Induction of Ovulation in Mares

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For the mare, the length of the estrus cycle is from 15-26 days, with a mean of 21 days and the duration of estrus ranges from 2-12 days with a mean of 7 days (Senger, 2003). This long estrus means a number of breedings per cycle to ensure the mare is mated close to the time of ovulation. Breeding close to ovulation increase pregnancy rates when using cooled, frozen, or poor-quality semen (Samper, et al., 2002). The time from onset of estrus to ovulation in a mare is approximately 5 days and the time from the LH surge to ovulation is 2 days (Senger, 2003). The additional breedings result in over use of the stallion, more labour and additional cost to the owner.

The horse industry is concerned with reducing the number of breedings per cycle for both mare and stallion, shortening estrus, increasing of accuracy in the timing of breeding when using shipped, frozen semen or stallions with poor longevity, and getting mares in foal earlier in the year. One method of achieving these goals is to shorten the time to ovulation.

This paper will outline the importance of ovulation detection in a mare, including hormones to induce ovulation and manipulation of GnRH. Finally some side effects of these drugs will be discussed.

To better predict when ovulation will occur in a mare, frequent transactional palpations or ultrasound examinations are done and/or hormonal therapies are given to induce ovulations, for example hormones include human chorionic gonadotropin (Chorulon, Intervet Inc, Millsboro, DE) or deslorelin acetate (Ovuplant, Parmacia and UpJohn Co, Kalamazoo, MI) (Samper, et al., 2002). Ovuplant is a commercially available implant, and consists of a pellet impregnated with 2.1 mg of deslorelin acetate that releases over a 2-3 day period (McCue et al, 2000). It hastens ovulation in estrus
mares with a follicle greater than 30 mm in diameter. Deslorelin acetate is an analog of gonadotropin releasing hormone (GnRH) and shortens the time to ovulation by increasing concentrations of luteninizing hormone (LH) and follicle stimulating hormone (FSH), hastening maturation of the ova and a fertile ovulation.

The hypothalamus has been described as the ‘master gland’ (Frandson, and Spurgeson, 1992); it serves as the collecting centre for information and then coverts neural signals to hormonal signals. The hypothalamus produces GnRH, the pivitol regulatory hormone of reproduction. GnRH controls reproduction by acting on the adenohypophysis to cause a cascade of hormonal events. The major function of GnRH is to stimulate the secretion of the gonadotropins, LH and FSH (Frandson, Spurgeson, 1992). Gonadotropin releasing hormone (GnRH) has long been recognized as a potential target for the control and management of fertility in female animals (Herbert, Trigg, 2005). The gonadotropin releasing hormone (GnRH) and the Luteinizing hormone (LH) are important for the endocrine regulation of progesterone synthesis in luteal cells (Watson et al., 2000 in Kanitz, 2006). Folliculogenesis and ovulation can be induced out-of-season by replicating cyclic GnRH episodic release patterns (as determined from monitoring secretions in pituitary blood). Although GnRH must be present to generate an ovulatory cycle, the exact pattern of stimulation is relatively unimportant. One reason suggested by Alexander and Irvine, 1996, may be that increased pituitary responsiveness to GnRH plays a major role in producing the ovulatory LH surge and responsiveness is enhanced by GnRH by estradiol and oxytocin. When raising GnRH input this may also start a chain of events (folliculogenesis and estradiol secretion; sexual arousal and oxytocin release) that leads to ovulation in most mares (Alexander and Irvine, 1996).
In the attempts to apply GnRH-based technology to manage fertility, the main focus has been on the development of GnRH agonists (a substance that triggers a response in a specific tissue by binding to specific receptor), antagonists (nullifies the effect another substance has on the body) and vaccines. Herbert and Trigg, 2005, feel that all these methods have potential, but the application of these technologies has been limited to date. GnRH agonists have a much higher contraceptive success rate and less negative side effects than immunization against GnRH in both domestic and wild animals. Attempts to further develop GnRH antagonist and GnRH-toxin technology may provide useful products with a range of potential applications (Herbert and Trigg, 2005).

