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A clinical study on bovine dermatophilosis and its public health importance

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Abstract

Dermatophilus congolensis is a bacterium that causes exudative dermatitis with scab formation in bovines and is characterized by typical focal (or) localized lesions with “paintbrush” aspect and occasionally as disseminated cutaneous disease. Humidity and ticks like *Amblyomma variegatum* are the predisposing factors. As this organism also affects human beings, Dermatophilosis is considered as zoonotic disease with public health importance. This study describes skin lesions in 30 bovines from a herd of grazing livestock in Pagadapally village, Jagtial district, Telangana state, India. Lesions were noticed all over the body especially at the dorsum, neck and shoulders consisting thick grayish to dark brown scabs with exudates and blood. Blood samples were collected from all affected animals. Impression smears were prepared from 10 animals with typical lesions taken from the base of the freshly removed scabs along with the collection of crusts, exudates and pustules under proper aseptic precaution. The smears were stained with Giemsa stain and samples were processed for isolation and its colonial morphology and growth characteristics were examined on blood agar. The microbiological diagnosis enabled the identification of *Dermatophilus congolensis*. Among affected 30 animals were considered for the study and randomly divided into three different groups as group 1, 2 and 3 and three different antibiotic therapeutic regimens were given. In terms of recovery rate and preventing death, Gentamicin was found to be the most effective antibiotic, followed by Amoxicillin forte and finally Enrofloxacin. However, all group animals were treated with Meloxicam injection and topical scrubbing of the lesions with equal mixture of sodium bicarbonate and sodium chloride and topical spray of Povidone iodine solution. Treatment was not only effective in early, mild cases but also useful among moderately and heavily affected cattle.

Keywords: *Dermatophilus congolensis*, paintbrush, blood agar, giemsa staining, public health, gentamicin, amoxicillin forte, enrofloxacin and topical therapy

Introduction

Dermatophilus congolensis is a Gram-positive, non-acid fast, branching filamentous rod (cocci) and is facultative anaerobic, capnophilic (or) aerobic tolerant bacteria belonging to the order Actinomycetales (Quinn *et al.*, 2018) [13]. Dermatophilosis is also known with different names as ‘Streptothricosis’ in cattle, ‘Lumpy wool disease’ in Australian sheep, ‘Strawberry foot rot’ in Scottish sheep, ‘Mycotic dermatitis’ and ‘rain scald’. Dermatophilosis was first reported by Van Sacaghemin Belgian Congo in 1915 and later reported worldwide (Zaria, 1993) [17]. Dermatophilosis is an infectious, transmissible (or) contagious and economically important disease with acute (or) chronic, local (or) progressive and sometimes fatal exudative epidermatitis characterized by serous exudation, drying to form characteristic matting of hair and scab resulting in loss of condition, decrease in productivity (milk and meat) and depreciation of hide values (Admasu and Alemu, 2011) [1], gradual loss of body condition, reduced working ability in draft animals, reproductive failures and mortality in weak animals (Dalis *et al.*, 2014) [4]. This pathogen affects mainly livestock, occasionally companion animals (Dalis *et al.*, 2014; Greene 2007; Nath *et al.*, 2010) [4, 5, 10] and wildlife, and rarely humans (Zaria, 1993; Burd *et al.*, 2007) [17, 3], hence it has got public health importance. Although it is a normal inhabitant of the livestock skin (Radostits *et al.*, 2007) [14], its natural habitat is controversial (Marsella, 2014) [9], as it is also found in water, organic material, and in the environment of livestock farms (Zaria, 1993) [17]. Transmission occurs directly by means of zoospores from the skin, contact between carrier (or) sick and susceptible animals. The host species could suffer seasonally from acute, sub-acute (or) chronic forms of the disease. High and long period rainfall and warm and humid temperatures will reduce the normal superficial protective factors of the skin and predispose animals to clinical condition (Ojong *et al.*, 2016) [11].

