Capture and immobilisation of aardvark (*Orycteropus afer*) using different drug combinations

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ABSTRACT

Nine aardvarks (*Orycteropus afer*) were captured in the southern Free State, South Africa, for the placement of abdominal radio transmitters. Five combinations of ketamine hydrochloride with xylazine hydrochloride, midazolam or medetomidine hydrochloride were used to induce anaesthesia. In some cases the level of anaesthesia was maintained with 1.5 % halothane. A mixture of ketamine hydrochloride and medetomidine hydrochloride was found to be most effective. Atipamizole reversed the affects of medetomidine hydrochloride, resulting in a smooth and full recovery within 8 minutes. The immobilisation and subsequent anaesthesia of these animals on cold winter nights resulted in hypothermia, and keeping the animals warm was essential to the success of the procedures undertaken. Reversal of the sedative medetomidine hydrochloride proved to be important, because animals that were released before they were fully conscious took refuge in their burrows so that care was impossible.

Key words: aardvark, anaesthesia, atipamizole, halothane, ketamine, medetomidine, midazolam, *Orycteropus afer,* xylazine.

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INTRODUCTION

The aardvark *Orycteropus afer* is a nocturnal mammal and the only surviving representative of the order Tubulidentata[2]. It is widely distributed on the African continent south of the Sahara[2]. Aardvarks were immobilised at Tussendie-Riviere Nature Reserve in the southern Free State for the implantation of abdominal radio transmitters to permit telemetric monitoring in a behavioural study. As few data were available on anaesthetic agents and their dosages for the immobilisation of aardvarks, different drugs and dosage protocols were tested.

MATERIALS AND METHODS

Trapping

Aardvarks were located at night using a spotlight. When an animal was spotted, it was usually chased into a burrow by vehicle. A cage-trap was set in front of the burrow in such a way that the animal was compelled to go through it when attempting to escape. The sliding door to the trap faced the burrow opening and was linked to it by a funnel formed from iron sheeting. The door was triggered by a trip-wire placed across the floor of the trap. Initially the trap was checked hourly to determine when the animal had been captured. Later, someone was stationed downwind from the trap to enable the administration of immobilising drugs immediately after capture.

After capture, the trap was lifted onto its end. The animal slid down, to be confined at the bottom of the trap, and the drug could be injected through the bars of the cage. The animal was removed from the trap when immobilised and transported to the operating theatre.

Two animals were captured by hand before they reached burrows and were injected while restrained. Two habituated animals were caught a 2nd time for placement of new radio transmitters after the batteries of the 1st transmitters had failed. These animals were caught by dropping a square piece of netting over them and then restraining them manually until the anaesthetic took effect.

Antibiotics administered

The aardvarks were given 600 000 i.u. each of procain benzylpenicillin and benzathine benzyl penicillin (Peni LA®, Phenix SA) after surgery.

Immobilising drugs

Aardvarks were immobilised according to one of the following protocols (all drugs were administered intramuscularly):

1. 2.4 mg/kg ketamine hydrochloride (Anaket-V, Centaur, Bayer) and 71 μg/kg medetomidine hydrochloride (Domitor, Novartis).
2. 14 mg/kg ketamine hydrochloride and 0.94 mg/kg xylazine hydrochloride (Rompun 2 %, Bayer) with reversal by 0.3 mg/kg atipamizole (Antisedan, Novartis).
3. 20 mg/kg ketamine hydrochloride and 0.68 mg/kg midazolam (Dormicum, Roche).
4. 15.5 mg/kg ketamine hydrochloride and 0.28 mg/kg midazolam.
5. 3 mg/kg ketamine hydrochloride and 78 μg/kg medetomidine hydrochloride followed by maintenance with 1.5 % halothane (Fluothane, Zeneca) and reversal with 0.39 mg/kg atipamizole.

Radio transmitters (IMP/400/L implantable transmitter, Telonics Inc.) were implanted intra-abdominally into each animal, and temperature loggers (StowAway™ Tidbit, Onset Computer Corporation) were implanted into 4 of the animals.

Vital signs, as well as the level of consciousness, were monitored in all the animals. They were always released as close as possible to the locality of capture. Autopsies, which included microbiological investigations where appropriate, were conducted on aardvarks that had died.

