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Therapeutic management of bacterial dermatitis in captive Asian elephant (*Elephas maximus*)

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Abstract

A study was undertaken to find out the prevalence of bacterial dermatitis in captive Asian Elephants (*Elephas maximus*) of Assam. *Staphylococcus* spp. was the predominant causative organism. Coagulase positive (*S. aureus* and *S. intermedius*) and coagulase negative (*S. hyicus*, *S. choromogenes*, *S. caseolyticus* and *S. saprophyticus*) bacteria were detected from the skin lesions. Antibiotic sensitivity test for bacterial isolates showed the highest sensitivity to Ceftriaxone/Tazobactam followed by Amoxicillin/Clavulanic acid, Ceftriaxone/Sulbactam, Enrofloxacin and Mupirocin respectively. Among these, Amoxicillin/Clavulanic acid and Mupirocin showed significant efficacy during the treatment process.

Keywords: Captive Asian elephants, Bacterial dermatitis, *S. aureus*, *S.intermedius*, *S.hyicus*, *S. saprophyticus*, *S. caseolyticus*, and Amoxicillin/Clavulanic acid

1. Introduction

Elephants of the forest department, Govt. of Assam are mainly engaged in patrolling duty. Another major activity of the elephant is a joy ride for the visitor. During such activities in the forest they sustain injuries from unknown sources in their body surface and in the foot. Injuries during a training session of sub-adults elephants and due to improper use of guiding devices (Ankus and hooks) leads to severe laceration and punctured injuries to the skin tissues. Foot ailments are also common with a recorded 62% incidence due to split nails, 25% abscesses and 12.5% cracked soles [1]. Private owned elephants are engaged in timber logging and are kept in the forest areas in order to get them access to the forest food. Bites of external parasitic (ticks and flies) which are abundantly present in the environment of tropical countries facilitates entry of bacteria into the skin lesion which later leads to dermatitis [2]. On the other hand, a major cause of skin injuries for wild elephants is conflict retaliation due to shringing of suitable habitat for wild animals in Assam. The captive Elephants of forest department are frequently attacked by the wild elephants, Rhinoceros, Tigers and Leopards and the escaped one suffers from mauling wounds which severely damages the deeper epidermis. Centre for Wildlife Rehabilitation and Conservation, Bokakhat and Assam State Zoo, Guwahati is handling such injured, displaced young (infants & juveniles) elephants for rehabilitation. Subsequently, when such injuries are invaded by pathogenic bacteria and fungus, leads to damage of the deeper epidermis and results in different types of dermatitis. Keeping the above points into consideration, the present study was undertaken to find out the associated bacteria causing dermatitis, *in-vitro* drug sensitivity test of bacterial isolates and to determine an effective therapeutic regimen against bacterial dermatitis.

3. Materials and Methods

Clinical skin swabs were collected from various sites of 40 captive and rescued wild elephants. Amnesia was recorded prior to sample collection from the mahouts (the driver of elephants) and concerned authorities. Isolation and identification of the bacteria by colony characteristics (pigment production, haemolysin on 5% blood agar), staining characteristics by gram stain and biochemical tests viz. test for fermentation of carbohydrate (mannitol, sucrose, maltose), catalase activity and tube coagulase test was done [3,4]. Further, the bacterial isolates were also identified by using a biochemical identification kit (Hi Staph™ Identification Kit) supplied by Himedia Pvt. Ltd. A test for differentiation of staphylococci from micrococci was done on the

basis of the modified Hugh and Leifson test [5]. An attempt was made to standardize the method of polymerase chain reaction (PCR) for confirmation of *S. aureus* isolates. The species - specific PCR was conducted targeting *nuc* gene locus (359bp size) in the isolates by using specific primer pair. Nine isolates were randomly selected and subjected for molecular identification [6, 7]. The drug sensitivity pattern of the isolates to the various antimicrobial agents was determined by using disc diffusion techniques [4].

4. Results

A total of 21 skin samples were found positive for bacterial dermatitis out of 40 collected samples from the affected elephants with skin lesions. Coagulase - positive *Staphylococcus* species eg. *S. aureus* and *S. intermedius* were the bacteria isolated. While coagulase - negative staphylococcal isolates eg. *S. hyicus*, *S. chromogenes*, *S. caseolyticus* and *S. saprophyticus*. *Staphylococcus hyicus* were identified on the basis of colony characteristic on the selective medium. White and yellow pigmented colonies surrounded by a broad surface and sub-surface zone of precipitation were the characteristic feature of the growth pattern of *S. hyicus* on the selective medium [8]. Out of the 9 randomly selected *S. aureus*, five isolates were confirmed as *S. aureus* and all the five isolates exhibited a band size of 359 during the PCR study.

S. aureus was highly sensitive to the combination of Amoxicillin/Clavulanic acid, followed by Ceftriaxone/Tazobactam, Amoxicillin/Sulbactam and Mupirocin during *in-vitro* antibiotic sensitivity test. Isolates of *S. intermedius* was most sensitive to Enrofloxacin, Ceftriaxone/Tazobactam and Amoxicillin/Clavulanic acid followed by Amoxicillin/Sulbactam, Ceftriaxone/Sulbactam and Mupirocin. All the isolates of coagulase - negative staphylococci tested were sensitive to Ceftriaxone/Tazobactam and Ceftriaxone/Sulbactam, followed by Amoxicillin/Clavulanic acid and Amoxicillin/Sulbactam. But all the isolates of coagulase positive and negative staphylococci were least sensitive to Neomycin and Cefixime.

