

ANAESTHESIA OF THE MALAYAN SUN BEAR (*HELARCTOS MALAYANUS*) USING TILETAMINE-ZOLAZEPAM-XYLAZINE COMBINATION

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SUMMARY

Eight Malayan sun bears (*Helarctos malayanus*) were immobilised with Zoletil[®] ($x = 3.44$ mg/kg) and xylazine ($x = 0.65$ mg/kg). The sun bears were darted intramuscularly by using a blow-pipe at muscular areas such as the rump and shoulder regions. Physiological data were recorded every 10 min throughout the immobilisation period. No antagonist drug was used. The drug combination was able to induce smooth, rapid and good anaesthesia with analgesia within 11 – 30 minutes (mean \pm S.D. = 21.1 ± 6.44 min). Time from complete immobilisation to recovery (walking) ranged from 157 ± 25.6 min (range = 124 - 186 min). No pedal pinch reflex was observed in all animals. The anesthetic depth and analgesia were reasonably adequate to conduct a physical examination and perform minor clinical procedures. There were no significant clinical adverse effects observed except for hypersalivation and frothing during the reversible period.

Keywords: Immobilisation, anaesthesia, tiletamine-zolazepam, xylazine, Malayan sun bear, *Helarctos malayanus*

INTRODUCTION

Handling of wild animals including the sun bear is a risky challenge. The best way to handle the sun bear is using chemical restraint. Reversible anaesthesia is the method of choice because its rapidity and smooth reversal minimises the risk of injury during the recovery period. The anesthetic protocols for the sun bear must consider the safety of the animals and personnel as well. The choice of an anesthetic agent should include those that can be delivered intramuscularly (IM), small volume, rapid induction time and possessing a wide margin of safety.

There are many studies on chemical immobilisation in ursids and a few published protocols on sun bear anaesthesia have been reported. A combination of phencyclidine (1.7 ± 0.4 mg/kg) and promazine (1.9 ± 0.7 mg/kg) produced an induction time of 47.0 ± 28.0 min and a duration ranging from 30 min to 2 h with prolonged recovery and anesthetic effects (Bush *et al.*, 1980). A combination of tiletamine-zolazepam (4.1 ± 0.9 mg/kg and 4.0-5.5 mg/kg) has been reported to be effective in immobilising the sun bear within 2-12 min and a duration lasting 15-180 min. Recovery took about 2-6 h but the anaesthesia and recovery period showed positive correlation with the dose, with a higher dose producing longer anaesthesia and recovery time (Caulkett and Cattet, 2002; Bush *et al.*, 1980). A combination of medetomidine (50 μ g/kg) and zolazepam-tiletamine (2.0 mg/kg) given IM was able to immobilise the sun bear more than 1 h

and recovery time was significantly reduced by using atipamezole (250 μ g/kg, IV) as a reversal agent (Onuma, 2003).

The objective of this study was to evaluate the effect of a tiletamine-zolazepam-xylazine (ZX) combination for immobilising the sun bear.

MATERIALS AND METHODS

Sun bears at Zoo Negara comprising 2 males and 6 females ($N = 8$) were immobilised using a combination of Tiletamine-Zolazepam hydrochloride (Zoletil[®] 100 Virbac, Carros, France) and Xylazine HCl (Xylazil[®] 100 TROY, Lab Pty Ltd, NSW, Australia). All sun bears were fasted overnight prior to immobilisation. Dosage was given based on visual weight estimation. Dosage was estimated to be 3 mg/kg of Zoletil[®] and 2 mg/kg of Xylazine HCl to immobilise the sun bears based on data that have been used in other bear species (Caulkett and Cattet, 2002). Sun bears were darted IM by using a blow-pipe (Telinject[®] USA, Inc., California, USA) at muscular areas such as the rump and shoulder region.

