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EVALUATION OF AN ANAESTHESIA PROTOCOL FOLLOWING TRANSLOCATION OF FERAL HORSES OUTSIDE THE LETEA FOREST

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Abstract

This study was performed in order to evaluate an anaesthetic protocol used for remote chemical immobilization of ten free ranging feral horses (Equus ferus caballus) for the following purposes: translocation, health assessment and/or contraceptive immunization. Horses were immobilized using a Ketamine/Medetomidine combination delivered remotely with a 6 mL dart syringe from a dart gun. A mean ($\bar{X}$) induction time of 7 minutes (SD = 2.82) with a $\bar{X}$ = 83.3 minutes of recumbency was recorded using $\bar{X}$ = 2.37 mg/kg Ketamine (1.89-2.81 mg/kg) and $\bar{X}$ = 0.09 mg/kg Medetomidine (0.08-0.1 mg/kg). Heart rate ($\bar{X}$ = 38.43), respiratory rate ($\bar{X}$ = 26.14), rectal temperature ($\bar{X}$ = 35.12), relative arterial oxygen hemoglobin saturation ($\bar{X}$ = 83.11) and capillary refill time (1-1.5 s) were monitored during anaesthesia, every 10 minutes after induction until recovery. This protocol was suitable for the chemical immobilization of the feral horses from the Danube Delta - Romania providing a good anaesthesia depth and muscular relaxation. Nevertheless, supplementation of Oxygen is recommended for the resulting hypoxia.

Key words*: chemical immobilization, feral horses, ketamine, medetomidine, translocation.*

INTRODUCTION

This current study is part of ARCA's Feral Horse Birth Control Program in collaboration with Danube Delta Biosphere Reserve Authority and Romsilva Tulcea and took place in Letea Sandbank, Tulcea County, Romanian Danube Delta. Letea Sandbank consists mostly by forests and grassland (app. 10.000 ha), from which 2825 ha is represented by the strictly protected Letea Forest which is surrounded by a fence. According to ARCA's aerial census form 2019, up to 600 feral horses roam free in this area, from which 300 live in the Letea Forest (Roșu, 2017).

Due to the potential negative impact on the vegetation done by the rising number of horses in the Letea Forest, a need of both physical removal and reproduction control was necessary. Therefore, during ARCA's Birth Control Program, a protocol of chemical immobilisation was evaluated for ten horses from/near the Letea Forest with the purpose of translocating them outside the forest and/or contraceptive vaccination with Porcine Zona Pellucida (PZP) (Roșu et al., 2014; Roșu, 2017).

MATERIALS AND METHODS

The study was carried out from January to November (2019-2020). Ambient temperatures ranged from -4ºC to 6ºC (average of 1.75ºC), with an average wind speed of 5.1 m/s and a maximum of 6.6 m/s. No immobilizations had been carried out during snowfall or heavy rain. During heavy wind, the immobilization occurred in the wind shadows of the forest. Seven mares and three stallions were part of the study. They were either translocated (or already outside/near the Forest), microchipped, ear tagged and the mares received an immunocontraceptive vaccine with PZP (Roșu, 2017). All ten horses were healthy based on their physical appearance and behaviour and were members of established harem groups. The procedures involved physical restraint and transportation of eight horses outside the Forest. The car travelled each time about 3-4 km distance on a forest road. The two remaining horses of the study were immobilized only for reproduction control and did not need translocation, being outside the forest. For remote chemical immobilization, Ketamine dry powder (Ketamine 1 g, Kyron

Laboratories, Johannesburg, South Africa) diluted with Ketamine 100 mg/ml (Ketamidor®, Richter Pharma ag, Wels, Austria) and Medetomidine 40 mg/ml® (Kyron Laboratories) were used. The substances were delivered by Pneu-Dart® type "U" through a compressed air tranquilizer dart-gun Pneu-Dart® X-Caliber. The chemical immobilizations were done using a single disposable 6 ml dart, with a standard combination of 775 mg/horse Ketamine (K) and 30 mg/horse Medetomidine (M). A combination of Ketamine powder, diluted with a solution of Ketamine and Medetomidine was calculated and divided for 6 ml darts, according to the following formula: Ketamine dry powder 1000 mg + 2100 mg, injectable Ketamine 100 mg/ml (21 ml) +120 mg Medetomidine (3 ml)-total of 24 ml, 6 ml/dart used for anaesthesia.

