Healing of methicillin-resistant Staphylococcus aureus (MRSA) infected canine pyoderma by formulated neem oil: A case study

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Healing of methicillin-resistant *Staphylococcus aureus* (MRSA) infected canine pyoderma by formulated neem oil: A case study

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Abstract
Canine pyoderma, a common bacterial skin infection in dogs, often requires prolonged antibiotic therapy. However, the growing incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) poses significant therapeutic challenges, necessitating alternative treatment approaches. The present study assesses the efficacy of neem oil (*Azadirachta indica*), a traditional herbal remedy known for its antimicrobial and anti-inflammatory properties, in managing a chronic case of MRSA-induced canine pyoderma. A middle-aged canine (Labrador, F, 9Y) having recurrent skin ulceration and unresponsive to conventional antibiotics was treated topically with a standardized neem oil preparation. Clinical evaluation over two weeks showed marked improvement in the skin condition, reflected by reduced inflammation, and pruritus by the end of second week. This case supports the potential of neem oil as a natural, cost-effective alternative or adjunct in treating resistant bacterial skin infections in veterinary dermatology. Further studies are warranted to validate its broader clinical application and elucidate its mechanism of action.

Keywords: MRSA, Pyoderma, canine, drug resistance, alternative treatment

Introduction
Canine pyoderma, a common bacterial skin infection in dogs, has become increasingly challenging to manage due to the global rise of methicillin-resistant *Staphylococcus* (MRS), particularly methicillin resistant *Staphylococcus aureus* (MRSA) and *Staphylococcus pseudintermedius* (MRSP), (Putriningsih *et al.*, 2023; Weese and van Duijkeren, 2010) [6, 8]. Traditionally, treatment has relied on systemic and topical antibiotics; however, the emergence of multidrug-resistant strains has limited the effectiveness of conventional therapies and raised concerns about the overuse of antibiotics and the subsequent development of resistance (Pendergrass, 2018; Ventola, 2015) [5, 7]. Recent guidelines emphasize the importance of culture and sensitivity testing to guide antibiotic selection, especially for cases unresponsive to empirical therapy or with a history of resistant infections (Putriningsih *et al.*, 2023) [6]. While systemic antibiotics remain necessary for severe or deep infections, there is growing evidence that topical therapies alone can be effective for localized, superficial pyoderma, including cases caused by resistant bacteria (Hillier A, *et al* 2014; Putriningsih *et al.*, 2023) [2,6]. This shift has prompted interest in alternative, non-antibiotic treatments that can address both infection and wound healing. Herbal remedies, such as neem oil (*Azadirachta indica*), have gained attention for their antimicrobial and wound-healing properties. Studies on herbal preparations like moist exposed burn ointment (MEBO) have demonstrated comparable efficacy to conventional treatments in promoting healing and preventing infection in animal models, without the adverse effects associated with many chemical agents (Junker *et al*., 2013) [3]. Neem oil, in particular, is recognized for its broad-spectrum antimicrobial activity and potential to support tissue repair, positioning it as a promising adjunct or alternative in the management of canine pyoderma, especially in the context of MRSA infection.

This case study explores the therapeutic potential of neem oil in healing canine pyoderma complicated by MRSA, reflecting a broader movement toward integrating alternative herbal therapies in veterinary dermatology to combat antibiotic resistance and improve patient outcomes (Junker *et al*., 2013) [3].

Case history taken for the experiment

A nine-year-old female Labrador dog was presented at the Veterinary Clinical Complex, West Bengal University of Animal and Fishery Sciences, with a history of pruritus, pyometra, and persistent skin infection on the paw. Pustules, hair depilation, and intense dermatitis were observed on clinical examination. A slight elevation in body temperature (101.4°F) was another prominent clinical sign. Antibiotic sensitivity testing (ABST) and skin cytology were performed to further assess the cutaneous pyoderma manifestation.

Treatment plan

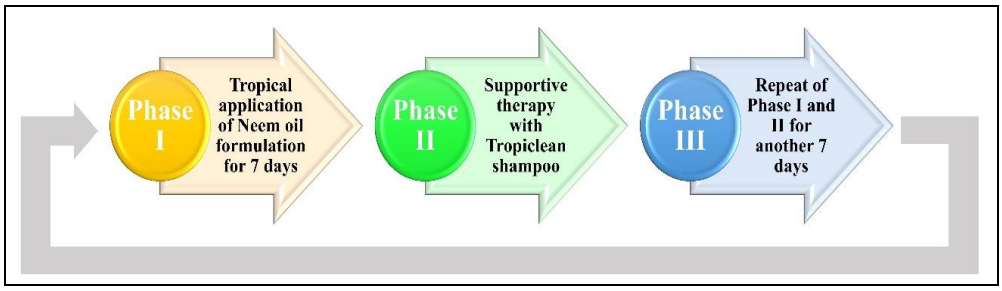

Fig 1: Treatment plan for a span of 14 days

As depicted in Figure 1, a three-phase treatment plan involving Neem oil and Tropiclean shampoo was implemented. Phase 1 involved the topical application of a Neem oil formulation for a period of 7 days. It was used as the major antimicrobial agent. Phase 2 included an additional Therapy with Tropiclean Shampoo. This was potentially done for cleansing the skin coat and enhancing the effects of Neem oil absorption. Phase 3 was typically a repetition of the above for another 7 Days, continuing the treatment for 14 days. A 14-day plan was taken up to ensure the resolution of the disease.

