

# RESTRAINT AND ANAESTHESIA OF WILD ANIMALS IN CAPTIVITY

L. H. LARSEN, B.V.Sc., M.S., Ph.D.,\*

*Veterinary School, University of Sydney, New South Wales.*

## Introduction

Restraint and anaesthesia of wild animals in captivity present the veterinary surgeon with special problems of control not experienced in general practice. These problems centre around the innate aggressiveness of many wild animals, especially carnivores such as lions, tigers and bears, the extremely timid, almost hysterical, reactions of wild ruminants such as deer, antelope, gnu, and the enormous size and weight of animals such as the elephant and rhinoceros. Superimposed on these characteristics, nearly all have a suspicious nature, making the oral administration of anaesthetics and tranquillizers a frustrating procedure.

During the years 1959 to 1962 the author has anaesthetized 62 animals of 18 different species at the Taronga Park Zoological Gardens, Sydney, and the purpose of this paper is to describe the methods adopted. The restraint of many other animals for the administration of drugs and biologics has also been undertaken.

Veterinary literature contains an increasing number of references to the use of tranquillization and chemical immobilization, and development of the projectile syringe gun permitting injections at a distance has extended their usefulness. The muscular relaxant, succinyl-choline, has now largely displaced nicotine for chemical immobilization (Pistey and Wright 1959, Thomas 1961, and Heuschele 1961); nevertheless its use is not entirely free from risk. This is due to a considerable species difference in tolerance to the drug, and the lack of precise knowledge of species' dose rates. To this must be added the uncertain rate of absorption with subcutaneous and intramuscular routes and the reliance on visual weight estimation of the animal. With increasing experience these errors have been reduced and approximate, safe dose rates have been established. The use of succinyl-choline on a large scale in bears is described by Craighead and Craighead (1960). Clifford *et al* (1962) also include a reference list of several instances of its use with this species.

\*Associate Professor of Veterinary Surgery, University of Sydney.

The use of tranquillizers to calm wild animals has been practised since their introduction into domestic animal anaesthesia, and several reports of their effectiveness have been recorded (Clifford *et al* 1962). These authors also describe the comparative tranquillizing effects of promazine, mepiridine and morphine, and their value as pre-anaesthetic agents in the bear. However, the high dosages recommended to achieve sufficient sedation to permit handling and anaesthesia have a marked depressant effect on respiration and render subsequent anaesthesia hazardous. Britz *et al* (1961) found in chimpanzees that chlorpromazine (Largactil), prochlorperazine (Compazine), promazine (Sparine) and perphenazine (Trilafon), when used in recommended dosage schedules, were satisfactory tranquillizers. Heuschele (1961) however, refers to observations of untoward side-effects in chimpanzees. More recently ataractic agents which have a specific action on the anxiety state and less motor and depressive effects have become available. Heuschele (1961) describes the use of chlordiazepoxide (Librium) in zoo animals and found it calmed 18 out of 22 aggressive animals. Other unpublished reports of newer ataractics or so-called "anti-rage" agents of this type indicate that control of apprehension without severe depression and loss of motor control is possible within safe limits in captive wild animals.

## Technique and Results

It has been found useful as a working basis, when deciding the form of restraint and anaesthesia to divide wild animals into major groups which are comparable with the main domestic types. Thus feline species such as the lion, jaguar and tiger, react in a manner not dissimilar to the domestic cat, while the bear more closely resembles the dog. In the herbivora, wild ruminants such as the deer and eland are little different from the bovine, and the rhinoceros and elephant are, in a general sense, comparable with the horse.

The description which follows is based on this classification, the procedure adopted, and the author's observations of the effectiveness of the

method used. Due to current usage the quantities of pentobarbitone and thiopentone have been expressed in grains (gr), while in the case of tranquillizers and succinyl-choline, the metric system has been used.

### Lion (*Panthera leo*)

Eleven lions were given general anaesthetics, 2 using pentobarbitone sodium and 9 thiopentone sodium. Each lion was transferred from its den to the surgery in an enclosed wooden cage with a sliding door at each end. From this it was transferred to a steel squeeze cage for anaesthesia.

