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Clinical managment of suspected organophosphate poisoning in *Gyps* vulture in Assam, India

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Abstract
A striking 97% population decline of the three endemic species of vultures in South Asia has been recorded since early 1990 with a possible threat of global extinction. This article puts into record of ten independent episodes of mass mortality and morbidity of *Gyps* vultures attended by veterinarians of Centre for Wildlife Rehabilitation and Conservation (CWRC) within a period of about 12 months in eastern and central parts of Assam. All these were episodes of secondary acute toxicity suspected to be caused by consumption carcasses of livestock and dogs drenched with organo-phosphate or organo-chlorine pesticides. From the description of the clinical symptoms and history given by the villagers, it is also suspected that a few of the stray dogs might have been affected with rabies or canine distemper. Upon clinical examination, the birds under comatose condition showed severe dehydration about10% (neck skin turgour test), hyper salivation, emesis, open mouthed breathing, greenish diarrhoea, cyanotic colouration of exposed skin, curled toe paralysis, squatting on sternum and in some birds mild to severe corneal opacity. The treatment protocol began with gastric lavage using oral rehydration salts like Sodium chloride (0.9% solution) to facilitate regurgitation of stomach content in order to prevent further absorption of the suspected poison. All affected birds were treated with Atropine sulphate (@0.04 mg/kg body weight) injected intramuscularly in pectoral muscle at 12 hours interval (Harrison G.J 1983), followed by the administration of Ringer's lactate (@200 to 250 ml BD/bird) intravenously for 3 consecutive days (Abou-Madi *et al.* 1992) and Dexamethasone Sodium @ 1 mg/kg body weight stat (Burns *et al.* 1988). Most bird with moderate symptoms responded to treatment within 24 hours. Signs of recovery included gaining consciousness, standing, reduction in emesis, diminished salivation, and disappearance cyanotic changes of exposed skin (respiratory distress, hypoxia). After second day of treatment, they were fed on chevon @500-600 g/day/bird. Subsequently after behavioural enrichment they were release back to wild.

Keywords: *Gyps* Vulture, Acute Toxicity, Rabies, Treatment, Rehabilitation

1. Introduction
A striking 97% population decline of the three endemic species of vultures in South Asia has been recorded since early 1990 with a possible threat of global extinction (Prakash *et al* 2003, 2007 and 2012, SAVE 2014) [8]. This significant decline is chiefly attributed to veterinary use of non-steroidal anti-inflammatory drug "Diclofenac Sodium" and of late a few other NSAID like Meloxicam and Nimesulide as well (Cutberth *et al* 2015). Reports of mass mortality and morbidity of *Gyps* vultures associated with deliberate or unintentional poisoning of carcasses with inorganic agricultural pesticides to kill predators including stray dogs have also been encountered and documented in India and globally as well (Naidoo and Wolter 2016, Choudhury *et al* unpublished). This article puts into record of ten independent episodes of mass mortality and morbidity of *Gyps* vultures attended by veterinarians of Centre for Wildlife Rehabilitation and Conservation (CWRC) within a period of about 12 months in eastern and central parts of Assam. All these were episodes of secondary acute toxicity suspected to be caused by consumption carcasses of livestock and dogs drenched with organo-phosphate or organo-chlorine pesticides (Fig 1). Organo-chlorine pesticide residues from random samples of vulture tissues and eggs across India reveal varying that it can also remain as a residue with no apparent clinical significance (Muralidharan *et al* 2008) [9].

Fig 1: Dead vultures at the spot

Materials and Method

Ten episodes of acute toxicity due to scavenging on baited carcass were attended by veterinarians of CWRC located near Kaziranga National Park. Detail of case history from eye witnesses, circumstantial evidences, clinical signs and symptoms, treatment and management in captivity and recovery and release of birds with subsequent post- release monitoring were recorded and analysed.

Case history

Case history was recorded upon arrival from information provided by the "rescuers", primary responders or eye witnesses in the field (table 1). A few strategic questions were also put uniformly across the villagers at random after inspecting the carcasses and surrounding areas. The summary of these conversations reveal the use of either livestock or stray dog carcass drenched with locally available agricultural pesticides of organochlorine/ organophosphorous as bait to kill predating stray dogs. From the description of the clinical symptoms and history given by the villagers, it is also suspected that a few of the stray dogs might have been affected with rabies or canine distemper. It is a practice in villages to kill such dogs using baits; they directly pour pesticides over the affected dog after its death and leave it open in the agricultural field. According to them the affected dogs may fed on the carcass and get eliminated which is scientifically not true. The vultures get targeted feeding of baited livestock or the target dogs similar to what has been described by Fajardo *et al*. 2011 [1].

Table 1: Details of ten incidences of vulture poisoning by the authors

Sl No.	Date	GPS	Carcass baited	Total birds affected	Mortality	Morbidity	Released After treatment
1	24-01-2015	N 27.131248° E 94.710878°	Cattle	52	51	1	1
2	11-02-2015	N 27.739770° E 95.570795°	Dog	7	6	1	1
3	04-03-2016	N 27.738726° E 95.588831°	Cattle	38	29	9	9
4	05-03-2016	N 27.635871° E 95.656370°	Cattle	2	1	1	1
5	07-03-2016	N 27.144410° E 94.717957°	Cattle and Dog	29	21	8	8
6	29-03-2015	N 27.445803° E 95.463764°	Goat	1	0	1	1
7	05-05-2015	N 27.516918° E 95.411525°	Goat	4	0	4	4
8	06-05-2015	N 27.516918° E 95.411525°	Goat	2	0	2	2
9	10-02-2016	N 27.131248° E 94.710878°	Cattle	2	0	2	2
10	27-02-2016	N 26.718431° E 93.656734°	Buffalo	11	0	11	6
Total				148	108	40	35

These ten (10) episodes, accounted for 148 vultures of *Gyps* species, of which 108 (72.9%) were found dead at the site itself, of the 40 vultures admitted (27%) for treatment, 35 (87.5%) were released back to the wild. All the poisoning incidences were recorded between winters (Mid-January) to Pre-monsoon (end of May) periods of the year.