RESULTS

Protocol 1

Male (42 kg) captured on the 2nd night of trapping. T_0 was taken as the starting time at which the 1st anaesthetic injection was administered. Results of anaesthesia and dosages used, consciousness and parameters monitored are presented in Table 1. As soon as the animal became tractable, it was transported to the operating theatre and prepared for the laparotomy.

The rectal temperature decreased from 35.5 °C at $T_{35\ min}$ to 34.2 °C at $T_{78\ min}$ despite efforts to increase the room temperature

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Table 1. **Results of using an intra-muscular combination of ketamine hydrochloride and medetomidine hydrochloride.**

Time (Tx) (min)	Drug administered	Dosage	Notes/animal activity	Rectal temperature (°C)	Pulse rate (per min)	Respiratory rate (per min)
0	Medetomidine hydrochloride	71 μg/kg				
	Ketamine hydrochloride	2.4 mg/kg				
6			Animal unconscious		100	18
35			Unconscious	35.5	85	14
50			Laparotomy started	34.9	82	12
70			Unconscious	34.3	80	12
78			Laparotomy completed	34.2	80	12
80	Procain benzylpenicillin	600 000 i.u.	Animal wakes up suddenly and needs manual restraint			
	Benzathine benzylpenicillin	600 000 i.u.				
	Sodium salicilate	60 mg				
82	Ketamine hydrochloride	1.8 mg/kg				
85			Animal tractable			
100	Ketamine hydrochloride	2.3 mg/kg	Strong voluntary movement			
110	Ketamine hydrochloride	1.8 mg/kg	Strong voluntary movement			
120			Animal released at burrow			
1 day			Animal out of burrow, fully recovers			

and placing heated water bottles against the animal's body. When the antibiotic was administered after the procedure, the animal reacted violently and had to be restrained manually. Despite the administration of an additional 75 mg ketamine hydrochloride, it started to struggle again within 10 minutes. Subsequent additional intra-muscular dosages of 50 mg and 75 mg ketamine hydrochloride did not result in adequate immobilisation of the aardvark and it was finally released at $T_{120\ min}$ because it became extremely difficult to restrain. The animal left the burrow the following night and was behaving normally. The total dosage of ketamine hydrochloride used during the procedure was 350 mg or 8.33 mg/kg .

Protocol 2

Male (32 kg) captured on the 3rd night of trapping. Additional ketamine hydrochloride was administered before and a few times during the operation to maintain an adequate level of anaesthesia (Table 2). When the pulse rate decreased to 40 beats/minute at $T_{40\ min}$ 0.03 mg/kg atropine sulphate was administered i.m. At $T_{55\ min}$ it was decided that the frequency at which additional dosages of ketamine hydrochloride were required would be a problem, and l mg medetomidine hydrochloride was administered i.m. A total of 850 mg ketamine hydrochloride (26.5 mg/kg) was administered in divided dosages to complete the procedure.

After the procedure, atipamizole hydrochloride was administered i.m. at 0.3 mg/kg and the animal placed in front of the burrow where it was captured. The aardvark regained consciousness sufficiently to enable it to crawl into the burrow within 15 minutes. It did not leave the burrow. After 3 days it was excavated and found dead. It appeared that the animal probably died of asphyxiation, as the nostrils were blocked with soil, and atelectasis of both lungs was observed. There was no evidence of an infectious process.

Protocol 3

Female (37 kg) captured on the 2nd night of trapping. She had notably more external parasites (predominantly mites) than the previous 2 animals and was visibly emaciated. The animal's body tem-

Table 2. **Results of using an intra-muscular combination of ketamine hydrochloride and xylazine hydrochloride.**

Time (Tx) (min)	Drug administered	Dosage	Notes/animal activity	Rectal temperature (°C)	Pulse rate (per min)	Respiratory rate (per min)
0	Xylazine hydrochloride	0.94 mg/kg				
	Ketamine hydrochloride	14 mg/kg				
	Atropine sulphate	0.03 mg/kg				
7			Immobilised and tractable			
20	Ketamine hydrochloride	4.7 mg/kg	Slight limb movements Laparotomy started after dosage	37.5	60	12
30				35.4	52	12
40	Ketamine hydrochloride	3.1 mg/kg	Intra-venous follow up dosage given due to voluntary movements	33.7	40	12
	Atropine sulphate	0.03 mg/kg				
50	Ketamine hydrochloride	3.1 mg/kg	Voluntary movements during surgery	33.7	48	12
55	Ketamine hydrochloride	1.5 mg/kg	Intra-muscular follow up dosage			
	Medetomidine hydrochloride	0.03 mg/kg	due to voluntary movements			
60	Procain benzylpenicillin	600 000 i.u.				
	Benzathine benzylpenicillin	600 000 i.u.				
	Sodium salicilate	60 mg				
75	Atipamizole hydrochloride	0.3 mg/kg	Animal placed in front of burrow			
90			Animal moved into burrow unaided			
3 Days			Animal does not exit burrow Found dead due to asphyxiation			

