THE USE OF DRUGS IN THE MANAGEMENT AND CONTROL OF LARGE CARNIVOROUS MAMMALS

by

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The need for a drug-immobilization technique which would enable the capture and examination of free-ranging lions in Africa, was stressed by Campbell and Harthoorn (1963). It was pointed out that lions in National Parks and Game Reserves are not infrequently wounded by other animals, or by the weapons and snares of poachers. These wounds usually become septic and may incapacitate the victim to such an extent that it may die of starvation or may be forced to attack man or domestic stock.

The pioneer ecological study on Grizzly bears by the Craigheads (1960) set the stage for similar research projects involving Africa's large carnivorous mammals. Workers such as Kruuk (spotted hyaena) and Schaller (lion) have recently captured study animals with the aid of drugs for the purpose of measuring, examining and marking them for future identification.

With similar objectives and others in mind, the research teams in the Kruger and Kalahari National Park, have also been conducting field trials with drugs in order to find a safe and reliable immobilizing agent for the capture of lions, hyaenas and other large carnivorous mammals. In the Kruger Park one of the main objectives is to fit radio-transmitting collars to lions and other large carnivores, in order to establish their kill frequency in different game habitats with varying prey communities, and during the various seasons of the year. In the Kalahari Gemsbok National Park, a large proportion of the prey community is migratory and seasonally cross the borders of the Park into the adjoining Botswana Game Reserve or into the Coloured settlements to the south of the Auob river. Many lions are forced to follow the same nomadic routine and this has a serious limiting influence on the population.

The predator community in the Kalahari Park is not a particularly strong one and losses other than from natural causes, will obviously have a detrimental influence on predator-prey relationships in such an unstable

environmental situation. Where the Kalahari lions leave the Park and enter settled areas, they often fall into the bad habit of killing domestic stock rather than wild prey, and many have been destroyed in punitive hunts by the irate owners.

It has long been standard practice with the Kalahari Ranger staff, to attempt to drive the marauding lions back to the sanctuary of the Park, when complaints were received from farmers in South West Africa or herdsmen in the Coloured settlement. Such operations invariably proved hazardous and time-consuming to the staff involved, and did not prevent the lions from returing to these prohibited hunting grounds and pursuing their bad practices. The whole of the South West African border has now been provided with a game fence by the Veterinary authorities and this fence was further improved by adding to it a wire netting layer of 4 ft. high, to prevent carnivora from slipping through to the farms on the South West African side. It has not yet been possible to make the southern boundary fence carnivora proof in a similar manner and lions still crawl through the barbed wire strands to the Coloured settlements.

By tracking these lions, which is not a difficult procedure in the sandveld of the Kalahari, particularly when utilising the uncanny sign-reading ability of an expert Bushman tracker, it is now possible to immobilize the animals, when located, by means of drug darts and convey them back to the Park by means of trucks. Here they are marked, and released many miles away from their usual points of egress, with the hope that they will not return. In this manner the lives of a number of valuable carnivorous animals, which would certainly have fallen victim to the rifles, traps or poison of hunters or stock owners, are now saved annually by the conservation staff of the Kalahari Park to the benefit of the game community as a whole.

In view of the easy access to experimental animals in the Kalahari, and the fact that darted animals cannot escape as readily in these comparatively open sandveld environs as in the denser vegetation of the Kruger Park, most of the experimental work and field testing of drugs on carnivorous animals, was conducted here.

Lions have been handled under conditions of captivity after the injection of the neuromuscular blocking agent succinylcholine chloride, at a dosage rate varying from 0.4 - 1.00 mgm./Kgm. by Thomas (1961), Heuschele (1961) and others, and after the administration of pentobarbital sodium and pethidine by Clifford, Stowe & Good (1960). Satisfactory immobilization was reported, and the patients all recovered well.

