

Clinical Management of Injured Juvenile Painted Storks (*Mycteria leucocephala*) Due to the Impact of Cyclone Fani

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Received: 10.12.2019 | Revised: 16.01.2020 | Accepted: 23.01.2020

ABSTRACT

Cyclone Fani hit the Koonthankulam Bird Sanctuary, Tirunelveli District, Tamil Nadu, India on 29th April, 2019 and inflicted morbidity and mortality in painted storks (*Mycteria leucocephala*). The juvenile painted storks perching on the trees fell along with nests and 13 were referred to Veterinary Clinical Complex, Veterinary College and Research Institute, Tirunelveli, South India in critical stages. On clinical examination two birds were in shock, one had fracture of pelvis and left femur which was treated by soft bandaging. The remaining 10 birds requiring procedures were inducted and maintained anaesthesia following pre-oxygenation for 5 minutes, Isoflurane was administered as inhalant anaesthetic in 100 per cent oxygen (3 L/min) at a concentration of 4 to 5 per cent for induction and 2 per cent for maintenance through a customized face mask made of plastic intravenous fluid bottle. For the long bone fractures, intramedullary pinning was performed in 5 cases of tibio-tarsal and tarso-metatarsal fractures and Plaster of Paris bandage was applied in 4 cases of tibio-tarsal and tarso-metatarsal fractures including radius-ulna fracture in one case. Anaesthesia was well tolerated with a mean Standard reflex score of 1.55 ± 1.23 after induction. Intramedullary pinning and Plaster of Paris bandage were tolerated and aided in healing of long bone fractures. The birds in shock (2), pelvis fracture (1) and radius-ulna fractures (1) died during the post treatment period in the Rehabilitation centre and the 9 recovered birds were released. The study indicated that isoflurane was a safe and ideal inhalant anaesthetic in Painted Storks and intramedullary pinning and Plaster of Paris bandage were well tolerated and they aided in the healing of long bone fractures of pelvic limbs in painted storks.

Keywords: Cyclone Fani, Painted Storks, Long bone fractures, Pelvic limb, Intramedullary Pinning

Abbreviations (L/min) – liters per minute

Cite this article: Bharathidasan, M., Vishnugurubaran, D., Gupta, C., Mohanapriya, T., Dharmaceelan, S., & Ramprabhu, R. (2020). Clinical Management of Injured Juvenile Painted Storks (*Mycteria leucocephala*) Due to the Impact of Cyclone Fani, *Ind. J. Pure App. Biosci.* 8(1), 97-104. doi: <http://dx.doi.org/10.18782/2582-2845.7936>

INTRODUCTION

Painted Stork (*Mycteria leucocephala*) is a common aquatic water bird seen in Indian Subcontinent. Although these birds were seen abundant; now the birds are classified as “Near Threatened” because of hunting, wetland drainage and population decline. Urfi et al. (2007) reported that loss of feeding grounds, over fishing from the feeding grounds, deforestation of useful trees for nest building, poaching of adults and young ones, reduced rate of egg incubation, starvation of developing young ones and predation of eggs (Shobrak & Aloufi, 2013) as the major threats to this birds.

The tanks in Tirunelveli and Tuticorin Districts of Tamil Nadu, South India support large populations of the Near Threatened Painted Stork (*Mycteria leucocephala*) and Spot-billed Pelican (*Pelecanus philippensis*) (Abhisheka et al., 2013). Koonthankulam Bird Sanctuary in Tirunelveli District is recently protected by the State Forest Department and is a community protected area, which harbors a high diversity of resident and migratory water birds (Abhisheka et al., 2013). The Cyclone Fani and thunderstorm hit South Tamil Nadu on 29th April, 2019 and lashed Koonthankulam Bird Sanctuary. It killed many painted storks, including chicks as the nests fell down when the trees on which they were perched got uprooted and many juvenile painted storks were injured. The critically injured birds were treated and were subjected to general anaesthesia and fracture immobilization / wound suturing. While subjecting the birds for general anaesthesia; the anaesthetist should consider about the lack of diaphragm, presence of pneumatic bone, gas exchange during both inspiration and expiration (Miller & Buitrick, 1999).

This paper described the anaesthetic and surgical management which were provided to the injured juvenile Painted Storks due to the impact of the cyclone Fani.

