Remote immobilization of the aardwolf

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Aardwolves Proteles cristatus (n = 52) were immobilized on 112 occasions using a combination of ketamine hydrochloride and acetylpromazine and three different darting systems. Ketamine hydrochloride doses of 10–20 mg/kg, together with doses of 0,15–0,40 mg/kg acetylpromazine were effective in inducing anaesthesia within 5 min. Low intramuscular doses of 0,10–0,15 mg/kg diazepam following immobilization proved effective in reducing the flight distance of aardwolves followed the night after darting.

Maanhaarjakkalse (aardwolwe) Proteles cristatus (n = 52) is by 112 geleenthede met 'n kombinasie van ketamienhidrochloried en asetielpromasien verdoof deur gebruik te maak van drie verskillende verdowing­stelsels. Ketamiendhidrochloried-dosisse van 10–20 mg/kg, is saam met dosisse van 0,15–0,40 mg/kg ase­tielpromasien gebruik. Verdowing het binne 5 min ingetree. Lae binnespierse dosisse van 0,10–0,15 mg/kg diazepam op die aand van verdowing het aardwolwe se vlugafstand tydens agtervolging die daaropvolgende aand verminder.

Keywords: aardwolf, Proteles cristatus, carnivore, immobilization, ketamine hydrochloride, acetylpromazine, diazepam

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Introduction

A ketamine hydrochloride-acetylpromazine combination has been used successfully in the immobilization of a number of small carnivores, e.g. black-backed jackal Canis mesomelas (Rowe-Rowe & Green 1980) and serval Felis serval (Rowe-Rowe & Lowry 1982), but its effectivity on the aardwolf Proteles cristatus has not yet been described. In this paper an effective field immobilization procedure for the darting and immobilization of free-ranging aardwolves is presented.

Materials and Methods

The study was conducted on Benfontein (28°50'S/24°50'E), an 11 300 ha game farm, situated approximately 6 km south-east of Kimberley in the northern Cape Province, South Africa. Free-ranging aardwolves (n = 52) were immobilized on an irregular basis between October 1981 (Richardson 1985) and February 1991 (Anderson unpubl.) as part of a long-term study on their social behaviour, ecology and physiology. The animals were immobilized for short periods (20–45 min) in order to fit radio-collars, draw blood samples and earmark individuals (Richardson 1985); or for longer periods (up to 2,5 h) in order to implant temperature telemeters (Telonics IMP/400/L, Arizona, USA) or to inject radio isotopes and draw equilibration blood samples.

Aardwolves were followed in a four-wheel-drive vehicle and visual contact at night was maintained by using the headlights of the vehicle and a spotlamp. They were darted from the vehicle during the late afternoon, or at night in the light of the spotlamp. Most animals were darted while standing still and feeding, or when lying down, when they could be approached to within less than 15 m.

Three different darting methods were employed and their frequency of use and the drug dosages used are summarized in Table 1. The drugs used were ketamine hydrochloride (Ketalar; Parke-Davis Laboratories (Pty) Ltd., Isando, RSA), acetylpromazine (ACP; Centaur Labs (Pty) Ltd., Johannesburg, RSA) and diazepam (Valium; Roche Products (Pty) Ltd., Isando, RSA).

Table 1 The darting methods and drug dosages used for the immobilization of 112 aardwolves. Ketamine hydrochloride and acetylpromazine were injected via the darts, and diazepam was injected after immobilization

<table>
<thead>
<tr>
<th>Number of Darings</th>
<th>Drugs and dosages used (mg/kg)</th>
<th>Daring method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ketamine</td>
<td>ACP</td>
</tr>
<tr>
<td>4</td>
<td>10,0</td>
<td>0,2</td>
</tr>
<tr>
<td>8</td>
<td>12,0</td>
<td>0,2</td>
</tr>
<tr>
<td>84</td>
<td>10,0–20,0</td>
<td>0,15–0,40</td>
</tr>
<tr>
<td>16</td>
<td>10,0–20,0</td>
<td>0,15–0,40</td>
</tr>
</tbody>
</table>

Fifty-two aardwolves were darted on 112 different occasions. Of these, 24 were adults (mean mass 8,9 kg; range 7,2–11,6 kg) which were darted on 68 occasions and 36 were subadults or cubs (mean mass 5,8 kg; range 1,6–9,2 kg), eight of which were later darted as adults. One adult female was darted 10 times.

Four aardwolves were darted from distances of 7–8 m using a blow pipe with projectile syringes as darts (Richardson 1983). Eight aardwolves were darted from 8–12 m with a crossbow system (Richardson 1983) and projectile syringes. Thereafter, aardwolves were darted on 100 occasions with a Telinject dartgun (Telinject SA, Randburg, RSA) and 1,5 ml Telinject darts. Aardwolves were darted from distances of 10, 12 or 15 m, and the dartgun was calibrated using the minimum amount of pressure required to dart accurately at these distances. All darts were marked with reflective tape
to facilitate recovery at night (Richardson 1983; McKenzie 1989).

