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Research Article

Determination of Antibacterial Activity of Strepto-Penicillin, Marbofloxacin and Cefoperazone/Sulbactam Against Common Pathogens

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Abstract

The study aimed to determine the sensitivity of commonly used antibiotics in veterinary practice, such as Strepto-penicillin, Marbofloxacin and Cefoperazone/sulbactam against different pathogens. The disc diffusion test was applied to test the effectiveness of Strepto-penicillin, Marbofloxacin, and Cefoperazone/sulbactam against ATCC culture of microorganisms. The zones of inhibition produced by Strepto-penicillin were 32 mm, > 40 mm, 22 mm, 24 mm, 29 mm, and 24 mm against E coli, Bacillus cereus, P aeruginosa, Klebsiella pneumoniae, Staphylococcus epidermidis, and Streptococcus agalactiae, respectively. Antimicrobial sensitivity testing (AST) plays a vital role in veterinary medicine, serving as a basis for selecting appropriate antibiotics to treat bacterial infections in animals. The study found that the selected bacteria were found sensitive for antibiotics i.e., Marbofloxacin, Cefoperazone-Sulbactam, and Strepto-penicillin. This finding is especially important in light of numerous studies documenting the growing resistance to newer classes of antibiotics, such as third-generation cephalosporins. Continuous monitoring of antimicrobial susceptibility is crucial for tracking resistance patterns and assessing the spread of resistant bacterial strains.

Keywords: Antibacterial; Strepto-Penicillin; Marbofloxacin; Cefoperazone/Sulbactam; Antimicrobial Resistance

Introduction

In recent years, there has been a growing concern in research and surveillance of antimicrobial resistance. Therefore, greater attention has been paid to antimicrobial activity screening for proper selection of antibiotics and to combat resistance. In recent years, there has been a growing interest in researching and developing new antimicrobial agents from various sources to combat microbial resistance. Therefore, a greater attention has been paid to antimicrobial activity screening and evaluating methods.

Antibiotics have always been considered one of the wonder discoveries of the 20th century. This is true, but the real wonder is the rise of antibiotic resistance in hospitals, communities, and the environment concomitant with their use. The extraordinary genetic capacities of microbes have benefitted from man's overuse of antibiotics to exploit every source of resistance genes and every means of horizontal gene transmission to develop multiple mechanisms of resistance for each and every antibiotic introduced into practice clinically, agriculturally, or otherwise [1].

Since Fleming's discovery, a continuous race has emerged between the development of new antimicrobials and bacterial resistance. Microbial resistance can arise as a consequence of selective pressure imposed on microorganisms due to the excessive use of antimicrobials in human and veterinary medicine [2].

Multidrug-resistant (MDR) bacteria represent a global challenge, with their prevalence increasing over the past decade. They are responsible for over 700,000 deaths annually [3]. and this number may reach 10 million by 2050, surpassing deaths caused by cancer, diabetes, and car accidents, resulting in costs that are expected to exceed $100 trillion [4]. This situation has become even more alarming after the COVID-19 pandemic, during which antimicrobial resistance increased [5]. Studies indicate that more than 70% of pathogenic bacteria exhibit resistance to at least one of the antimicrobials currently in use, with this percentage expected to rise annually [6].

Strepto-penicillin is commonly used in large ruminants to treat mixed bacterial infections caused by Penicillin and Streptomycin sensitive organisms. The formulation containing a combination of Streptomycin Sulphate, Procaine Penicillin and Penicillin G Sodium, is one of the preferred choices for veterinary clinicians. Marbofloxacin, a synthetic third-generation fluoroquinolone, is specifically developed for veterinary use with a broad spectrum of activity against most G -ve, G +ve bacteria, Mycoplasmas, and some intracellular pathogens such as Chlamydia and Brucella species. Cefoperazone/sulbactam is a combination of third generation, semi- synthetic cephalosporin and ß-lactamase inhibitor Sulbactam used against commonly encountered G -ve, G +ve bacteria and anaerobes.