#### (a) Pentobarbitone Sodium.

##### (1) Lioness

*Description:* Estimated weight 275-300 lb; aged.

*Indication:* Carcinoma of the left eye.

*Restraint and anaesthesia:* Using a 17 gauge, 4" needle connected to a syringe by 2 feet of rubber tubing, 85-90 grains of pentobarbitone sodium were injected intra-peritoneally, with the animal restrained as described under (b) (ii). Some struggling occurred during administration, but in 20 minutes deep surgical anaesthesia was induced.

*Recovery:* Very marked respiratory depression with prolonged recovery of consciousness resulted; a slight response to sensory stimulation occurred at 72 hours, but the animal was unable to sit up until the fifth day. Parenteral administration of 2 litres of 5% glucose saline was given intra-peritoneally every 12 hours until recovery. On the second and third days 200 ml of 0.5% bemegride (Megimide) was given intravenously, and 300 ml on the fourth day. For a period of several minutes respiratory rate was increased and eye reflexes were more acute, but the effect was transitory.

*Comment:* On an estimated weight basis, overdosage was the primary factor in causing such a prolonged recovery.

##### (ii) Lioness

*Description:* Estimated weight 200 lb; immature.

*Indication:* Clipping of claws and wounds.

*Restraint and anaesthesia:* An intramuscular injection of 150 mg chlorpromazine was given in squeeze cage with only slight depression at 60 minutes. It was then given 40 grains of pentobarbitone sodium intravenously in the recurrent tarsal vein (method, see later) which induced deep surgical anaesthesia.

*Recovery:* Marked respiratory depression resulted; consciousness returned between 36 and 48 hours.

*Comment:* Combined dosage higher relative to domestic cat and likely to have contributed to prolonged recovery. Length of recovery time following pentobarbitone considered excessive for useful anaesthesia.

#### (b) Thiopentone Sodium.

##### (i) 3 lionesses

*Description:* Estimated weights 120 lb, 90 lb, 90 lb; Approximately 1 year old.

*Indication:* Ovariectomy.

*Anaesthesia:* Intravenous thiopentone—1st lioness (120 lb), 13.5 gr initial, 9.0 gr maintenance; 2nd lioness (90 lb), 11.2 gr initial, 8.2 gr maintenance; 3rd lioness (90 lb), 11.2 gr initial, 7.5 gr maintenance. Duration of operation, 25 to 30 minutes.

*Recovery:* It required a period between 3 and 4 hours

for the animals to sit up in sternal recumbency. This is longer than group (b)(ii), but comparison with Table I indicates a lower dose ratio in the latter. Also a deeper plane of anaesthesia was evident in these 3 lionesses than in the next group.

##### (ii) 6 lionesses

*Description:* Age and exact weight known, see Table I.

*Indication:* Ovariectomy.

*Restraint and anaesthesia:* A careful time and dose record was kept with the object of comparing the response of the wild feline with the domestic cat. No pre-anaesthetic medication was given; each animal was placed in the squeeze cage and prevented from forward and backward movement by a grid. A soft, willow stick was placed between its jaws while a noose was passed around each forelimb and held by attendants. The animal could now no longer revolve on its longitudinal axis. One panel of the squeeze cage opposite a hind limb was removed, a noose passed around the limb, and the limb withdrawn from the cage. The recurrent tarsal vein was clipped and the thiopentone injected intravenously. The recurrent tarsal vein is much easier to locate than the cephalic vein in the forelimb and is safer in that it is well away from the animal's head.

