Aberrant follicular dynamics in dairy cows due to subluteal levels of progesterone after incomplete luteolysis or CIDR application during and after superovulation

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Many cows do not return to normal estrous cyclicity after embryo collection. We therefore followed three Holstein dairy cows in a research study on superovulation and embryo collection by ultrasound and blood sampling to measure peripheral progesterone twice weekly. In the first case (Lola), luteal regression was induced by two injections of prostaglandin on Day 7 and 8 and one CIDR (CIDR® 1380, Pfizer Animal Health, Pfizer Canada Ltd, Kirkland QC, Canada) was inserted at the time of first prostaglandin injection. The CIDR alone created circulating levels of progesterone (0.7 to 1.3 ng/ml). The superovulation protocol starting on Day 11 failed to result in multiple follicle formation and ovulation. Instead, a single huge persistent follicle developed, ovulated after CIDR withdrawal and formed into an abnormally large corpus luteum (CL) producing 9.0 ng/ml of progesterone. A second cow (Martha) was followed after embryo collection. This cow demonstrated progesterone levels that did not decline completely, but remained detectable (>0.2 ng/ml) although she had received two injections of prostaglandin at two and four days after embryo collection. An injection of gonadotropin releasing hormone induced the ovulation of a persistent follicle, which formed a CL with cavity secreting levels of only 1.0 ng/ml of progesterone. Induced luteolysis of this CL and the insertion of two CIDRs resulted in 0.9 to 1.6 ng/ml of circulating progesterone which was accompanied by newly forming persistent follicles. In this specific cow, only the insertion of three CIDRs and the injection of 100 mg of progesterone twice daily raised circulating progesterone levels up to 4.2 ng/ml. The withdrawal of CIDRs and the discontinuation of progesterone injections after one week resulted in ovulation and normal CL formation and pregnancy thereafter. In the third dairy cow (Monica) a follicle that persisted until the day of embryo collection developed into a follicular cyst once the two injections of prostaglandin were administered after the embryo collection, while the CLs slowly regressed. A treatment was put in place with the application of two CIDRs, which achieved circulating levels of progesterone of 3.3 to 3.5 ng/ml. Two new cysts appeared during this treatment. The two CIDRs were replaced with new CIDRs and 100 mg of progesterone twice daily was added, achieving a plasma concentration of over 6.0 ng/ml. The treatment was followed by a normal ovulation and CL formation. From these observations we conclude that incomplete luteolysis resulting in residual circulating levels of progesterone could cause the development of persistent follicles, anovulation and poor CL formation. Depending on the animal, the intravaginal insertion of one or even two CIDRs may not be sufficient to increase peripheral progesterone to normal luteal levels, and may result in abnormal cyclic function. Progesterone testing combined with ultrasonography may be a valuable tool to foresee and diagnose aberrant follicular dynamics in individual dairy cows.

Keywords: Abnormal follicle development, progesterone, CIDR, prostaglandin