Materials and Methods

The study was conducted in the Department of Veterinary Pharmacology and Toxicology in collaboration with the Department of Veterinary Microbiology, College of Veterinary Science and Animal Husbandry, N.D.V.S.U, Jabalpur, Madhya Pradesh. The duration of study was for a period of four months, from February 2025 to May 2025. Antibiotic discs of Strepto-penicillin, Marbofloxacin and Cefoperazone/Sulbactam were provided by Zenex Animal Health India Private Ltd.

Methodology

In this study, the disc diffusion test (Kirby Bauer method) was applied and the effectiveness of Strepto- penicillin (Dicrysticin S), Marbofloxacin (Marbodac) and Cefoperazone/sulbactam (Pathocef) were tested against ATCC culture of microorganism - *E coli, Bacillus cereus, Pseudomonas aeruginosa, Klebsiella pneumoniae, Staphylococcus epidermidis* and *Streptococcus agalactiae*. In this test a filter disc impregnated with an antibiotic was applied to the surface of an agar plate containing the organism to be tested and the plate was incubated at 37°C for 24-48 hours. As the substance diffuses from the filter paper into the agar, the concentration decreases as a function of the square of the distance of diffusion. The effectiveness of a particular antibiotic was shown by the presence of growth-inhibition zones. These zones of inhibition (ZOIs) appear as clear areas surrounding the disc from which the substances with antimicrobial activity were diffused. The zone of inhibitions was measured and interpreted as Sensitive (S), Intermediate (I) or Resistant (R) to the exposed agent according to the zone diameter interpretative standards.

Results

In disc diffusion test, the more susceptible the microorganism is to the antimicrobial agent, the larger the zone of inhibition, conversely, the more resistant the microorganism, the smaller the zone of inhibition. The zones of inhibition produced by Strepto-penicillin, Marbofloxacin and Cefoperazone/Sulbactam *against E coli, Bacillus cereus, Pseudomonas aeruginosa, Klebsiella pneumoniae, Staphylococcus epidermidis* and *Streptococcus agalactiae* are depicted in the table 1.

S. No	Organism	Zone of Inhibition (mm)		
		Strepto-penicillin (Dicrysticin S)	Marbofloxacin (Marbodac M)	Cefoperazone/sulbactam (Pathocef)
1.	*E coli*	32 mm	40 mm	31 mm
2.	*Bacillus cereus*	> 40 mm	> 40 mm	38 mm
3.	*Pseudomonas aeruginosa*	22 mm	35 mm	23 mm
4.	*Klebsiella pneumoniae*	24 mm	33 mm	27 mm
5.	*Staph. epidermidis*	29 mm	33 mm	18 mm
6.	*Strep. agalactiae*	24 mm	38 mm	36 mm

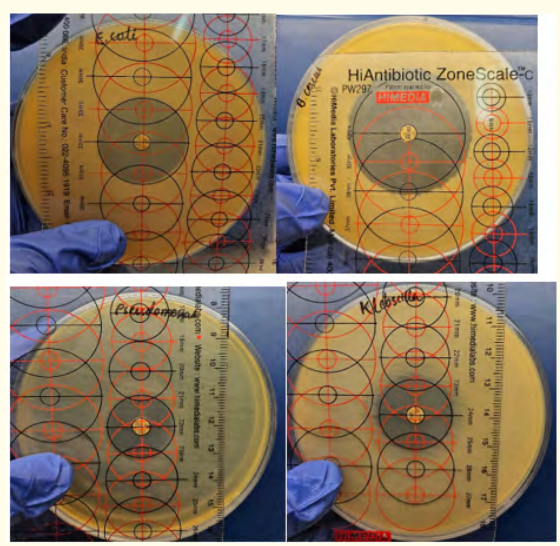
Table 1: *Antibiogram of Strepto-penicillin, Marbofloxacin and Cefoperazone/Sulbactam against common pathogens.*

Based on the zone of inhibition sensitivity of the pathogens were interpreted against the antibiotics as tabulated below.

