

Therapeutic management of wounds in Asian elephants

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ABSTRACT

A review study was undertaken to find out the prevalence of wounds in Asian elephants. Antibiotics were used to treat the Asian Elephant wounds. This study primarily focus on the efficacy and better dosage forms of the various medicines that were used to treat the wounds in Asian elephants. Recent studies showed that nano-formulated curcumin//gelatin-blended nanofibrous mats (NMs) accelerates acute wound healing through Dkk-1-mediated fibroblast mobilization and MCP-1-mediated anti-inflammation and recently new approach has been designed in ulcer prevention and wound healing treatment for animal diseases using Doxycycline and Amoxicillin/LDH Nanocomposites. In future, nanotechnology can be used for the management of wounds in elephants.

KEY WORDS: *Elephas maximus*, Managements, Nanotechnology, Wounds

INTRODUCTION

Asian elephant (*Elephas maximus*) is the largest herbivorous mammals of the world, which is now enlisted as critical endangered species in Bangladesh. An elephant has a rich symbolism in the Asian nation as they are closely associated with religious and cultural aspects of their hosting nations. The Asian elephant has assumed a vital job for a considerable length of time in Asian cultures; today, they are pushed to the edge of close termination. At present, it is estimated that there are somewhere around 30,000 elephants in the wild and around 16,000 in captivity, totaling the Asian elephant population was found to be around 50,000. Elephant skin is sensitive and very thick measuring about 2.5–5.0 cm,^[1] it may delay in healing of wound so the mahouts take care of a cursory wound. The skin wound is the common wound affected by an elephant; it may cause due to pieces of wood, cuts from the chain. Foot ailments are common with a recorded 62% incidence due to split nails, 25% abscesses, and 12.5% cracked soles.^[2] During wild conditions, the elephant makes the use of mud and slush to cover its skin for the retention of moisture and protection from

ultraviolet rays. The elephant's skin lacks sebaceous glands. The anatomical factor that interferes with wound healing in the elephant is dry and thick wound is the frequently found disorder in elephant, wound treatment in the elephant is expensive.



TYPES OF WOUNDS

Elephant wounds can be classified into foot wound, skin ulcer wound, subcutaneous abscess wound, and trunk wound.

FOOT WOUNDS

Elephant falls into a gathering called near ungulates, which refers to the way that they have toenails as

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opposed to hooves. An elephant foot is planned so that elephants really stroll on the tips of the toes.

NAIL CRACK

Asian elephant suffers several splits in the nails and sole in India. The treatment aims to stop the advancement of the crack and allows the nail to grow back and to prevent the development of abscesses. The treatment process includes the removal of any dark, foul-smelling nail material, and foreign particles. Then, iodine antiseptic will be applied on the nails and the feet should be kept dry.

SOLE OVERGROWTH IN ELEPHANTS

Asian elephant sole of feet showing the normal grooves on the surface. The treatment process includes trimming with an illustration blade and trying to shave off one slight sheet of congested sole at the time. The section of holes can be passed out with a sharp foot blade. Yellowish-pink keratin shading showing upon the sole demonstrates that the corium is close; Extremely congested soles may require a few scenes of cutting. Agate might be utilized rather than an illustration blade, however, taken considerably more time and exertion.

SOLE ABSCESS IN ELEPHANTS

Mixed infections caused by the pathogens such as *Staphylococcus*, *Streptococcus*, *Klebsiella*, *Fusobacterium*, *Bacteroides*, and *Pseudomonas* from one sole abscess complicated by phalange osteomyelitis. The treatment process includes if the abscess cannot be fully drained, flushed, and exposed; then, systemic antibiotics are indicated. Regularly lavage or foot soaks after drainage of the abscess along with antibiotics such as ampicillin are employed.

SKIN ULCER WOUND

Skin ulcers may occur due to grinding or rubbing. It can happen during defending themselves or fighting; it could be mainly wounded in tail, forehead, and ears flap. The treatment process includes clean the external surface, apply an antibiotic ointment, provide good nutrition, and treat the painful ulcer wound with analgesia.

SUBCUTANEOUS WOUND

Abscesses can occur in all parts of the body in elephants and may become chronic, if not treated on time.^[3] The treatment includes clean the injury with a tincture of iodine solution. Remove the pus from the

wound to prevent the bacteria. The wound is packed with a Triple Sulfa powder and the tetanus toxoid injection was given as a single dose.^[4]

TRUNK WOUND

The trunk portion may be bitten off. The male elephant is used to lift the wooden pieces that have got cut on the tip of the trunk. The treatment includes the wound that will clean with potassium permanganate (KMnO_4) and an antibiotics dexamethasone.^[5]

ORGANISMS ISOLATED FROM ELEPHANT FEET

Streptococcus agalactiae, Beta hemolytic streptococci, *Staphylococcus aureus*, *Prevotella melanogenia*, (*Peptostreptococcus*) *Corynebacterium* spp., *Clostridium tetani*, *Bacillus cereus*, *Eggerthella lenta*, (action bacterium, *Eubacterium*), *Pseudomonas aeruginosa*, *Aeromonas hydrophila*, *Pasteurella multocida*, *Pasteurella haemolytica*, *Mannheimia haemolytica*, (*Pasteurella*), and *Dichelobacter nodosus* (*Fusiformis* and *Bacteroides*).^[6]

MICROORGANISM ISOLATED FROM FOOT INFECTION AND ABSCESES IN ELEPHANT

Escherichia coli, *Proteus vulgaris*, *P. aeruginosa*, *Fusobacterium necrophorum*, *Dichelobacter (Bacteroides) fragilis*, *D. nodosus*, Beta hemolytic streptococci, *S. agalactiae*, *Staphylococcus aureus*, *Pasteurella multocida*, *A. hydrophila*, *Enterococcus zymogenes*, *Salmonella* spp., and *Klebsiella* spp.^[7-10]

THE SOLUTION USED TO SOAK ELEPHANT FEET

Magnesium sulfate, USP, $\text{MgSO}_4 \cdot \text{H}_2\text{O}$, chlorhexidine diacetate, povidone-iodine solution; other names include iodophor, tamed iodine, copper sulfate, and sodium hypochlorite.