Horses were darted from 15 to 40 m distance in the rump or cervical region. First signs of induction were noticed when mild ataxia and stilted gait occurred. The induction time was evaluated form the time of successful dart placement to lateral recumbency. Once induced horses were blindfolded and placed with the head and lower forelimb extended at the beginning of anaesthesia then restrained for transportation. All hands-on procedures were done in a safe zone behind the horse's spine to prevent any possible injury (Gimenez R. et al., 2008). During anaesthesia, heart rate, pulse rate (evaluated using a stethoscope or with the pulse oximeter Nonin® 2500 A; Minneapolis, USA with the probe attached to the tongue), respiratory rate (evaluated using a stethoscope or by observing the thoracic movements), rectal temperature (digital thermometer), oxygen haemoglobin saturation - SpO_2 (Nonin® 2500 A; Minneapolis, USA) and capillary refill time were monitored every ten minutes after induction, until recovery (Muir WW, Hubell JAE, 2009). For the transportation, the following restraint method was used: the horses in lateral recumbency were pulled on the rescue glide (8' x 4' Assisting Glide, L.A.R.G.E Inman, South Carolina, USA) through the backside manner technique, legs were pulled and tied together by hobbles (Nylon Hobbles, L.A.R.G.E Inman, South Carolina, USA) at the pastern level and secured to the glide holes by one 2 m long strap (Gimenez R. et al., 2008). The head was fitted with a halter and secured to the glide and the glide front was attached to the car by a 1 m long stap. The horses were monitored during transportation from the back of the car through the glass window, respiratory frequency was evaluated every ten minutes by counting the thoracic movements or the warm air coming out the nostrils. At the end of anaesthesia 25 mg Atipamezol (Antisedan® 5 mg/ml, Orion Corporation Animal health, Turku, Finland)/horse was administrated iv.

During the recovery phase the horses were monitored based on the behaviour changes during sternal recumbency (calm/increased muscle tension/padding), on the transition to sternal recumbency with the number of attempts to recover the standing position, after stimulation (calm, well-coordinated/ difficult/ rolls to the other side/immediately tries to stand), description of sternal recumbency, transition to standing position, balance and coordination while standing, an overall impression and the final score.

Total body weight was measured with the tape measure technique. For the tape technique the horses were measured around the girth (times 2) while recumbent, then the value was multiplied by the body length measured from point of shoulder to point of the ischial tuberosity in cm, and divided by a standard number, resulting the weight in kilograms.

The set-out formula to asses body weight in horses (Elizabeth L. Wagner et al., 2011) is:

weight (kg) = [(heartgirth^2 × body length)/ (11,880 cm^3)].

RESULTS AND DISCUSSIONS

Two groups of horses were established according to their weight: 200-300 kg, 5 horses, > 300 kg, 5 horses.

Seven out of ten horses were immobilized after administering anaesthesia through a single dart and three needed a supplemental standard combination dart (775 mg/horse Ketamine (K) and 30 mg/horse Medetomidine (M) since they were not induced/or presenting any signs of induction at 15 minutes after a fully discharged dart.

For induction of anaesthesia the following total dosages were used in this study: $\bar{X}$ = 2.37 mg/kg Ketamine (1.89-2.81 mg/kg) and $\bar{X}$ =

0.09 mg/kg Medetomidine (0.08-0.1 mg/kg). The mean ($\bar{X}$) induction time was 7 minutes (SD = 2.82) with a $\bar{X}$ = 83.3 minutes of recumbency after induction. Heart rate ($\bar{X}$ = 38.43), respiratory rate ($\bar{X}$ = 26.14), rectal temperature ($\bar{X}$ = 35.12), relative arterial oxygen haemoglobin saturation ($\bar{X}$ = 83.11) and capillary refill time (1-1.5 s) were monitored during anaesthesia, every 10 minutes after induction until recovery (Table 1).