MATERIALS AND METHODS

Anaesthetic and surgical procedures were performed on 10 juvenile painted storks of

unknown age and sex, weighing between 1.8 and 2 kg were referred to Veterinary Clinical Complex, Veterinary College and Research Institute, Tirunelveli, South India in critical stages following the lashing of Koonthankulam Bird Sanctuary by the cyclone Fani and thunderstorm on 29th April 2019. On physical and clinical examination all the birds were dehydrated and two were in shock. All the 13 birds were in class IV and V of Risk Assessment Values (Fig. 1) as per the guidelines proposed by Ritchie et al. (1994). Procedures under anaesthesia were performed on 10 birds, 2 were managed for shock and one with pelvic fracture was bandaged. Warmed (96°F) Ringers lactate was administered through brachial wing vein at the rate of 10 ml/kg/hour (Miller & Buitrick, 1999). Following examination and stabilization 10 birds were induced anaesthesia and the required surgical procedures were performed. Bandage was applied with soft padding in one case of pelvis and femur fracture (Table 1).

2.1 Anaesthetic Induction

All the birds were pre-oxygenated with 100 per cent oxygen at flow rate of 3 liters through a customized face mask using empty plastic Intravenous fluid bottles (Fig.1) (Degernes & Biggs, 2008) for 5 minutes. Anaesthesia was induced using isoflurane 4 to 5 per cent in 100 per cent oxygen as carrier gas (3 L/min) (Korbel, 2012) through the same customized face mask (Fig.2), which facilitated entire part of the head upto external nares and beak to be inserted to minimize the dead space (Degernes & Biggs, 2008). Following induction, anaesthesia was maintained with 2 per cent isoflurane in 100% oxygen (3 L/min) (Seok et al. 2017) through the face mask. The anaesthetic parameters and blood samples for haemato-biochemical analysis were collected before induction and after recovery. The depth of anaesthesia was assessed by Standard reflex score chart for birds (Korbel, 2004). The score chart ranged from 0 to 27 points, considering the reflex status of eye lid opening, palpebral reflex, pupil opening, pupillary reflex, cornea reflex,

head positioning, neck tone, leg tone, pectoral reflex, propatagium reflex. The reflex status was assessed as absent, partial or intact / present and were scored as 0, 1 and 2 respectively.

2.2 Surgical Procedures

The surgical procedure performed was intramedullary pinning (Sahu et al., 2018), for fracture of tibio-tarsal and tarso-metatarsal fractures in 5 cases (Fig. 4) and Plaster of Paris bandage cases of tibio-tarsal and tarso-metatarsal fractures (cases) (Fig. 5) and one case of radius and ulna fracture. The procedures were performed based on the type of the fracture (Michael & Egger, 1979, Islam et al., 2002, Muller & Nafeez, 2017). Bandage was applied with soft padding in one case of pelvis and femur fracture. After recovery the birds were housed in the Rehabilitation Centre in the Bird Sanctuary. Post operatively they were managed with antibiotics, analgesics and wound dressing.

RESULTS

3.1 Type of Injuries

Among the 13 juvenile painted strokes, long bone fractures were encountered in 10 (76.92 %), collision injures in 2 (15.38%) and simple injury in one (7.69%). Out of 10 long bone

fractures, pelvic limb fracture including tibia, tarsals and metatarsals were encountered more (90%) and only one sustained fracture of radius and ulna (Table 1).

3.2 Anaesthesia

Isoflurane was administered at a concentration of 4 to 5 % settings in the vaporizer of the anaesthetic circuit (3 L/min) through the customized mask using empty plastic 500 ml intravenous fluid bottle. The induction time varied from 2 to 4 minutes with a mean of 2.90 ± 0.73 minutes in the 10 birds. The induction was smooth without resistance and struggle and the mean Standard reflex score after induction was 1.55 ± 1.23 . The anaesthesia was characterized by closed eyes, delayed papillary reflex response to light, slow movement of nictitating membrane over the cornea and muscle relaxation. Anaesthesia was maintained (Fig. 3) with 2 per cent isoflurane in vaporizer setting with 100 per cent oxygen (3L/min) which was sufficient to accomplish procedures ranging from 10 to 20 minutes. The relative Standard reflex score ranged from 0 to 3. All the haematological and biochemical parameters before anaesthesia and after recovery were within the normal clinical range (Table 2).