The capture of dangerous carnivorous mammals in the wild state however, involves considerations which are different from the handling of the same species in captivity. As a rule a single injection only is possible and the darted animal may then resort to thick cover and may collapse out of sight. In view of the fact that the body weight of free-roaming

animals can only be estimated, the use of neuromuscular blocking agents under such conditions has many disadvantages. These drugs usually have a narrow margin of safety and the possibility of administering a fatal over-dose due to an error in the estimation of body weight is great. This is particularly true where irreversible drugs are utilised and the time taken to locate the stricken beast in thick cover, may result in excessive delay in applying restorative treatment. On the other hand, the injected lion may also be underdosed and, therefore already partially or wholly recovered by the time it is located, and may turn on its pursuers. As with other wild animals, the time factor between injection and immobilization is all-important, and rapid induction is necessary if the animal is not to be lost.

Campbell and Harthoorn (1963) suggest that under bush conditions, the indication is for a high dose of a drug with a wide safety margin, which has a reasonably long time of action and which, preferably, has a tranquilizing effect.

A drug combination which conforms to these requirements is Sernylan (Parke-Davis), when it is administered with a suitable tranquilizer such as Acetylpromazine or Chlorpromazine.

Sernylan or phencyclidine is an analgesic, cataleptic and anaesthetic agent which acts primarily on the central nervous system either by stimulation or depression, but the usual effects are sedation, ataxia, catalepsis or immobilization and anaesthesia, depending on dosage and the animal species involved. The chemical name is 1 - (1 - Phenylcyclohexyl) piperidine hydrochloride and its pharmacology has been described by Chen. *et al* (1959).

Sernylan or phencyclidine is an analgesic, cataleptic and anaesthetic to lapse into a catatonic stupor, but with most of the reflexes unchanged. It has a wide therapeutic index in the Felidae and it is possible to immobilize members of this family with doses ranging from 1.0 - 8.0 mgm./Kgm. (Harthoorn, 1965; Kroll, 1962; Young, 1966, a.o.) Cats are very resistant to overdosages of drugs such as barbiturates and Sernylan, and can withstand prolonged anaesthesia. At the lower dosage levels Sernylan produces a state of locomotor inco-ordination, catalepsis and paresis, whereas at higher dosage levels a state of second plane (medium) anaesthesia is produced. It is possible to produce anaesthesia in lions with Sernylan alone but the addition of other drugs such as tranquilizers further increases its safety margin, induction is hastened, relaxation is improved and the chances of aggression on the part of the recovering patient are decreased.

Harthoorn (1965) advocates the addition of subtherapeutic doses of a reversible centrally-acting drug such as pethidine (10 mgm./Kgm.) to the Sernylan as it reduces the amount of Sernylan needed to produce anaesthesia, and reduces also the reaction to painful stimuli. Pethidine is reversible with Nalorphine and it is therefore possible to hasten recovery of the individual by antagonizing the action of the centrally-acting drug.

Satisfactory immobilization and recovery of captive wild Felids have been reported with Sernylan at doses of 2 - 2.8 mgm./Kgm. in combination with Chlorpromazine at 3 - 4 mgm./Kgm. by such workers as Young (1966).

Campbell and Harthoorn (1963) produced complete immobilization and anaesthesia in a full-grown, free-roaming male lion of approximately 180 Kgm. body weight with a drug combination containing Sernylan (2 mgm./Kgm.), Chlorpromazine (0.8 mgm./Kgm.) and hyoscine hydrobromide (0.1 mgm./Kgm.). On the basis of their results with domestic cats these workers deducted that the dose administered by them was about double the minimum amount. This allowed a good lower safety margin to offset contingencies such as the injection having occurred by the subcutaneous route. Their patient was fully recovered about ten hours after the injection.

To date, a total of 27 lions of both sexes have been successfully captured in the Kalahari Gemsbok National Park, using a combination of Sernylan and either Acetylpromazine or the butyrophenone neuroleptic Azaperone (Janssen). The mortality rate was nil. An injured lioness was also captured in the Kruger National Park with the same drug combination.

