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Current Clinical Trends in the Management of Acute Foot Rot in Sheep and Goats

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Abstract

Foot rot is a common, complex, and important disease in the sheep caused by two microorganisms Dichelobacter nodosus and Fusobacterium necrophorum resulting lameness. Prompt action is direly required in acute foot rot; otherwise, acute cases will culminate in chronic ones. Neglected foot rot will end permanent lameness, suppuration and necrosis, sloughing of hooves, and sometimes pain, shock, and deaths would result in huge economic loss to the shepherds. The synergistic efficacy oral antioxidant, antibacterial and topical antibacterial effect of Micro minerals, Azithromycin, topical Oxytetracycline and Gentian violet were tried. Over 2256 sheep and goats belonged to 30 shepherds who attended for expert treatment for foot rot to Sreepathi veterinary services Kadapa during 2023 to 2024 were formed clinical material for the study.

Keywords: Acute Foot Rot; Sheep; Topical Alvimycin Spray; Bioplex High Seven; Oral Azithrmycin Solution

Abbreviations

FT: Foot Rot; GV: Gentian Violet; AZM: Azitromycin; OTC: Oxytetracycline; AM: Alvimycin; SG: Sheep and Goats.

Introduction

In the sheep industry, foot (FT) is a prevalent, intricate, and significant illness. It is the primary cause of lameness in sheep (Sp) and is a painful and incapacitating infection of the interdigital skin. Dichelobacter nodosus, an anaerobic gram-negative bacterium, is the most significant of a complex variety of bacteria that cause FT. Fusobacterium necrophorum colonizes and macerates the interdigital skin before to and concurrent with D. Nodosus infection. Animals that suffer from FT must be cured or culled which results in large losses.

The condition causes the hard keratin covering of the hoof to completely degrade, which usually leads to lameness. It is characterized by foul-smelling, inflammatory exudates and necrosis of the hoof's epidermal layers [1].

A 0–5 rating system can be used to characterize the FT lesions [2]. Score 1 occurs in herds with and without FT and is not consistent with disease. According to the Australian approach, for example, FT can be clinically categorized as either benign or virulent at the flock level. Viral FT is diagnosed in a flock when over 10% of the feet have score 4 lesions present at a time when the disease has had a chance to fully manifest. Lesions that typically don't go past the interdigital skin are the hallmark of benign FT at the flock

level. The diagnosis FT is clinically established based on the severity of the foot lesions (score 2-5) [2].

Environmental factors, host immunity, genetics, stocking rate, nutrition, frequent or continuous rainfall for several weeks, and low temperatures can all complicate or enhance the disease transmission process of FT, which is dynamic and complex and involves infection with multiple etiological agents [1-3].

Interdigital dermatitis may result from the impaction of the interdigital region with grass, mud, and excrement, which can weaken the epidermis and allow F. necrophorum to invade [4].

Archanobacterium pyogenes or other pyogenic bacteria that cause foot abscesses may cause purulent infections with deeper lesions, including a foot abscess at the distal interphalangeal joint [5]. Long-term exposure of the feet to ambient and wet grass, excrement, and urine makes animals more susceptible to infection and disease transmission [6].

Kaler J, et al. [7] found that topical use of $KMnO_4$ solution and parenteral administration of long- acting oxytetracycline (OTC)and enrofloxacin were highly successful in treating both acute and chronic FT in sheep.It was determined that treating the clinico-physical symptoms of acute FT with parenteral antibiotics and footbath is very successful.

Ansari MM, et al. [8] concluded that treating the clinico-physical symptoms of acute FT with parenteral antibiotics and footbath is very successful. The farmers will probably get socioeconomic advantages from this, and welfare concerns will be strengthened.

In organisms, oxidants and antioxidants are in balance Aktas MS, et al. [9]. In situations where antioxidant intake is hindered, such as illness, inflammation, malabsorption, stress, exercise, metabolic and environmental variables, and cellular damage in living organisms, this equilibrium is upset in favor of oxidants.

Oxidative stress is what this is Marreiro DN, et al. [10-12]. F T and sheep's oxidant/antioxidant balance are related, according to Yurdakul BA, et al. [13] who also found that oxidative stress and lipid peroxidation arise as a result of an increase in free radicals.

Around the world, foot washing in disinfectant solutions has been a common practice for treating and curing flock FT Zanolari P, et al. [14,15]. Although there is growing concern about the toxicity of heavy metals to the environment, common disinfectants include formalin, copper sulfate, and zinc sulfate [16].

