

Chemotherapy of mycoplasmosis in sheep and goats

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Abstract

Mycoplasmosis in small ruminants is considered an economically important respiratory infection resulting in huge economic losses. Small ruminant mycoplasmosis is prevalent worldwide. Chemotherapeutic efficacy With Tylosin, Moxifloxacin injections and Azithromycin oral solution, in 2014 affected goats were studied. It was observed that solitary and dual combinations increased the cure rate and saved the affected goats. The percentage of cure was more in combinations than single Tylosin injection. The combination of Moxifloxacin and Azithromycin was very effective with a 93% cure percentage.

Keywords: Mycoplasma, Sheep, Tylosin, Moxifloxacin, Azithromycin.

Introduction

The outstanding work of No card and Roux at the Pasteur Institute in 1898, that the bovine pleuropneumonia was caused by a filterable organism, which they cultured on a cell-free medium, has remained to this day, unique and unparalleled.¹ Mycoplasmosis in small ruminants is considered as an economically important respiratory infection resulting in huge economic losses. Small ruminant mycoplasmosis is prevalent worldwide, while it remains prevalent in many countries of Africa, Asia, and is widespread in India and Pakistan.²⁻⁵ The Office International des Epizootic has declared Contagious Caprine Pleuropneumonia (CCPP) as a notified disease the disease is caused by members of a group of six closely related bacteria species known as *Mycoplasma mycoides* (MM) cluster.⁶ A literature study shows that *Mycoplasma capricolum* subspecies *capripneumoniae* (Mccp) has been mainly responsible for causing CCPP in sheep and goats.^{6,7} However, *Mycoplasma myoicodes* subsp. *capri*, a member of MM cluster, has also been shown reported to cause CCPP in addition to secondary complications such as urogenital infection, arthritis, mastitis and occasional abortion in ewes in Asia and Africa.^{8,6,9,2}

Mycoplas are the smallest, wall less prokaryotes¹⁰⁻¹¹ the pathogens have autonomous replication and are extracellular parasites on mucous membranes in animals.¹² They are mostly commensals but can cause heavy morbidity and mortality under favorable circumstances.¹³

The occurrence was higher in winter season followed by rainy and summer seasons more occurrences in winter season might be due to longer survival of organisms in winter months, huddling of animals due to cold, etc.¹⁴ However, DaMassa *et al.*¹⁴ and Frey¹⁵ reported a high prevalence of mycoplasmas in the summer season. In this study, percent positivity of *Mycoplasma* from goats varied significantly in different age groups i.e. below six months (8.31%), between 6-12 months of age group (5.08%) and more than 12 months of age (10.00%). Age-related difference in the occurrence of *Mycoplasma* has earlier been reported.¹⁶

Clinical signs of mycoplasmosis are highly variable and usually not specific hence confusing. They range from

respiratory, genito-reproductive, mastitis, arthritis, conjunctivitis, skeletal, and nervous signs due to the involvement of various systems.^{17,14,16,18}

The diagnosis of mycoplasmosis under routine Indian conditions involves history, clinical signs, physical examination followed by post mortem.

Mycoplasma species lack a cell wall and are therefore refractory to all antimicrobials that target the cell wall (e.g., β -lactams; Lysnyansky and Ayling, 2016). Hence, relatively few antimicrobials are effective or licensed for treating Mycoplasma infections.

The fact that animal mycoplasma has been cultured in cell-free media provided the opportunity to screen a large number of antibiotics and chemicals for inhibitory activity and thereafter use them for in vivo therapy. Many of the Mycoplasma species and their strains are inhibited by specific groups of antibiotics, but almost all of them are resistant to penicillins, bacitracin, polymyxins and the sulfonamides. Schutze¹⁹ tested various antibiotics against different Mycoplasma species and found that Tylosin, Erythromycin, Lincomycin, Dihydrostreptomycin, Tetracycline, Leucomycin and Chloramphenicol were effective. He found that Rifamycin, novobiocin, polymyxin-B were less effective, while penicillin, cephalothin, Nystatin, and Bacitracin did not affect at all.

In *peracute* cases, goats may die within one to three days with minimal clinical signs.²⁰ Typical CCPP lesions occur in the thoracic cavity only,²¹ and sometimes affect one lung with abundant pleural exudates and conspicuous pleuritis.¹⁶ Coughing is irregular and nasal discharge is often absent initially.²² Affected lungs degenerate into a voluminous abscess as a consequence of secondary bacterial infection.¹⁶ Affected lungs become hepatized and take on a port wine color,¹⁶ with pea sized yellow nodules surrounded by congestion.²² The pleural cavity contains an excess of straw colored fluid with fibrin flocculations.^{23,24,20,25} Adhesions between the lung and the pleura are very common and often very thick.²⁶ In sub-acute or chronic cases, the symptoms are very similar to acute cases but weak, A clinical study in 2014 goats brought to Sreepathi veterinary services Kadapa, during 2017 -2019 with mycoplasmosis, was conducted, with four

treatments to find out, the effective and useful combination for routine treatment.