It has been possible to establish the minimum effective dose of Sernylan for free-roaming lions in the Kalahari as about 0.6 mgm./Kgm. (in combination with 10 - 20 mgm. of Acetylpromazine). A large male lion weighing 186 Kgm. could be handled 30 minutes after receiving a total of 100 mgm. Sernylan in two separate doses of 75 mgm. and 25 mgm. respectively. The first dose produced marked ataxia after 13 minutes but the animal remained mobile until the second dose was injected. After the second dose the patient was prostrated but never deeply anaesthetized and recovered within 4 hours. This is not a safe dosage to employ, particularly in overgrown conditions, because of the danger of inadequate absorption and incomplete immobilization. For this reason, the majority of other lions in our series were captured with Sernylan at dosage levels varying from 1 - 2 mgm./Kgm. and in combination with small dosages of Acetylpromazine (10 - 20 mgm. total dose) or Azaperone (50 - 100 mgm. total dose). Excellent results were achieved.

A typical reaction was provided by an adult male lion weighing 191 Kgm. and which was caught at Kwang, in the Nossob river. This particular animal was darted at 2.50 p.m. with 250 mgm. Sernylan and 20 mgm. Azaperone. The animal became aggressive after being hit by the dart from the crossbow, and charged the Land Rover (Fig. (i)), but then became ataxic and lay down after 15 minutes. The respiration rate decreased and the head moved around as if the animal was suffering from halucinations. Forty-five minutes after darting, the animal was flat on its side and could be handled and weighed. (Figs. (ii) and (iii)).

The corneal and swallowing reflexes remained unimpaired but mild spastic convulsions were noticed at intervals. Signs of returning to con-

Fig. 1. After darting a lion the hunter becomes the hunted.

Fig. 2. Completely immobilized lion, 30 minutes after darting with Sernylan. Note the wide, staring eyes.

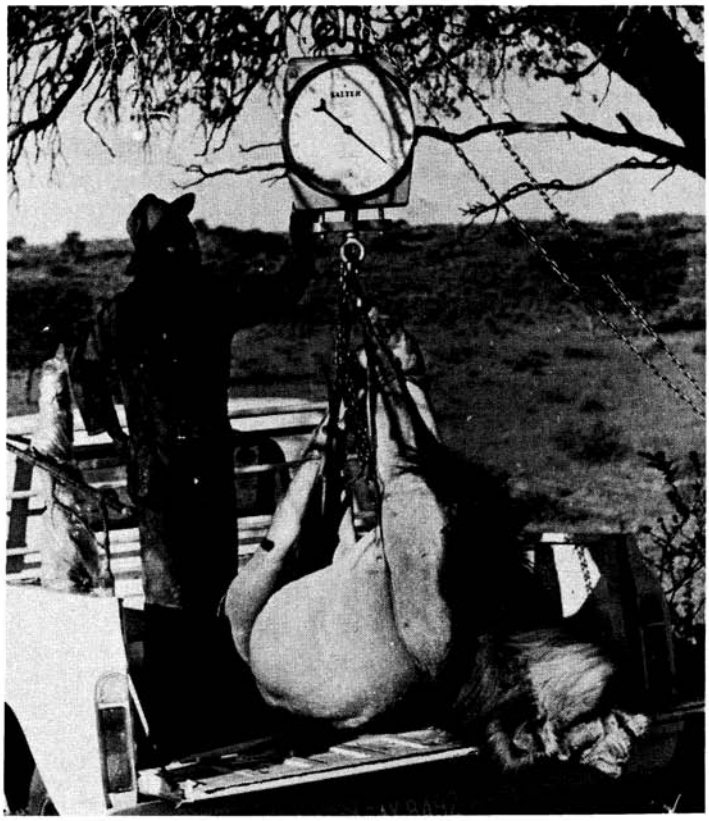

Fig. 3. Lions can be weighed after Sernylan immobilization.

Fig. 4. Sernylan-anaesthetized lion loaded for translocation.

sciousness became evident after about an hour and was evinced by slight shaking of the head and movement of the body. At a later stage it could be roused by shouting and emitted low roars. It remained unable to rise for about 3 hours but then managed to walk with swaying hindquarters, and recovered completely during the night.

Whilst under the influence of Sernylan anaesthesia the lions captured in the Kalahari felt no pain and were marked by branding with a hot iron. Some were transported for long distances, on the back of an open truck, without further restraint, although on occasion, small additional doses of Sernylan had to be administered when the beast showed signs of recovery before the destination had been reached (Fig. (iv)).

