THE USE OF HALOPERIDOL AS A LONG-ACTING NEUROLEPTIC IN GAME CAPTURE OPERATIONS*

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Haloperidol (R1625, Serenace) a potent, long-acting butyrophenone neuroleptic, was shown to be very effective in game capture operations for the neuroleptization of several species of African wild herbivores, especially the medium and small antelopes. With a rapid onset of action following intravenous injection and a duration of action of 10-12 h in the majority of cases, haloperidol produced profound psychomotor effects and remarkable tractability in red hartebeest, blesbok, springbok, duiker, steenbok and dik dik. Haloperidol suppressed the alarm reaction and facilitated the large-scale handling and translocation of captured animals. It also produced favourable sedation in Hartmann's zebra, Burchell's zebra, tsessebe and Black-faced impala. Extrapyramidal effects were observed in some species.

Key words: antelopes, Equidae, game capture, haloperidol, Serenace, transportation, tranquillizer, wild animals.

INTRODUCTION

One of the major problems in the capture and transport of wild herbivores is animal losses caused by an alarm reaction which results in stress, exertion, hyperthermia and injuries. Moreover, in aggressive species and amongst male animals of many species, fighting is a major drawback during translocation operations. In view of these problems, there has long been a need for a suitable long-acting neuroleptic that would effectively suppress the alarm reaction, reduce the effects of psychological, somatic and heat stress and facilitate the handling and transport of captured wild herbivores.

Haloperidol (R1625, Haldol, Halopidol, Serenace***) is a potent and specific neuroleptic drug or major tranquillizer which was developed by Janssen Pharmaceutica, Beerse, Belgium[13 14]. It belongs to the butyrophenone group of compounds, and the chemical designation and empirical formula for haloperidol are, respectively 4'-fluoro-4-[4-hydroxy-4 (4-chloro-phenyl)-piperidino]-butyrophenone and C21 H23 Cl FNO_2[14]. The butyrophenones also include such well-known neuroleptics as fluanisone (Janssen Pharmaceutica, Beerse, Belgium), azaperone (Stresnil, Janssen Pharmaceutica, Beerse Belgium) and droperidol (Inapsine, Janssen Pharmaceutica, Beerse, Belgium)[21]. Of these drugs, haloperidol has the longest action.

Janssen[13 14] gives a comprehensive description of the mode of action and pharmacology of haloperidol and other potent neuroleptics and states that these drugs are powerful and effective central nervous system dopamine blocking agents which have a high affinity for the membranes surrounding the synaptic cleft of dopaminergic neurones in the midbrain. At lowest effective doses, the nigrostriatum, or A9-system is specifically depressed. At significantly higher doses these drugs exert a blocking effect on the noradrenergic A10-group of neurones, i.e. on the median forebrain bundle system for self-stimulation. The autonomic noradrenergic system in the mid-brain and the rest of the sympathetic system are only significantly interfered with at much higher doses[14]. Janssen[14] put forward the hypothesis that the true antipsychotic activity of neuroleptic drugs is associated with their inhibitory effects on the dopaminergic nigrostriatum system of the midbrain and that the psychomotor sedative effects are associated with their inhibitory effects on the noradrenergic median forebrain bundle system.

In contrast, the low potency so-called sedative neuroleptic drugs such as promazine, are active only at much higher dose levels and are relatively aspecific in their neuroleptic action. Their first effect is to block noradrenergic neurotransmission in the midbrain, including the autonomic sympathetic centre. They are also active as peripheral alpha-adrenolytic compounds at low dosage levels, while the dopaminergic neurones in the midbrain are interfered with at very high doses only[14].

It is therefore not surprising that in man haloperidol is extensively used in psychiatry and is the drug of choice in the emergency treatment of psychomotor agitation, irrespective of its origin[15]. Crane, according to Thomas[23], states that in man, the most important side effects of haloperidol are extrapyramidal symptoms and dystonia, closely followed by restlessness, including akathisia.