Following darting, the animals were left undisturbed and monitored for onset of anaesthesia. Body weight was measured immediately after animal was safe to be handled. Induction time was the interval between darting and no response to external stimuli. After induction, the sun bears were weighed individually and physical examination was performed. Physiological data of rectal

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temperature, heart rate, respiratory rate and haemoglobin oxygen saturation (SpO₂) were recorded every 10 min throughout the immobilisation period. Recovery time was recorded as soon as the animals started to stand and walk.

Mean arterial pressure (MAP), pulse rate (PR) and haemoglobin saturation (SpO₂) were determined by using pulse oximeter (V3303 Hand Held Pulse Oximeter, SurgiVet® V3303, Smith Medical, Wisconsin, USA). Palpebral reflex was tested by gently touching the lateral and medial canthus. Eyeball position was checked by observing the position of eyeball directly. Jaw tone was tested by pushing both upper and lower jaws to the opposite direction. Score range was from 0-3 (absent, mild, moderate and strong) respectively. Capillary refill time (CRT) was determined by pressing on the buccal mucosa for 1 second and releasing. The time for the return of colour was recorded. The body temperature was noted rectally by using digital thermometer (Omron® MC-270, Kinsmedic, Kuala Lumpur, Malaysia). The time period from induction to return ear flick or tongue movement, righting reflex, sternal recumbency and standing or walking was recorded.

Descriptive statistics were used to analyse the dosage and time of anaesthesia and recovery. A general linear model was used to test the changes of cardiopulmonary parameters and rectal temperature over time. For all tests, a *P*-value of less than 0.05 was considered significant.

RESULTS

The mean dose for tiletamine-zolazepam (83.33 mg/ml) and xylazine (33.33 mg/ml) were 3.47 ± 0.77 mg/kg and 0.65 ± 0.26 mg/kg respectively. The mean induction time was 157 ± 25.6 min (range = 124 - 186 min). The time to first effect of ataxia ranged from 3 - 14 min (mean ± S.D. = 6.6 ± 4.27 min) (Table 1). The effects of sitting and lateral or sternal recumbency were 5 - 24 min (mean ± S.D. = 10.8 ± 7.1 min) and 7 - 25 mins (mean ± S.D. = 12.4 ± 6.67 min) respectively. All sun bears showed no response and were safe to be handled at 11 - 30 min (mean ± S.D. = 21.1 ± 6.44 min).

Cardiopulmonary parameters and rectal temperature are presented in Table 2. The parameters of the individual animals were taken every 10 min starting from 0 min which was the time when the animal showed no response. Mean recovery time was 157 ± 25.6 min (range = 124 - 186 min). The recovery assessment is presented in Table 3. Mucous membranes were pink and the capillary refill time was less than 2 sec in all bears. The palpebral reflex was recorded as strong, deep to light anesthesia. No pedal pinch reflex was observed in all animals. The anesthetic depth and analgesia were reasonably adequate to conduct physical examination and perform minor clinical procedures. No severe adverse effects were observed except in two animals that showed hypersalivation and frothing.

DISCUSSION

Malayan sun bears were effectively immobilised with ZX at an average dose of 4.12 mg/kg (Z at 3.44 mg/kg + X at 0.65 mg/kg). Muscle relaxation was good throughout the immobilisation period; all bears remained immobilised and unresponsive. Palpebral and pedal reflexes have been noted when Zoletil® was used in isolation; thus mixing with xylazine completely abolished those effects. Combination with xylazine has been reported to give a better analgesic effect (Cattet *et al.*, 2003a). The delay in induction time when ZX was used was most probably due to low volume of Zoletil® and xylazine used in this study. According to Bush *et al.* (1980), a dosage of 4.1 ± 0.9 mg/kg Zoletil® produced a faster effect at 8.7 ± 3.0 min. Previous data also support the finding that a dosage ranging from 3 - 5.5 mg/kg is able to give a rapid effect (Wong *et al.*, 2004; Ramsay, 2003; Caulkett and Cattet, 2002; Kreeger, 1999; Bush *et al.*, 1980).

