

## Case Report

# Clinical management of foot rot in goats: A case report of lameness

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## ABSTRACT

**Objective:** Foot rot is one of the most important causes of lameness and economic losses in sheep and goats world-wide. This case report described the clinical management of lameness due to foot rot in two female Boer goats aging 4-year both from two different farms in Selangor, Malaysia.

**Materials and methods:** The goats were presented with the complaint of non-weight bearing lameness of the right forelimbs. The hoof was broken and the interdigital space was filled with dirt and exuding a foul smelling odor.

**Results:** On clinical examination, the goats were looking as dull and isolated with body condition scores of 2.5/5 (case 1) and 3/5 (case 2), respectively. The goats had a rectal temperature of 38.8°C and 40.4°C, pulse rate of 80 and 100 beats per minutes, and respiratory rate of 44 and 24 cycles per minute, respectively. Blood sample was collected for complete blood count and serum biochemistry from case 1 only. The hoof was thoroughly washed and disinfected. Parenteral administrations of Flunixin meglumine (dosed at 2.2 mg/kg bwt, IM) thrice daily and Oxytetracycline (dosed at 20 mg/kg bwt, IM case 1) once and Sulfadiazine+trimethoprim (dosed at 1 mL/16 kg bwt, IM case 2) for 3 days. Topical oxytetracycline was applied to the area for 5 days.

**Conclusion:** The prognosis was very good as there was a significant improvement in the hoof injury of both animals. The goats were recovered after 7 days of treatment.

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## KEYWORDS

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## INTRODUCTION

Foot rot is a debilitating and highly contagious disease of ruminants particularly of cattle, sheep and goats. The disease causes significant loss in animal production, and is considered as a serious emerging problem in animals worldwide ([Zhou et al., 2009](#)). The disease is manifested by complete destruction of the hard keratin layer of the hoof which in most cases results to lameness. Foot rot is characterized by foul smelling, inflammatory exudates and necrosis of the epidermal tissues of the hoof. Two forms of the disease have so far been described and well-studied. The most significant and highly virulent form of the disease is considered as an economically important infection in goats and sheep. This is due to the burden exerting on livestock production and health. In addition, it is expensive and difficult to control as compared to the mild form of the disease, which does not require much intervention ([Wani and Samanta, 2006](#)).

The disease is thought to be caused by the simultaneous actions of two bacteria; *Fusobacterium necrophorum* which is involved in the induction and development of the disease process and *Dichelobacter nodosus* which is the agent of transmission ([Raadsma and Egerton, 2013](#)).

The transmission of foot rot is dynamic and complex, involving infection with more than one etiologic agents and often complicated or enhanced by environmental factors, host immunity and genetics, stocking rate and nutrition ([Bennett et al., 2009](#)). In addition, transmission of foot rot has also been observed to be enhanced by frequent or continuous rainfall for several weeks, and low temperature mostly below 10°C. Outbreaks were mostly reported during the rainy season when the frequency of rainfall is high. This is because studies have shown that wet season influenced the susceptibility of foot rot either by changing the biology of the disease causing agent or by changing the physical structure of the hoof making it more vulnerable to attacks ([Raadsma and Egerton, 2013](#)).

Despite the biology of the organism which indicated that *D. nodosus* does not require oxygen for growth, it was observed that the pathogen can survive for up to 10 days when exposed to air and can be transmitted via contact with soil, suggesting that the rate of stocking of new animals can drastically reduce the speed of *D. nodosus* in a herd. In addition, studies have also shown that the ability of the pathogen to survive in the open air and transmission via contact with soil makes the management of foot rot difficult ([Bennett and Hickford, 2011](#)). Furthermore, other disease control measures that have proven to be very effective in reducing the onset and severity of foot rot but however, very expensive and

difficult to maintain included selective breeding, quarantine, foot paring with zinc, use of appropriate antibiotics, and vaccination. Employing these control measures is also not a guarantee that the disease might not reoccur again ([Bennett et al., 2009](#)). This case report describes the management of a clinical case of lameness due to foot rot in two Boer goats from different farms in Selangor, Malaysia.