Binoculars on which the focusing ring had been marked for distances of 10, 12 and 15 m were used to determine the range of the aardwolf to be darted. Recumbency time was recorded as the time lapse between darting and the moment of first sternal contact with the ground. Difficulties owing to dart falling out, poor visibility or temporarily losing the animal in the long grass prevented the accurate determination of recumbency in most instances.

On a few occasions complete induction did not take place because the dart became dislodged from the animal and the full dose was not injected. These animals were then given additional ketamine hydrochloride (5-10 mg/kg) using a syringe, or were redarted from the vehicle from 5-10 m if it was not possible to approach them on foot.

Once the induction of anaesthesia was complete the needle was removed from the aardwolf and the entry wound cleaned and treated (Kemi Spray; C.E. Industries, (Pty) Ltd, Kempton Park, RSA). Animals were also injected with a wide spectrum antibiotic (Combimycin; C.E. Industries, (Pty) Ltd, Kempton Park, RSA) and those immobilized during winter were wrapped in a blanket to prevent hypothermia. Maintenance of anaesthesia, when necessary, was achieved by administering additional intramuscular doses of ketamine hydrochloride (usually "half-doses", 6-8 mg/kg) when the animal started showing signs of recovery. Once the handling of the animal was complete it was taken to an open area near the place of capture and placed in lateral recumbery on the ground. Recovery was observed from the vehicle from 20-30 m. When the animal started walking it was followed to see that it recovered properly and came to no harm from black-backed jackals. In their drugged states, these aardwolves were completely unperturbed by the presence of the vehicle. Whenever possible, aardwolves were followed the next night to check that they were not suffering any ill effects as a result of the immobilization.

Towards the end of the study we tried to reduce the trauma of prolonged immobilization, and reduce post-capture shyness, by injecting aardwolves intramuscularly with diazepam (Table 1).

**Results**

When aardwolves were encountered for the first time, their flight distance at night was usually between 50 and 100 m. By day this varied between 100-400 m. However, by maintaining visual contact with the animal at a distance at which it was not disturbed, this flight distance was reduced to between 15-30 m within 2-4 days. When aardwolves were feeding, they became so engrossed that it was possible to approach and dart them from 10-15 m.

Most aardwolves displayed a post-darting flight reaction by running a distance of up to 100 m. After 2-5 min the animals became ataxic, lost coordination and began to stumble, and at this stage seemed unaware of the vehicle and spotlight. Recumbency took place after 3-5 min (Table 2; these data are for animals which were immobilized after a perfect darting and where visual contact was maintained until the animal fell to the ground). The reaction then progressed to a state of catlepsy in which the animals were unconscious. This usually occurred within 2 min of the animal first falling to the ground.

Aardwolves which received only one dose of ketamine hydrochloride started showing signs of recovery after 20-45 min. Usually within 60 min they were able to stand for the first time, but continued to be ataxic for the next 45-60 min. At this stage they appeared completely steady and it was considered safe to leave them. Many aardwolves, particularly during winter, returned to their dens within an hour of recovery and stayed there for the rest of the night. All 20 aardwolves immobilized for longer than 2.5 h recovered fully.

No aardwolves died while under anaesthesia. However, one aardwolf was clearly sick when darted and although it recovered and walked back to its den, it died a few days later. His condition may have been exacerbated by the immobilization. Only two aardwolves suffered from more than the usual wounds associated with needle penetration. These two aardwolves suffered from fractures of the humerus and femur respectively. After treatment by a veterinary surgeon both animals recovered. No serious or adverse effects were noted after the implantation or removal of the internal transmitters, although it usually took at least two days before the animals could be approached to within 20 m.

Moderate muscle rigidity, particularly of the legs and neck, and salivation, which are typical side effects of immobilization using ketamine (Hash & Horlicker 1980), were noted in some animals. However, muscle rigidity could be reduced to negligible levels by administering an additional quarter to half dose of ketamine. Muscle spasm, as is sometimes found in other carnivores, was never recorded. Salivation was not excessive and was not regarded as hazardous because the swallowing reflexes remained intact.