Among 21 affected elephants, 8 were adult male (>15yrs), 2 adult female, 6 sub adult male (>5yrs), 2 sub adult female, 1 female calf (<1yrs) and 2 male juvenile (>1yrs) was recorded.

The affected one showed marked pyogenic lesions in the trunk, neck, abdomen, tail, back, thigh, leg and in the foot regions. The signs of depression and loss of appetite were recorded in few elephants, but most of them remain apparently healthy. Treatment was given based on the *in-vitro* antibiotic sensitivity pattern of the bacterial isolates. The affected 21 elephants were divided into four groups comprising of 6 in group I and 5 each in group II, III and IV. The grouping of animals was completely on clinical cases and no control group maintained. It was taken into consideration that the affected elephants with dermatitis had to treat with best effective drugs for immediate recovery.

In all groups, the affected areas were initially dressed with potassium permanganate (KMnO₄) and povidone iodine (Bectosept, Ranbaxy Pvt. Ltd.) solution and Mupirocin (T-bact, Glaxo Smithkline) ointment were applied. Antibiotics were administered parenterally (Intra-muscular and intravenous route) at an interval of 12 hrs daily for one week in group I and 24 hrly in II, III & IV groups respectively. Vitamins and mineral (Supercare @ 100 ml & Vimeral @40 ml) were supplemented once daily orally for 4 weeks. In group I, antibiotic Amoxicillin/Clavulanic acid (Venclox inj, Venky's Pvt. Ltd.) was given parenterally (Intra-muscular and intravenous route) twice daily (12hrs) for a week with application of mupirocin and were found to be 100 % effective. While, in group II, III and IV Ceftriaxone / Tazobactam (Intacef- Tazo, Intas Pvt. Ltd.), Enrofloxacin (Fortivir, Virbac Animal Health India) and Ceftriaxone/sulbactam (Exact, Excellar Pvt. Ltd) respectively was administered parenterally once daily for one week. The elephants were observed for 60 days at an interval for 7 days (Table No. 1). On day 14th there was clinical improvement and on day 28th and on day 35th marked recovery was noticed and finally from day 42nd onwards there was complete recovery of the skin lesion of the elephants of group I. While in group II, III and IV the animals showed clinical recovery on day 21st and 28th. Marked recovery was observed on day 35th and complete recovery was observed from 42nd day onwards. However, one elephant of each group II, III, and IV group could not recover till the 60th day. The efficacy of Amoxicillin /Clavulanic acid with Mupirocin (100%) is higher than Ceftriaxone / Tazobactam, Enrofloxacin and Ceftriaxone/ Sulbactam and the use of povidone iodine was significant in all the elephants having bacterial dermatitis.

Table 1: Therapeutic Evaluation of Clinical Improvement of Bacterial Dermatitis

Group	No. of animals	No. of Animals Recovered								
		7 th day	14 th day	21 st day	28 th day	35 th day	42 nd day	49 th day	56 th day	60 th day
I	6	2	2	4	4	5	6	6	6	6
II	5	0	2	2	3	4	4	4	4	4
III	5	0	2	2	3	4	4	4	4	4
IV	5	0	2	2	3	4	4	4	4	4

5. Discussion

Both free-ranging and captive elephants have ample opportunities to sustain injuries to the skin, punctured wound may result from sharp objects (thorns, nails) or from the improper use of guide devices (ankush or hook), leg chains that may cause abrasion, laceration or even degloving. Tail is particularly prone to injury; bite wounds from other elephants [9]. The occurrence of bacterial dermatitis in elephants is higher, due to their habitats which are rich in trees bearing thorns, which causes prick injuries to their skins, later on getting supervened with suppurative bacteria [10]. The lack of sebaceous glands makes the skin dry and in natural habitats,

elephants keep their skin moist and protected from UV rays by covering with mud and dust [11]. Wallowing of elephants in mud and dust bathing may facilitate the growth of soil pathogens in damaged skin [12]. *Staphylococcus* species were the predominant causative bacteria in the present study. A similar finding was reported from the skin wounds of domesticated working elephants in Assam [12]. Staphylococci are commensal and opportunistic organisms residing on the normal skin. The normal skin acts as a protective barrier against a wide range of pathogenic organism, but the damaged skin, provides a favorable condition for their growth and multiplication. This might be a possible cause of

predominance of most Staphylococci. Similar finding was cited from the skin lesion of trunk pyoderma in a male Ceylon Elephant (*Elphus maximus maximus*)^[13] while *S. aureus* was recorded as a pathogenic organism from the elephant feet^[9].

6. Conclusion

Captive elephants are susceptible to staphylococcal skin infection. Coagulase-positive *Staphylococcus* species (*S. aureus* and *S. intermedius*) and coagulase-negative staphylococcal isolates (*S. hyicus*, *S. chromogenes*, *S. caseolyticus* and *S. saprophyticus*) was identified as the pathogens of bacterial dermatitis in captive Asian elephants. The efficacy of Amoxicillin /Clavulanic acid with Mupirocin was significant although other sensitive antibiotics had also showed good efficacy. Application of povidone iodine was significant in all the elephants having bacterial dermatitis. Elephants are prone to skin affections and therapeutic management suggests intensive care (hygiene & nutrition) and regular attention to the elephants during the therapeutic period.

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