Using topical OTC spray and 10% zinc sulphate foot bathing every day for five days in a row (Alamycin Aerosol, Norbrook), Maley AM, et al. [17] assessed the clinical cure rates from FT and contagious ovine digital dermatitis and discovered that both treatments produced cure rates that were comparable to documented cure rates

The study's clinical material consisted of more than 2256 sheep and goats (SG) that belonged to 30 shepherds who visited Sreepathi Veterinary Services Kadapa in 2023 and 2024 for professional FT treatment. Azithromycin (AZM) topical OTC, and GV were chosen for their synergistic oral antioxidant, antibacterial, and topical antibacterial properties.

Materials and Methods

Materials

Two thousand two hundred fifty six SG owned by 30 shepherds in and around Kadapa district in Andhra Pradesh during 2023 to 2024 included as study material after obtaining their consent.

Year	Number of sheep and goats	Number of days required for complete cure	Percentage of cure
2023 to 2024	2256	5 to 7 days	89%

Table 1: Percentage of Cure.

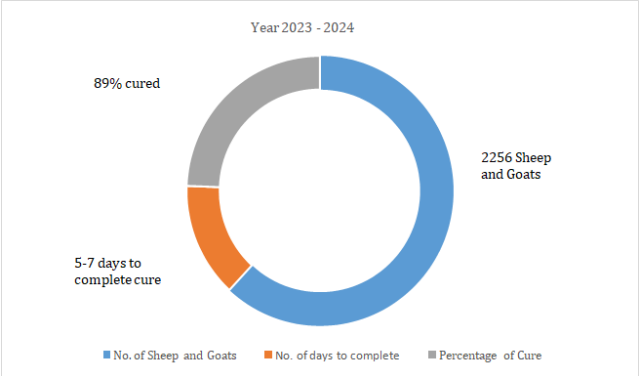

Figure 1: Graphical Presentation of Results Obtained During the Clinical Trial 2023-2024.

Alvimycin (AM) topical spray, a brand product of Alivera Animal Health Limited, Mumbai, containing OTC 2.5 %and gentian violet (GV) 0.35%. Zethrin oral suspension , a brand product of install health care, Kadapa containing Aziyhromycin dehydrate equivalent to 40 mg per ml and Bioplex high seven bolus, a brand product of Alltech

Biotechnology Private Limited ,Bangalore containing Zinc Min. 360mg; Copper Min. 60mg; Cobalt Min. 6.25mg; Chromium Min. 1.68mg; Manganese Min. 143mg; Iodine Min. 14.5mg; Selenium Min. 1.5mg per bolus ,were procured .

Methods

After cleaning the affected foot with saturated normal saline and drying, (AM)topical spray was sprayed on the affected part, housed on hard surface, in the evening and continued till complete recovery .Zethrin oral suspension was drenched @ 10 mg per kg body for 3 to 5 days in the evening. One Bioplex high seven bolus was dissolved in 100 ml of drinking water and supplemented @ 10 ml per sheep for 5 to 7 days consecutively.

Mechanism of Action Of Oxyteracycline

By attaching itself to the ribosomal complex, the bacteriostatic antibiotic prevents bacteria from synthesizing proteins Chopra I, et al. [18]. OTC enters Gram-negative bacteria through porin channels in their membranes and builds up in the periplasmic region. The prokaryotic 30S ribosomal subunit and the OTC molecules bind reversibly once within the bacterial cell, preventing aminoacyl-tRNA from attaching to the bacterial ribosome and halting protein synthesis. In addition to inhibiting protein synthesis in mitochondria, OTC binds to the 70S ribosomes present in mitochondria. The selective antibacterial characteristics of tetracyclines with few adverse effects in humans are thought to be caused by poor interaction OTC with the 80S ribosome of eukaryotic cells, which results in a relatively modest suppression of protein synthesis [19]. After seven days, all the treated sheep recovered. 89% of cases were cured. There were no adverse effects noted.

Mechanism of Action Of Gentian Violet

The precise mode of action of GV is unknown Burkhart CN, et al. [20]. There are several theories to explain its antimicrobial properties Docampo R, et al. [21] including inhibition of decreased nicotinamide adenine dinucleotides phosphate (NADPH) oxidases and a change in redox potential caused by the dye Ingraham MA [22] free radical formation [23] inhibition of protein synthesis [24,25] inhibition of glutamine synthesis [25] uncoupling of oxidative phosphorylation [26] formation of an un-ionized complex of bacteria with the dye Levin D, et al. [27,28] or inhibition of the formation of the bacterial cell wall [26,29]. Notably, GV is highly effective against Gram positive bacteria, which also form adducts with GV, due to its ability to penetrate the bacterial cell wall and covalently bond to proteins. GV is far less effective against Gram negative bacteria and Mycobacterium, presumably due to its inability to penetrate the lipids surrounding the cell wall [29].