The observations are recorded in Table I. The death of number 1 is attributed to a combination of high maintenance doses at an early period compared with the rest of the group, and respiratory obstruction. Had a free airway been established initially in this animal it is likely that it would have survived. Endotracheal tubes are essential to maintain a free airway, especially in the larger felines when placed in dorsal recumbency, as obstruction of the larynx can occur, due to the relaxed walls of the pharynx, the soft palate and the epiglottis occluding the airway on inspiration. In numbers 2, 3, 4 and 5 a lower comparable dose of thiopentone was given initially than in the domestic cat, although it is appreciated that the rate of 1 gr per 7 lb is only a guide dose in the latter species. This difference is accountable for in part by the fact that the depth of the initial anaesthesia was slightly lower than normal, in that no apnoeic period immediately subsequent to the initial dose occurred and the palpebral eye reflexes were not eliminated. A slightly longer time is required to anaesthetize the wild animal in a cage and assess the degree of anaesthesia, and this rate of injection difference should be considered in the initial effects of the ultra-short-acting anaesthetics. When these factors are considered there is little evidence to suggest that lions differ from the domestic cat in their anaesthetic requirements. Recovery time to the sitting-up stage took 1 hour 46 minutes in Number 2, 1 hour 47 minutes in number 3, and 1 hour 18 minutes to lifting of the head in number 4. The keeper reported that numbers 5 and 6 recovered to this stage earlier than numbers 2, 3 and 4 but the act-

**TABLE I**  
*Details of Anaesthesia of Six Lionesses.*

No.	Weight (lb.)	Age (months)	Anaesthetic (gr)		Maintenance Actual Dose		Respiration Time Rate (per minute)		Operation Terminated	Remarks
			Initial Calculated*	Actual	Time†	Dose	Time	Rate	Time	
1.	114	13	16.3	15.5	00.06 00.12	4.5 6.0	00.00 00.05 00.12 00.15 00.22	20 18 22 18 0	Died 00.27	Animal on back, no endotracheal tube. Death considered due to high maintenance dose and upper respiratory obstruction.
Total dose = 26 gr.										
2.	123	13	17.7	14.0	00.07	4.0	00.00 00.05 00.10 00.15 00.20 00.40	22 (no apnoea) 10 20 28 40 40	00.32	00.20—no palpebral reflexes. 00.34—endotracheal tube removed. 00.40—eye reflexes brisk. 01.46—growling, sitting up. 02.46—sternal recumbency.
Total dose = 18.0 gr.										
3.	131	13	18.7	16.0	00.12 00.24	3.5 2.5	00.00 00.02 00.10 00.15 00.20 00.25 00.40	38 (no apnoea) 10 10 10 15 20 23	00.42	00.12—brisk palpebral reflexes. 00.30—eye reflexes brisk. 00.35—eye reflexes brisk. 00.38—yawning. 00.40—endotracheal tube removed. 00.45—righting reflex. 00.50—growling. 01.47—sitting up (could have occurred earlier).
Total dose = 22.0 gr.										
4.	141	13	20.0	19.0	00.12 00.17	5.0 3.0	00.00 00.05 00.10 00.15 00.20 00.25 00.40	20 (no apnoea) 15 17 17 12 20 20	00.42	00.02—eye reflexes brisk. 00.10—eye reflexes sluggish. 00.18—eye reflexes brisk. 00.22—swallowing reflex. 00.42—endotracheal tube removed. 01.18—lifting head.
Total dose = 27.0 gr.										
5.	75	7	10.7	6.0	00.02 00.03 00.04	2.0 3.0 2.5	00.00 00.01 00.02 00.05 00.10 00.15 00.20	100 70 40 20 22 35 35	00.20	00.03—brisk palpebral reflex. 00.08—brisk palpebral reflex. 00.20—brisk palpebral reflex. Endotracheal tube removed.
Total dose = 13.5 gr.										
6.	45	7	6.4	8.0	—	—	00.00 00.05 00.10 00.15 00.20	30 (deep apnoeic breath at end of 7th gr.) 20 20 20 20	00.20	00.02—palpebral eye reflexes brisk. 00.13—palpebral eye reflexes brisk. Growling. 00.20—endotracheal tube removed.
Total dose = 8.0 gr.										

\*Calculated dose is an estimate based on the rate of 1 gr. per 7 lb. used as a guide in domestic cats.

†For convenience, the maritime method of recording hours and minutes is used, thus 00.00 = zero hour, zero minute; e.g., recovery to sternal recumbency in No. 2 (02.46 = 2 hours 46 minutes).

ual time is unavailable. If the time of the last maintenance doses is examined in Table I, there is little to suggest that recovery to the sitting-up stage is prolonged in the lion beyond that in the domestic cat.