Results and Discussion

Neem oil has been experimentally proved to contain antimicrobial, anti-inflammatory, and anti-wound healing properties (Alzohairy, 2016) [1]. In the present study, following a 14-day course of Neem oil treatment, a significant reduction in skin ulceration on the paw and purities was observed. Reviewing the case on the 15th day from the start of treatment, all other clinical conditions, including body temperature fluctuations, had been resolved. Bacterial growth obtained from the mannitol salt agar (MSA) streaking produced yellow-coloured colonies, providing evidence of *Staphylococcus aureus* presence, and also an antibiotic sensitivity test (AST) was performed using Mueller-Hinton agar (MHA) plate. Throughout the treatment, no side effects were reported. The MRSA strain recovered from the skin sample culture showed resistance to Cefoxitin, Enrofloxacin, and Doxycycline, but was susceptible to Chloramphenicol and Tetracycline, as indicated by the results obtained through AST (Figure 2). A study conducted on pyoderma by Kale *et al*. (2024) [4] reported similar findings on disease resolution, although the experiment was performed with the antibiotic Doxycycline. The drug showed promising results in curing pyoderma.

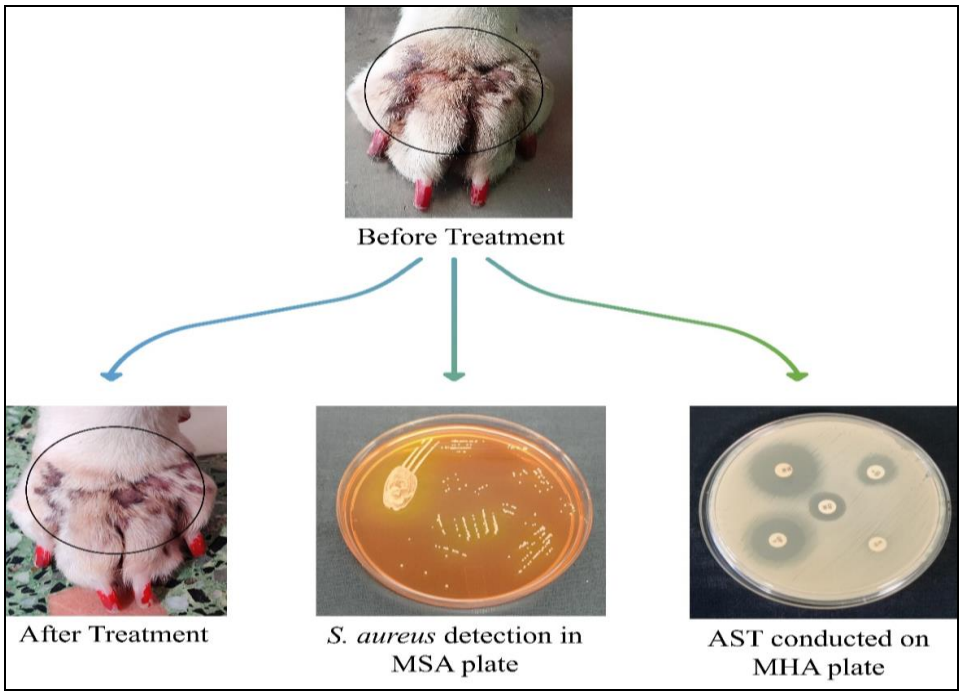

Fig 2: Schematics representing the course of the experiment performed and the results obtained.

Conclusion

This case study highlights the promising therapeutic potential of neem oil as an alternative treatment for antibiotic-resistant canine pyoderma caused by MRSA. The rapid clinical improvement observed, along with the eradication of the resistant pathogen, underscores neem oil's antimicrobial efficacy and its role in reducing inflammation and promoting skin healing. As antibiotic resistance continues to challenge conventional veterinary treatments, incorporating evidence-based herbal alternatives like neem oil may offer a valuable and sustainable approach. While this single case provides encouraging results, controlled clinical trials and further pharmacological investigations are essential to establish standardized protocols, assess long-term safety, and fully understand the mechanisms underlying neem oil's therapeutic effects in veterinary dermatology.

Conflict of Interest: Not available

Financial Support: Not available

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