Table 3. **Results of using an intra-muscular combination of ketamine hydrochloride and midazolam.**

Time (Tx) (min)	Drug administered	Dosage	Notes/animal activity	Rectal temperature (°C)	Pulse rate (per min)	Respiratory rate (per min)
0	Midazolam	0.68 mg/kg				
	Ketamine hydrochloride	20 mg/kg				
3.5			Unconscious			
30	Ketamine hydrochloride	8.1 mg/kg		35.4	84	16
	Oxygen *via* face mask	4ℓ/min				
36			Laparotomy started			
40				35.5	72	14
45	Ketamine hydrochloride	5.4 mg/kg	Unconscious, deep pain reflex present			
50	Procain benzylpenicillin	600 000 i.u.	Laparotomy completed	33.7	64	12
	Benzathine benzylpenicillin	600 000 i.u.				
	Sodium salicilate					
60			Wrapped in blanket in heated vehicle			
80			Slight voluntary limb movements			
110			Retracts tongue, strong limb movements			
165			Difficult to restrain, so released in veld			
225			Left to enter burrow			
1.5 days			Animal does not exit burrow			
			Dug up but is barely alive			
			Dies, probably as a result of hypothermia			

perature continued to drop in spite of the fact that the operation room was heated (Table 3).

Additional doses of ketamine hydrochloride were required to maintain an adequate level of surgical anaesthesia during the course of the procedure. A total of 1240 mg (33.5 mg/kg) ketamine hydrochloride was used. After the operation, the animal was taken to the capture site and kept in a heated vehicle. The outside temperature was 0 °C.

At $T_{165\ min}$ the animal was released because it was becoming difficult to restrain inside the vehicle. It displayed compulsive digging and sniffing, even while partially on its side, and this continued until $T_{225\ min}$ when the animal became relaxed, with drooping eyelids, and only moved when disturbed. At this stage the animal was released into the burrow. Although the rectal temperature was not monitored with a thermometer until the aardvark was released, it felt warmer to touch at $T_{225\ min}$ than at $T_{50\ min}$, possibly because of the constant muscular activity.

The aardvark did not leave the burrow the following evening, and was dug up the following morning. It was found moribund, barely breathing and very cold. A digital thermometer did not register its temperature and the animal died within 15 minutes. The *post mortem* examination revealed multifocal disseminated yellow-white hard nodules 1–3 mm in diameter throughout the lungs. Areas of severe superficial congestion were found in the caudal lobes of the left lung. The pathological indicated subacute, multifocal to disseminated pneumonia. No other abnormalities were found. Lung samples were cultured for aerobic bacteria and *Actinobacillus suis* was identified as the cause of the pneumonia. The cause of death is thought to have been hypothermia, aggravated by the poor condition resulting from the pneumonia.

Protocol 4

Female (45 kg) in good condition was captured on the night that the trap was set. Its body temperature immediately after capture was 37.9 °C (Table 4). Time taken to become recumbent was 4 minutes, but the animal still moved quite strongly. At $T_{7\ min}$, 4.4 μg/kg medetomidine hydrochloride was administered, after which movements ceased. From $T_{25\ min}$, oxygen was administered using a face mask. At $T_{30\ min}$, the animal was able to feel deep pain and 300 mg ketamine hydrochloride was administered intravenously. The animal went into apnoea following this injection; 40 mg doxapram hydrochloride (Dopram® injection, 20 mg/mℓ, Intramed) was administered i.v., after which respiration resumed.

After implanting the transmitter, 4 mg betamethasone (Betsolan Soluble injection, Janssen) was administered (i.v.) together with a combination of 600 mg phenylbutazone, 120 mg sodium salicilate (Arthridine®, 200 mg phenylbutazone/mℓ, 40 mg Na-salicylate/mℓ, Virbac Laboratories) i.m. A combination of 20 000 i.u./kg procain benzylpenicillin and 20 000 i.u./kg benzathine benzylpenicillin (Peni LA®, Phenix SA) was administered as an antibiotic.

