Research Article

Clinical treatment of rabbits experimentally infected with *Staphylococcus aureus* using different antibiotics

Mohammad Hamid Kareem[1], Aula Hassoon Obaid[2], Amanee Mohammed Radhy[3], Mustafa Salah Hasan[1]*

ABSTRACT

Background: The recurrent bacterial strains antibiotic-resistant is a dangerous problem that has been interfere with human and animal's public health. The bacteria have permanently the aptitude to keep themselves from the antibiotics that used by the ways of getting resistance through the interchange of the genetic materials with another bacterium. The problematic has been heightened as the occurrence of resistant of bacteria to the antibiotic has increased, and multiply drug-resistant strains have arisen in numerous species that cause illness in humans as well as animals. **Materials and Methods:** A 30 local rabbits were used in the present study to evaluate the most efficient antibiotic that treats the *Staphylococcus aureus* infection. These rabbits were divided randomly into six groups, each group contain five rabbits, all groups (except G6) were infected experimentally with 1 ml intraperitoneal of bacterial suspension containing 1 × 108 cfu/ml of viable virulent *S. aureus* then treated each group with different antibiotic 10% gentamycin 0.5 ml for G1, ceftiofur 5% 0.5 ml for G2, florfenicol 20% 0.5 ml for G3, oxytetracycline 20% 0.5 ml, all given intramuscular after 7 days post-infection for once daily for 3 consequence days, G5 used as control positive, and G6 used as control negative. **Results:** The results showed that all rabbits in G2 and G3 were cured after using florfenicol and ceftiofur, respectively, while G1 showed two rabbits cured, and there was a resistance of *S. aureus* for oxytetracycline used in G4. **Conclusion:** Ceftiofur as well as florfenicol can be used in the treatment of infection with *S. aureus.*

KEY WORDS: Ceftiofur, Florfenicol, Gentamycin, Oxytetracycline, *Staphylococcus aureus*

INTRODUCTION

The recurrent bacterial strains antibiotic-resistant is a dangerous problem that has been interfere with human and animal's public health. The bacteria have permanently the aptitude to keep themselves from the antibiotics that used by the ways of getting resistance through the interchange of the genetic materials with another bacterium. The problematic has been heightened as the occurrence of resistant of bacteria to the antibiotic has increased, and multiple drug-resistant strains have arisen in numerous species that cause illness in humans as well as animals.[1] In current years, the bacteria that resist antibiotics have become an excessive disquiet to the public health. The number of bacterial species has been increased that have acquired resistance to the antibiotics[2] *Staphylococcus aureus* regarded as main bacteria that resist to the different antibiotics. It is particularly adapted to the antibiotic pressure.[3] *S. aureus* is a predominant bacterium approved by humans that can cause numerous problems, ranging from slight skin infections to severe illnesses including food poisoning, wound infections, pneumonia, as well as toxic shock syndrome.[4] Although several years of study, mastitis remains the most economically harmful illness for dairy manufacturing globally regardless animal's species.[5] It is a disease that can cause overwhelming belongings to the farmer since of severe economic losses.[6] Furthermore, there is a hazard that the milk bacterial contamination from the affected cattle makes it unsuitable for consumption to the human by producing a food poisoning or in occasional cases offer a mechanism of disease spreading to the humans.[7] For these reasons, this study was designed to find a suitable drug for treatment of this bacteria.

Access this article online

Website: jprsolutions.info | ISSN: 0975-7619

MATERIALS AND METHODS

Experimental Bacteria

S. aureus isolate was obtained from the College of Veterinary Medicine, University of Fallujah, and then

[1]Department of Internal and Preventive Medicine, College of Veterinary Medicine, University of Fallujah, Fallujah, Iraq, [2]Department of Pharmacology, College of Veterinary Medicine, University of Fallujah, Fallujah, Iraq, [3]Department of Internal and Preventive Medicine, College of Veterinary Medicine, University of Baghdad, Baghdad, Iraq

***Corresponding author:** Mustafa Salah Hasan, College of Veterinary Medicine, University of Fallujah, Fallujah, Iraq. E-mail drmustafasalah7@gmail.com

Received on: 19-07-2019; Revised on: 21-08-2019; Accepted on: 26-09-2019

we confirmed this strain using Gram stain as well as other biochemical tests.