Table 1. Physiological parameters measurements (given in mean ± SD and range) - Temp. = temperature; SpO_2 = relative arterial oxygen haemoglobin saturation; CRT = capillary refill time, K = Ketamine (additional intravenous dose administered), A = Atipamezole (a total intravenous dose administered), T1 = induction time, T2 = recumbency time, n = number of animals evaluated

Variable	n	200-300 kg	n	>300 kg
HR (bpm)	5	36.58 ± 5.95 (31-54)	5	39.78 ± 10.78 (28-68)
RR (breaths)	5	26.12 ± 4.28 (20-36)	5	26.97 ± 4.6 (18-40)
Temp (°C)	5	34.83 ± 1.14 (32.7- 36.6)	3	35.42 ± 0.73 (34.1-36.8)
SpO_2 (%)	5	83.87 ± 5.88 (71-96)	5	82.6 ± 7.93 (64-97)
CRT (sec)	5	1.28 ± 0.26 (1-1.5)	5	1.25 ± 0.24 (1-1.5)
T1 (minutes)	5	7.2 ± 2.38 (4 – 10)	5	6.8 ± 3.49 (2-11)
T2 (minutes)	5	74.2 ± 14.21 (62 – 95)	5	92.2 ± 44.66 (64-169)
K (mg) iv	0	-	3	600 ± 264.5 (400.0-900.0)
A (mg) iv	3	25	5	25

During recovery all horses experienced a certain degree of ataxia. All horses were provided with good myorelaxation during transportation and the medical assessments. Three horses required supplemental doses of ketamine (top up administered iv in the jugular vein) due to signs of spontaneous recovery or incomplete immobilization. Mean translocation time ($\bar{X}$) of 24 minutes was recorded (SD = 9.94 minutes). The horses immobilised to the rescue glide attached to the car were extracted outside the Letea Forest fence, one by one, using the forest roads trying to protect the surrounding vegetation. Field conditions (the area where the anesthetised horse fell asleep and the difficulty of finding it, fences, trees, bad weather: heavy rain, fog) made animal extraction challenging in some situations, thus the duration of transportation longer. One stallion (exception) with the duration of recumbency of 169 minutes received two intramuscular darts (the second one was given because the stallion was in a standing position after the first dart, although already sedated) and needed supplementation of anaesthesia (two top ups). It took 25 minutes to pull the glide with the horse and attach it to the car so it could be translocated (first top up of Ketamine during the extraction). During the transportation (total of 35 minutes) it showed signs of spontaneous recovery (ear twitching, muscle contraction, head tilt). The horse managed to get up and rolled over while connected to the rescue glide with the straps and hobbles. The car was stopped, the anaesthesia was supplemented IV and the hobbles and straps securely repositioned. The recovery was prolonged and in standing position the stallion was ataxic and unstable for about 10 minutes. At the end of anaesthesia eight of the horses were antagonized with 25 mg Atipamezole/horse iv as a standard dose, while two recoveries were spontaneous. The horses that received antagonization, were assisted recoveries (the horses needed help transitioning from lateral recumbency to sternal recumbency, then to standing position) by hand.

CONCLUSIONS

The standard combination used proved to be effective for the remote chemical immobilization of the feral horses, providing an appropriate degree of anaesthetic depth and myorelaxation.

All the horses showed a slight increase in cardiac and respiratory frequency, with the decrease of tissular oxygenation and temperature. The resulting peripheral hypoxia can be countered with the supplementation of oxygen which was difficult to do in field conditions. One factor that influenced the respiratory frequency and amplitude was the restraint and transportation of horses on the glide.

An advantage of the anaesthetic combination is the possibility of antagonizing one of the components (M).

To the best of the authors' knowledge this is the first case of equine transportation by car with the rescue glide under general anaesthesia for the purpose of translocation under continuous monitoring. This procedure can be potentially

dangerous for the animal and it has to be carefully monitored.

All the procedures were conducted with safety measures taken at each step. No mortalities were recorded.

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