## MATERIALS AND METHODS

### Case 1

**History and clinical examinations:** A 4-year adult female intensively raised Boer cross goat was presented to University Veterinary Hospital (UVH) with a complaint of injury at the right forelimb which was due to poor flooring ([Figure 1](#)). The condition worsens and the animal was isolated by the farm owner in order to prevent spread to other animals in the farm. Clinical examinations revealed that the Boer goat had a rectal temperature of 38.8°C, pulse rate of 80 beats per minutes, and respiratory rate of 44 cycle per minute. The goat had a body condition score of 2.5/5 and non-weight bearing lameness at the right forelimb. The hoofs were overgrown and one of the affected limbs was moist and showed sign of sloughing off, and spreaded foul smelling ([Figure 2](#)). Blood samples were collected for complete blood count and serum biochemistry.

### Case 2

**History and clinical examinations:** From another farm nearby, a 4-year old female intensively managed Saanen breed was also presented to the UVH with a complaint of non-weight bearing lameness. Clinical examinations revealed that the doe had a body condition score of 3/5 and a moist foul smelling wound at the interdigital space of the right hind limb ([Figure 3](#)) with a bilateral dried crusty lesion on the dewclaw of the left hind limbs ([Figure 4](#)). Other clinical findings observed included bilateral nasal discharge. The doe had a rectal temperature of 40.4°C, pulse rate of 100 beats per minute, and respiratory rate of 24 beats per minute. For this case, no samples were collected for laboratory evaluation.

## RESULTS

**Diagnostic workups:** The findings of the hematological analyses for case 1 showed that there were no significant changes in the total red blood cell count and erythrocyte indices. However, the mean corpuscular volume (MCV) was higher than normal ([Table 1](#)). The band neutrophil count was slightly increased without an increase in total

white blood cells. There was hyperproteinemia associated with hyperglobulinemia which resulted in a decreased albumin-globulin ratio. Hepatocyte damage was evidenced by marked increase in the levels of Gamma Glutamyl Transferase (GGT) and aspartate aminotransferase (AST). Electrolyte levels were within normal range (**Table 1**).

**Treatment regime:** The hoof was thoroughly washed and disinfected. The goats were then administered Flunixin meglumine (dosed at 2.2 mg/kg bwt IM) for 3 days in order to reduce inflammation at injury site,

followed by Oxytetracycline (dosed at 20 mg/kg bwt IM) once and 5 mL of topical oxytetracycline for 5 days. In addition, the goat of case 2 was administered Sulfadiazine +trimethoprim (dosed at 1 mL/16 kg bwt, IM) for 3 days, due to the signs of mild pneumonia. The prognosis was very good as there was a significant improvement in the hoof injury and overall welfare of the animal (**Figure 5 and 6**). The farmer was advised to ensure that the floors are cleaned from time to time and devoid of any harmful wood piece and also to trim the hoof of the animals at least twice a year.



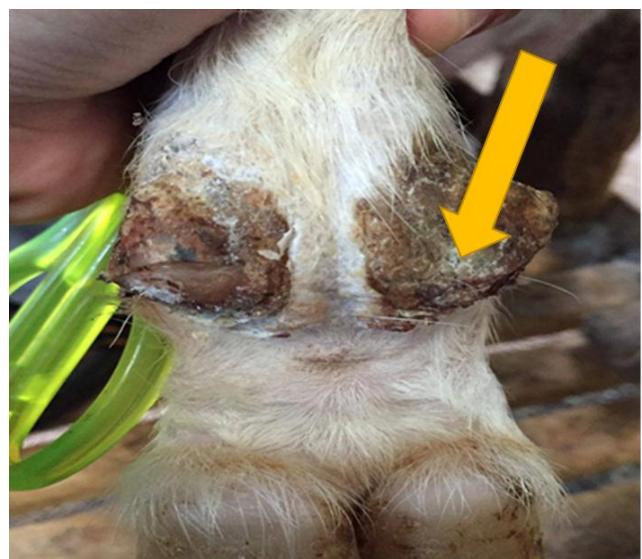
**Figure 1.** Boer goat with none weight lameness at the right forelimb



