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Popular Article

Antibiotic Resistance and MRSA: A Challenge to Human and Pet Medicine

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Abstract

Antibiotic resistance occurs when bacteria change its response to the use of antibiotics. When such bacteria infect human and animals, the management of infection become a difficult task as it poorly responds to antibiotics. Antibiotic resistance is exacerbated by the exorbitant mass use of antibiotics in necessary and unnecessary situations. *Staphylococcus aureus* is one of the bacteria identified with resistance mechanism against antibiotics. Even though it was identified in human beings in the beginning, later reports started coming from animals too. In this writing we are describing about its origin, symptoms and control in a brief way.

Key word: Antibiotic resistance, Bacteria, Canine, MRSA, Veterinary

Staphylococcus aureus, gram-positive bacteria in the Staphylococceae family with a diameter of about 1 μm , produces grape-like collections. *S. aureus* is a bacterium that lives commensally or often symptomless in healthy individuals' skin and skin glands, nasal epithelial cells. The most common human pathogen is *Staphylococcus aureus* found in mucous membranes, and gut. In dogs and cats *S. aureus* is less common than *S. pseudintermedius* and *S. hyicus*. *Staphylococcus aureus* is commonly found in the skin, nose, armpit, groin, and other areas. These organisms are not always harmful but they can cause infection under certain circumstances. *S. aureus* is the leading cause of skin and soft tissue infections.

Staphylococcus bacteria are very adaptable, and many varieties have become resistant to one or more antibiotics. Treatment with penicillin was very much effective against many of bacteria and virus. But after few years of its introduction, an enzyme produced from *Staphylococcus aureus* that inactivate the antimicrobial properties of penicillin. This enzyme known as beta-lactamase which can hydrolyse the beta lactam ring structure of penicillin. Due to excessive use of penicillin, *S. aureus* increases their resistance power against these antibiotics which results to produce Methicillin-Resistant *Staphylococcus aureus* (MRSA). MRSA has become a pathogen of animals in due course of time. Management of this bacterium is difficult not only because of its resistance to many

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antibiotics but also because it possesses many virulence factors that increase its ability to damage body tissue and interrupt the body's host defenses. Fortunately, MRSA is not found as often in dogs and cats as it is in humans. Dogs could be source of zoonotic MRSA.

There is a sudden emergence of MRSA in dogs and cats mainly due to clonal spread. Due to the multi resistant characteristics of these bacteria they constitute a new prominent risk to animal health. MRSA mainly transmitted by direct contact of healthy animal and infected animal. MRSA in dogs can infect person through licking, kissing, bathing or direct contact. MRSA can be spread in kennels and Veterinary hospitals. Dogs can carry MRSA without showing any clinical symptom. Clinical symptoms are easily found in immunocompromised and unhealthy dogs. Symptoms in MRSA in dogs might include erythema, pustules, hair loss, inflammation in the ear, crusts and scaling.

Diagnosis should be done by isolation of bacteria from samples. Samples from infected lesion were collected with sterile swab under aseptic precaution. Swab samples can be collected from skin lesion like pus, abscess, ulcer, burn area, boils, furuncles and blood in cases of bacteremia. *Staphylococcus* bacteria can be easily grown on special laboratory media. The sample from the patient is placed onto a culture media which could be a liquid for providing nutrition, energy, nitrogen carbon for the bacteria to grow.

Baird Parker Agar (BPA) media can be used as a selective media for *Staphylococcus* bacteria. These media are placed on petri dishes and swabbed with the sample. The dishes are then incubated overnight at 37°C. After a period of time the typical black colonies of *S. aureus* are seen. *Staphylococcus* bacteria can be identified by Gram staining and catalase test from the culture. On gram staining *Staphylococcus* bacteria are small round gram-positive cocci which stain purple or blue under microscope. The catalase test was significant for isolation of *Streptococci* which were catalase negative and staphylococcus bacteria which were showing positive reaction for catalase test. For catalase test 3% hydrogen peroxide was required on culture. In case of positive catalase test cultures bubble produced at once. Presence of *S. aureus* was confirmed by coagulase test on tube test. Methicillin susceptibility of *S. aureus* can be done by disc diffusion, Minimum Inhibitory Concentration (MIC) measurements (in broth or by E test), chromogenic agar, latex agglutination, automated methods, rapid screening methods and molecular approaches. Antibiotic Sensitivity test is used for isolation of MRSA and MSSA.