The administration of deslorelin acetate as a slow-release implant induced ovulation within 18 hours; this effect did not diminish when mares were treated for 3 or more cycles. There was no added benefit of an increased dose for induction of ovulation of pre-ovulatory follicles. Furthermore, implants were safe and effective as an alternative to hCG, especially when administered over multiple cycles (Mumford et al., 1995). One potential disadvantage is that the implant has to be removed at the time of ovulation in order to prevent follicle suppression and delayed return to estrus. Also some practitioners or mare owners may object to the removal of the implant. However, there is now a biocompatible liquid vehicle available to be administered intramuscularly as a single dose (Berezowski, et al., 2006). Although injectable preparations of GnRH can induce ovulation, multiple injections or continuous administration are necessary, making them impractical for routine use. The administration of buserelin (4 doses of 40 µg at 12 hour intervals) to an estrous mare when the largest follicle reached 33 mm significantly
hastened ovulation, and therefore was an alternative to hCG for the induction of ovulation (Barrier-Battut, et al., 2001).

Deslorelin acetate treatment was associated with decreased pituitary FSH secretion during the diestrous period following ovulation. The decreased FSH serum concentration in treated mares may lead to decreased follicular development and a delay in the emergence of a dominant follicle. Also if a mare is treated with deslorelin acetate to induce ovulation doses not become pregnant, the interovulatory period maybe prolonged (McCue et al, 2000).

Human chorionic gonadotropin (hCG) has been used for many years to induce ovulation in mares because of its luteninizing hormonone (LH)-like activity (Vanderwall, et al., 2001). Although administration of hCG to estrus mares with a follicle >30 mm generally induced ovulation to occur within 36 to 48 hours, the interval from treatment to ovulation was quite variable, especially in older mares. Therefore, there has been interest in using GnRH or its agonists to induce ovulation in mares.

Developments in the use of hCG have become so specialized that ovulation can be programmed in mares on a specific day, with a success rate of 67%, by combining treatment with antarelix (a GnRH antagonist) during the preovulatory period with one injection of hCG (Briant et al., 2004). There exists a certain percentage of mares that do not respond to hCG treatment. The possible reasons given by McCue, 2000, “immature follicles” even when a 35 mm follicle is present and the mare is displaying behavioral signs of estrus; (2) mares with large diestrus follicles and no behavioral signs of estrus; and (3) anovulatory follicles.
After detection of ovulation and the mare having been breed by using cooled, frozen, or live cover and achieving pregnancy. There develops a major problem in mares with early embryonic mortality, although less is known about the antiluteolytic mechanism during early pregnancy than in ruminants. Mares routinely receive progesterone supplementation during early pregnancy to increase the chances of embryo survival despite a lack of knowledge as to its need or efficacy. Newcombe et al. (2001) in Peters, (2005) evaluated the use of 20-40 µg buserelin between days 8 and 12 post service on pregnancy rates in 2346 mares over a 4 year period and showed that overall pregnancy rates up to day 40, were increased by about 10 percentage points. Sout et al. (2002) in Peters, (2005) reported that 40µg buserelin on day 10 after ovulation did not alter progesterone or prostaglandin concentrations in pregnant or non-pregnant mares thereby questioning the physiological rationale for this treatment (Barrier-Battut, et al., 2001). Buserelin is a synthetic analog of natural gonodatropin-releasing hormone (GnRH/LHRH). The effects of buserelin on follicle stimulating hormone (FSH) and luteinising hormone (LH) release are 20 to 170 times greater than those of LHRH. Chronic administration of buserelin results in sustained inhibition of gonadotropin production, suppression of ovarian and testicular steroidogenesis, and reduced circulating levels of gonadotropin and gonadal steroids (British Columbia Cancer Agency, 2004).

In concern for the brood mare industry, the timing of ovulation becomes desirable and has many potential advantages for the veterinarian, breeding farm manager, and owner. The benefits include a timed and reliable ovulation also a reduction in the number of services per cycle in highly booked stallions, increased accuracy in the timing of breeding with the use of frozen, cooled shipped, or stallions with poor longevity of sperm
motility, a reduction in the number of breedings or inseminations of problem or difficult mares and the maximization of the use of stallions with subfertility problems (Samper, et al., 2002). The old way or natural selection for the mare exists no more as the advances in breeding continues through the development of new drugs takes over in the brood mare industry.

Works Cited


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