corporation, Union, NJ) 125 to 250 μg IM while in behavioral diestrus. Mares were examined for signs of estrus 2 to 3 days after administration of cloprostenol by teasing with a stallion and/or by transrectal examination. Mares that did not come into estrus within 5 days were excluded from the study. The comparison group of untreated mares (n = 230) transitioned into behavioral estrus under natural conditions.

All mares in heat were examined daily by transrectal palpation and ultrasound. When there was ultrasonographic evidence of maximal endometrial edema and a growing dominant follicle, an ovulation induction agent was administered (1,500 IU hCG IV [Estrumate[R] Schering-Plough Animal Health Corporation, Union, NJ] or 10 mg deslorelin acetate IM [Deslorelin[R] BET Laboratories Lexington, KY]). After induction, mares were bred 24 to 48 hours with cooled or frozen semen. Ovulation was confirmed

From the Honahlee Reproduction PC Owner, Sherwood, OR[a]; and Department of Biology, Colorado State University, Fort Collins, CO[b].
Reprint requests: Elizabeth S. Metcalf, MS, DVM, Dipl ACT, Honahlee PC 14005 SW Tooze Rd, Sherwood, OR 97140.
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by the ultrasonographic identification of a corpus hemorrhagicum. Pregnancy diagnosis was determined by recovery of an embryo 7 to 8 days after ovulation or by ultrasonographic evidence of an embryonic vesicle 12 to 21 days after ovulation.

The Pearson's Chi Square Test of Contingency was used for statistical analysis of data.

RESULTS

The pregnancy data from 461 heat cycles is depicted in Table 1. On the basis of the records, there was a 58% per cycle pregnancy rate (269/461) for all mares in the study. There was no difference in pregnancy rate between mares that received PGF2α administration (134/231) for induction of estrus versus mares that did not (135/230) ($P < .001$).

Table 1. The effect of cloprostenol (125–250 μg IM) on pregnancy rates

	Positive Pregnancy (+)	Negative Pregnancy (−)	Total
Prostaglandin (+)	134	97	231
No prostaglandin (−)	135	95	230

DISCUSSION

The effect of prostaglandin administration during various phases of the mare estrous cycle on fertility has received attention from many researchers. Early in the cycle, the precise timing of PGF2α administration during the periovulatory period appears to control the resultant effect on persistence of the CL and subsequent cycle length.[4-6] Treatment of mares with PGF2α within 2 days after ovulation does not appear to affect pregnancy rates, despite an impairment to, but eventual recovery of, the development of the CL.[4,5] However, the CL appears to be mature at 3 days postovulation because injection of PGF2α in either mares or jennies at this time induces regression of the CL and a return to estrus.[6,7]

The use of PGF2α analogues in diestrus mares is associated with a high degree of synchronization[8,9] and is used frequently in appointment breeding. Although it appears that there is an average interval of 7 days between PGF2α injection and ovulation,[10] the timing is dependent on the dose of PGF2α and the size of the follicle at the time of administration.[11] Newcombe et al[11] reported that the shortest interval from treatment to ovulation (2.4 days) was found in mares with follicles of 36 mm or larger after administration of 625 μg cloprostenol This is in contrast to the longest interval (4.9 days) that was found in mares with follicles of an average diameter of 28 mm that received 8.75 μg PGF2α. Interestingly, the incidence of regression of follicles, as opposed to ovulation, was significantly higher ($P < .001$) in mares treated with 875 μg cloprostenol (34.4%) as opposed to mares treated with 250 or 625 μg cloprostenol (14.2% and 18.1%, respectively). Similarly, regression of follicles was found to be higher in mares with follicles >36 mm in diameter versus 28 to 35 mm in diameter. This high rate of regression of follicles may influence pregnancy outcome and fertility studies.

With respect to the effect of diestrus administration of PGF2α on mare fertility, there are many conflicting reports. In an early study, Voss et al[8] reported that despite reliable synchronization of estrus after 2 injections of PGF2α 14 days apart, pregnancy rates were lower ($P > .05$) in mares that were treated with the PGF2α protocol versus untreated control mares (32% and 66.7%, respectively). During this same era, two independent studies reported that no differences in pregnancy rates were seen in mares receiving a single injection of a prostaglandin analogue 6 to 7 days postovulation, and in control mares.[9,12] Similarly, in early postpartum mares, the use of PGF2α analogues to stimulate uterine involution and/ or delay the interval to first ovulation did not affect pregnancy or early embryonic death rates.[13]Although the aforementioned studies may reflect a single versus timed double administration of PGF2α, they represent conflicting results from a single diestrus injection of PGF2α.

Lindeberg et al[2] examined the results from 475 estrous cycles in mares; these researchers found that mares treated with intramuscular 5 mg dinoprost (Dinolytic^R Pharmacia Upjohn Animal Health) or 7.5 mg luprostiol (Prosolvin^R Intervet International, BV) (n = 163 cycles) had lower pregnancy rates than untreated controls (n = 312 cycles) (50.3% versus 90.7%, respectively). In support of this study, Nielson et al[3] also found that the administration of 125 μg cloprostenol to mares in diestrus (n = 490) had a significant ($P = .007$) negative influence on per cycle pregnancy rate. These researchers stated, however, that the prostaglandin injection was used only in mares that failed to show estrous behavior; these mares possibly had concomitant reproductive pathology that could lead to lower pregnancy rates for reasons unrelated to PGF2α administration.

In the present study, there were no differences in pregnancy rates between mares that received PGF2α for estrus induction and those that came into estrus without the use of exogenous PGF2α administration (58% versus 58.7%, respectively). In support of the present study, Veronesi et al[14] reported that there were no significant differences in singleton pregnancy rates between mares that received