

PHARMACOLOGICAL METHODS OF ENHANCING PENILE ERECTION FOR EX-COPULA SEMEN COLLECTION IN STANDING WHITE RHINOCEROS (*Ceratotherium simum simum*)

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Abstract

In a double-blind trial, the influence of alpha-adrenergic agents on manual semen collection in a standing white rhinoceros (*Ceratotherium simum simum*) was evaluated. When comparing the medicated to the non-medicated trials, significant differences in onset, strength and duration of penile erection were noted. Pulsatile contractions of the penile muscles occurred more frequently. The seminal fluid collection was not significantly influenced by drug administration.

Zusammenfassung

Im Rahmen einer Doppelblind-Studie wurde der Einfluss von Medikamenten mit alpha-adrenerger Wirkung auf die manuelle Desemination beim stehenden Breitmaulnashorn (*Ceratotherium simum simum*) untersucht. Beim Vergleich der Versuchseinheiten mit pharmakologischer Unterstützung gegenüber den Placebogaben traten signifikante Unterschiede im Hinblick auf Eintritt, Stärke sowie Dauer der Erektion auf. Pulsatile Bewegungen des Penis nahmen an Häufigkeit zu. Die Gewinnung seminaler Flüssigkeiten wurde jedoch nicht signifikant durch die Medikation beeinflusst.

Résumé

Une étude en double aveugle a permis d'évaluer l'influence des agents alpha adrénergiques sur la récolte manuelle de sperme chez un rhinocéros blanc (*Ceratotherium simum simum*) en station debout. Lorsque l'on compare les essais avec et sans médication, des différences significatives pour le déclenchement, l'intensité et la durée de l'érection ont été notées. Des contractions pulsatiles des muscles péniens étaient plus fréquentes. La collecte de sperme n'était pas significativement influencée par l'administration de médicaments.

Key words: White rhinoceros, *Ceratotherium simum simum*, alpha-adrenergic agonist, detomidine-hydrochloride, butorphanol, erection

Extended Abstract

This study is part of ongoing work toward developing a pharmacological method for ex-copula semen collection in standing white rhinoceros (*Ceratotherium simum simum*). As the common technique to obtain semen samples from rhinoceros is electroejaculation a less invasive procedure for repeated deseminations is required. According to equine literature, alpha-adrenergic agents

can successfully induce ejaculations in domestic stallions (2,3,5). This is sometimes necessary to provide safe semen collection in disabled or injured horses that are unable to mount.

In view of the encouraging results from a previous work (4) we used a combination of Detomidine-Hydrochloride (*Domosedan*®, Pfizer Corporation Austria Ges.m.b.H., A-1071 Wien) and Butorphanol (*Butomidol*®, Richter Pharma AG, A-5600 Wels) applied IM. While Detomidine-HCl as an alpha-adrenergic agonist predominantly promotes central alpha₂-events, the partial opioid agonist Butorphanol enhances the alpha-adrenergic effect (1). Both agents are commonly used in rhinoceros anaesthesia as sedatives and analgesics and are proven to be safe in this species (8).

A double-blind trial was conducted on a thirty-year-old white rhinoceros at Salzburg Zoo. The male was conditioned to enter an indoor restraint chute and to tolerate manual stimulation of penis and prepuce (7). The influence of alpha-adrenergic agonists compared to non-medicated trials was evaluated by administering various dosage combinations of Detomidine-HCl/Butorphanol (mg Detomidine-HCl/mg Butorphanol: 8/4, 8/8, 10/4, 10/8, 14/4) and a placebo (sterile water) in a random fashion. The first author and the keeper were blind to the treatment. Prior to IM injection of the standardised volume of 5 ml into the neck muscles, dermal anaesthesia was achieved by applying a eutectic mixture of local anaesthetics (*Emla*®, 5%-Creme, Astra Ges.m.b.H, A-4020 Linz) (6). Manual stimulation consisted of genital massage in cases where no penile prolapse occurred within 15 minutes after injection in order to induce the onset of penile erection. Manually compression of the glans and the base of the penis performed the stimulation of the erect penis. Seminal fluids were collected into pre-warmed graduated containers.

A variety of thirteen different behavioural patterns such as eagerness to enter the chute, fear, nervousness, aggressive and avoidance behaviour during the manipulation, erection strength etc. were assessed independently by the first author and the keeper using questionnaires resembling those described by Wielebnowski (9). Immediately after each session, a coding form with calibrated horizontal lines was rated. Each line was 100 mm long and presented a continuous scale for a particular behavioural item - with minimum and maximum at either end. The score for each item was rated by a vertical crossing. Subsequently, the distance from the minimum side of the line to the position of the cross was measured in millimetres. The distance then represented the numerical score, resulting in scores from 0 to 100.

In addition to the evaluation of subjective behavioural patterns, six objective parameters (time till onset of erection, duration of erection, number of penile contractions, whether seminal fluids could be collected etc. were assessed.