The pulse rate in ZX which ranged from 72 - 80 bpm. was close to the normal range of 50 - 70 bpm as reported by Caulkett and Cattet (2002). Pulse rate for ZX was not significantly lowered over 30 min of observation. Respiratory rate in ZX was slightly low. Zoletil® is believed to cause a respiratory depression when given at a higher dose (Plumb, 2002). All sun bears monitored

Table 1: Mean and standard deviation (SD) for the dosage and duration of each trial dosage of Zoletil®-xylazine

Parameters	Zoletil (mg/kg)	Xylazine (mg/kg)	TI to ataxia (min)	TI to sitting (min)	TI to recumbency (min)	TI to no response (min)
N	8	8	8	8	8	8
Mean	3.47	0.65	6.6	10.8	12.4	21.1
S.D.	0.77	0.26	4.27	7.10	6.67	6.44
Min	2.7	0.4	3	5	7	11
Max	4.7	1.2	14	24	25	30

N=number of sample, Min=minimum value, Max=maximum value, mg/kg=milligram per kilogram, TI=time of induction, min=time in minutes

Table 2: Cardiopulmonary parameters and rectal temperature of the sun bears after recumbency when using Zoletil®-xylazine as anaesthetic drugs

Parameters	Time after recumbency ± S.D.(N = 8)				P = 0.05
	0 min	10 min	20 min	30 min	
PR (beat/min)	80 ± 14.3	76 ± 14.2	74 ± 16.7	72 ± 19.4	0.786
RR (breath/min)	34 ± 10.4	29 ± 8.45	30 ± 8.55	28 ± 11.1	0.703
RT (°C)	37.9 ± 0.95	37.8 ± 1.08	37.8 ± 1.07	37.8 ± 0.96	0.988
SpO ₂ (%)	89 ± 5.31	89 ± 3.88	88 ± 9.19	90 ± 6.83	0.979

SD=standard deviation; ±=plus minus; N=number of sample; min=time in minutes; P=significant value; PR=pulse rate; RR=respiratory rate; RT=rectal temperature; °C=degree celcius; SpO₂=haemoglobin oxygen saturation; %=percentage

Table 3: Recovery time for Zoletil®-xylazine anaesthetic drug without reversal agent

Parameters	TI to chewing/ Licking (min)	TI to start head lifting (min)	TI to maintain sternal (min)	TI to start to rise (min)	TI to maintain standing (min)
N	8	8	8	8	8
Mean	80	97	123	138	157
S.D.	32.1	32.6	27.5	26.3	25.6
Min	45	55	91	112	124
Max	151	164	175	180	186

N=number of sample; SD=standard deviation; Min=minimum value; Max=maximum value; min=time in minutes; TI=time of induction

with a pulse oximeter had a range from 88 – 93% SpO₂. Table 2 shows the changes in respiration rate; SpO₂ was not significant. An SpO₂ level of less than 85% is associated with bluish mucous membrane indicating hypoxaemia which was not seen in this study (Cattet *et al.* (2003b). Rectal temperature (RT) in ZX group was not significantly decreased from 37.9 to 37.8°C as shown in Table 2.

Recovery in ZX group was prolonged, ranging from 124 – 186 min. According to a study by Moris (2001), ZX may give rapid onset, but recovery may be prolonged and take up to more than 2 h. A combination of drugs without any reversal agent may produce slow recovery (Caulkett and Cattet, 2002; Ramsay *et al.*, 1985). Frothing and hypersalivation were observed in 4 bears in Zoo Negara, but this may be due to the effect of xylazine and tiletamine-zolazepam which causes hypersalivation and produces an emetic effect (Plumb, 2002).

In conclusion, a combination of ZX effectively immobilised the sun bear. Physiological parameters such as respiratory rate, pulse rate, SpO₂ were good during the immobilisation duration. The use of a reversal agent such as yohimbine hydrochloride may give a better recovery.

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