#### Discussion.

There is no obvious difference between lions and domestic cats in their behaviour under thiopentone anaesthesia. Pre-anaesthetic tranquillization was not used in this series to enable this comparison to be made. It has been the author's experience in the handling of a group of healthy lions, when only one can be introduced to the squeeze cage at a time, that double restraining to inject the tranquillizer produces more apprehension than a single initial dose of the anaesthetic. Further, when the tranquillizer is given intramus-



Figure 1—Side panel in "squeeze" cage can be replaced with a steel bar to permit withdrawal of the hind limb for intravenous injection. A "baffle" board has been inserted to restrict to-and-fro movement.

cularly, a delay of over 1 hour is necessary for the effect to be observed. Intravenous tranquillization requires as much handling as the anaesthetic and a high dose rate of 4.0 mg per kilo body weight of promazine is necessary to achieve sufficient sedation for ease of handling. This level severely depresses respiration during subsequent anaesthesia.

#### Tiger (*Felis tigris*)

*Description:* Malaya: male: estimated weight 200-250 lb: 14 years.

*Indication:* Exploratory laparotomy and gastrotomy in acute gastric dilatation with suspected obstruction.

*Anaesthesia:* This animal was suffering from acute dehydration and was a poor anaesthetic risk. Pre-medication consisted of atropine sulphate, 1.3 mg, and

promazine, 100 mg, intramuscularly. Induction was effected with 10.0 gr thiopentone sodium intravenously and maintenance with a mixture of oxygen, nitrous oxide and halothane, using a closed-circuit apparatus with a circle absorber. The total time of anaesthesia was 2 hours 10 minutes and the operating time, 1 hour 45 minutes.

*Comment:* The tiger was a poor risk but it tolerated the anaesthesia well. It died 6 days later; death was associated with pulmonary arterial thrombus formation with infarction.

#### Jaguar (*Felis onca*)

*Description:* Female: Estimated weight 250 lb.

*Indication:* Caesarian section.

*Male:* estimated weight 280 lb.

*Indication:* Fighting injuries, severe abdominal muscular laceration, abdominal hernia, diaphragmatic hernia.

*Restraint and anaesthesia:* Induction and maintenance were effected by intravenous thiopentone sodium, using the steel squeeze cage.

*Comment:* Both these operations were emergencies, the repair of the abdominal injuries in the male requiring 2 hours' anaesthesia. Maintenance doses of thiopentone were given by a keeper under the author's directions. In the female the ventral lingual veins of the tongue were used for this purpose. Both animals recovered without any untoward results.

#### Ocelot (*Leopardus pardalis*)

*Description:* Male: 35 lb.

*Indication:* Fracture of radius and ulna, immobilization with plaster of paris bandage.

*Anaesthesia:* Thiopentone sodium, 5 gr, plus 2 gr for maintenance, administered intravenously.

#### Kodiak Bear (*Ursus middendorffi*)

*Description:* Male: estimated weight 1750-1800 lb: age 7 years.

*Indication:* Removal of canine tooth with chronic osteomyelitis of mandible.

*Restraint and anaesthesia:* Animal was starved for 12 hours and restrained in a large, wooden, cage box with both ends enclosed with sliding steel grills. A tranquillizer, 1500 mg promazine, was injected intramuscularly in 3 doses over a period of 15 minutes, but at the end of 1 hour only slight sedation resulted. Due to this animal's enormous strength, control for intravenous anaesthesia at this stage was impossible. Both ends of the wooden cage were then sealed off with plywood and hessian, converting the bear's enclosure into a relatively air-tight cell. Chloroform was then poured on to 3 horse anaesthetic sponges and air under pressure was pumped through an anaesthetic mask containing the sponges, into an opening in the box. Within 20 minutes, using 4.5 lb chloroform, a sufficient concentration was achieved to reach stage II surgical anaesthesia. At this point the cage was opened and a forelimb roped and extended. Thiopentone, 1 gr per ml, was then injected intravenously in the left cephalic vein until deep surgical anaesthesia was reached. The vein was not visible even with a tourniquet due to the thick hairy integument and the considerable subcutaneous fat

present, hence its position had to be carefully located by probing with the needle. Maintenance anaesthesia was effected using the ventral lingual veins of the tongue. The duration of the anaesthesia from the initial thiopentone injection was 1.5 hours. Recovery to the standing position took 5.0 hours.