**Figure 2.** Showing the overgrown hoof showing signs of sloughing off.



**Figure 3.** Arrow showing crusty and necrotic interdigital space.



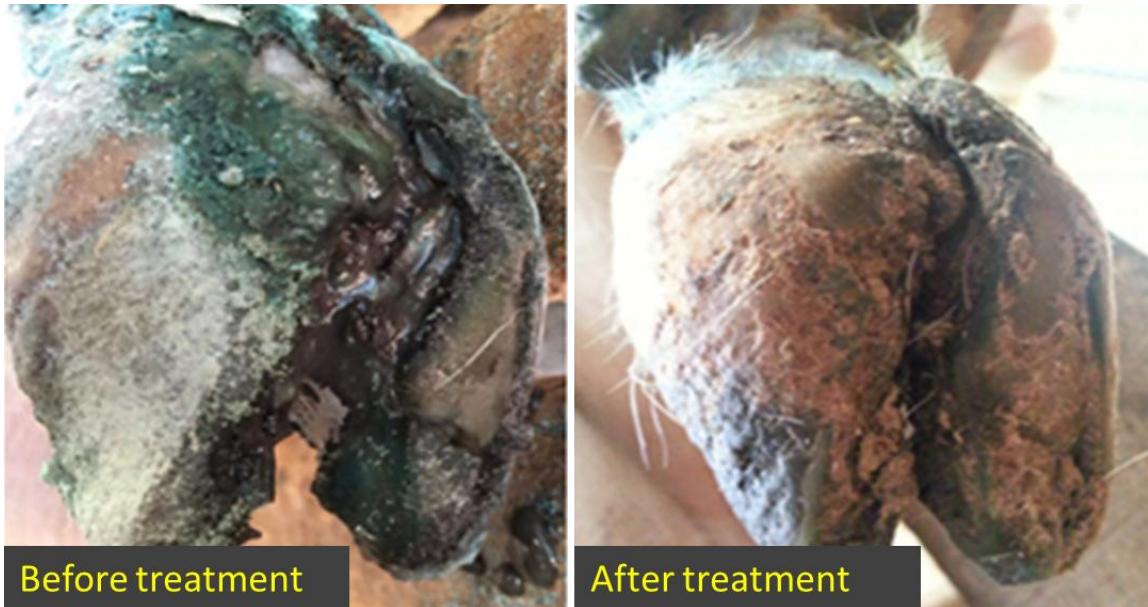
**Figure 4.** Arrow showing dry and crusty dewclaws in the left hind limbs.

**Table 1.** Hematological parameters of female Boer Goats in case 1

Parameters	Values	Reference values
RBC $\times 10^{12}/L$	13.6	8-18
Hb g/L	99.8	80-120
PCV L/L	0.32	0.22-0.38
MCV fL	24	16-25
MCHC g/L	312	300-360
WBC $\times 10^9/L$	11	4-13
Band Neutrophils $\times 10^9/L$	0.11	0
Seg. Neutrophils $\times 10^9/L$	6.93	1.2-7.2
Lymphocytes $\times 10^9/L$	2.86	2.0-9.0
Monocytes	0.77	<0.05
Eosinophils	0.33	0.05-0.65
Total protein g/L	74	55-70
Albumin g/L	27	25-35
Globulin g/L	67.3	25-45
A:G	0.4	0.6-1.3
GGT	84	30-35
AST	255	50-100
CK	187	100-200
Sodium	147	142-155
Potassium	5.1	3.5-5.7
Chloride	106	99-110



**Figure 5.** Improvement in the healing process of the wound in case 1.



**Figure 6.** Improvement in the wound after treatment in case 2.

## DISCUSSION

Diseases associated with foot are the major etiology of lameness causing significant economic loss in small ruminants. This loss is manifested by the reduction in feed intake, decrease in body weight, decrease in production, and reduction in milk yield as well as increased rate of premature culling of animals ([Tadich and Hernández, 2000](#); [Aguiar et al., 2011](#)). Foot rot is one of the leading causes of foot diseases in goats and sheep. Although the remote cause of the disease is *D. nodosus*, the disease may occur with the synergistic actions of *F. necrophorum* whose natural habitat is the soil and feces. *F. necrophorum* causes interdigital dermatitis in animals which allows the invasion of the digits by *D. nodosus* ([Wani and Samanta, 2006](#)).