Antimicrobials

Four types were selected from different company and different concentrations for *in vitro* and *in vivo* study as follows:

1. Gentamycin: 10%
2. Ceftiofur: 5%
3. Florfenicol: 20%
4. Oxytetracycline: 20%.

Determination of Minimum Inhibitory Concentration (MIC)

This is done according to Markey *et al*.[8]

Experimental Animals

A 30 local rabbits were selected for use in this study; these were divided into six groups each group contains five animals as follows:

G1: This was infected with 1 ml intraperitoneal of bacterial suspension containing 1 × 10^8 cfu/ml of viable virulent *S. aureus* then treated with 10% gentamycin 0.5 ml intramuscular after 7 days post-infection for once daily for 3 consequence days.

G2: This was infected with 1 ml intraperitoneal of bacterial suspension containing 1 × 10^8 cfu/ml of viable virulent *S. aureus* then treated with 5%ceftiofur 0.5 ml intramuscular after 7 days post-infection for once daily for 3 consequence days.

G3: This was infected with 1 ml intraperitoneal of bacterial suspension containing 1 × 10^8 - of viable virulent *S. aureus* then treated with 20% florfenicol 0.5 ml intramuscular after 7 days post-infection for once daily for 3 consequence days.

G4: This was infected with 1 ml intraperitoneal of bacterial suspension containing 1 × 10^8 cfu/ml of viable virulent *S. aureus* then treated with 20% oxytetracycline 0.5 ml intramuscular after 7 days post-infection for once daily for 3 consequence days.

G5: This was infected with 1 ml intraperitoneal of bacterial suspension containing 1 × 10^8 cfu/ml of viable virulent *S. aureus* and serve as control positive after 7 days post-infection for once daily for 3 consequence days.

G6: This serves as control negative.

Clinical Signs

All animals were examined for the presence or absence of signs such as fever, anorexia, depression, and any other signs after treatment.

Gross Lesions

After 5 days post-treatment, the animals sacrificed and internal organs such as liver, spleen, and kidneys were examined for the presence of any lesions.

RESULTS

All infected animals showed signs of fever, anorexia, and depression after 3–5 days post-infection with *S. aureus*. After treatment, all rabbits in G2 and G3 showed signs of healing after 2–3 days post-treatment, while G1 showed that two rabbits healing from signs and G4 also showed one animal were healed from signs, while the remaining treated rabbits showed no any improvement.

The current results of gross lesions were compatible with those of clinical signs were G2 and G3 showed complete healing from the signs and showed normal viscera as in control groups, while G1 and G4 showed different stages of healing in some treated rabbits, they showed severe congestion in all internal organs especially (liver, spleen, and kidney), and there is many whitish spots disseminated on liver surface, petechial hemorrhage throughout the intestine, and there are purulent spots disseminated on kidney surface, also, G5 showed same lesions [Figures 1 and 2].

DISCUSSION

Ceftiofur and florfenicol were showed to be more efficient than the oxytetracycline and gentamycin in the treatment of staphylococcus infection.

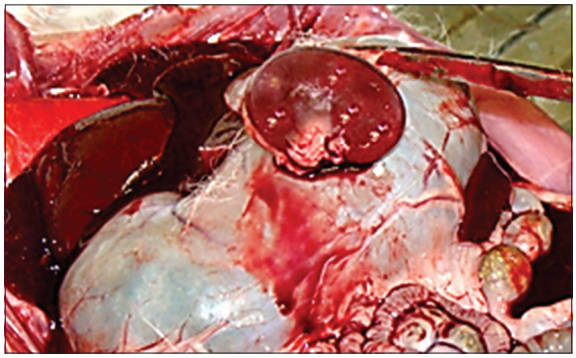

Figure 1: Control positive group infected with *Staphylococcus aureus* showed severe congestion in all internal organs and the presence of purulent spots disseminated on kidney surface

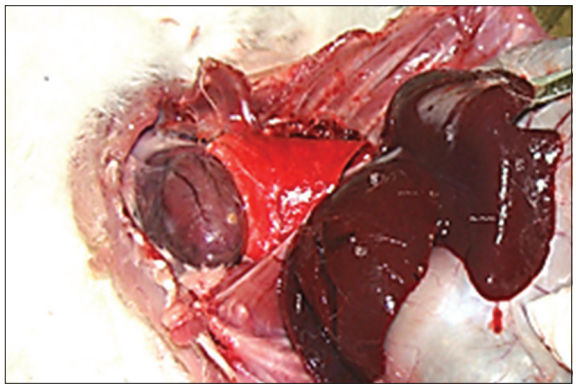

Figure 2: Rabbits infected with *Staphylococcus aureus* showed severe congestion in the liver and many whitish suppurated spots spread on the surface

These results were in agreement with the results of Bosch *et al*.[9] who showed that the efficacy of locally administered ceftiofur was higher in the treatment of experimental staphylococcus infection. Furthermore, Erskine *et al*.[10] showed that systemic ceftiofur was cured cases of clinical mastitis in dairy cattle.