#### Discussion.

The bear presents two difficulties, its innate ferocity and the lack of readily visible, superficial blood vessels. With more accurate knowledge of the dose rate of succinyl-choline given by the intramuscular route, this method of preliminary immobilization would appear to be justified even in this rare and valuable species. Craighead and Craighead (1960) recommend a dose rate of 1 mg per 3 lb body weight. Clifford *et al* (1962) found that the intramuscular injection of high doses of morphine and/or tranquillizer, such as morphine (8.8 mg per kg) with promazine (4.4 mg per kg) was satisfactory in effecting a severe depression, enabling subsequent injections of pentobarbitone to be made. The exposure of the cephalic and saphenous veins by their technique deserves consideration, although the ventral lingual veins of the tongue are readily accessible for maintenance anaesthesia.

#### Hyena

Striped (*Hyaena hyaena*) and Spotted (*Crocuta crocuta*).

*Description:* Two mature hyenas: estimated weight 120 lb each.

*Indication:* One had a fibroma on the prepuce; the other a lacerated, contused wound in the perineum involving the anus.

*Restraint:* Each was held in the squeeze cage and a local anaesthetic, Xylocaine in 1% concentration, was used in the injury case while promazine, 1 mg per lb body weight, plus Xylocaine infiltration anaesthesia was used for the removal of the fibroma.

*Comment:* Despite their apparent aggressiveness, they permitted surgical interference without a general anaesthetic.

#### Monkey

Pig-tailed Macaque (*Macaca nemestrina*).

*Description:* A large male used in the circus: weight 25 lb.

*Indication:* Castration to permit easier handling.

*Restraint and anaesthesia:* Placed in squeeze cage and thiopentone, 1 gr per ml, was injected intravenously in the cephalic vein to induce light surgical anaesthesia. Recovery to sitting position in 15-30 minutes. After 7 days, anaesthesia was repeated and scrotal sutures removed. These had been inserted during healing of the scrotum to prevent interference by the monkey.

#### Ape

Chimpanzee (*Pan satyrus*).

*Description:* Female: weight 35 lb.

*Indication:* Correction of prolapsed rectum.

*Restraint and anaesthesia:* Placed in squeeze cage and promazine, 1.5 mg per lb, injected intramuscularly. At 60 minutes the effect was only slight; the animal remained quiet until her arms were extended for intravenous anaesthesia when she displayed marked resistance. Thiopentone, 4.0 grains, injected intravenously resulted in light surgical anaesthesia. Within 15 minutes recommenced straining on rectal interference. Sitting-up stage was reached in 30-40 minutes. Anaesthesia repeated in 7 days for suture removal. Promazine dose increased to 3.0 mg per lb, thiopentone 3 gr intravenously; less struggling during administration.

#### Discussion.

The dose rate of promazine at 1.5 mg per lb given intramuscularly proved inadequate for pre-anaesthetic restraint in the ape. Without a pre-anaesthetic tranquillizer the Macaque monkey recovered from thiopentone anaesthesia in a relatively short time.

#### Kangaroo

(*Megaleia rufa*, *Macropus major*)

*Description:* Fourteen red and grey male kangaroos of various ages (1½-2 years) and varying in weight from 30-60 lb, were castrated to prevent fighting.

*Restraint and anaesthesia:* Animals were confined in small wire pen and caught individually by the tail; they were then held on their side by 2 assistants. Intravenous thiopentone, 1 gr per ml, was injected into recurrent tarsal vein until light surgical anaesthesia induced. No exact estimate of dosage was possible without individual weights. All animals required only the initial dose of thiopentone. Recovery time varied between 1½ and 3 hours.

*Comment:* Care needs to be exercised when catching and restraining kangaroos as the claws on the hind limbs are well developed and can cause severe lacerations. An occasional kangaroo will bite and claw with his fore paws also.

#### Elephant

Indian (*Elephas maximus*).