In addition, contamination of puncture wounds and utensils; bites of the flies and tick and lesions over the face and limb caused due to pointed-tip pasture (*Brachiaria* sp.) may predispose animals to indirect infection. Microenvironmental conditions especially high temperature, with more humidity could activate the dormant skin zoospores leading to production of germ tubes containing active multi-flagellated zoospores that invade the epidermis. Cutaneous lesions are determined by a cyclical pattern of invasion, epidermis inflammation, serous exudation, and formation of micro abscesses, followed by regeneration resulting in the formation of scabs and crusts containing the pathogen (Nath *et al.*, 2010)^[10]. Diagnosis is done based on clinical appearance of lesions and demonstrating the causative organism from lesions (Kahn, 2005)^[8].

Materials and Methods

In the first week of August 2016, the unit of the veterinary teaching hospital has consulted a farm with more than fifty (50) cattle in a closed herd located at Pagadapally village, Jagityal district, Telangana state having skin lesions of mostly scabs and papules persisted for three weeks before our visit (Fig.1). The prevailing condition was warm, humid with an average ambient temperature of $34^{\circ}\text{C} \pm 3$ and was the peak of the rainy season in the geographical area. Clinical examination of the affected animals showed wide areas of dermatitis presenting as scabs and papules with matting in some areas of the skin and in some severely affected animals,

the lesions were extended to the entire body. In most of the animals, the skin lesions were present on the dorsum, neck and shoulders and also over the limbs and brisket area and the lesions were varied from scabs to nodular circumscribes with extensive accumulation of crust lesions with “paintbrush” aspect measuring up to 0.5 to 2.5 cm in diameter with varied colours from cream to brown (Fig.2 & 3). In some animals there were matting which adheres to the hairs and evoke pain sensation by the animal on palpation. Temperature and pulse rates were recorded in all the affected animals. Impression smears were prepared from 10 animals with typical lesions, from the base of the freshly removed scabs and also skin scrapes, crusts and hair samples were collected aseptically and divided into two parts, one part preserved in filter paper and other part was preserved in potassium hydroxide solution for onward transportation to the veterinary public health and preventive medicine laboratory. The impression smears were stained with Giemsa stain. Swabs were collected by sterile swab sticks applying gentle rubbing on concave surfaces of scabs and raw lesions on the body. Immediately after collection the samples were put into sterile test tubes and carried to laboratory for inoculation into culture media and were processed for isolation of *D. congolensis*. The specimens were seeded on 7% sheep blood agar and incubating under a concentration of 5% CO₂, as well as by using selected biochemical properties, as recommended (Quinn *et al.*, 2018)^[13].



Fig 1: Skin lesions on the dorsum, neck, shoulders, face and limbs.



Fig 2-3: Hair matted in tuft (Paint brush appearance)

Thirty (30) Dermatophilosis affected animals were considered for the present clinical study and are divided into three groups and evaluated parenteral treatment using three different antibiotic regimens. Among these, Group 1 animals were

treated with Gentamicin (Gentamycin sulphate 10%) intramuscularly @ 4 mg/kg body weight given twice on the first day and then once a day for a further six days. Group 2 animals received Amoxirum forte (Amoxicillin sodium and

Sublactam) @ 10 mg/ kg body weight intramuscularly for seven days and Group 3 animals were given Enrofloxacin (5%) subcutaneously, @ 2.5 mg/kg body weight for five days and two more doses were given subsequently at intervals of three days. However, all group animals were treated with Meloxicam injection @ 15ml intramuscularly for five days along with the topical scrubbing of the lesions with equal mixture of sodium bicarbonate and sodium chloride and topical spray of Povidone iodine solution 5% w/v (PovidalB) for a period of 15 days. All the animals were kept under observation in every three days during the course of the therapy. Their general health was observed and affected areas were inspected for evidence of drying up and dropping of the scabs and beginning of new hair growth was also monitored. Affected animals were considered clinically recovered when the crust dropped off and new hair appeared at the sites of the scabs.

Statistical analysis of the data was subjected to one-way ANOVA using statistical package for social sciences (SPSS) version 10. Differences between means were tested using Duncan's multiple comparison test and significance was set at 5 percent ($p < 0.05$) and also 1 percent ($p < 0.01$). The values were represented as mean \pm standard error.