Florfenicol is a time-dependent antimicrobial agent that shows strong bactericidal activity at MICs for many bacteria and bacteriostatic activity at the MIC for *S. aureus*.[11]

Furthermore, the World Health Organization[12] reported that florfenicol is effective in the treatment of staphylococcus infection.

The current results showed that gentamycin presents moderate effectiveness against *S. aureus* infection; these were in agreement with the results of Schafer *et al*.,[13] who showed that clinical gentamicin concentrations can kill *S. aureus* with equivalent effectiveness.

Furthermore, the current results showed that most animals treated with oxytetracycline were not cured from signs these may be due to random using of oxytetracycline in Iraq in proper dose and coarse, these results were in agreement with results reported by Papich[14] that *S. aureus* was mostly resist the oxytetracycline therapy. Nathwani *et al*.[15] not recommended for using oxytetracycline against *S. aureus* infections.

CONCLUSION

We recommended to use ceftiofur as well as florfenicol in the treatment of S. aureus infection.

REFERENCES

1. Devine DA, Hancock RE. Cationic peptides: Distribution and mechanisms of resistance. Curr Pharm Des 2002;8:703-14.
2. Annour MA. Antibiotic Resistant *Staphylococcus aureus* Infection Studies in Hospitals. Thesis Ph.D. Middle East Technical University; 2008.
3. Bozdogan B, Esel D, Whitener C, Browne FA, Appelbaum PC. Antibacterial susceptibility of a vancomycin-resistant *Staphylococcus aureus* strain isolated at the Hershey medical center. J Antimicrob Chemother 2003;52:864-8.
4. McGowan JE Jr. Economic impact of antimicrobial resistance. Emerg Infect Dis 2001;7:286-92.
5. Owens WE, Ray CH, Watts JL, Yancey RJ. Comparison of success of antibiotic therapy during lactation and results of antimicrobial susceptibility tests for bovine mastitis. J Dairy Sci 1997;80:313-7.
6. Ameh JA, Tari IS. Observation on the prevalence of caprine mastitis in relation to predisposing factors in Maiduguri. Small Rumin Res 2000;35:1-5.
7. Bitew M, Tafere A, Tolosa, T. Study on bovine mastitis in dairy farms of Bahir Dar town and its environs. J Anim Vet Adv 2010;9:2912-7.
8. Markey B, Leonard F, Archambault M, Cullinane A, Maguire D. Clinical Veterinary Microbiology e-Book. Edinburgh: Elsevier Health Sciences; 2013. p. 119.
9. Bosch G, van Duijkeren E, Bergwerff AA, Rijkenhuizen AB, Ensink JM. Clinical efficacy of local administration of ceftiofur in a *Staphylococcus aureus* infection in tissue cages in ponies. J Vet Pharmacol Ther 2006;29:31-6.
10. Erskine RJ, Bartlett PC, VanLente JL, Phipps CR. Efficacy of systemic ceftiofur as a therapy for severe clinical mastitis in dairy cattle. J Dairy Sci 2002;85:2571-5.
11. Pasmans F, Baert K, Martel A, Bousquet-Melou A, Lanckriet R, De Boever S, *et al*. Induction of the carrier state in pigeons infected with *Salmonella enterica* subspecies *enterica* serovar typhimurium PT99 by treatment with florfenicol: A matter of pharmacokinetics. Antimicrob Agents Chemother 2008;52:954-61.
12. World Health Organization. Critically Important Antimicrobials for Human Medicine. Geneva: World Health Organization; 2016.
13. Schafer JA, Hovde LB, Rotschafer JC. Consistent rates of kill of *Staphylococcus aureus* by gentamicin over a 6-fold clinical concentration range in an *in vitro* pharmacodynamic model (IVPDM). J Antimicrob Chemother 2006;58:108-11.
14. Papich MG. Saunders Handbook of Veterinary Drugs-e-Book: Small and Large Animal. St. Louis: Elsevier Health Sciences; 2015.
15. Nathwani D, Davey PG, Marwick CA. MRSA: Treating people with infection. BMJ Clin Evid 2010;2010:0922.

Source of support: Nil; Conflict of interest: None Declared