*Description:* Male: 8 years of age: weight 2300 lb.

*Indication:* Surgical exploration of the left mandible affected by suppurative osteomyelitis with a discharging sinus. Inflammation of the alveolus associated with necrosis of the molar tooth was also present. The tooth was removed.

*Restraint and anaesthesia:* All 4 legs were immobilized in the standing position with chains, with the keeper at the elephant's head to control the trunk. The elephant's left ear was held by 2 assistants and the posterior aspect exposed. Several radicles of the auricular vein were now visible and capable of distension by finger pressure. Promazine 1250 mg (approximately 0.5 mg per lb) was injected intravenously. The tranquillizer reduced the weaving motion of the animal and resulted in moderate sedation, thus facilitating subsequent anaesthesia. Thiopentone (2 gr per ml) was injected intravenously in a branch of the auricular vein. The animal went down quietly without struggling or damage and maintenance anaesthesia was continued as required, using an ear vein as previously. Total thiopentone used, 165 gr. Duration of operation, 1 hour 20 minutes.

*Recovery:* Within 20 minutes of cessation of opera-

tion, elephant attempted to rise and was able to remain standing 5 minutes later.

*Comment:* Elephant tolerated anaesthetic well without any postanaesthetic complications. The plane of anaesthesia lay between medium and deep surgical, and permitted extensive resection of mandible and removal of tooth. The posterior auricular veins provide a suitable means of intravenous anaesthesia in this species. No other superficial veins were apparent. In one of the peripheral radicles of the auricular vein a small amount of thiopentone escaped in the subcutaneous tissue. Some atrophy and curling of the ear occurred at this point, but no sloughing.

### Rhinoceros

(*Diceros bicornis*).

#### (a) Female

*Description:* Born in captivity; 4 years of age.

*Indication:* Penetrating injury of solar surface of right hind foot as a result of a 2" diameter piece of glass being embedded in the foot to a depth of 4 inches.

*Restraint:* 2 keepers directed head movements while limb was held up by attendants. Local Xylocaine infiltration anaesthesia used to remove glass.

*Comment:* Animal tolerated this degree of restraint and anaesthesia, but 3 days later, during a subsequent injection of antibiotics, it received sufficient pain stimuli to excite it, and it charged. This type of restraint is considered too dangerous in view of the unpredictable nature of the species.

#### (b) Female

*Description:* Born in captivity; 1 year 8 months of age; estimated weight 1200 lb.

*Indication:* Exploration of right mandible at ventral border at the site of a discharging sinus from a suppurative osteomyelitis and necrotic mandibular bone.

*Restraint:* A large, mobile, wooden crush was constructed with removable side panels. The animal was coaxed into the crush by daily feeding in it for 3 days. Forty hours before the operation, the animal was locked in the crush and water withheld. Green hay was fed until 16 hours before the operation.

#### Anaesthesia:

0.0 hours. Given 3 oz chloral hydrate in 2.5 gallons of water in a shallow tray. It drank immediately; last fraction assured by adding an extra gallon of water which was readily drunk.

30 minutes. Rhinoceros staggering to the point of light narcosis but still standing. Given 1 oz chloral hydrate in 1 gallon of drinking water. Received approximately 2/3 oz chloral hydrate.

45 minutes. Went down on haunches. Cage opened. Head could be moved without resistance. Palpebral eye reflexes absent. Respiratory rate, 20 per minute.

1 hour. Commenced intravenous thiopentone maintenance anaesthesia *via* posterior auricular vein, using 1 gr per ml.

2 hours. Ceased thiopentone administration. Total of 50.0 gr thiopentone used.

6 hours. Standing.

*Comment.* No motor movement and very little sensory reaction throughout, despite the bone surgery. Respiration remained at approximately 20 per minute throughout anaesthesia. The hot, humid environment necessitated spraying the animal's body with cool water during

the operation. This method of restraint and anaesthesia was highly satisfactory.

Previous observation of animals of this species has indicated their readiness to drink water such as that from drainage in their yards. This was confirmed by the readiness to drink water containing 0.75% chloral hydrate. There were no post-operative complications.

### Mongolian Wild Horse

(*Equus caballus przewalskii*).