Results and Discussion

Geimsa stained smear revealed branching, filamentous Gram-positive *Dermatophilus congolensis* organisms with characteristic rail road track arrangement (Fig. 4). Cultural examination revealed characteristic hemolytic, dry, golden-yellow colonies of with 1 mm diameter on defibrinated sheep blood agar after 48 hours of incubation (Fig. 5).

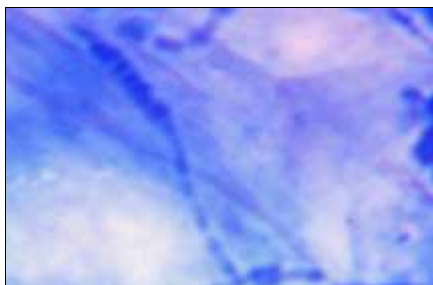


Fig 4: Geimsa stained smear with filamentous Gram-positive *Dermatophilus congolensis* organisms with characteristic rail road track arrangement.



Fig 5: Microbiological diagnosis of bovine dermatophilosis - Rough, hemolytic, dry, golden-yellow colonies of 1 mm in diameter of *Dermatophilus congolensis* isolated in defibrinated sheep blood agar at aerobic and 5% CO₂ conditions, after 48 hours of incubation.

The mean rectal temperature (°F) in group I, II and III before treatment was higher and were 102.63 \pm 0.12, 103.30 \pm 0.21 and 102.51 \pm 0.22, respectively. Following therapy, the values came down significantly ($P < 0.01$) to normal in all the groups and were 100.32 \pm 0.12, 101.20 \pm 0.06 and 100.45 \pm 0.06, respectively. The mean pulse rate per minute in group I, II and III before treatment were 56.83 \pm 0.40, 57.72 \pm 0.36 and 56.42 \pm 0.28 respectively. Following therapy, the values were 57.61 \pm 0.31, 56.79 \pm 0.40 and 57.14 \pm 0.47, respectively and there was no significant difference ($P < 0.05$) in all the groups after therapy. The mean total erythrocyte count (TEC) in group I, II and III before and after therapy were recorded as 7.15 \pm 1.61 and 8.34 \pm 1.29; 6.13 \pm 1.41 and 7.93 \pm 1.26; 7.75 \pm 1.61 and 7.92 \pm 1.95, respectively and increased levels were significant ($p < 0.05$) in I and II after therapy. The mean hemoglobin concentration in group I, II and III before and after therapy were 7.32 \pm 0.64 and 9.78 \pm 0.57; 6.95 \pm 0.38 and 9.62 \pm 0.34; 9.94 \pm 0.73 and 10.28 \pm 0.39 g%, respectively. After therapy, the increased levels were significant ($P < 0.05$) in both group I and II. The mean total leukocyte count (TLC) in group I, II and III before and after therapy were reported as 9.67 \pm 1.80 and 7.74 \pm 1.53; 9.84 \pm 1.20 and 8.49 \pm 1.10; 10.16 \pm 1.20 and 9.67 \pm 1.80 ($\times 10^3/\mu\text{L}$), respectively and decreased levels were significant ($p < 0.05$) in group I and II (Table 1).

Table 1: Mean physical and hematological findings before and after treatment in Group – I, II and III cattle affected with Dermatophilosis

S. No.	Parameter	Group – I (n= 10)		Group – II (n= 10)		Group - II(n= 10)	
		Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment
1	Temperature (°F)	102.63 \pm 0.12	100.32 \pm 0.12**	103.30 \pm 0.21	101.20 \pm 0.06**	102.51 \pm 0.22	100.45 \pm 0.06**
2	Pulse rate (/Minute)	56.83 \pm 0.40	57.61 \pm 0.31	57.72 \pm 0.36	56.79 \pm 0.40	56.42 \pm 0.28	57.14 \pm 0.47
3	TEC ($\times 10^6/\mu\text{L}$)	7.32 \pm 0.64	9.78 \pm 0.57*	6.95 \pm 0.38	9.62 \pm 0.34*	9.94 \pm 0.73	10.28 \pm 0.39
4	Hb (g %)	7.15 \pm 1.61	8.34 \pm 1.29*	6.13 \pm 1.41	7.93 \pm 1.26*	7.75 \pm 1.61	7.92 \pm 1.95
5	TLC ($\times 10^3/\mu\text{L}$)	9.67 \pm 1.80	7.74 \pm 1.53*	9.84 \pm 1.20	8.49 \pm 1.10*	10.16 \pm 1.20	9.67 \pm 1.80

