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Use of diazepam and ketamine anaesthesia in prevention of capture myopathy in the ostrich (*Struthio camelus*)

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Abstract

Capture or exertion myopathy (CM) is an attendant complication of manual restraint in ratites, asides physical injuries that handlers may suffer. CM arises from a combination of stress and anaerobic glycolysis during handling. This work was carried out to restrain and immobilize two ostriches (*Struthio camelus*) in a bid to facilitate their clinical examination and transportation from one location to another, without subjecting the birds to capture myopathy that arises from the stress and exertion associated with physical restraint and capture. Two ostriches, male and female, weighing 120kg and 105kg respectively, were requested to be immobilized for relocation over a distance of 15 kilometres within Ibadan metropolis of Oyo State, Nigeria. The birds were fasted for 16 hours overnight and fed little amounts of feed mixed with diazepam at 3mg/kg. Mild sedation was achieved with diazepam after one hour. Samples for haematology and coprology were obtained. Ketamine at 10mg/kg was then administered intramuscularly. The birds were successfully transported. Complete recovery was 3 hours post administration of ketamine. We conclude that the diazepam and ketamine combination is generally safe to use for restraint and transportation of ratites and at the same time prevent the risk of capture myopathy. We suggest that the current dose of diazepam might need to be increased if the oral route is to be employed in order to shorten the onset of sedation and increase the depth of sedation.

Keywords: Capture myopathy, Chemical restraint, Haematology, Nigeria, Ostrich

Introduction

In the recent past, ostrich farming has increased globally and has become a recent worldwide economic activity (Carrer & Kornfeld, 1999). The ostrich *(Struthio camelus)* is the largest bird in the world with the adult measuring as much as 2.75 meters in height and weighing up to 150 kilograms (Huchzermeyer, 1998). They belong to the ratite family of birds that comprises running birds. Their extreme visual acuity and open habitat makes them difficult to approach undetected. Also, as a result of the size, speed and powerful kicking ability of the adult birds, chemical immobilization and general anaesthesia are usually made use of in these animals to provide veterinary care (Al-Sobayil & Omer, 2011).

They are highly susceptible to stress caused by physical methods of restraint (Cornick-Seahorn, 1996). Knowledge about ratite anaesthesia refers mostly to non-captive or zoo animals, in contrast to little information available from ostriches reared in commercial production systems (Cornick-Seahorn, 1996). In commercial rearing, chemical restraints and interventions are needed in many procedures such as sample collection and picking of feathers

(Ostrowski & Ancrenaz 1995) and in some minor surgical procedures such as suturing of lacerations and placement of oesophageal probe and intubation (Cornick & Jensen, 1992). Anaesthesia in ratites has been performed both intramuscularly (IM) and intravenously (IV), as well as using inhalation anaesthesia (Cornick-Seahorn, 1996). However, ratite anaesthetic events are often dangerous because these birds use their powerful legs and clawed feet as a defence, and physical restraint can result in self-trauma or injury to handlers.

Capture myopathy (CM), or exertional myopathy (Williams, 1996), is among the important complications of capture and handling in many species of wildlife and other mammals (Chalmers & Barrett, 1982). Pursuit and capture of ostriches elicits stress, struggling, and exertion, which in turn, create a patho-physiologic cascade with hyperthermia, anaerobic glycolysis, metabolic acidosis, reduced tissue perfusion, and hypoxia (Spraker, 1993). This cascade results in necrosis of cardiomyocytes and rhabdomyocytes. Clinical signs of ataxia, weakness, and paralysis could result from reduced muscle function. Williams (1996) reports that evidence of renal failure, circulatory collapse, and even death can occur in severe cases. However, some animals do appear to recover, and then present with sudden death days or weeks later following another exertive event (Spraker, 1993). There are few published reports of successful treatment of CM in wild birds (Rogers *et al.*, 2004; Smith *et al.*, 2005; Businga *et al.*, 2007), and the focus remains on prevention (Williams, 1996). An extensive work on various agents that could produce anaesthesia and chemical restraint in ratites has been reported (Speer, 2006).

This work was carried out in order to screen the ostriches for blood and faecal parasites, determine their complete blood counts and facilitate their transportation from one location to another without subjecting the birds to capture myopathy that arises from the stress and exertion associated with solely physical restraint and capture.

Materials and Methods

Two ostriches, male and female, weighing 120 and 105 kilograms respectively, were requested to be immobilized for relocation over a distance of about 15 kilometers in Oyo State, Nigeria. The ratites were fasted for about 16 hours. Diazepam [Valium 10mg tablets; SwissPharma, Nigeria] was administered orally through reduced amounts of thoroughly mixed feed and drug at the rate of 3mg/kg body weight. The fast and reduced amount of feed allowed the ostriches to consume the drug in the feed quickly and completely. After one hour, with slight manual restraint, the birds were examined. Blood was obtained from the cutaneous ulnar vein into EDTA-containing sample bottles for haematology. Faecal samples were obtained, for coprology, from the cloaca/terminal rectum and put into Bijou bottles before transportation. Ketamine [Ketamine hydrochloride 50mg/ml; Rotex Medica, Germany] was administered at 10mg/kg body weight intramuscularly. Birds were carried into a semi-open truck with padded flooring and transported within Ibadan metropolis over a distance of about 15 kilometres. After transportation, signs of recovery were observed and recorded.

