

## Efficacy of different therapeutic regimens for acute foot rot in adult sheep

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### ABSTRACT

In this study, efficacies of different therapeutic regimens along with 10% zinc-sulfate footbath for the treatment of acute foot rot in adult sheep were evaluated. The research work conducted on the adult sheep (n=104) of both sexes which were presented to the Teaching Veterinary Clinical Complex during April 2013 to May 2014. Foot rot was confirmed based on clinical and physical examinations. The sheep were divided into four equal groups; G-I, G-II, G-III, and G-IV. The animals of the G-I, II and IV were treated with a mixture of amoxicillin and cloxacillin at 15 mg/kg body weight (b.wt.) through intramuscular (IM) route, oxytetracycline at 20 mg/kg b.wt., IM, and enrofloxacin at 5 mg/kg b.wt., IM, respectively. The animals of G-III were treated with gamma benzene hexachloride cream. Along with the above treatments, all four groups were given footbath with 10% zinc-sulfate. Mean recovery time (days) was recorded as lowest in G-II (3.83±0.64) followed by G-I (4.17±0.31), G-IV (4.38±0.0.79) and G-III (5.67±0.98), respectively. The mean±SE values of rectal temperature and ruminal motility that were recorded before and after the treatment showed significant ( $p<0.05$ ) differences. In conclusion, administration of parenteral antibiotics in combination with footbath was highly effective to treat combination with footbath was highly effective to treat the acute foot rot in sheep.

### Keywords

Antibiotics, Foot rot, Footbath, Lameness, Sheep

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### INTRODUCTION

Foot rot (also known as footrot or infectious pododermatitis) is a kind of highly contagious infection of hoof, which is considered as an economically important disease of ruminants especially sheep and goats. *Dichelobacter nodosus* (a Gram-negative rod) is the main causal agent of this disease (Wani et al., 2007). Other organisms like *Fusobacterium necrophorum* also causes to develop foot rot (Egerton et al., 1989). The disease is characterized by an exudative inflammation followed by necrosis of the epidermal tissues of the interdigital skin and hoof matrix, which results in separation of the hoof from the underlying soft tissues (Sreenivasulu et al., 2013). The affected animals showed loss of body condition, lameness, decreased fertility, and reduced production of wool and meat (La Fontaine et al., 1993). Lameness is usually the first sign varying from scarcely noticeable to severe in one or more feet followed by reddening of the interdigital tissues and swelling of the foot, causing spreading of the toes (Stewart, 1989).

**Table 1. Design for therapeutic regimen of acute foot rot in sheep (n=104)**

Group	Animals	Therapeutic Regimen	Dose and Route	Duration (Day)
I	n=26	Amoxicillin and Cloxacillin <sup>A</sup>	15 mg/kg IM	3
		+ Zinc-sulfate <sup>B</sup>	10% Footbath	7
II	n=26	Oxytetracycline <sup>C</sup>	20 mg/kg IM	3
		+ Zinc-sulfate <sup>B</sup>	10% Footbath	7
III	n=26	Gamma benzene hexachloride <sup>D</sup>	Topically twice	3
		+ Zinc-sulfate <sup>B</sup>	10% Footbath	7
IV	n=26	Enrofloxacin <sup>E</sup>	5 mg/kg IM	3
		+ Zinc-sulfate <sup>B</sup>	10% Footbath	7

<sup>A</sup>Intamox: Intas pharmaceuticals limited, Ahmedabad, India

<sup>B</sup>Zinc sulfate: AVA Chemicals Private Limited, Maharashtra, India

<sup>C</sup>Oxytetracycline: Zydus Animal Health limited, Ahmedabad, India

<sup>D</sup>Loxane Cream: Virbac Animal Health Private Limited, Mumbai, India

<sup>E</sup>Enrodac-10: Zydus Animal Health limited, Ahmedabad, India.

In the world, India ranked 6<sup>th</sup> in sheep population with an estimated 61.5 million sheep (Hegde, 2006). In northern hilly areas of India, such as Kashmir, sheep farming is considered as the key livestock industry, where it serves as a major source of income for poor rural communities. In this area, people rear sheep mainly for mutton and wool purposes (Biswas et al., 1994). In the past few years, the disease became as a challenge for sheep farmers with a reported prevalence of 13-16% in Kashmir. An estimated annual cost of 37 million rupees (approximately 8.26 million US dollars) is lost due to foot rot sheep only in south Kashmir region (Rather et al., 2011).