S. No	Organism	Strepto-penicillin (Dicrysticin S)	Marbofloxacin (Marbodac M)	Cefoperazone/Sulbactam (Pathocef)
1.	*E coli*	S	S	S
2.	*Bacillus cereus*	S	S	S
3.	*Pseudomonas aeruginosa*	S	S	S
4.	*Klebsiella pneumoniae*	S	S	S
5.	*Staph. epidermidis*	S	S	S
6.	*Strep. agalactiae*	S	S	S

Table 2: *Antibacterial activity of Strepto-penicillin, Marbofloxacin and Cefoperazone/Sulbactam against common pathogens [7].*

The zones of inhibition produced by Strepto-penicillin were 32 mm, > 40 mm, 22 mm, 24 mm, 29 mm and 24 mm against *E coli, Bacillus cereus, P aeruginosa, Klebsiella pneumoniae, Staphylococcus epidermidis* and *Streptococcus agalactiae*, respectively. The zones of inhibition produced by Marbofloxacin were 31mm, 38 mm, 23 mm, 27 mm, 18 mm and 36 mm against *E coli, Bacillus cereus, Pseudomonas aeruginosa, Klebsiella pneumoniae, S. epidermidis* and *S. agalactiae*, respectively. Similarly, the zones of inhibition produced by Marbofloxacin were 31mm, 38 mm, 23 mm, 27 mm, 18 mm and 36 mm *against E coli, Bacillus cereus, P aeruginosa, Klebisiella pneumoniae, S. epidermidis* and *S. agalactiae*, respectively.



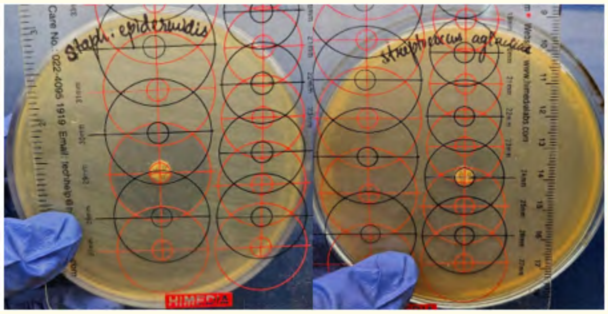


Plate 1: Antibiogram of Strepto-penicillin (Dicrysticin S).

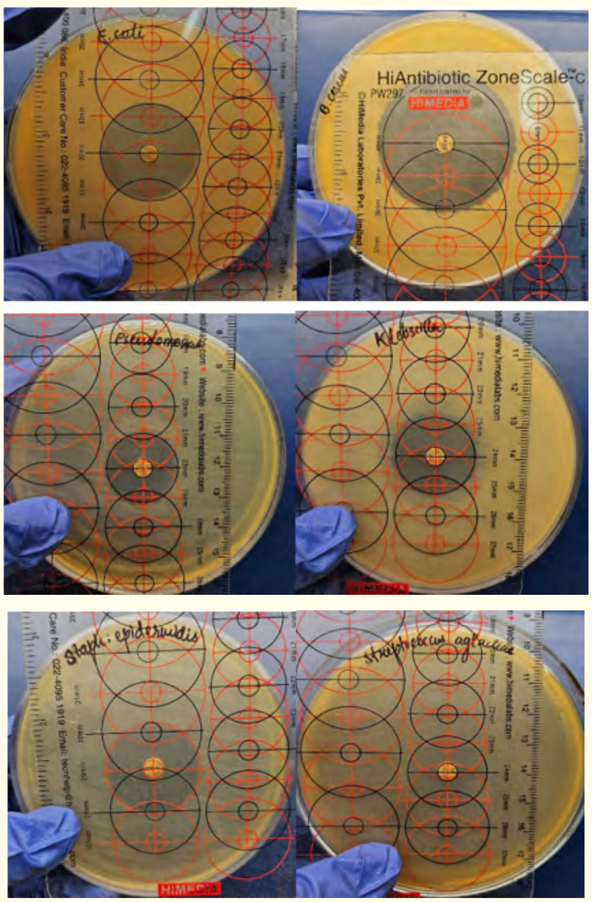


Plate 2: Antibiogram of Marboflaxacin (Marbodac M).