MRSA in clinical practice was the most significant problem observed now a days and the incidences of MRSA infections were increasing day by day. Methicillin resistance in *staphylococci* involved the *mecA* gene, which encodes for the penicillin-binding protein 2a and results in reduced affinity for all β -lactam antimicrobial drugs. Thus, medical management of MRSA cases can become complicated and can result in the administration of various classes of antimicrobial drugs.

MRSA bacterial infection responds quickly to a modern class of antibiotics and develops a



resistance mechanism. Treatment of methicillin-resistant strains, vancomycin, teicoplanin and mupirocin are used after antibiotic sensitivity test. Vancomycin has remained the medication of choice in treating MRSA infection conditions. In clinical management, *S. aureus* is a multidrug-resistant condition known as a potentially life-threatening superbug. In small animal medicine, fluoroquinolones are commonly used because of their activity against a wide range of bacteria and their ability to be given orally.

If we think about antibiotic resistance and its prevention and control, certain things can be done from our side too. Use antibiotics when it is prescribed by a qualified health professional or veterinarian. Demanding antibiotics from medicine shops should be discouraged. Don't use the antibiotics from old prescriptions and offer to others. Let's follow hygienic measures in tackling infections and a healthy lifestyle in our day-to-day routine.

References

- Abdullahi, I. N., Zarazaga, M., Campaña-Burguet, A., Eguizábal, P., Lozano, C., & Torres, C. (2022). Nasal *Staphylococcus aureus* and *S. pseudintermedius* carriage in healthy dogs and cats: a systematic review of their antibiotic resistance, virulence and genetic lineages of zoonotic relevance. *Journal of Applied Microbiology*, 133(6), 3368-3390.
- Boost, M. V., O'donoghue, M. M., & James, A. (2008). Prevalence of *Staphylococcus aureus* carriage among dogs and their owners. *Epidemiology & Infection*, 136(7), 953-964.
- Burstiner, L. C., Faires, M., & Weese, J. S. (2010). Methicillin-resistant *Staphylococcus aureus* colonization in personnel attending a veterinary surgery conference. *Veterinary Surgery*, 39(2), 150-157.
- Enoch, D. A., Karas, J. A., Slater, J. D., Emery, M. M., Kearns, A. M., & Farrington, M. (2005). MRSA carriage in a pet therapy dog. *Journal of Hospital Infection*, 60(2), 186-188.
- Rutland, B. E., Weese, J. S., Bolin, C., Au, J., & Malani, A. N. (2009). Human-to-dog transmission of methicillin-resistant *Staphylococcus aureus*. *Emerging infectious diseases*, 15(8), 1328.
- Magalhães, R. J. S., Loeffler, A., Lindsay, J., Rich, M., Roberts, L., Smith, H., & Pfeiffer, D. U. (2010). Risk factors for methicillin-resistant *Staphylococcus aureus* (MRSA) infection in dogs and cats: a case-control study. *Veterinary research*, 41(5).
- Silva, V., Caniça, M., Manageiro, V., Vieira-Pinto, M., Pereira, J. E., Maltez, L., & Igrejas, G. (2022). Antimicrobial resistance and molecular epidemiology of *Staphylococcus aureus* from hunters and hunting dogs. *Pathogens*, 11(5), 548.
- Yamauchi, T., & Santorelli, F. (2005). Recovery of methicillin-resistant *Staphylococcus aureus* (MRSA) from dogs and cats. *American Journal of Infection Control*, 33(5), e175