The behaviour of aardwolves followed by vehicle the day after immobilization varied considerably. Their flight distance depended on a number of variables, such as their level of habituation, their hunger and the availability of food, so the impression of the effect of diazepam on the ketamine-ACP drug combination was subjective. Nevertheless, after taking these factors into account, the use of diazepam is

**Table 2 Recumbency times of 10 aardwolves after administration of ketamine hydrochloride and acetylpromazine**

<table>
<thead>
<tr>
<th>Sex</th>
<th>Mass (kg)</th>
<th>Age*</th>
<th>Darter dose (mg/kg)</th>
<th>Recumbency time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Female</td>
<td>Female</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>5.3</td>
<td>10.5</td>
<td>13.2</td>
<td>18.2</td>
<td>14.0</td>
</tr>
<tr>
<td>6.8</td>
<td>6.8</td>
<td>6.8</td>
<td>6.8</td>
<td>6.8</td>
</tr>
<tr>
<td>7.0</td>
<td>7.2</td>
<td>7.6</td>
<td>8.6</td>
<td>9.3</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>0.38</td>
<td>0.36</td>
<td>0.28</td>
<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td>4 min 30 s</td>
<td>3 min 22 s</td>
<td>2 min 54 s</td>
<td>3 min 25 s</td>
<td>4 min 30 s</td>
</tr>
</tbody>
</table>

* A = adult (> 2 years); S = subadult (1-2 years); C = cub (< 1 year)
believed to have been successful as eight aardwolves which were not fully habituated were approached to within 20 m, within 2 h, the night after immobilization. Normally, aardwolves with similar levels of habituation, but not injected with diazepam, would have to be followed for at least 6 h (and occasionally for a few nights) to be approached this close.

Discussion

The major difficulty with darting aardwolves with a blow pipe was that the effective range was only 7–8 m. Richardson (1983) therefore designed a crossbow system which was accurate up to 10 m. However, the release of the elastics produced a loud noise which aardwolves sometimes reacted to by jumping away, resulting in a miss. A major problem associated with both these darting methods was that the dart followed a very curved trajectory, so an error in range estimation of 1 m easily led to a miss. The Telinject dartgun was highly effective and reliable in darting aardwolves at ranges of 10–15 m. This dartgun makes use of compressed air, adding considerable power in comparison with the previous two systems. The darts travel much faster and have a flatter trajectory, thus allowing more room for error in range estimation. Another advantage of this system is that the gun is virtually silent, reducing the problem of animals reacting to the sound of the gun.

When immobilizing animals in the wild, two of the most important requirements are a rapid recumbency time, in order to reduce the chances of losing the animal after darting, and a wide dosage tolerance to prevent the accidental administration of an overdose. The combination of ketamine hydrochloride and ACP, when used on aardwolves, satisfies both these requirements, making it a suitable combination for the immobilization of free-ranging animals. Nevertheless, if an aardwolf continued to run after its initial post-darting reaction, it became very difficult to maintain visual contact with it until it became recumbent, so a faster acting drug would have been more desirable.

Van Jaarsveld (1988) found Zoletil to be a very safe and effective drug for the immobilization of spotted hyaenas Crocuta crocuta, with a recumbency time of under 3 min. However, Zoletil is generally not available in South Africa and is difficult to obtain. It is also supplied in a freeze-dried form and rapidly loses its potency after being reconstituted (Van Jaarsveld 1988). The difficulty of darting aardwolves in the wild on a predictable basis therefore made it uneconomical to consider using this drug on the aardwolf.

It is worth noting, however, that although ketamine hydrochloride is supposed to have a long shelf life it was found that certain batches appeared to be less potent. It was for this reason that the dosage was increased from the initial 10 mg/kg ketamine hydrochloride (in line with Rowe-Rowe & Green (1980) for short-period immobilization) to approximately 15 mg/kg with 0.25 mg/kg acetylpromazine. This accommodated any decline in potency without being so high as to endanger the life of the animal.

On many occasions since 1988 detailed information from direct observations were necessary the night after immobilization. This was possible for the more habituated individuals, but proved difficult for the less habituated animals. It was because of this problem that diazepam was used in an attempt to minimize any negative reaction by the animal after recovery and reduce the stress of immobilization. Harthoorn (1975) has suggested that an immobilized animal's vigorous reaction to ocular and auditory stimuli can be suppressed with diazepam, thereby calming the animal and reducing stress caused by noise and disturbance. The ketamine-diazepam combination is an excellent and safe anaesthetic, which provides both profound muscle relaxation and visceral analgesia (Harthoorn 1975).

The number of biotic variables involved make our data largely subjective. Nevertheless, we believe injecting immobilized aardwolves with diazepam had a calming effect and hence reduced post-capture shyness.

To conclude, ketamine hydrochloride and acetylpromazine was found to be a successful drug combination for the immobilization of aardwolves, and a dosage of 15 mg/kg ketamine and 0.25 mg/kg acetylpromazine is recommended. The additional use of diazepam to reduce post-capture shyness should also be considered.

Acknowledgments

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References