

## GNRH AGONIST IMPLANTS FOR OVARIAN DOWN REGULATION AND OVULATION INDUCTION IN RHINOCEROSSES

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### Extended Abstract

Mammals in captivity can exhibit increased longevity, but in some, such as white rhinoceros (*Ceratotherium simum*), there are reproductive problems associated with captivity (JONES, 1992; HERMES et al., 2002a,b). In the past non-reproductive periods of 10 - 15 years of female white rhinoceros were not considered too critical. Endocrine studies revealed that over 60 % of the captive white rhinoceros exhibit acyclicity or persistent luteal activity associated with a low rate of reproduction (SCHWARZENBERGER et al., 1998; PATTON et al., 1999). Breeding management efforts such as development of ovulation induction and artificial insemination protocols, and reproductive monitoring with the aid of ultrasonography and endocrinology as well as animal translocations have increased markedly since these studies were published (SCHWARZENBERGER et al., 2003).

Recent ultrasound examination, in combination with endocrine monitoring, have revealed ovarian pathologies such as cysts, micro-corpora lutea and inactive ovaries all of which appear to be associated with lack of reproductive activity (HERMES et al., 2001). As many as 63 % of all females examined (n = 46) exhibit progressive development of endometrial cysts and uterine tumours (≥ 15 years), and 32 % of these rhinoceros are classified as post-reproductive due to the severity of the lesions. However, despite mild pathologies, 31 % are considered to be capable of reproduction (HERMES et al., 2002c). A strong hormonal influence associated with persistent luteal activity and non-conceptive oestrous cycles is thought to cause endometriosis and tumours in non-reproductive females (NEZHAT et al., 1999; TAZUKE and GIUDICE, 1999). Especially, nulliparous females with non-conceptive reproductive cycles are exposed to repetitive surges of reproductive steroid hormones and exhibit premature ageing of the reproductive tract. The reproductive organs 'burn out' reduces the reproductive lifespan. In extreme cases the fertile life of a non-reproducing female ends 15 years earlier than her multi-parous counterpart (HERMES et al., 2002). Because 87.5 % of all nulliparous females (n = 35) had an intact hymeneal membrane, the possibility of sub-clinical genital infections, potentially transmitted by males during copulation, were excluded as a primary cause of tumour development or endometriosis.

In captivity, the low rate of reproduction in aged rhinoceros seems to correlate with reproductive tract pathologies perhaps caused by an increased exposure to steroid hormones as a result of non-conceptive, repetitive oestrous cycles (HERMES et al., 2002). Therefore, pregnancy at a young age may present a physiological protection against these reproductive pathologies. In an attempt to maintain a normal reproductive lifespan in captive megavertebrates, the purposes of this study were two-fold: 1) to down-regulate endogenous steroid hormone production for periods of over 6 months; and 2) to re-initiate ovarian activity and induce ovulation in acyclic non-reproductive females.

For these purposes long and short-acting GnRH agonist implants (Deslorelin®, Peptech, Sydney, Australia, Decapeptyl®; Deslorelin®; Fort Dodge, IA, USA Ovuplant®) were used. Gonadotropin releasing hormone (GnRH) agonists inhibit reproductive function (NILLIUS et al., 1978), and act to shut down cyclicity in females by binding to receptors at the pituitary's gonadotrophs. GnRH agonists cause acute increases in LH release followed by a decline with chronic agonist exposure (GONG et al., 1995, 1996; MACLELLAN et al., 1997). Reproductive exams were conducted in the rhinoceros by ultrasound before, during and after GnRH agonist treatment, concurrent with faecal hormone monitoring. Ultrasound exams were performed in standing sedation or in lateral recumbent animals under general anaesthesia (WALZER et al., 2000; WALZER et al., 2003). Implants were placed subcutaneously in 8 acyclic white rhinoceros (*Ceratotherium simum simum / cottoni*). The implants resulted in suppression of ovarian activity in all but one female, which showed regular oestrous cycles during and after the treatment. During the GnRH release period of 6-8 months ovaries were reduced in size and had no follicular development. Follicular cysts disappeared while para-ovarian cysts remained unaffected by the hormone treatment. Effects of the reduction of sex steroid hormone secretion in the uterus resulted in an inactive endometrium and a reduction of cystic endometrial hyperplasia. One female showed regular oestrous cycles during and after the treatment. Post GnRH agonist treatment ovarian activity was re-initiated in all females and follicular activity was enhanced when compared to the pre-treatment ovarian status. In one Indian rhinoceros (*Rhinoceros unicornis*) the size of uterine leiomyomas was significantly reduced under long-term GnRH treatment.

In order to induce follicular growth and ovulation in a white rhinoceros exhibiting minimal follicular activity, two treatments with a short-acting GnRH agonist were performed within 6 months. Each treatment consisted of three applications (2 implants) given every second day. Ultrasound exams were performed every third day to monitor the ovarian and uterine dynamics. During treatment the female showed signs of behavioural oestrous including increased interest in males. The formation of a follicular wave with the development of a dominant follicle was observed by ultrasound. The sonographic detection of a luteal structure marked the end of the hormone treatment. The sudden cessation of behavioural oestrous was concurrent with the observation of large luteal structures. The preliminary results on the ovulation induction with short acting GnRH agonist implants are encouraging for the development of an alternative ovulation induction protocol in aged rhinoceros to that by SCHWARZENBERGER et al. (1998).

In summary, ultrasound and endocrine monitoring were used in tandem to evaluate the success of two different GnRH agonist hormone treatments (long and short) to overcome premature reproductive senescence in white rhinoceroses. Long-term administration of GnRH agonist implants substantially improved the reproductive health status, whereas short-term administration was successful in re-activating follicular growth in aged females.

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