According to Pienaar[21] the butyrophenones are not active hypotensive and hypothermic substances and consequently have little effect on the heat regulatory mechanism, blood pressure or heart rhythm of animals. In contrast these side effects are pronounced for some of the commonly used phenothiazine derivatives. Gerle[6] reports that although mild arterial hypotension is regularly seen in haloperidol treatment, it is considered insignificant and that the drug is remarkably well tolerated in patients with grave heart complaints. He concludes that haloperidol has a remarkably low toxicity and possesses powerful neuroleptic properties.

Reports on the use of haloperidol in wild animals are limited to a few studies only. Pienaar[21] found it to be a useful drug for acclimatising newly captured impala (*Aepyceros melampus melampus*) lambs to their holding pens. Hofmeyr et al.[12] found that springbok (*Antidorcas marsupialis*) are one of the more excitable ungulates and are easily alarmed during capture operations. They report on the successful tranquillization of this species with haloperidol at dosage rates of approx-

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imately 0,25 mg/kg. Tranquillized springbok were exceptionally calm and tractable and showed marked catalepsy when they were placed in the back of an enclosed truck. In addition, they were not alarmed when clinical examinations were performed and blood samples taken. Therapeutic effects were maintained for 10-12 h. Extrapyramidal effects were absent even when springbok received as much as 30 mg haloperidol. However, restlessness, possibly due to over-dosage was occasionally observed. Because Hofmeyr et al.[12] only gave dosage rates, the recommended dosages for the different age groups and sexes in springbok are given in Table 1.

During the same study, Gericke et al.[5] investigated the effects of haloperidol on various blood parameters in captured springbok. They found that although the animals were considerably over-exerted as a result of the capture operation, clinical observations and blood chemistry studies showed that haloperidol was effective in reducing the effects of stress and suppressing the alarm reaction. This resulted in a marked reduction in capture mortalities[12].

Dr D.G.A. Meltzer of the Department of Physiology, Pharmacology and Toxicology, Faculty of Veterinary Science, University of Pretoria (personal communication), used haloperidol for the transportation of bontebok (*Damaliscus dorcas dorcas*). He found that initial doses of 10 mg haloperidol for ewes and 15 mg for rams appeared to be too high following immobilization with etorphine hydrochloride (M99, Reckitt & Colman, Hull, England) and that the animals were only calm when the transport vehicle was stationary. Consequently Meltzer suggests a combination of 5 mg haloperidol and 5 mg xylazine (Rompun, Bayer, Leverkusen, Germany).

Mr P. Norton, Department of Nature and Environmental Conservation, Cape Province, (personal communication), reported suitable psychomotor sedation in a single klipspringer (*Oreotragus oreotragus*) injected with 4,0 mg (0,3 mg/kg) haloperidol.

Because of its long-acting properties which maintain therapeutic levels for 8-12 h, haloperidol was evaluated in several other species of wild ungulates, including eland (*Taurotragus oryx*), kudus (*Tragelaphus strepsiceros*), gemsbok (*Oryx gazella*), roan antelope (*Hippotragus equinus*), sable antelope (*Hippotragus niger*), Burchell's zebra (*Equus burchelli*), Hartmann's zebra (*Equus zebra hartmannae*), red hartebeest (*Alcelaphus buselaphus caama*), blesbok (*Damaliscus dorcas phillipsi*), tsessebe (*Damaliscus lunatus lunatus*), Black-faced impala (*Aepyceros melampus petersi*), reedbuck (*Redunca arundinum*), common duiker (*Sylvicapra grimmia*), steenbok (*Raphicerus campestris*), and Kirk's dik dik (*Madoqua kirki*).

GENERAL PROCEDURE

Pharmaceutical solutions of haloperidol at concentrations of 10 mg/ml, 20 mg/ml and 40 mg/ml were used (see addendum). The animals under consideration were captured in South West Africa/Namibia during the period 1972-1980. Dosages and routes of administration, drug action and duration of therapeutic effects were noted. In several cases, clinical observations on rectal temperature, cardiac rate and respiration rate were monitored. Wherever possible the mass of a sample of animals was determined in order to ascertain the dosage rate, otherwise it was calculated from body mass obtained from other sources (Tables 1 & 2).