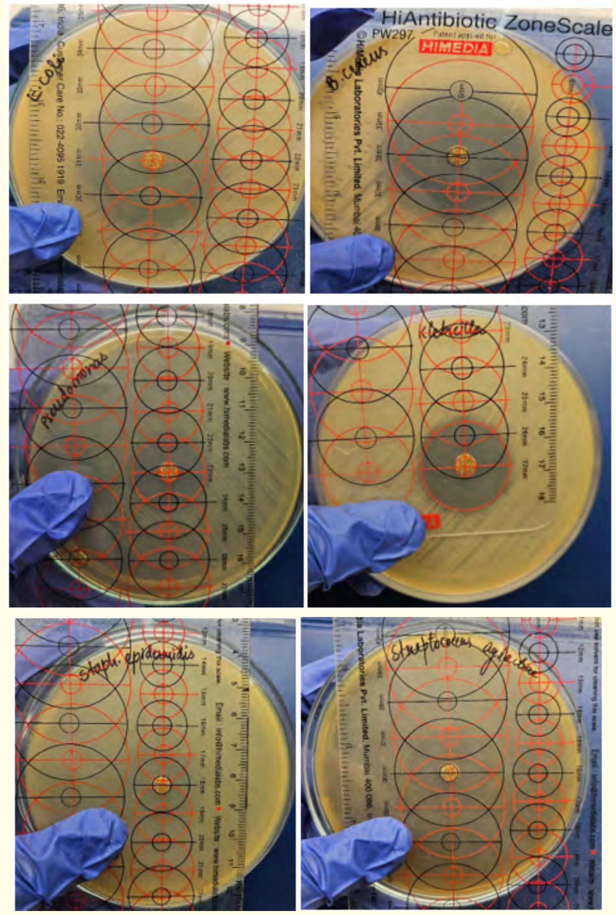


Plate 3: Antibiogram of Cefeperazone sulbactum (Pathocef).

Discussion

Antimicrobial sensitivity testing (AST) plays a vital role in veterinary medicine, serving as a basis for selecting appropriate antibiotics to treat bacterial infections in animals. By identifying the specific antimicrobials to which a pathogen is susceptible, AST enables veterinarians to make informed treatment decisions and helps mitigate the emergence and spread of antimicrobial resistance. The present study aimed to evaluate the antimicrobial susceptibility of commonly used antibiotic Strepto-penicillin, Marbofloxacin, and Cefoperazone/Sulbactam against a range of bacterial pathogens, including *Escherichia coli*, *Bacillus cereus*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Staphylococcus epidermidis*, and *Streptococcus agalactiae*. These pathogens were obtained from ATCC cultures.

As per the results of the study, the selected bacteria were found sensitive for antibiotics i.e. Marbofloxacin, Cefoperazone-Sulbactam and Strepto-penicillin. Remarkably, Strepto-penicillin continued to demonstrate effectiveness against the common pathogens despite its widespread use in veterinary practice. This finding is especially important in light of numerous studies that have documented the growing resistance to newer classes of antibiotics, such as third-generation cephalosporins [8,9].

Conclusion

This study highlights the continued relevance of antimicrobial sensitivity testing (AST) in guiding effective antibiotic therapy in veterinary medicine. The tested antibiotics—Marbofloxacin, Cefoperazone-Sulbactam, and notably Strepto-penicillin—demonstrated efficacy against a range of clinically important bacterial pathogens. These findings emphasize the importance of ongoing AST surveillance to inform responsible antibiotic use and to combat the growing threat of antimicrobial resistance. Regular evaluation of susceptibility patterns remains essential for ensuring optimal treatment outcomes and preserving the efficacy of available antimicrobial agents. Continuous monitoring of antimicrobial susceptibility is crucial for tracking resistance patterns and assessing the spread of resistant bacterial strains. The data obtained from these efforts plays a vital role in helping veterinarians make informed decisions on antibiotic use and in formulating effective strategies to address antimicrobial resistance.

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