During the operation and until release, the animal was kept warm with hot-water bottles and a blanket. From $T_{50\ min}$ to $T_{85\ min}$. It was kept in a vehicle with the heater on. In total, 994.5 mg ketamine hydrochloride was administered (22.1 mg/kg). The aardvark left the burrow the following evening and made a complete recovery.

Protocol 5

The combination of ketamine hydrochloride and medetomidine hydrochloride as induction agents, followed by maintenance of anaesthesia using 1.5 % halothane, was used in 8 animals, 3 females and 2 males, with weights ranging between 19 and 43 kg (Table 5).

The operations were usually completed within 30 minutes of arrival of the animals at the theatre. After the operations were completed, pure oxygen was administered by face mask at 25 mℓ/kg/minute using an open system, until voluntary movements commenced. This usually occurred 20–60 minutes after halothane administration was discontinued. Administration of medetomidine hydrochloride rendered the animals calm and tractable during transport, which took 10–15 minutes, back to the capture site. At the capture site the animals were placed in sternal recumbency and atipamizole hydrochloride administered at 0.34–0.45 mg/kg i.m. The animals were then left to recover undisturbed. Some movement was usually evident within 3 minutes of the atipamizole injection. Recovery was smooth in all cases and the animals were usually ambulatory within 8 minutes of the atipamizole injection. Some individuals resumed normal feeding activities within 10 minutes. No mortalities occurred when using this protocol.

Table 4. **Results of using an intra-muscular combination of ketamine hydrochloride and midazolam.**

Time (Tx) (min)	Drug administered	Dosage	Notes/animal activity	Rectal temperature (°C)	Pulse rate (per min)	Respiratory rate (per min)
0	Midazolam	0.28 mg/kg				
	Ketamine hydrochloride	15.5 mg/kg				
4			Tractable but strong movements			
7	Medetomidine hydrochloride	0.0044 mg/kg	Tractable but strong movements			
11			Unconscious, no voluntary movement			
25	Oxygen *via* face mask	2ℓ/min	Laparotomy started	35	96	12
30	Ketamine hydrochloride i.v.	6.6 mg/kg	Deep pain reflex present	35.3	72	12
			Slight limb movements			
31	Doxapram hydrochloride i.v.	40 mg	Apnoea after ketamine			
31.5			Respiration resumed			
40				35.2	76	12
45			Laparotomy completed	35.1	80	12
48	Betamethasone i.v.	4 mg				
	Procain benzylpenicillin	600 000 i.u.				
	Benzathine benzylpenicillin	600 000 i.u.				
	Arthridine	3 mℓ i.m.				
50			Wrapped in blanket in heated vehicle	35	80	12
60			Legs and ears moving, retracts tongue	34.9	78	12
85			Released because difficult to restrain	35.7	80	16
			Uncoordinated when trying to walk			
160			Walks 2–3 paces before falling over			
170			Walks 5–10 paces before falling over			
190			Walks almost normally			
195			Finds and enters burrow			
1day			Animal out of burrow, recovers fully			

DISCUSSION

Protocol 1

The 1st drug combination of ketamine hydrochloride–medetomidine hydrochloride provided effective immobilisation and subsequent anaesthesia. It appeared, however, that deep pain reflexes should be monitored from $T_{30\,min}$ onwards, as the animal woke up suddenly at $T_{80\,min}$. Increasing the ketamine hydrochloride dose to 4 mg/kg may be advantageous, particularly if surgery is intended. The advantage of this combination is the availability of an antidote for medetomidine hydrochloride (atipamezole hydrochloride), as well as the relatively low dose rate needed for ketamine hydrochloride. Enough time should be allowed for the ketamine hydrochloride to be metabolised and eliminated before the atipamizole hydrochloride is administered.

After the animal awoke suddenly, ketamine hydrochloride was administered on 3 separate occasions to restrain the animal. These additional doses of ketamine, however, seemed to have less effect, and were of shorter duration, than the single 1st injection given.