Table 1: Weight, Risk Assessment Values, Nature of injury / Fracture and Procedures Performed on Juvenile Painted Storks

Bird No	Weight (Kg)	Risk Assessment Values (Class)	Nature of injury / Fracture	Standard reflex score (after induction of anaesthesia)	Procedure Performed
1	1.8	V	Collision Injury- Shock	-	Fluid therapy
2	1.8	V	Collision Injury- Shock	-	Fluid therapy
3	2	V	Left femur & Pelvis fracture	-	Bandaged
4	2.0	IV	Lacerated wound	2	Wound management
5	2.1	IV	Left tibio-tarsal fracture	0	Intramedullary Pinning-K-wire
6	2.2	IV	Left tibio-tarsal & Right metatarsal fracture	2	Plaster of Paris bandaging
7	2.0	IV	Left tibio-tarsal fracture	3	Plaster of Paris bandaging
8	1.9	IV	Right tarso-metatarsal fracture	0	Intramedullary Pinning-K-wire

9	1.8	IV	Left tibio-tarsal fracture	2	Plaster of Paris bandaging
10	1.9	V	Right radius and ulna fracture	0	Intramedullary Pinning-K-wire + Cerclage wiring
11	2.0	IV	Left tibio-tarsal fracture	2	Plaster of Paris bandaging
12	2.0	IV	Right tibio-tarsal fracture	1	Intramedullary Pinning-K-wire
13	2.0	IV	Right tibio-tarsal fracture	1	Intramedullary Pinning-K-wire

Table 2: Haemato-biochemical parameters of Painted Strokes before and after anaesthesia

Parameters	Before induction	After recovery
Haematology		
Haemoglobin (g/dl)	8.45±1.52	8.40±1.47
Packed Cell Volume (%)	25.27±4.65	25.25±4.43
Erythrocytes (10 ⁶ /mm ³)	4.19±0.81	4.12±0.83
Leukocytes (10 ³ /mm ³)	12.45 ±1.54	12.53±1.94
Platelets (lakhs/mm ³)	3.22±0.69	3.31±0.42
Heterophils (%)	30.27±1.95	30.58±2.15
Lymphocytes (%)	64.08±2.39	64.55±1.86
Monocytes (%)	1.50±0.97	1.55±0.93
Eosinophils (%)	4.00±1.04	3.88±1.16
Biochemical		
BUN mg/dl	46.74±19.34	47.86±18.60
Creatinine mg/dl	0.28±0.12	0.25±0.10
ALT IU/L	13.70±10.70	13.77±11.34
AST IU/L	286.10±111.35	269.78±104.68
Calcium mg/dl	9.88±1.01	9.74±0.98
Phosphorous mg/dl	7.73±2.78	7.73±2.86
Glucose mg/dl	166.07±38.97	189.38±55.90



Fig. 1: Injured juvenile painted strokes with class IV & V Risk assessment values



Fig. 2: Use of plastic intravenous fluid bottle in juvenile painted stroke as mask for induction of anaesthesia



Fig. 3: Anaesthetic maintenance - isoflurane in a juvenile painted stroke with tibial fracture



Fig. 4: Management of metatarsal fracture with normograde intramedullary pinning



Fig. 5: Management of tarso-metatarsal fracture with Plaster of Paris in a juvenile painted stroke

3.3 Surgical Procedures

The 2 birds in shock, one bird with pelvis fracture and one bird with radius and ulna fracture died during the period of treatment in the Rehabilitation Centre. All the remaining 9 birds with fractures of the long bones in the pelvic limb recovered and were released in the sanctuary after one month.

DISCUSSION

4.1 Type of Injuries

Fracture of tibia, tarsal, metatarsal, femur and combination of hind limb long bone fractures were encountered along with pelvis fracture in one bird. The trees were uprooted and the nests were fallen from the trees and the juvenile birds perching on them fell on the ground and sustained fracture of the legs. Veltri and Klem, Jr. (2005) reported that

collision injuries due to wind in avian would cause subdermal injuries, fracture of beaks and head injuries when they collide with hard objects due to wind velocity. Fall from the height was the major cause for long bone fractures in other species of animals or human and in the affected juvenile painted strokes, as it was predisposed by the long and thin bone cortex and fall from height while the trees were uprooted, high wind velocity, lack of coordination of wings and the ground reaction force due to collision (Zadpoor & Nikooyan, 2011). Natural calamities such as floods, forest fires and earthquakes are known to result in bird mortality. Thiyagesan and Nagarajan (1997) reported mortality of water birds at Pichavaram Mangrove Forests, Tamil Nadu due to the cyclone that hit the Coromandal coast of India on 4th December 1993. The

injured birds were dull and depressed with drooped wings and were in Class IV and V of Risk Assessment Values. Fani cyclone and thunderstorm caused devastating injuries and mortality in juvenile and mortality in adult painted strokes at Koonthankulam Bird Sanctuary, Tirunelveli, Tamil Nadu.