The survivability of the organism is influenced by environmental conditions. Studies have shown that it cannot survive for more than 10 days in the environment ([Green and George, 2008](#)) indicating that frequent cleaning of the pen will help to reduce the onset and severity of infection. In addition, it was also observed that exposure of the feet for a long period of time to a relatively humid environment, wet pastures, urine and feces of infected animals greatly enhance the onset and spread of the disease between animals ([Aguiar et al., 2011](#)). This scenario is consistent with the findings of this clinical case report since the clinical history showed that the goat had been exposed to a wet and dirty environment for a long period of time. In addition, the floor of the pen was made of wood which encourages the

absorption of surrounding moisture, thus exposing the animal to a relatively wet and humid environment.

In most cases, foot rot is mostly seen in sheep; however, goats can also be infected with the disease. In addition, transmission of foot rot from sheep to goat has also been reported ([Ghimire et al., 1999](#)). The severity of lesions in goat is usually less as compared to sheep; however, in both cases lameness is seen. This was in consistent with our findings showing that the goats had non-weight bearing lameness of the right forelimb.

Studies have shown that dirty environment which encourages the impaction of the interdigital spaces of the hoof with mud, feces, and grass may result to loss in the integrity of skin, thus giving room for invasion of the digits by *F. necrophorum* causing severe dermatitis and subsequently lameness ([Winter, 2008](#)). Similar findings were observed in this case report where it was observed that the inter-digital space of the hoofs was filled with dirt and the hoofs were overgrown. Depending on the degree of the invasion, deep rooted lesions can result to be contaminated by pyogenic bacteria which may cause foot abscess. The lesions observed in this case report was observed to have foul smell, which might be due to the activity of pyogenic bacteria ([Aguiar et al., 2011](#)).

In addition, most cases of foot rot leads to lameness associated with pain, and typical lesions on the foot are the most prominent clinical symptoms observed. The clinical diagnosis of foot rot is carried out based on the degree of severity of the lesions. In addition, confirmatory diagnosis can be achieved by combining the

clinical symptoms and bacteriological test for *D. nodosus* and *F. Necrophorum*, which can be detected by Gram staining and microscopy. PCR of cultures isolated from the hoof region can also be carried out ([Wani and Samanta, 2006](#); [König et al., 2011](#)).

To reduce the onset and severity of foot rot, there is in need of a holistic approach towards preventing the predisposing factors. For example, for over 6 decades, studies have shown that the eradication of foot rot in a herd is possible ([Abbott and Lewis, 2005](#)). In Australia and New Zealand, a successful regional eradication program was carried out in 1997. However, in the UK there was no recognized period of the year where the onset of transmission of foot rot is low, thus, successful eradication programs was not achievable. This was due to lack of feasible methodologies to achieve the eradication program ([Wassink et al., 2003](#)). In order to achieve a successful eradication program, intervention strategy should be employed at the early stage of the transmission period. This is aimed at reducing the quantity of infectious materials already in the environment, increasing the resistance of the animal to infection and to halt the onset of interdigital infection from mild to severe. Furthermore, eradication programs should be aimed at reducing rather than eradicating all focal points of infection ([Wani and Samanta, 2006](#)).

In this case report, the infected hoof was thoroughly washed and disinfected. The goats were then administered with Flunixin meglumine in order to reduce inflammation at injury site, followed by Oxytetracycline injection (case 1) and topical oxytetracycline. The goat of case 2 was administered with Sulfadiazine+trimethoprim to treat the clinical signs of pneumonia observed.

## CONCLUSION

The prognosis was good and there was a very significant improvement in the welfare of the animal. The farmers were advised to ensure hygiene in the farm. In addition, trimming of the hoofs at least twice a year was recommended. The animals recovered after one week of treatment and were returned to the pen.

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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## AUTHORS' CONTRIBUTION

All authors contributed equally.

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