A number of marauding lions were captured in this manner in the Coloured Settlement and brought back to the Park where they were released a long distance away from the danger zone. Some of these lions however, exhibited a remarkable persistency to return to the prohibited area, and a case in question was a large male which was captured in the Coloured Settlement some 50 miles west of Twee-Rivieren on the 4th September, 1967. It was released at Nossob camp in the Park, a distance of about 150 miles from the place of capture. This same lion was shot and killed on the 11th April, 1968, in the same locality where it was originally captured!

Fortunately, this was not the regular pattern of behaviour of translocated lions and a substantial number have been saved, with the aid of drugs, from an untimely death in the settled areas around the Park. Lions which had been caught, marked and released in their original habitats in the Park, were still regularly observed in the same area six months later.

It was found that the spastic convulsions were less evident in lions captured with Sernylan and Azaperone than when Acetylpromazine or other phenothiazines were used as the synergist.

The analeptic drug Methylphenidate ('Ritalin', Ciba) seemed to be of value in enhancing the recovery of Sernylan-anaesthetized lions.

A young female leopard, which weighed 37.3 Kgm. and was obviously pregnant, was darted at Ellie-se-Kolk in the Nossob river, with 40 mgm. Sernylan and 30 mgm. Azaperone. This had no apparent effect and another 40 mgm. Sernylan and 20 mgm. Azaperone were administered 40 minutes later. After 18 minutes the animal still showed little effect and was still aggressive. A further 20 mgm. Sernylan and 10 mgm. Azaperone were administered. Five minutes after the third dart had struck, the leopard showed signs of ataxia, lay down on her brisket and lapsed into an anaesthetized state some 35 minutes later. Slight clonic and tonic spasms involving the body musculature, became evident. Consciousness was regained about 8 hours after darting, whereupon the leopard took refuge in a tree until fully recovered. The relatively higher dose required for the

immobilization of the leopard when compared with lions, also corresponds with the reactions found in captive leopards, where a dose of at least 2 mgm./Kgm. seemed indicated (Lang and Young, 1966); although Kroll (1962) managed to immobilize a black panther in 11 minutes with a dose of Sernylan of 1.25 mgm./Kgm.

A full-grown female cheetah, weighing 47.3 Kgm. was captured within 12 minutes at Groot-kolk in the Nossob, after receiving a dose of 60 mgm. Sernylan and 20 mgm. Azaperone. She regained consciousness an hour and 15 minutes after darting and was able to walk away 35 minutes later. In this particular case there was very little evidence of the convulsive muscular twitching usually associated with Sernylan anaesthetized animals.

In contrast to the wild Felidae, Hyaenidae apparently require lower doses of Sernylan to effect complete immobilization and both spotted hyaenas *(Crocuta crocuta)* and brown hyaenas *(Hyaena brunnea)*, ranging in body weight from 36 - 60 Kgm. have been successfully immobilized with Sernylan at a dosage rate of 0.7 - 1.0 mgm./Kgm. in combination with small doses of a suitable tranquilizer. Complete surgical anaesthesia is produced and recovery generally takes as long as 10 hours. During this time the animals are best kept in a crate or guarded in some manner from the attention of other carnivores or vultures. This is a necessary precaution even with lions and represents the only disadvantage to a technique which is in all other respects perfectly safe and reliable for both patient and personnel.

SUMMARY

A drug-immobilization technique which would enable the capture and handling of free-roaming large carnivores, had become a necessity in Africa. On the strength of promising results achieved with the cataleptic and anaesthetic drug Sernylan (Parke-Davis) on captive carnivorous mammals, a series of field trials were initiated on wild lions, hyaenas (spotted and brown), leopards and cheetahs in the Kalahari Gemsbok and Kruger National Parks. Reliable dosage rates for Sernylan have been established for all these species in combination with suitable tranquilizing drugs, and the knowledge thus gained has been put to good effect in the control and management of the large carnivorous mammals in both these game sanctuaries.

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The photographs illustrating this paper were taken by one of us (C. S. le Roux).

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