Protocol 2

A ketamine hydrochloride-xylazine

Table 5. **Summary of results using and intra-muscular combination of ketamine hydrochloride and medetomidine hydrochloride to immobilise aardvarks** (*n* = 6)**, followed by maintenance with 1.5 % halothane.**

Time (Tx) (min)	Drug administered	Average dosage	Dosage range	Notes/animal activity	Rectal temperature (°C)	Pulse rate (per min)	Respiratory rate (per min)
0	Ketamine hydrochloride	3.45 mg/kg	2.8–4.1 mg/kg				
	Medetomidine hydrochloride	0.0825 mg/kg	0.074–0.09 mg/kg				
	Atropine sulphate	0.035 mg/kg	0.02–0.05 mg/kg				
3–5				Unconscious	36.6	75–91	15 (8–28)
15	Oxygen *via* face mask	25 mℓ/kg/min		Arrival at theatre			
	Halothane *via* face mask	1.5 %					
20				Laparotomy starts			
45	Oxygen *via* face mask	25 mℓ/kg/min		Laparotomy ends			
	Halothane *via* face mask	1.5 %					
65–120				Voluntary movements start	34.7	65–74	12
80–120				Arrive at release site in heated vehicle wrapped in blanket			
	Atipamezole hydrochloride	0.39 mg/kg	0.34–0.45 mg/kg	On arrival at release site			
88–128				Ambulatory within ±8 minutes after atipamezole injection			
				Animal enters 1st burrow			
1 day				All animals exit burrows			
				All animals recover fully			

hydrochloride combination was previously used to immobilise aardvark at Tussen-die-Riviere[3]. The dosages used were 10 mg/kg ketamine hydrochloride and 1.5 mg/kg xylazine hydrochloride, but no details were provided on the effect of this combination. From the current work, it appears that xylazine hydrochloride at 1 mg/kg and ketamine hydrochloride at 20 mg/kg should work well, especially for surgical procedures. For restraint, ketamine hydrochloride at 15 mg/kg should keep the animal immobilised for about 20 minutes.

In this study the ketamine hydrochloride-xylazine hydrochloride combination resulted in the death of the 1st animal by asphyxiation in the burrow after release. From Table 2 it can be seen that ketamine hydrochloride was administered 4 times, and in addition the animal was given a dose of medetomidine hydrochloride. The final dose of ketamine hydrochloride was administered only 20 minutes before the release of the animal, and this probably played an important part in its death. Ketamine hydrochloride appears to be effective in immobilising the animal for at least 1 hour. Had this animal been maintained on halothane, as were the last 5 aardvarks, and time allowed for the effects of the ketamine hydrochloride to wear off, it may have survived. In addition to the effects of the drugs, this aardvark had been confined to its burrow for 3 days, during which time it could not have eaten. It was probably in a weakened condition and this may have contributed to its death. After the aardvark died it was decided to let all animals recover fully from anaesthesia before allowing them to enter a burrow.

As was the case with the 1st drug combination, additional doses of ketamine hydrochloride administered when the aardvark showed signs of regaining consciousness had less effect than the initial doses. Maintenance by halothane after the initial immobilisation appears to be a safer approach than administering additional ketamine hydrochloride.

Another disadvantage of the ketamine hydrochloride-xylazine hydrochloride combination without halothane is the stormy recovery that results if the sedative is not reversed. The use of flumazenil as a diazopenone antidote might well have alleviated this problem, but it is unfortunately too expensive for routine use. The use of atipamizole hydrochloride is therefore recommended when xylazine hydrochloride is used in combination with ketamine hydrochloride. A dosage of 1 mg atipamizole should be used for every 8–12 mg xylazine hydrochloride[1].

Protocols 3 and 4

Midazolam was used as a premedication drug because it is known to cause amnesia. Human patients usually have no recollection of events during and immediately before a procedure being conducted after administration of midazolam. Dosages of midazolam for humans are 0.3–0.335 mg/kg for induction of anaesthesia and 0.15 mg/kg for premedication. Recovery times range from 30–80 minutes. As one of the aims of the project was to habituate the aardvarks to humans, and to be able to immobilise the animals on more than 1 occasion, it was thought that drug-induced amnesia would be beneficial.

In both cases where ketamine hydrochloride was used in combination with midazolam, additional ketamine was needed during the laparotomy to maintain adequate levels of anaesthesia. This is not ideal, as additional doses have less effect, therefore higher doses are required. In the case of the 2nd animal (protocol 4), medetomidine was administered at $T_{7\,min}$ to induce better relaxation. A further disadvantage of using midazolam without the antidote was that the animals recovered badly. The 4th animal (which survived) took almost 190 minutes before it could walk normally, while the 3rd animal did not recover fully and died. This animal was in relatively poor condition, with many external parasites (Hybophthyridae), so it is likely that poor health and slow recovery from the midazolam contributed to its death.