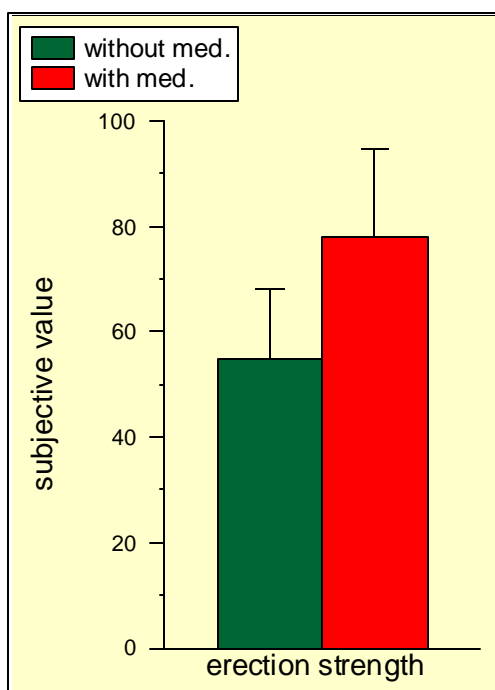


Fig. 1: Pharmacological influence on erection strength. A superior degree of erection was rated in the medicated trials (mean ± SEM). The numerical subjective value score ranges from 0 indicating the minimum to 100 indicating the maximum degree possible.

Comparing the results of the medicated trials to those using a placebo by T-test, the male was scored significantly less aggressive ($p < 0,05$), less anxious ($p < 0,01$), less nervous ($p < 0,01$) and quieter standing ($p < 0,01$) in the chute during the manipulation when medication was applied. In addition to those findings that are mainly due to the sedative effect of the applied agents, a superior degree of erection was achieved using the alpha-adrenergic agonists ($p < 0,05$) (Figure 1).

Inter-rater reliability was assessed using the T-test and was high for most questionnaire items. Seminal fluids were obtained in 25% of the medicated trials compared to 21% of the non-medicated sessions (total number of trials: $n=24$). With the exception of one ejaculate consisting of three fractions with a total volume of 23 ml and acceptable quality, only small amounts of seminal droplets with poor sperm concentration ($< 10000/\text{mm}^3$) could be collected. In most cases, motility and vitality were high (60-85%). For further analysis details on the collected ejaculate with stress on morphologic and morphometric characteristics see Silinski et al. these proceedings. In contrast to the disappointing results concerning our initial aim to allow repeated and predictable manual semen collections, the medication had a significant influence on onset of penile erection ($p < 0,05$; T-test) and duration ($p < 0,05$; T-test) (Figures 2 and 3).

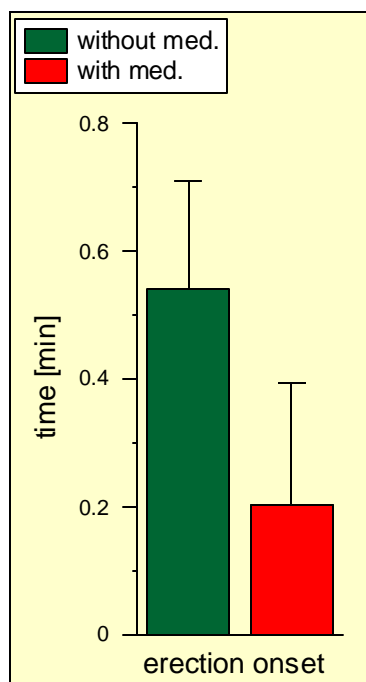


Fig. 2: Onset of penile prolapse and subsequent erection after beginning with manual stimulation in non medicated and medicated trials (mean \pm SEM).

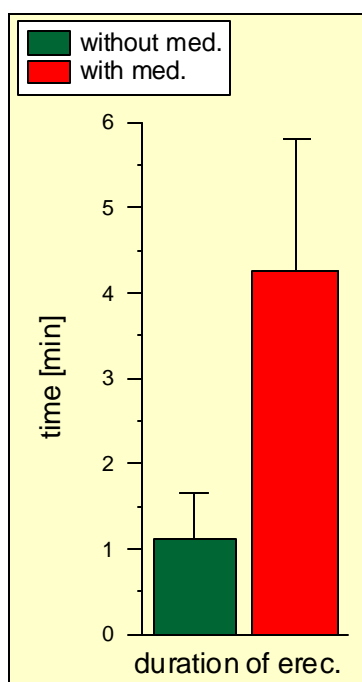


Fig. 3: Duration of penile erection induced by non medicated trials and medicated trials (mean \pm SEM).

The induction and number of penile muscle contractions showed a positive trend when alpha-adrenergic agents were administered. Comparing the influence of the various applied doses, no significant difference was noted on the assessed objective parameters.

Though one ejaculate of acceptable quality and quantity was obtained in a medicated trial, a routine collection of semen samples using Detomidine-HCl combined with Butorphanol was not achieved in the evaluated individual.

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