4.2 Anaesthesia

In the present study, the birds were induced anaesthesia through a face mask which was customized to using a plastic empty intravenous fluid bottle with the provision to attach the end of breathing circuit just to accommodate the long beak and part of the head up to the external nares of the birds. Since the customized mask was narrow with less empty space; the mechanical dead space of ventilation is reduced, thereby provided effective gas exchange. Degernes and Biggs, (2008) had customized various hollow materials ranging from syringes to soft drink bottles as masks for induction of anaesthesia in birds according to the length and size of the beaks of the birds. The birds were not intubated with endotracheal tubes as the procedures were shot and completed in 20 minutes. Degernes and Biggs (2008) recommended that procedures in birds lasting more than 20 minutes only need to be intubated as the post-intubation tracheal obstruction and respiratory distress of unknown origin was common in birds (Sykes et al., 2013).

Relatively larger tracheal diameter and higher dead space in normal awake bird is compensated by low respiratory rate (approximately one-third that of mammals) that decreases the impact of the larger tracheal dead space volume on ventilation, movement of fresh air into lung during both inspiration and expiration as air capillaries function as the anatomic location of gas exchange instead of alveoli in mammals. Efficiency of gas exchange in the avian lung is excellent because the blood gas barrier is not as thick as in mammals (Miller & Buitrick, 1999). Good analgesia and adequate muscle relaxation in birds anaesthetized with isoflurane. The blood / gas partition coefficient

was 1.4 when compared with 2.3 for halothane and 12 for methoxyflurane, which allowed rapid induction and rapid and smooth recovery in birds. Isoflurane is the least soluble of the remaining three agents with a blood/gas partition coefficient of 1.4 compared to 2.3 for halothane and 12 for methoxyflurane. Isoflurane molecules were stable and resistant to metabolic breakdown (Doolen & Jackson, 1991). This property affords a higher level of safety in critical and compromised birds. The MAC (Minimum Alveolar Concentration) was also low (1.46) as studied in Eagles (Chan et al., 2013), which was also an additional benefit to achieve smooth and quick induction and faster recovery. The recovery was smooth and struggle free and all the birds recovered in 4.72 ± 1.68 minutes. The standard reflex score ranged between 0 and 3; indicating good surgical plane of anaesthesia (Table 1). Korbel, (2004) reported that a standard reflex score ranging between 0 and 4 was an indicative of good plane of anaesthesia. Isoflurane anaesthesia provided smooth induction, stable plane of surgical plane of anaesthesia and smooth recovery in juvenile Painted Strokes as observed in Harris's Hawk (*Parabuteo unicinctus*) by Hoybergs et al. (2018).

The cellular elements in differential count of Painted Strokes were similar to the reference values of birds (Albokhadaim, 2012). All the haematological and biochemical parameters before anaesthesia and after recovery were within the normal clinical range revealing isoflurane did not induce adverse effects on the haemato-biochemical parameters (Chan et al., 2013).

4.3 Surgical Procedures

The birds sustained collision injuries, shock, fracture of pelvis and radius ulna died during the treatment and post-operative care period.

Intramedullary pinning was performed for immobilization of long bone fractures of tibio-tarsal and tarso-metatarsal for osteosynthesis in 5 cases. Verma, et al., (2017) reported that intramedullary pinning for long bone fracture was safe procedure in birds. Plaster of bandage was applied in 4 cases of

long bone fracture and in one case of radius and ulna fracture. Islam et al., (2002) compared different fracture fixation devices including plating and concluded that both intramedullary pinning and adhesive tape with wood splint are the best devices for fracture fixation in birds but intramedullary pin was excellent method as it does not loosen before healing like adhesive tape with wood splint. Jones, (2013) observed faster bone healing in avian than mammalian and heal by both primary and secondary healing and majority of healing was with the latter, which was characterized by stages of inflammation, soft callus formation and remodeling.

CONCLUSION

Cyclones and thunderstorms could be a major threat to Painted Strokes causing injury and fracture to the long bones of pelvic limbs and mortality, due to the fall from the trees which were uprooted. Isoflurane was an ideal inhalant agent for induction and maintenance of anaesthesia, which could be administered through customized plastic intravenous bottles as masks. Intramedullary pinning and Plaster of Paris bandage was well tolerated and aided in fracture healing of long bones in painted strokes

Acknowledgments

The authors thank to Directorate of Clinics, TANUVAS and Dean, Veterinary College and Research Institute, Tirunelveli for all the support and facilities provided for the study. The corresponding author acknowledges Dr. B. Justin William, Former Professor and Head, Department of Veterinary Surgery and Radiology, Madras Veterinary College for technical guidance and support during the study.

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