Eland, kudus, gemsbok, plains zebra, mountain zebra and hartebeest were captured with the boma method described by Oelofse[19] and Pienaar[22]. These animals were loaded via a ramp into communal crates on trucks. Animals were injected with haloperidol by darting them either in the holding pen or following immobilization. The holding bomas were about 25-40 m long and not wider than 20 m to accommodate the darting of animals using a pneumatic projector (Palmer Chemical & Equipment Co. Inc, Palmer Village, Georgia, USA), which has a range up to 15-20 m. The darting was done through appropriate slits made in the hessian or plastic lining, care being taken to prevent human shadows from falling against the lining and frightening the game. Zebra were usually injected while moving up the loading ramp.

The drop net technique[10 22] was used to capture sable antelope, red hartebeest, tsessebe, blesbok, reedbuck, duiker and steenbok. Black-faced impala were either lured into a capture boma or caught in drop nets. Roan antelope were lured into a boma and then immobilized before haloperidol was administered. Dik dik were caught with a netting method. Netted animals were injected intramuscularly or, preferably, intravenously with haloperidol, using disposable syringes fitted with 22 or 25 gauge needles. The veins of the ear pinna were considered the most suitable sites for injection. Animals which were darted from a helicopter or in a holding pen with etorphine hydrochloride (M99) and azaperone were injected with haloperidol before the administration of the narcotic antidote. Because haloperidol precipitates when mixed with etorphine or fentanyl (Janssen Pharmaceutica, Beerse, Belgium), it could not be incorporated in the narcotic-neuroleptic mixture.

In the majority of cases, animals were transported in communal crates and were observed to determine the effects of haloperidol during transport and release as well as the duration of therapeutic effects. Observations also included the reactions of animals to humans and other animals. In the case of red hartebeest, blesbok, Black-faced impala, duiker and steenbok, attendants usually travelled with the animals which were kept under constant surveillance in transit.

INDIVIDUAL ANIMAL SPECIES: PROCEDURE, RESULTS AND DISCUSSION

Although obvious species differences exist, the neuroleptic effects of haloperidol were to a considerable degree influenced by the capture and transport methods used for each species, while other extraneous factors and variables also played a role. It is, therefore, necessary to give a brief description of the procedure used for each species, followed by the results obtained and a discussion where necessary.

Burchell's zebra and Hartmann's zebra

When captured with the boma method, both species invariably commenced biting and kicking one another in the holding pen. Furthermore, considerable fighting and restlessness were displayed by untranquillized zebra transported in communal crates. This led to mortalities and injuries caused by exertion, particularly amongst foals.

Other species

Eland

Adult eland bulls may be particularly pugnacious and can fatally injure other eland when captured in a boma or transported in a communal crate[11].

Although 3 adult bulls which were captive for 3 months were successfully transported together following haloperidol therapy at 0,1-0,125 mg/kg[11], communal transportation was not possible with 3 free ranging bulls which were immobilized, injected with 150 mg haloperidol (approximately 0,22-0,3 mg/kg) and then revived. In view of these findings, the communal transportation of free ranging adult bulls tranquillized with haloperidol is not recommended and problems may also be experienced with the communal transportation of captive bulls.

The effects of haloperidol when used alone, that is without the after effects of or interaction with immobilizing drugs, were not determined.

Kudu

Haloperidol produced a favourable response in 2 young kudus, one of approximately 150 kg and another of approximately 50 kg body mass, when injected intravenously with 30 mg (0,2 mg/kg) and 12,5 mg (0,25 mg/kg) haloperidol respectively. However, an adult bull darted with 60 mg haloperidol and which showed a neuroleptic response after 30 min, became decidedly aggressive and dangerous when attempts were made to herd it on to a ramp and charged the author.