*Description:* Stallion, 35 years old; estimated weight 550-600 lb.

*Indication:* Examination of mouth, correction of teeth abnormalities.

*Restraint and anaesthesia:* Animal extremely resistant to handling and wooden crush used to gain control. Thiopentone, 60 gr in 20 ml of water injected into left jugular vein. Considerable struggling, excitement and sweating occurred before injection. Duration of anaesthesia: 30 minutes before limb movement; 60 minutes horse was on its feet.

*Comment:* Use of a depolarising muscular relaxant such as succinyl-choline may be necessary to gain control in this species, where the drug has a safer dose-response ratio and is rapidly excreted.

### Pigmy Hippopotamus

(*Choeropsis liberiensis*).

*Description:* male, mature; estimated weight 600 lb.

*Indication:* Lacerated penetrating wound of right upper hind limb which occurred at mating.

*Restraint and anaesthesia:* Animal placed in squeeze cage and access to wound provided by removing panels as needed. Extensive local infiltration of 200 ml of 2% procaine around injured tissues.

*Comment:* Animal tolerated interference well with no attempt to resist.

### Giraffe

(*Giraffa camelopardalis*)

*Description:* Female; 9 years of age; estimated weight 3000 lb.

*Indication:* Foetal dystocia due to lateral deviation of the head and neck, of 7-9 hours duration.

*Restraint and anaesthesia:* Animal was loose in a large room with a high ceiling; no means of crushing was available. With a rope neck-noose it was possible to give a rapid, subcutaneous injection of the muscular relaxant, succinyl-choline chloride. The dose was computed on a comparative estimate of the bovine dose, *ie* 1 mg per 100 lb body weight. This was increased by a factor of 4 as the subcutaneous dose lies between 4 and 8 times the intravenous dose in the horse (Larsen and Robinson, unpublished data 1960). In the above instance a minimal estimated dose was given, *ie* 30 x 1 x 4 = 120 mg succinyl-choline. Within 3-4 minutes the giraffe began to show effects of the injection, throwing its forelegs about spasmodically, and within 5-6 minutes it collapsed to the ground. Positive pressure ventilation of the lungs was immediately instituted using a 20 litre capacity respirator. Lung ventilation was maintained while correction of the dystocia was attempted. No voluntary respiratory efforts of the animal occurred after its collapse, despite adequate ventilation of the lungs. Cardiac auscultation at 10 minutes after going

down failed to detect any cardiac rhythm, and the animal was presumed dead at 20 minutes after falling. Autopsy did not reveal any morbid changes consistent with the sudden collapse.

*Comment:* Overdosage was not considered to be the primary cause of death. The variation in species reaction to succinyl-choline has been referred to earlier, and of the domestic species, the bovine is more susceptible than the horse. The exact cause of death when adequate lung ventilation is instituted early and there is no evidence of gross vascular damage, remains unexplained.

### Deer

Wapiti or Elk (*Cervus canadensis*).

*Description:* Stag, aged 19 years, estimated weight 700 lb.

*Indication:* Correction of preputial prolapse.

*Restraint and anaesthesia:* A lasso was passed around antlers and the deer drawn up to a tree, the hindlimbs secured and thiopentone, 60 grains, injected intravenously into recurrent tarsal vein to induce light surgical anaesthesia. There was no initial apnoea and respiration remained between 10 and 20 per minute; palpebral reflexes were present throughout. Recovery was very slow, sitting position reached at 1 hour 30 minutes, but animal lay on its side during most of the recovery period, with marked paddling movements. At 12 hours, it still maintained a lateral posture and the shoulder nearest the ground was severely contused and lacerated. Radial paralysis was present at this time. At 36 hours the animal was unable to rise to sternal recumbency and was destroyed.

*Comment:* The dose of 1 gr per 11 lb (approximately) was not considered excessive, nor a primary factor in causing death. The age of the animal and the self-inflicted trauma to the left shoulder with radial paralysis prevented it gaining its feet, and thus contributed more to the end result.

### Antelope

(a) Indian or Blackbuck (*Antilope cervicapra*).