Fig. 1: Hepatized Lungs



Fig. 2: Granular lung appearances

Materials and Methods

They are Tylosin injection alone, given at 6 mg per kg body weight intramuscularly for 3 days (Treatment-1), Tylosin Intramuscularly at 6 mg per kg in the morning and Moxifloxacin 6 mg per kg intramuscularly in the evening for 3 consecutive days (Treatment-2), Tylosin at 6 mg per kg intramuscularly and Azithromycin at 4 mg per kg orally for 3 consecutive days (Treatment-4) and Moxifloxacin at 6 mg per kg intramuscularly in the morning and Azithromycin at 4 mg per kg orally for 3 consecutive days (Treatment-4).

1) Tylon 200 injection (20 percent Tylosin), a brand product of Vets Farma, Jullander, India, 2) Mofoi (10 Percent Moxifloxacin) injection, a brand product of Globion India Private Limited, Secunderabad India and 3) Zymox 4 percent (Azithromycin oral solution), a brand product of Bio-Nutraceutical, Secunderabad, India were procured.

Table 1

S.No	Medicine administered	Years of study		
		2017	2018	2019
1.	Tylosin injection			
	Attended	240	260	280
	Cured	168	177	168
	Percentage	70	68	60
2	Tylosin and Moxifloxacin injections			
	Attended	94	84	77
	Cured	70	65	62
	Percentage	74	77	80

It was observed that solitary and dual combinations increased the cure rate and saved the affected goats. The percentage of cure was more in combinations than single treatment and had the highest percentage of cure ranging from 87 to 93 with no adverse effects. The efficacy of the drugs tried was due to their unique mechanism of action.

Macrolide antibiotics are bacteriostatic compounds that reversibly bind to the 23S rRNA in the 50S ribosome subunit and inhibit mRNA-directed protein synthesis. Moreover, they stimulate the dissociation of peptidyl-tRNA from ribosomes during translocation. The precise mechanism of action has not been fully explained and many theories exist.^{27,28} It has been suggested that 16-membered-ring macrolides (Tylosin) inhibit protein synthesis by blocking elongation of the peptide chain, but the 14-(Azithromycin) and 15-membered-ring macrolides are only potent inhibitors of mRNA-directed peptide synthesis.²⁹

The macrolide antibiotic azithromycin (CP-62,993; 9-deoxy-9a-methyl-9a-aza-9a-homoerythromycin A; also designated XZ-450 has a significant improvement in potency against gram-negative organisms compared with erythromycin while retaining the classic erythromycin spectrum. Azithromycin also demonstrated improved bactericidal activity in comparison with erythromycin. The mechanism of action of Azithromycin was similar to that of erythromycin since Azithromycin competed effectively for [14C] erythromycin ribosome binding sites.³⁰

The quinolone, Moxifloxacin has a bicyclic aromatic core with carbon at position 8 and with nitrogen at position 8, demonstrate s an N-1 cyclopropyl moiety. This confers enhanced activity against anaerobes and potency against gram-positive organisms, especially *Streptococcus pneumoniae*. It also contributes to reduced photosensitivity and the potential for the emergence of resistance. Because a halide ion is lacking in position 8, the likelihood of photosensitivity is less than that seen with earlier-generation fluoroquinolones, such as sparfloxacin and lomefloxacin. Moxiflaxacin demonstrates bactericidal activity by binding roughly equivalently to bacterial topoisomerases II (DNA gyrase) and IV. The gyrase is a tetramer composed of 2 subunits, 1 encoded by the *gyrA* gene and 1 encoded by the *gyrB* gene. By binding to these enzymes, the fluoroquinolone interferes with DNA replication, repair, and transcription, resulting in bacterial death. The ability to target both enzymes has been promoted as a major advantage of these agents in preventing or delaying the emergence of resistance.³¹

3.	Tylosin Injection and Azithromycin oral			
	Attended	--	440	326
	Cured	--	352	274
	Percentage	--	80	84
4.	Moxifloxacin injection and Azithromycin oral			
	Attended	89	66	69
	Cured	80	62	60
	Percentage	90	93	87

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The macrolide antibiotic azithromycin (CP-62,993; 9-deoxy-9a-methyl-9a-aza-9a-homoerythromycin A; also designated XZ-450) has a significant improvement in potency against gram-negative organisms compared with erythromycin while retaining the classic erythromycin spectrum. Azithromycin inhibited the majority of gram-positive organisms at 1 µg/ml. It displayed cross-resistance to erythromycin-resistant *Staphylococcus* and *Streptococcus* isolates. Azithromycin also demonstrated improved bactericidal activity in comparison with erythromycin. The mechanism of action of azithromycin was similar to that of erythromycin since azithromycin competed effectively for [14C] erythromycin ribosome binding sites.

Conclusion

It is concluded that treatment with tylosine injection, Tylosine injection and azithromycin oral solution, Moxifloxacin injection and Azithromycin oral solution, Tylosin and Moxifloxacin injections proved effective in 2014 goats without any side effects. Field veterinarian can adopt any one of the treatment against mycoplasmosis in sheep and goats.

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Conflict of Interest

None.

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