There are various reports of foot rot in Jammu and Kashmir, where the climate is temperate and favorable for foot rot (Wani et al., 2007; Hussain et al., 2009). The main predisposing factors of foot rot infection include muddy pastures, frequent rains and injury to feet (Asif et al., 2011), and other factors include low land farms, high stocking densities, winter housing, routine foot trimming and inadequate treatment, and failure to isolate the affected sheep (Whittington, 1995; Stewart, 1989). However, there are very few reports worldwide about the efficacy of parenteral antibiotics that can be used for successful treatment of foot rot, with almost no clinical trials conducted in India so far on the efficacy of combination therapy ( i.e., antibiotics, zinc-sulphate and gamma benzene hexachloride) to treat foot rot in sheep.

Sheep with acute foot rot treated with long acting parenteral oxytetracycline, enrofloxacin and topical application of potassium permanganate (an inorganic chemical compound with the formula  $KMnO_4$ ) solution on day 0 responded well to the treatment, however topical application of  $KMnO_4$  alone was not effective (Kaler et al., 2012). Present paper communicated the comparative efficacy of different therapeutic regimens

for the successful treatment of acute foot rot in adult sheep.

## MATERIALS AND METHODS

The present study was carried out on adult sheep (n=104) of both the sexes (70 females and 34 males), which were presented to the Teaching Veterinary Clinical Complex, Faculty of Veterinary Sciences and Animal Husbandry, SKUAST-Kashmir, during the period April 2013 to May 2014. The ages of the sheep were  $2.3 \pm 1.5$  years, and the weights were  $37.5 \pm 5$  kg. All the animals were presented with the history of visible nodding of the head, pus in affected feet, irregular stride having an inflammation of the interdigital space, a characteristic smell, and under running of hoof horn. Foot rot was confirmed by clinical and physiological examinations of the animals. On clinical examination the animals showed hard horn, junction between horn and skin broken, soft horn of inside wall of hoof and sole cracked. Their duration of mild lameness ranged from 4 to 12 days as reported by farmers (**Figure 1**). Physiological parameters of sheep like, rectal temperature, pulse rate, respiratory rate, and ruminal motility were recorded. The animals were randomly allotted to four equal treatment groups; these were G-I, G-II, G-III and G-IV (**Table 1**). The animals of G-I were administered with mixture of amoxicillin and cloxacillin through intramuscular (IM) route dosed at 15 mg/kg body weight (b.wt.) once a day for 3 days.

The animals of G-II received oxytetracycline dosed at 20 mg/kg b.wt., IM, once a day for 3 successive days. The animals of G-III were treated with topical application of gamma benzene hexachloride twice a day for 5 days. The animals of G-IV were given enrofloxacin dosed at 5 mg/kg b.wt., IM, once a day for 3 days. Footbath was applied to animals of all the four

groups using 10% zinc-sulphate solution once a day for 7 days (Table 1).

**Statistical Analysis:** The data recorded, wherever applicable, was statistically analyzed using simple one way analysis of variance (ANOVA) at 5% level of significance. The efficacy of therapeutic regimens was evaluated on the basis of clinical response and duration.

## RESULTS AND DISCUSSION

The mean±SE values of age in years and weight in kilograms for all the sheep were 2.3±1.5 and 37.5±0.5 respectively. The mean±SE values of rectal temperature and ruminal motility recorded before and after

treatment showed significant ( $p<0.05$ ) differences, whereas the changes in heart rate and respiratory rate were insignificant (Table 2). Acute foot rot was characterized by the presence of active lesion with interdigital inflammation with or without hoof horn separation, characteristic foul smell, absence of hyperplasia of the sole and/or wall horn, and lameness for <28-day. The findings of the present study were comparable to that of Egerton and Roberts (1968). The different antibiotics were administered IM to the animals in their assigned respective groups on the first day after the diagnosis and repeated on day 2<sup>nd</sup> and day 3<sup>rd</sup> along with footbath with 10% zinc-sulphate daily for 5 min for 7 days. The animals of G-I treated with a mixture of amoxicillin and cloxacillin

**Table 2. Physiological parameters (Mean±SE values) before and after treatment.**

Observations	Before Treatment	After Treatment
Rectal Temperature (°F)	104.63±0.75 <sup>b</sup>	103.43±0.85 <sup>a</sup>
Heart rate beats/min	63.67±2.33 <sup>ab</sup>	62.67±2.23 <sup>ab</sup>
Respiratory rate/min	19.63±1.31 <sup>ab</sup>	18.93±2.31 <sup>ab</sup>
Ruminal motility/2 min	2.83±0.31 <sup>b</sup>	3.03±0.31 <sup>a</sup>

Means bearing same superscript in a row were not significant ( $p>0.05$ )

Means bearing different superscript in a row differ significantly ( $p<0.05$ )