A total of 17 animals, varying in weight between 30-80 lb, was dehorned to reduce fighting in enclosures.

*Anaesthesia:* Thiopentone via recurrent tarsal vein or external jugular to plane II surgical anaesthesia. The recovery period varied between 45-90 minutes to the sitting posture. A characteristic of their behaviour during recovery is marked opisthotonus.

*Comment:* One died due to regurgitation and upper respiratory tract obstruction.

(b) Situtunga, Marsh-buck (*Limnotragus spekei*)

*Description:* Estimated weight 80-90 lb.

*Indication:* Fracture of pelvis in female, fracture of tibia in male.

*Anaesthesia:* Intravenous thiopentone via recurrent tarsal vein to induce light surgical anaesthesia. Recovery to sitting posture in 1 to 1½ hours.

*Comment:* Very timid animals, great care necessary in initial restraint.

### Eland

(*Taurotragus oryx*).

*Description:* Female: estimated weight 500 lb.

*Indication:* Prolapse of the vagina.

*Restraint and anaesthesia:* Given promazine, 150 mg intramuscularly, and local infiltration anaesthesia for vaginal sutures.

*Comment:* Quite a docile animal and submitted to interference.

### Huanaco

(*Lama huanacos*).

*Description:* Estimated weight 180 lb.

*Indication:* Fracture of forelimb.

*Anaesthesia:* Thiopentone, 1 gr per ml injected intravenously to plane II surgical anaesthesia. Recovery to sitting posture in 45-60 minutes.

### Discussion

Four deaths occurred in the restraint and anaesthesia of the sixty-two animals described. In addition a tiger died in the post-operative period on the sixth day but death was not attributed to the direct effects of the anaesthetic. In the first of the four deaths, a lioness, death was considered to be due to a combination of excessive thiopentone and upper respiratory obstruction, while in an antelope, regurgitation with respiratory obstruction was the cause. In the other two animals, a Wapiti deer and a giraffe, the cause of death is not so apparent. Old age and self-inflicted injury contributed to the loss of the deer, but no obvious explanation of the circulatory failure in the giraffe can be offered following the use of succinyl-choline.

Apart from the above four animals, it would seem that the behaviour and response of wild animals in captivity to anaesthesia is not dissimilar to that of the domestic animal. It is interesting to note that Louw (1957) recalls two cases of greatly prolonged recovery times in lions following pentobarbitone anaesthesia. While, in the first lioness of this series, a high dose of the anaesthetic contributed to the length of unconsciousness, in Louw's first case recovery took 16 hours despite only half the computed dose being given. The use of thiopentone in the six lionesses in Table I indicates it is a preferable agent in this species. From the observations in this group, it is seen that lions do not exhibit any different reaction from domestic cats to thiopentone. This also appears likely to be true in the tiger, ocelot and jaguar.

The choice of anaesthetic in any species depends largely on the facilities available and the practicability of giving intravenous injections. If this is possible, pre-anaesthetic medication using ataractic agents followed by intravenous thiopentone anaesthesia is the method of choice in the author's opinion. Where closed-circuit apparatus is available, maintenance anaesthesia using halothane, ether, nitrous oxide or cyclopropane, is an advantage, especially in poor risk cases as the

tiger described. Several reports of its use, such as that of Graham-Jones (1962), have appeared in the literature.

It is to be expected that with newer ataractic drugs becoming available, fear and apprehension in wild animals will in large measure be eliminated. This is an advantage which will be received with favour by veterinarians and public alike (Campbell 1950). It must, however, be stressed that in the handling of wild animals, zoo keepers who understand the habits and reactions of each species and who are skilled in handling them are invaluable. To this must be added the use of the squeeze cage. This eliminates much of the risk in handling innately savage species such as the carnivores. A means of accurately weighing wild animals would also eliminate errors of computing dosage. This is of particular importance in muscular relaxants and ataractics when they are used in projectile syringe rifles.

#### Summary

Restraint and anaesthesia of sixty-two animals of eighteen different species of wild animals in captivity at the Taronga Park Zoological Gardens are described.

The method used in each species is recorded and its value discussed.

Four deaths associated with the anaesthetics used are reported.

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