Significant at $P < 0.05$

** Significant at $P < 0.01$

Animals at all ages and both sexes are susceptible to Dermatophilosis infection (Haward, 1996) [7]. Death may result in calves particularly because of generalized disease with (or) without secondary bacterial infection and secondary fly or screw worm infestation (Kahn, 2005) [8]. In present clinical study, skin lesions were noticed all over the body especially at the dorsum, neck and shoulders consisting thick grayish to dark brown scabs with exudates and blood. Similar findings were reported in previous investigation (Tresamol

and Saseendranath, 2015) [12]. In cattle, initially lesion commences as a circumscribed moist patch, often with raised or matted hairs, giving characteristic 'paint brush' appearance. Discrete lesions occur in the initial stages which coalesce to form large areas of hyperkeratotic scab and crust. Distribution of gross lesions usually seen due to predisposing factors that reduce (or) permeate the natural barrier of integument. Typical lesions consist of circular, dome shaped scab 2-9 cm in diameter may be of variable thickness and on removal will

have concave underside coated in thick, yellowish exudates, leaving a row, bleeding epidermis (Andrew *et al.*, 2003) [2]. Other molecular diagnostic tests like polymerase chain reaction (Samon *et al.*, 2010) [15] could be used for definitive diagnosis of *Dermatophilus congolensis* organisms.

In the present case study, there was a significant improvement in the red blood cell count and haemoglobin and significant decrease in total leukocyte count among Group I and II cattle treated with Gentamycin and Amoxicillin forte compared to Enrofloxacin treated group III. In terms of recovery rate, Gentamycin was found to be the most effective antibiotic, followed by Amoxicillin forte and finally Enrofloxacin. These findings are in correlation with previous study (Hamid and Musa, 2009) [6]. Where in, significant improvement in mean corpuscular hemoglobin concentration ($p = 0.021$); mean corpuscular volume ($p = 0.021$), and white blood cell count ($p < 0.021$) were recorded in cattle treated with Gentamycin, long-acting Oxytetracycline, combination of Penicillin Streptomycin except Enrofloxacin treated cattle. Treatment was not only effective in early, mild cases but also useful among moderately and heavily affected cattle. It generally happens that in rainy season, owing to devitalizing effect on skin barriers, high relative humidity had significant influence on maturation and motility of infective zoospores and motility had been claimed to be a major predisposing factor in spread and epidemiology of dermatophilosis (Yeruham *et al.*, 2010) [16]. Till now there is no vaccine for Dermatophilosis.

Furthermore, Dermatophilosis has got public health importance as it affects humans, especially persons with challenged immunity may get the infection after direct contact with a diseased animal. In humans there will be development of painless pustules on the hands and arms which later break down and form shallow red ulcers that heal and leave scars. Hence, while handling the infected animals and dealing with the samples, one must wear the gloves, protective clothing and thoroughly wash the hands after the work.

Conclusion

With the present findings it can be concluded that, Giemsa stained smear examination can be considered as preliminary test for diagnosis of Dermatophilosis, however, cultural examination reveal the actual and confirmatory diagnosis. Present study recommends Gentamycin as a drug of choice for treating Dermatophilosis in bovines followed by Amoxicillin forte, along with parenteral Meloxicam, scrubbing of the affected areas with equal mixture of sodium bicarbonate and sodium chloride and topical spray of Povidone iodine solution 5% w/v (Povidone Iodine). Further, it is suggested that, cattle owners have to be cautious during rainy season especially with predisposing factor like prevailing high humid climate and ectoparasitic infestation by keeping animals and surrounding area dry and avoiding overcrowding. The best methods for control of Dermatophilosis are isolation of infected animals, culling of chronic cases and controlling external parasites. As Dermatophilosis is a zoonotic disease, every precaution should be taken while handling the affected animals.

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