Results

Physical response to anaesthetic protocol

The onset of diazepam sedation at 3mg/kg was about 63 minutes. A mild amount of physical restraint was needed to examine the birds, obtain blood and faecal samples as well as intramuscular administration of ketamine. Following ketamine administration, the birds only showed signs of mild ataxia and wobbling before maximum muscle relaxation was achieved.

Physical examination

Both birds were in apparent good body condition, alert and active. However, the ocular mucous membrane of the male was moderately pale (suggestive of anaemia). The cloaca of the male was devoid of sufficient amount of faeces and that precluded faecal examination.

Clinico-pathologic findings

The haematologic findings are presented in Table 1. Notably, the erythrocyte and leukocyte indices of the male revealed a moderate anaemia (PCV = 23%), leucopenia (TWCC = 2,600/uL) as well as a mild hypoproteinaemia.

Parasitologic findings

Faecal sample, obtained from the female, was reported to have no parasite.

Recovery findings

On reaching the target destination and following off-loading the ostriches from the truck, the birds were still under anaesthesia for a period of 57 minutes. Cumulatively, time from intramuscular injection of

Table 1: Haematologic parameters of two (2) ostriches after oral administration of diazepam

	Sex	PCV %	RBC x10^6/ul	Hb g/dl	MCV fl	MCHC pg	PLT X10^6/ul	TWCC /ul	H %	L %	M %	E %	TP g/dl
1.	F	40	10.24	13.2	39	33	12	5400	24	76	0	0	6.2
2.	M	23	6.42	7.7	35	33	08	2600	25	74	1	0	3.4
RV*		40-57						10-24[b]	10-17	2-8	0-0.7		0-0.4

TWCC: total white cell count; H: heterophils; L: lymphocyte; M: monocyte; E: eosinophil
TP: total protein; PLT: platelet; PCV: packed cell volume; RBC: red cell count; Hb: haemoglobin concentration; MCV: mean corpuscular volume; MCHC: mean corpuscular haemoglobin concentration RV: reference values
*Fudge AM. Clinical haematology and chemistry of ratites. In: Tully TN, Shane SM eds. Ratite management, medicine and surgery. Malabar: Kreiger 1996
[b]Absolute values [percentage values X TWCC] are provided

ketamine to when initial signs of recovery were noticed was approximately 2 hours. Signs of recovery from anaesthesia included flapping of wings and initial wobbling during attempts to stand. This lasted a couple of minutes. Complete recovery following ketamine administration was observed in about 2 hours 50 minutes when the ostriches regained full consciousness and were able to move about freely. In our opinion, recovery appeared smooth and non-violent.

Discussion

Restraint is imperative in the handling, examination, immobilization and transportation of ostriches. Manual restraint is particularly associated with exertional/capture myopathy (CM) to the birds as well as varying degrees of physical injuries to unsuspecting handlers. CM arises from a combination of stress and anaerobic glycolysis during handling. Treatment is not effective and emphasis is placed on preventing its occurrence and thus the need for chemical restraint.

With good facilities, such as a dart gun, delivering chemical agents is simple, precise and easy. However, in the absence of such facilities, administering chemical restraint may present a daunting task. In this case, we opted for sedation using the oral route before anaesthesia. To achieve this, the birds were fasted for about 16 hours. This action was important for three reasons. First, it was going to help empty/rest the gastrointestinal tract. Second, it would avoid aspiration pneumonia that may result from emesis which is a side effect of a few sedatives such as xylazine. Finally, we expect that fasting for such duration of time would stimulate the appetite and rate of consumption of a sedative-laden feed when presented to the birds in reduced amounts.

The ease of oral administration of diazepam makes this technique a promising one. However, the prolonged onset of action and mild depth of sedation associated with the dose we used, in our opinion, is not satisfactory. Although a delay in the onset of action is expected when a drug is delivered enterally, this may be compensated for with an increase in the dosage administered. It is plausible that an increase in dose administered orally will not only shorten the onset of action, but also increase the depth of sedation. It is noteworthy to mention that reduced onset of action and an increased depth of sedation can also be achieved if the diazepam is delivered IM using a pole syringe or a blow pipe. However, care must be taken to avoid trauma to the bones or coelomic organs if a blow pipe is used. The increased depth of sedation may preclude the need for an anaesthetic (ketamine in this case) in a number of situations. These situations will include non/less-invasive procedures such as phlebotomy, obtaining a fine needle aspirate as well as interventions that are of sufficiently short duration such as suturing of lacerations and relocation from one enclosure to another.

In this case, we assert that the diazepam and ketamine combination is generally safe. This is evidenced by the smooth, non-violent recovery of the birds and the absence of any obvious negative side-effects. We conclude that oral administration of diazepam, and accompanied by intramuscular administration of ketamine provides restraint in ratites while also avoiding the risk of capture myopathy.

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