Abstract

Effect of different doses of hCG on diameter of the preovulatory follicle and interval to ovulation in mares

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1. Introduction

Equine reproductive management and the applicability of techniques such as AI with fresh, chilled, or frozen semen, embryo transfer, and oocyte transfer have been facilitated with the more popular use of hCG for induction of ovulation. During the breeding season, hCG is quite often used in the same mare for more than one cycle, even though repeated administration of hCG has been reported to stimulate development of antibodies (Roser et al., 1979) which may reduce the hCG efficacy. Recent data have suggested that cessation of preovulatory follicle growth occurs immediately after hCG treatment (Gastal et al., 2006). The objectives of the present experiment in mares were: (1) to compare the ability of different doses of hCG to induce ovulation during three estrous cycles during the breeding season; (2) to determine the efficacy of a reduced dose of hCG in inducing ovulation; (3) to study ovarian follicular growth within and between estrous cycles after different hCG treatments; and (4) to test the hypothesis that an ovulatory dose of hCG induces cessation of follicle growth thus reducing the follicle diameter during the preovulatory period.

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2. Materials and methods

2.1. Animals

Nonlactating, estrous cycling, crossbred Breton mares (n = 36) between 3 and 15 years of age, weighing 350–600 kg, and in good body condition were used during three estrous cycles (n = 108) from October to March during the ovulatory season in Brazil (latitude, 21°S).

2.2. Ultrasonography and groups

Transrectal ultrasonographic evaluation of the ovaries and uterus was done once daily 13–15 days after ovulation until a growing, 28 mm follicle was detected at the beginning of estrus. Thereafter, evaluation was done every 12 h until mares were treated with hCG (Ovusyn®; Syntex S.A., Argentina) or saline when the diameter of the largest follicle had reached ≥35 mm (Hour 0 = treatment). At Hour 0, mares were randomly assigned to four groups (n = 9 per group) to receive the following intravenous treatments: 2500 IU hCG; 1500 IU hCG; 500 IU hCG; or saline (controls). After treatment, ultrasonographic evaluation was done every 6 h until ovulation. Day-to-day identity of the largest follicle was maintained, and blood samples were taken for hormone assays at each ultrasound scanning. Mares were kept in the same experimental group during the study.

2.3. Statistical analyses

Follicle data were analyzed using PROC MIXED procedure of SAS with a repeated measures statement to determine the main effects of group, hour, and an interaction. One-way ANOVA was used to locate mean differences between groups within hour and ovulation time. Percentage data were analyzed by \( \chi^2 \)-test.

3. Results

The mean intervals from treatment to ovulation were similar in the 2500 IU hCG group (43.5 ± 1.0 h) and the 1500 IU hCG group (44.0 ± 1.0 h) and shorter (P < 0.0001) than those observed for the 500 IU hCG group (82.6 ± 8.5 h) and the control group (98.2 ± 5.6 h). The percentage of mares ovulating within 24–48 h after treatment did not differ between cycles within groups. This percentage was greater (P < 0.0005) in groups 2500 IU (23/24, 96%) and 1500 IU hCG (20/21, 95%) than in groups 500 IU (12/25, 48%) and control (2/27, 7%).

The diameter of the preovulatory follicle from Hour 0 (treatment) to ovulation did not differ between cycles within groups. Therefore, estrous cycles were combined within each group to evaluate the effect of group (Fig. 1a). Effects of group (P < 0.03), hour (P < 0.0001), and a group-by-hour interaction (P < 0.0001) were observed. Follicle diameter was smaller (P < 0.0001) from 24 to 36 h post-treatment in the hCG-treated groups combined when compared to the control group.

There was no effect of estrous cycle or interaction of cycle-by-hour within group when the diameter of the preovulatory follicle was normalized to ovulation. Therefore, cycles were combined to evaluate the effect of group (Fig. 1b). Effects of group (P < 0.0001), hour (P < 0.0001), and interaction of group-by-hour (P < 0.009) were observed. The diameter of the preovulatory follicle was similar in the 2500 IU hCG group (38.3 ± 0.2 mm) and the 1500 IU hCG group.
Fig. 1. Mean (±S.E.M.) for diameter of the largest follicle normalized to treatment (Hour 0; largest follicle ≥ 35 mm: (a)) and to ovulation (b) in hCG-treated and control groups. Main effects of group, hour, and the interaction from 0 to 36 h after treatment and from 48 to 6 h before ovulation are indicated in the text.

(39.1 ± 0.4 mm) and smaller (P < 0.0001) than in the 500 IU hCG group (43.6 ± 0.4 mm) and the control group (44.9 ± 0.4 mm) from 48 to 6 h before ovulation.

4. Discussion

Time to ovulation after hCG treatment does not seem to be affected even when hCG is given in three estrous cycles during the breeding season. Controversy has existed for years in regard to the repeated use of hCG within a breeding season; some consider it to result in reduced efficacy of inducing a timed ovulation (Sullivan et al., 1973; Wilson et al., 1990; McCue et al., 2004) while others (Roser et al., 1979; Barbacini et al., 2000; Blanchard et al., 2003) have reported no such effect. The mean time to ovulation was shorter and the synchrony of ovulation enhanced after hCG-injection in the 2500 and 1500 IU groups than in the 500 IU and control groups (Fig. 2). Although the 500 IU treatment was not adequate to induce a high rate of ovulations within 24–48 h, it did result in a shorter (P < 0.001) time interval to ovulation and in a greater number of mares ovulating during this period when compared to the control group.

The pattern of follicle development within group was similar among cycles, and the hCG treatment had a depressive effect on follicle growth after 24 h post-treatment. Diameter of the preovulatory follicle was smaller in hCG-treated groups using standard ovulatory doses (2500 and 1500 IU) compared to the control group. Although the mean follicle diameter in the 500 IU group seemed smaller than in controls for every estrous cycle, no significant difference was found between these groups.

The results of the present study yielded the following conclusions: (1) hCG doses of 2500 and 1500 IU have similar efficacy in the induction of ovulation; (2) 500 IU of hCG does not induce an acceptable rate of ovulations between 24 and 48 h; (3) repeated hCG treatments in three estrous cycles during the breeding season do not change the efficacy or the preovulatory follicle diameter; and (4) the use of standard ovulatory doses of hCG (2500 and 1500 IU) induces cessation of follicle growth thus reducing the follicle diameter during the preovulatory period in mares.
Fig. 2. Distribution of the number of mares ovulating after treatment with different doses of hCG or saline. Detection of ovulation was performed every 6 h by ultrasonography.

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