**Table 3. Comparative efficacy of different treatment regimens for acute foot rot in sheep.**

Observations	Group I	Group II	Group III	Group IV
Recovery time (in days) (Mean±SE values)	4.17±0.31 <sup>ab</sup>	3.83±0.64 <sup>ab</sup>	5.67±0.98 <sup>b</sup>	4.38±0.79 <sup>ab</sup>
Complete healing time in days (Mean±SE values)	28.83±2.31 <sup>ab</sup>	27.17±1.64 <sup>ab</sup>	30.67±1.98 <sup>b</sup>	28.83±1.79 <sup>ab</sup>
Recovery by single therapy (%)	69	73	45	65
<b>Recovery (%)</b>	<b>100</b>	<b>100</b>	<b>80</b>	<b>100</b>

Means bearing same superscript in a row were not significant ( $p>0.05$ )

Means bearing different superscript in a row differ significantly ( $p<0.05$ )



**Figure 1. Clinical examination of foot rot lesions.** Left: characteristic lameness due to foot rot; Right: (A) hard core, (B) horn and skin junction broken, (C) soft horn of inside wall of hoof and sole broken.

dosed at 15 mg/kg b.wt. IM, and footbath with 10% zinc-sulfate showed 100% recovery within 4.17±0.31 days; whereas, complete healing was observed in 28.83±2.31 days. The animals of G-II treated with oxytetracycline dosed at 20 mg/kg b.wt. IM, and 10% zinc-sulfate footbath also recovered 100% within 3.83±0.64 days, with complete healing within 27.17±1.64 days. The animals of G-II showed faster response as compared to G-I, which might be attributed to the inclusion of oxytetracycline. On the other hand, the animals of G-III treated with Gamma benzene hexachloride cream by local application twice a day for three days, and footbath with 10% zinc-sulfate showed 80% recovery within 5.67±0.98 days, with complete healing within >30.67±1.98 days. The prolonged healing time and incomplete recovery in this group could be attributed to the fact that zinc-sulfate footbath along with application of Gamma benzene hexachloride cream in the absence of any parenteral antibiotic was not sufficient to eliminate the causal agents of foot rot completely. Recovery in G-IV sheep administered with enrofloxacin dosed at 5 mg/kg b.wt. IM, and footbath with 10% zinc-sulfate occurred within 4.38±0.79 days with complete healing in 28.83±1.79 days (Table 3).

When compared with 1<sup>st</sup> day, clinical lameness reduced in all the sheep of the four groups after the single treatment, as reflected in the reduction in the number of foot rot affected feet. Therefore, in our study, it was observed that the sheep with acute foot rot that were treated with parenteral antibacterial had a significantly rapid recovery from lameness and had complete healing of lesion within short time as compared with those of treated with Gamma benzene hexachloride and 10% zinc-sulfate footbath (<50% recovered in 28 days). Recovery period from this disease does not relate to body condition score, age, duration of lameness, or presence of pus in the feet of acutely affected sheep. Similar to our findings, treatment of acute foot rot was successfully done by using short acting parenteral antibiotics such as penicillin and streptomycin, lincospectin, lincomycin and erythromycin (Venning et al., 1990; Ware et al., 1994; Jordan et al., 1996), and efficacy could be improved by providing dry environment for 24 h after the treatment (Egerton et al., 1968). On the contrary, Kaler et al. (2010) and Wassink et al. (2010) observed a rapid recovery from foot rot within 3-10 days in response to the administration of long acting parenteral oxytetracycline, without any provision of dry environment. For the treatment of foot rot in sheep by

using parenteral antibiotics in Southern Germany, it was found that the use of gamithromycin dosed at 6 mg/kg b.wt., IM, and long-acting oxytetracycline dosed at 20 mg/kg b.wt., IM, under field conditions were effective in controlling foot rot in sheep (Strobel et al., 2014).

Kaler et al. (2012) reported that parenteral use of long acting oxytetracycline and enrofloxacin, and topical application of KMnO<sub>4</sub> solution for the treatment of both acute and chronic foot rot in sheep was very effective. The results of our study indicated that the sheep with acute foot rot that were treated with parenteral antibiotics, along with footbath exhibited a significantly rapid recovery from lameness, and completely healed within shorter time as compared to those of treated with the combination of gamma benzene hexachloride and zinc-sulfate footbath (Table 3).

## CONCLUSIONS

From the present study, it is concluded that the administration of parenteral antibiotics in combination with footbath to treat clinico-physical symptoms of acute foot rot is highly effective. This is likely to provide socio-economic benefits to the farmers and strengthen welfare concern.

## COMPETING INTEREST

The authors declare that they have no competing interest.

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