Mechanism of Action of Azithromycin

All macrolides, including azalides (AZM) work in a similar way. By attaching to the 23S rRNA on the major ribosomal subunit—50s—at the nascent peptide exit tunnel adjacent to the peptidyl transferase center, they prevent protein synthesis in bacteria that are sensitive [30] and the ribosome's ability to elongate expanding peptide chains is interrupted and insufficient [31-33]. According to Vázquez-Laslop and Mankin, et al. [33,34] macrolides are bacteriostatic and therefore mostly time dependent, but at higher doses they may exhibit bactericidal effects since binding is temporary and the inhibition is reversible.

Results and Observation

All the treated sheep were recovered eventually within 7 days. The cure rate was 89%. No side effects were observed. The remaining 11 percent mortality was due to noncooperation of the shepherds and improper administration of the prescribed medicines. The acute cases would have transformed into chronic cases.

Discussion

It turned out that the three medications worked well together. Applying AM topical spray to FT. lesions increased the pace of healing by acting as an antibacterial, antifungal, and antimageticidal agent.

Thornberry H [35,36] found that a 10% chloromycetin and GV tincture works better to prevent than either a 50% formalin solution or 30% copper sulphate. It also has the advantage of being easier to apply thoroughly, saving time, and being considerably safer and more enjoyable to work with than powerful solutions of formalin or copper sulphate, the latter of which poses a serious risk to the operator's eyes and exposed mucous membranes. Antimicrobial, anti-inflammatory, and immunomodulatory properties of Zethrin enhanced the effectiveness of healing. More and more evidence points to immunomodulatory effects of AZM on early inflammation, which include changes in autophages, suppression of neutrophil influx, stimulation of macrophage regulatory activities, and inhibition of pro-inflammatory cytokine production [37,38].

The antioxidant and immunomodulatory effect of Bioplex enhanced the recovery rate and improved the general condition of the affected sheep and goats.

Conclusions

In summary, the combination of oral Zethrin solution, topical spray, and oral Bioplex High Seven bolus yielded amazing

outcomes. The cure rate was 89%, and all afflicted lambs recovered in 7 days.

Conflict of Interest

None

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References

1. Bitrus AA, Abba Y, Jesse FFA, Yi LM, Teoh R, et al. (2017) Clinical management of foot rot in goats: A case report of lameness. J Adv Vet Anim Res 4(1): 110-116.

2. Stewart DJ, Claxton PD(1993) Ovine foot rot: Clinical diagnosis and bacteriology. In: Corner LA, Bagust TJ (Eds.), Australian standard diagnostic techniques for animal diseases, CSIRO pp: 1-27

3. Bennett G, Hickford J, Sedcole R, Zhou H (2009a) Dichelobacter nodosus, Fusobacterium necrophorum and the epidemiology of Foot rot. Anaerobe 15(4): 173-176.

4. Winter AC (2008) Lameness of sheep. Small Ruminant Research 76(1-2): 149-153.

5. Riet-Correa F (2007) Foot abscess. In: Riet-Correa F, Schild AL, et al. (Eds.), Ruminant and Equine Diseases, 3rd (Edn.), Varela, São Paulo 1: 199-201.

6. Egerton JR (2002) Management of footrort in small ruminants. XII International Symposium on lameness in ruminant. Orlando-USA. (Eletronic Publishing)

7. Kaler J, Wani SA, Hussain I, Beg SA, Makhdoomi M, et al. (2012) A clinical trial comparing parenteral oxytetracyline and enrofloxacin on time to recovery in sheep lame with acute or chronic Foot rot in Kashmir, India. BioMedm Central Veterinary Research 8: 12.

8. Ansari MM, Dar KH, Tantray HA, Bhat MM, Dar SH, et al. (2014) Efficacy of different therapeutic regimens for acute foot rot in adult sheep. J Adv Vet Anim 1(3): 114-118.

9. Aktas MS, Kandemir FM, Kirbas A, Hanedan B, Aydin MA (2017) Evaluation of oxidative stress in sheep infected with 8. In: Moin M, Dar KH, et al. (Eds.), Efficacy of different therapeutic regimens for acute foot rot in adult sheep, J Adv Vet Anim Res 1(3): 114-118.

10. Marreiro DN, Cruz KJC, Morais JBS, Beserra JB, Severo JS, et al. (2017) Zinc and oxidative stress: Current mechanisms. Antioxidants 6(2): 24.

11. Sezer K, Keskin M (2014) Role of the free oxygen radicals on the pathogenesis of the diseases. Fırat Üniversitesi Sağlık Bilimleri Veteriner Dergisi 28(1): 149-156.

12. Tabakoglu E, Durgut R (2013) Oxidatıve stress in veterinary medicine and effects in some important diseases. Adana Veteriner Kontrol Enstitüsü Müdürlüğü Dergisi 3(1): 69-75

13. Yurdakul I, Yildirim BA (2018) Assessment of Oxidative Status in Foot Diseases of Sheep. Acta Scientiae Veterinariae 46(1): 1-6.