If midazolam is used in combination with ketamine hydrochloride, the midazolam dose of 0.3 mg/kg in conjunction with ketamine hydrochloride at 20 mg/kg appears to be suitable for surgical procedures. Although limb movements were present after 15 mg/kg ketamine hydrochloride, this dose might be sufficient for short procedures, *e.g.* marking or weighing. The total dose of ketamine hydrochloride required was greatest when used in combination with midazolam.

The only tranquilliser that significantly decreased the required ketamine hydrochloride dose was medetomidine hydrochloride. With xylazine hydrochloride and midazolam, the ketamine hydrochloride dose needed to produce anaesthesia was 15–33 mg/kg , compared to 3 mg/kg in combination with medetomidine hydrochloride. The other advantage of medetomidine hydrochloride is the availability of the antidote atipamizole.

Protocol 5

The most effective combination used was induction by ketamine hydrochloride at 3 mg/kg and 80 μg/kg medetomidine hydrochloride, followed by maintenance with 1.5 % halothane. Induction time was 2.5–3.0 minutes. The main advantage of this protocol is the low effective dosage of ketamine hydrochloride needed. Ketamine hydrochloride at a dose rate of 0.8–1.6 mg/kg together with 60–100 μg/kg medetomidine hydrochloride has been found effective in ruminants. Felids, ursids and canids have been immobilised with 2.5–3 mg/kg in combination with medetomidine hydrochloride as above; the dose of ketamine hydrochloride is higher (5–8 mg/kg) in primates[1].

In the aardvark, induction was achieved using 3 mg/kg ketamine hydrochloride together with 0.08 mg/kg medetomidine hydrochloride. After surgery, 45–60 minutes later, the effect of ketamine hydrochloride appeared to be minimal. Maintaining the animal on oxygen or air for 20–40 minutes after the procedure reduced the effects of the halothane. The decision to administer the atipamizole was usually based on the detection of slight limb movement or subjectively by smelling the strength of the halothane on the breath of the aardvark. Soon after the laparotomy, the smell of halothane on the breath of the animal is strong, and diminishes later. Once the halothane level has fallen so that it is not easily detected by smell, the administration of atipamizole will result in a smooth recovery within 7–8 minutes.

One of the advantages of using halothane to maintain anaesthesia during the operations was that the initial drug dosages required were much lower, and that additional doses during the operations were not required. Apart from reducing costs, risks to the animals are reduced by decreased drug administration and improved recovery.

Problems encountered

Three problems were experienced: a) asphyxiation due to allowing the animal to enter its burrow before becoming fully conscious, b) determining the depth of anaesthesia, and c) reduced body temperature.

All animals that awoke from anaesthesia without receiving an antidote to the sedative, displayed compulsive digging. This might be due to the hallucinating side-effects of ketamine hydrochloride. In these instances, the animals had to be kept under observation until able to walk without falling over. Animals should only be released into a burrow when fully awake, otherwise suffocation might result.

Depth of anaesthesia was difficult to determine with all the protocols used. It appeared that the palpebral reflex, as well

as superficial and deep pain reflexes, were depressed by medetomidine hydrochloride, even when ketamine hydrochloride and halothane had mostly been eliminated.

Three of the temperature-logging devices that were implanted intra-abdominally were subsequently recovered and showed that body temperature fluctuated between 34 °C (when inactive in a burrow) and 37.5 °C (when active aboveground). The drop in body temperature observed during the operations, although not desirable, was in fact quite normal and resulted from inactivity. Keeping the ambient temperature warm is nevertheless advisable, especially in winter.

CONCLUSION

Comparing the 5 anaesthetic protocols, we recommend the administration of a low dose of ketamine hydrochloride (3 mg/kg) combined with medetomidine hydrochloride (80 μg/kg) for induction, followed by 1.5 % halothane to maintain anaesthesia. The animal should be kept warm during anaesthesia. After the procedure, maintenance on oxygen is advantageous until the ketamine hydrochloride and halothane have been eliminated, and the animal is ready to be taken to the release site. This results in rapid recovery after administration of the atipamizole, decreasing stress. It also eliminates the problem of suffocation of a semi-conscious animal in its burrow.

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