Carcasses fed by the affected vultures include cattle (04 cases), dogs (01 cases), and goats 03 cases), buffalo (01 case) and one case of both cattle and dog together.

Species affected

The three vulture species affected were Himalayan griffon (*Gyps Himalayensis*), slender-billed vulture (*Gyps tenuirostris)* and white-rumped vulture (*Gyps Bengalensis*). Of the 148 affected vultures, 106 (71.6%) were Himalayan griffon, 23 (15.5%) were slender-billed vultures and 19 (12.8%) were white-rumped vultures.

Clinical symptoms

Upon clinical examination, the birds under comatose condition showed severe dehydration about10% (neck skin turgour test), hyper salivation, emesis, open mouthed breathing, greenish diarrhoea, cyanotic colouration of exposed skin, curled toe paralysis Fig 2), squatting on sternum and in some birds mild to severe corneal opacity.

Fig 2: Affected vultures during treatment

Treatment

The birds were provided first aid at the rescue site itself and later transported to the rehabilitation facility (CWRC) depending on the need. The treatment protocol began with gastric lavage using oral rehydration salts like Sodium chloride (0.9% solution) to facilitate regurgitation of stomach content in order to prevent further absorption of the suspected poison. All affected birds were treated with Atropine sulphate (@0.04 mg/kg body weight) injected intramuscularly in pectoral muscle at 12 hours interval (Harrison G.J 1983) [2], followed by the administration of Ringer's lactate (@200 to 250 ml BD/bird) intravenously for 3 consecutive days (Abou-Madi *et al*. 1992) [4] and Dexamethasone Sodium @ 1 mg/kg body weight stat (Burns *et al*. 1988) [3]. Most bird with moderate symptoms responded to treatment within 24 hours. Signs of recovery included gaining consciousness, standing, reduction in emesis, diminished salivation, and disappearance cyanotic changes of exposed skin (respiratory distress, hypoxia). After second day of treatment, they were fed on chevon @500-600 g/day/bird.

Recovery in Captivity

Recovery was rapid as evidenced by the following behavioural changes:

1. Birds could stand on their feet without any obvious discomfort on day 2.
2. Preening was observed on day 3.
3. Vocalization with "squeaking" and "quaking" like sounds were observed from 2^{nd}-3^{rd} day of treatment largely during feeding.
4. The birds began to spread their wings after 4^{th}-5^{th} day of treatment.
5. Perching on dead branches and short flights could be observed inside the enclosure from 5^{th}-8^{th} day onwards.

Release and awareness creation

The recovered vultures were released at the same site (Fig 3) or the nearest suitable sites. Since all the cases of poisoning happened inside or near human settlements, an open grazing field or playground inside a school campus adjacent to scrub forest and tall perching trees were selected as a site of release. Recovered birds were transported in wooden cages of 1 x 2 x 2 feet dimensions or in groups of 4-5 birds in larger cages like 5 x 5 x 3 feet in dimensions. When the cage doors were opened, the birds would walk for a distance of 6-10 feet before taking off roosting on the nearest tree. The location of release was strategically chosen so that villagers of all age groups especially children of the area can witness the release of the birds. The people gathered at the release site were sensitized so that such accidental deaths do not happen in the area. The local print and electronic media, NGO's and forest officials were also invited to spread the message. A public pledge was also undertaken to prevent such situation in future.

Fig 3: Release of vultures after treatment

Marking for monitoring

Prior to release, few birds were ringed using an indigenously designed plastic bird ring that ri had WTI/IFAW written on it using indelible (permanent) ink. This would help opportunistic monitoring whenever ring birds are sighted. The rings were showed to the public and forest department personnel so that they can look for it when they see vultures around their area and can inform the nearest forest/ police and WTI officials.

Result

The history, circumstantial evidences, gross pathological lesions and laboratory findings suggested that the acute morbidity and mortality among *Gyps* vultures were due to organophosphate poisoning. The acute symptoms revealed *muscarinic* effects like SLUDGEM (Salivation, Lacrimation, Urination, Defecation, Gastrointestinal motility and Emesis) (Reece and Handson, 1982) [6]. Forensic result confirmed the presence of Carbamate and organophosphorus compound in the visceral organs sent for examination, although the quantification of the toxin could not be carried out due to lack of proper facility. Out of 35 affected vultures, 27 could be released back to the wild.

Discussion

The morbidity and mortality among individuals of Gyps species of vultures through accidental toxicity of organophosphorus compounds can have a significant impact on the population that is affected by Diclofenac toxicity. Elimination of nuisance stray dogs by poisoning through baited carcasses with common agricultural pesticides by ignorant villagers needs immediate attention of enforcement authorities and all stakeholders. Similar mode of control of stray dog population has also been documented by Hern´andez, M. & A. Margalida, 2008 [7] in Europe as well. Educating the villagers and strengthening the Veterinary and Animal Husbandry support for vaccination for rabies of livestock and stray dogs at the foraging and nesting locations of Gyps vulture will address such unfortunate incidences in near future. It is also interesting that organochlorine and organophosphate compounds are still being used largely by the Agricultural practitioners despite the arrival of many new broad spectrum pesticides in recent years. Banning these

products will be the long term answer to prevent such unscrupulous use by ignorant farmers. The authors feel that regular monitoring of persistent organochlorine and organophosphate residues in visceral organs of resident vultures from opportunistic sampling need to be taken up.

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