Although untranquillized kudu cows and calves remain calm inside suitably enclosed transport crates, haloperidol may be indicated for the release of kudus into pens. Dr T. van Wyk, veterinarian of the game capture team, Department of Agriculture and Nature Conservation, South West Africa/Namibia (personal communication), found haloperidol useful for the handling of kudu calves which had been caught in drop nets.

Gemsbok

This is one of the aggressive species which present significant problems during capture operations. Ten gemsbok darted with 80 mg (approximately 0,36 mg/kg) haloperidol did not show any favourable drug effect, neither did 5 gemsbok which were each injected with 90 mg (approximately 0,40 mg/kg) haloperidol. The animals fought and remained restless.

Roan antelope

Although roan antelope have been successfully air-lifted under narcosis[8], their transportation by road in communal crates, remains a problem. Following the immobilization of 43 boma-captured roan antelope, the intravenous injection of 5-10 mg haloperidol for 21 calves and 20-30 mg for 22 adults, did not produce favourable psychomotor sedation. During the 6 h 425 km journey, hypertonia, allotrophagia, hyper-excitability and occasional, but severe, fighting were observed which resulted in 6 casualties, of which 2 were the victims of fighting and 4 died of capture myopathy.

Sable Antelope

Sable calves, 45-70 kg body mass, captured in drop nets, and transported in communal crates, showed favourable psychomotor sedation, but were not fully tractable when injected with 20-25 mg haloperidol at dosage rates of 0,29-0,42 mg/kg.

Reedbuck

Although a subadult semi-tame reedbuck ram was very tractable during an airlift operation when injected with 7,5 mg haloperidol, suitable tranquillization could not be achieved in 8 free ranging reedbuck which received as much as 90 mg haloperidol without producing soporific effects in certain individuals. In this species 30-40 mg xylazine produced suitable tractability but it was accompanied by pronounced soporific effects.

GENERAL CONCLUSIONS AND SUMMARY

Janssen[15] points out that one surprising fact about tranquillizers in veterinary practice is their marked species specificity, which generally limits the usefulness of a particular neuroleptic to a few species only. During these investigations, haloperidol was shown to be particularly effective in the majority of small and medium antelope species, especially red hartebeest, blesbok, springbok, duiker, steenbok and dik dik. In these animals it produced a pronounced psychomotor effect. It was shown to effectively control psychological stress, injuries and additional exertion after capture and to suppress the alarm reaction during handling, transportation and even initial acclimatisation. The very successful application of this drug has made it possible to overcome innumerable problems associated with the handling, treating, sorting and transportation of game.

In the author's experience, haloperidol has greatly enhanced the management and survival rate of the above species during translocation operations. In particular, farmers who received animals tranquillized with haloperidol, have been most impressed with the favourable responses produced by this drug. Haloperidol also shows considerable promise in tsessebe.

In the larger ungulates, variable results were obtained. However, haloperidol produced a favourable response in young kudus and sable calves, and in Burchell's and Hartmann's zebra. Recent studies have shown it to be a useful and effective neuroleptic for the transportation of black rhino (*Diceros bicornis*) (personal observations).

Side effects of an extrapyramidal nature were observed in roan antelope, Black-faced impala, red hartebeest and to a lesser degree in blesbok and duiker. Springbok tend to show transient restlessness. Although certain animals may show an individual predisposition to side effects, there is substantial evidence that these effects are enhanced by hyperthermia, noise, excitability and a concommitant catecholamine reaction. Care should therefore be taken not to over-excite the animals during capture and handling and not to exceed recommended dosage rates in species which are prone to extrapyramidal symptoms. It is essential to keep animals calm after injection to enable haloperidol to exert its desired effect. In addition, in view of the abnormal feeding behaviour which occasionally accompanies haloperidol therapy, special care should be taken to prevent the ingestion of foreign bodies such as syringe needles or bits of wire as this can lead to a traumatic reticulo-pericarditis. Extrapyramidal effects, particularly excitomotoric phenomena, combined with ex-