14. Zanolari P, Dürr S, Jores J, Steiner A, Kuhnert P (2021) Ovine Foot rot: a review of current knowledge. Vet J 271: 105647.

15. Abbott KA, Lewis CJ (2005) Current approaches to the management of ovine Foot rot. Vet J 169(1): 28-41.

16. Meena RAA, Sathishkumar P, Ameen F, Yusoff ARM, Gu FL (2018) Heavy metal pollution in immobile and mobile components of lentic ecosystems-a review. Environ Sci Pollut Res 25(4): 4134-4148.

17. Maley AM, Arbiser JL (2013) Gentian Violet: A 19th Century Drug Re-Emerges in the 21st Century. Exp Dermatol 22(12): 775-780.

18. Chopra I, Roberts M (2001) Tetracycline Antibiotics: Mode of Action, Applications, Molecular Biology, and Epidemiology of Bacterial Resistance. Microbiol Mol Biol Rev 65(2): 232-260.

19. Roberts MC (2003) Tetracycline Therapy: Update. Clin Infect Dis 36(4): 462-467.

20. Burkhart CN, Katz KA (2012) Chapter 222. Other Topical Medications. In: Goldsmith LA, Katz SI, (Eds.), Fitzpatrick's Dermatology in General Medicine, 8th (Edn.), New York: McGraw-Hill.

21. Docampo R, Moreno SN (1990) The metabolism and mode of action of gentian violet. Drug metabolism reviews 22(2-3): 161-178.

22. Ingraham MA (1933) The bacteriostatic action of gentian violet and dependence on the oxidationreduction potential. Journal of Bacteriology 26(6): 573-598.

23. Perry BN, Govindarajan B, Bhandarkar SS, Knaus UG, Valo M, et al. (2006) Pharmacologic blockade of angiopoietin-2 is efficacious against model hemangiomas

in mice. J Invest Dermatol 126(10): 2316-2322.

24. Gustafsson P, Nordström K, Normark S (1973) Outer penetration barrier of Escherichia coli K-12: kinetics of the uptake of gentian violet by wild type and envelope mutants. Journal of bacteriology 116(2): 893-900.

25. Hoffmann ME, Jang J, Moreno SN, Docampo R (1995) Inhibition of protein synthesis and amino acid transport by crystal violet in Trypanosoma cruzi. J Eukaryot Microbiol 42(3): 293-297.

26. Moreno SN, Gadelha FR, Docampo R (1988) Crystal violet as an uncoupler of oxidative phosphorylation in rat liver mitochondria. Journal of Biological Chemistry 263(25): 12493-12499.

27. Levin D, Lovely T, Klekowski E (1933) Light-enhanced genetic toxicity of crystal violet. Mutation research 103(3-6): 283-288.

28. Harrelson W, Mason RP (1982) Microsomal reduction of gentian violet. Evidence for cytochrome P-450- catalyzed free radical formation. Molecular pharmacology 22(2): 239-242.

29. Dinos GP (2017) The macrolide antibiotic renaissance. Br J Pharmacol 174(18): 2967-2983.

30. Vannuffel P, Cocito C (1996) Mechanism of action of streptogramins and macrolides. Drugs 51(S1): 20-30.

31. Menninger JR (1985) Functional consequences of binding macrolides to ribosomes. J Antimicrob Chemother 16: 23-34.

32. Corcoran JW (1984) Mode of action and resistance mechanisms of macrolides. In: Macrolide Antibiotics: Chemistry, Biology, and Practice, Omura S (Ed.), Academic Press: Orlando, FL, USA, pp: 231-259.

33. Vázquez-Laslop N, Mankin AS (2018) How Macrolide Antibiotics Work. Trends Biochem Sci 43(9): 668-684.

34. Blondeau JM, Shebelski SD, Hesje CK (2015) Killing of Streptococcus pneumoniae by azithromycin, clarithromycin, erythromycin, telithromycin and gemifloxacin using drug minimum inhibitory concentrations and mutant prevention concentrations. Int J Antimicrob Agents 45(6): 594-599.

35. Thornberry H (1955) Irish Veterinary Journal. In: Jl. S.A.V.M.A, 27(3): 1956.

36. Venditto VJ, Haydar D, Abdel-Latif A, Gensel JC, Anstead MI, et al. (2021) Immunomodulatory effects ofs revisited: Potential applications to covid19. Front Immunol 12: 574425.

37. Yan Y, Wu L, Li X, Zhao L, Xu Y (2023) Immunomodulatory role of azithromycin: Potential applications to radiation-induced lung injury. Front Oncol 13: 966060.

38. Warken AC, Lopes LS, Bottari NB, Glombowsky P, Galli GM, et al. (2017) Mineral supplementation stimulates the immune system and antioxidant responses of dairy cows and reduces somatic cell counts in milk. An Acad Bras Cienc 90(2): 1649-1658.