ANTIMICROBIAL AGENTS APPLIED TO LESIONS OF THE FOOT

Copper sulfate, chlorine-dioxideoxychlor complex, dilute acetic acid, dimethylsulfoxide, formalin, 10% formaldehyde, and hydrogen peroxide: colorless, odorless liquid, ammonium ichthyol-sulfonate, bitumen sulfonate, ichthammol, copper naphthenate, Kopertox 37.5%, zinc oxide (ZnO), KMnO_4 , sucrose, and polyhexosamine polymer from deacetylation of chitin.

CLINICAL MANAGEMENT OF ELEPHANT WOUNDS

Drugs	Dose and route of administration
Antibiotics	
Antituberculosis	
Ethambutol	30 mg/kg PO
Rifampin	10 mg/kg orally only
Isoniazid	5 mg/kg PO
Aminocyclitols	
Amikacin	6–8 mg/kg IM q 24 h
Gentamicin	4.4 mg/kg IV (or IM) once daily
Cephalosporins	
Ceftiofur	1.1 mg/kg IM
Macrolides	
Tylosin	12 mg/kg/day IM
Penicillins	
Amoxicillin	11 mg/kg IM q 24 h
Quinolones	
Enrofloxacin	2.5 mg/kg PO
Sulfonamides	
Sulfadimethoxine	16.2–18.5 mg/kg po BID on day 1 then 9.25 mg/kg

Source and credit Elephant Care International Dr. Susan Mikota DVM^[11]

TREATMENT OF ELEPHANT WOUNDS BY AYURVEDA

A mixture of ghee and honey should be applied to the wound for a period of 3 days. The leaves of TILIA and IMBA pounded with Rajani and mixed with honey the best medicine for the dress the wounds. Wounds of soles treatment include turpeth should be poured into the evoke of the trees which have milky sap and the powders of Triphala, Rochana, and Laksha. A resinous substance stashed by a scale insect (*Laccifer lacca* Kerr) and used chiefly in the form of shellac, achiote (red lead), rodhra, guggula, bhallata, ghontaphala, kasira (kasima), saindhava (rock salt), and the saurashtrikanjana (antimony or a special clay from Gujarat having alum-like properties; extract of sarja and shriveshtha (oleoresin from pines) should be mixed with it and the mixture should be heated on low fire constantly stirring with a large ladle until it becomes a thick and sticky paste. An expert should apply a thick layer of this for enforcement wounds of the elephant's sole and then tied with a piece of cloth.^[11-12]

NANOFORMULATION

In recent years, nanotechnology plays a key role in humans and veterinary medicines. Nanotechnology is a discipline of science that deals to manipulate, ability to measure organize matter at a nanoscale level.^[13] A nanoparticle is <100 nm in at least a single dimension and it consists of various biodegradable materials such as natural polymers or synthetic

polymers and lipids or metals. Nanoparticles are more adequate than micromolecules, it rapidly achieves at a targeted place, and so it is used as a drug delivery vehicle.^[14] In veterinary studies, nanotechnology has a potency to improve the treatment and also helps to provide new techniques for cellular and molecular breeding. Nowadays, nanoparticle overcomes the commonly used treatment to treat elephant wounds because it seeks interest due to its nontoxicity and biodegradability. It has a greater potency to manage the elephant wounds.

TYPES OF NANOFORMULATION

Nanoformulation is silver, ZnO, gold, and copper nanoparticles containing antibacterial and antimicrobial agent used to the treatment of wound healing.^[15]

SILVER NANOFORMULATION

Silver is used as an antibacterial and antimicrobial agent to treat wounds such as an open wound, infective wound, and burn.^[16] It is more effective and healed completely compare to other antibiotics such as amoxicillin and metronidazole.^[17] Silver nanoparticles are capable even at a lower concentration. Silver nanoparticle used to prevent the growth of various microorganisms.^[18]

GOLD NANOFORMULATION

Gold is used as a therapeutic agent, elephant, as thick skin surface gold nanoparticles are used as multipurpose properties such as drugs, targeting agent, and diagnostics agent.^[19] Gold nanoparticles deliver various drug molecules, vaccines, or recombinant protein into a specific targeted area and its control release of drugs in internal or external.^[20]

NANOFORMULATION FOR ELEPHANT WOUND MANAGEMENT

In general, elephants require a large quantity of medicines for external applications to treat wounds. The absorption and volume of distribution of the administered medicines are a big challenge for large animals such as elephants. Recent studies showed that nano-formulated curcumin//gelatin-blended nanofibrous mats (NMs) accelerates acute wound healing through Dkk-1-mediated fibroblast mobilization and MCP-1-mediated anti-inflammation.^[21] New approach in ulcer prevention and wound healing treatment for animal diseases using Doxycycline and Amoxicillin/LDH Nanocomposites were well documented.^[22] Nanoformulation needs less quantity of medicine and it also increases the

absorption and volume of distribution. Hence, nanoformulation will pave a new way for the elephant wound management.

CONCLUSION

The present review mainly focuses on the treatment of wounds in Asian elephants. Nanoformulation of antibiotics and antiseptics will play a crucial role in wound healing in elephants.

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