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Theriogenology
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Theriogenology 65 (2006) 1605–1619
www.journals.elsevierhealth.com/periodicals/the

Regression and resurgence of the CL following $PGF_{2\alpha}$ treatment 3 days after ovulation in mares

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Received 26 July 2005; accepted 28 August 2005

Abstract

The present study was designed to characterize and compare the physiology and ultrasonographic morphology of the corpus luteum (CL) during regression and resurgence following a single dose of native prostaglandin $F_{2\alpha}$ (PGF) given 3 days after ovulation, with a more conventional treatment given 10 days after ovulation. On the day of pre-treatment ovulation (Day 0), horse mares were randomly assigned to receive PGF (Lutalyse®; 10 mg/mare, i.m.) on Day 3 (17 mares) or Day 10 (17 mares). Beginning on either Days 3 or 10, follicle and CL data and blood samples were collected daily until post-treatment ovulation. Functional and structural regression of the CL in response to PGF treatment were similar in both the Day 3 and 10 groups, as indicated by an abrupt decrease in circulating concentrations of progesterone, decrease in luteal gland diameter and increase in luteal tissue echogenicity. As a result, the mean ± S.E.M. interovulatory interval was shorter ($P < 0.0001$) in the Day 3 group (13.2 ± 0.9 days) than in the Day 10 group (19.2 ± 0.7 days). Within the Day 3 group, functional resurgence of the CL was detected in 75% of the mares (12 of 16) beginning 3 days after PGF treatment, as indicated by transient major (6 mares) and minor (6 mares) increases ($P < 0.05$ and <0.1, respectively) in progesterone. Correspondingly, mean length of the interovulatory interval was longer ($P < 0.03$) in mares with major resurgence (15.8 ± 1.6 days) than in mares with minor (11.2 ± 1.2 days) and no resurgences (13.5 ± 0.3 days) in progesterone. Structural resurgence of the CL in the Day 3 group and functional and structural resurgence in the Day 10 group were not detected. In conclusion, PGF treatment 3 days after ovulation resulted in structural and

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0093-691X/$ – see front matter © 2005 Elsevier Inc. All rights reserved.
doi:10.1016/j.theriogenology.2005.08.024

functional regression of the CL and hastened the interval to the next ovulation, despite post-treatment resurgences in progesterone.
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Keywords: Corpus luteum; Luteolysis; Prostaglandin F2α; Progesterone; Mare

1. Introduction

In mares, native prostaglandin $F_{2\alpha}$ (PGF) and its analogues have been used alone or in combination with gonadotropins (FSH and LH) and steroids (estrogen and progestogens) to manipulate ovarian function for many basic and applied purposes as reviewed [1–5]. Although its primary use is as a luteolysin, PGF treatment has been used alone or in combination with oxytocin to enhance uterine clearance, primarily in mares susceptible to inflammation, especially post-breeding endometritis [4,6]. Apart from its clinical effects on the uterus, PGF treatment during the periovulatory period induced functional regressive changes in the corpus luteum (CL) during early diestrus [7–10], which seems contrary to the prevailing concept [1–5] that an early developing CL <5 days after ovulation is not susceptible to PGF.

There is consensus that complete functional and structural regression of a CL in response to exogenous PGF cannot be achieved in a high proportion of mares until mid-diestrus [1–5]. It appears this concept originated in the 1970s when numerous studies [11–13] reported that the intervals to estrus and ovulation were rarely hastened when PGF treatment was given early, as compared to later, during the estrous cycle. Even though there was an abrupt decrease in circulating concentrations of progesterone in response to PGF treatment early as well as later during the cycle, treatment earlier in the cycle was often followed by resurgence in circulating concentrations of progesterone [14–16]. Thus, it seems that the failure to hasten estrus and ovulation with PGF treatment early in the estrous cycle was due, at least in part, to partial or incomplete luteolysis. Nonetheless, the results of these and other studies in mares [1–5] provided the rationale for considering and promoting the concept that the early developing CL is resistant or refractory to PGF treatment.

The transient, functional response of the early developing CL to PGF treatment has been substantiated in more recent studies in mares [7–10]. Initially, circulating concentrations of progesterone significantly decreased after PGF treatment during the periovulatory period but, soon thereafter, progesterone increased such that concentrations completely or partially recovered to control concentrations by mid- to late diestrus. The results of these latest studies in mares provide more evidence that an early developing CL, <5 days after ovulation, is susceptible to exogenous PGF.

Ultrasonographic imaging of the CL involving diameter and area measurements and gray-scale scores (i.e., luteal tissue echogenicity) have been used to characterize development of the luteal gland in relation to circulating concentrations of progesterone during the estrous cycle and early pregnancy in mares as reviewed [17,18]. Spontaneous regression of the CL during late diestrus/early estrus is characterized by a decrease in circulating concentrations of progesterone in association with a decrease in luteal gland dimensions and an increase in luteal tissue echogenicity. Although the change in

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