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PHOTOBIOMODULATION IN A SURGICAL WOUND CONTAMINATED BY KLEBISIELLA IN A DOG'S ESOPHAGEAL TUBE

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ABSTRACT

The bacterium Klebsiella spp. is opportunistic and can be isolated from various animal species and humans. They are known to cause serious nosocomial infections, including pneumonia and primary bloodstream infections, and are found in the environment and on the mucosal surfaces of mammals. They can easily survive in hospitals, being transmitted from patient to patient through the hands of health professionals working in the veterinary hospital environment, and difficult to solve due to their high resistance to commonly used antibiotics. Photobiomodulation is a treatment option that has no resistance to bacteria, fungi and viruses, being a safe and effective form of treatment for numerous pathologies. This report brings the importance of hygiene care with hospitalized patients and a new treatment option, showing that integrative treatment works and does not cause side effects.

Keywords: Hospital infection, Laser therapy, Klebisiella.

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INTRODUCTION

A wound is any situation of anatomical/cellular discontinuity, with impairment of functions, usually produced by external traumatic action, whether accidental or surgical (5). Injuries can have different origins, such as secondary to being run over, bites, burns, neoplasms, surgical wounds, mistreatment, among others, and can be classified as open or closed wounds, with contamination, clean, clean-contaminated, contaminated and infected, depending on the time of occurrence (5).

LASER (Light Amplification the Stimulated Emission of Radition) therapy, or also known as Photobiomodulation, is a source of light and energy that produces high, medium and low intensity radiation, used for wound healing treatments, infections, edema reduction, pain relief and useful for tissue and nerve damage (4,5). The low-power laser, below 30 joules per cm^2, does not provide noticeable heating, it is applied in tissue repair, unlike the high-power laser that has destructive power, such as cuts (5).

Currently, phototherapies with dermatological application in human medicine have been showing an exponential growth, being great tools used to accelerate the healing process, as well as to control local bacterial growth and even stimulate follicular growth, and in veterinary medicine it has also been growing, as a form of non-invasive and rapid treatment for numerous pathologies (6).

Photobiomodulation (FBM) consists of the irradiation of cells with a non-ionizing light source at a certain wavelength, which can lead to the activation of cellular components and promote photochemical and photophysical reactions that alter cell metabolism, resulting in pain or inflammation relief, immunomodulation, wound healing and tissue regeneration, and can modulate physiological reactions locally and systemically, through photochemical reactions (7). The wound bed and edges can also be irradiated in order to accelerate tissue neoformation (7) Antimicrobial photodynamic therapy (aPDT) is a reaction in which light associated with a photosensitizing substance will produce a photodynamic reaction through the production of highly reactive oxygen, inducing microorganisms to die (6,7). The photosensitizer reacts with the oxygen molecules of the cell, leading to the production of free radicals, or transferring energy or oxygen, leading to the production of singlet oxygen, causing disturbance in the cell wall and DNA damage, inducing cell death and destruction of the compromised tissue, in addition to having antimicrobial action and representing an alternative treatment for pathogens resistant to conventional drugs, as an alternative for

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the treatment of multidrug-resistant infections and to date, there are no reports of microorganisms becoming resistant to photodynamic therapy (PDT) (7).

Treating patients in a hospital environment requires great care with the hygiene of the place, the patient and the professionals who are in the environment, in order to reduce hospital infections and induction of bacterial resistance (8). Hospital or nosocomial infection is acquired during the patient's hospitalization, and can be related to invasive hospital procedures performed during hospitalization or simple procedures such as dressing changes or medication application (8). The main hospital syndromes that affect hospitalized human patients are bloodstream infections, surgical site infection, urinary tract infection, respiratory infection and sepsis, and when it comes to the incidence of hospital infection in the veterinary, it is not yet well established mainly due to the lack of Hospital Infection Control Committees, but there are several factors that contribute to its occurrence, such as the increase in the quantity and quality of intensive care performed, the use of intravascular devices and esophageal/nasal/bladder tubes, increased hospitalization time, indiscriminate use of antimicrobials, surgeries with implant placement and use of immunosuppressive drugs (8).

Thus, this report brings the importance of care for hospitalized patients and a new possibility of treatment that does not have microbial resistance.

CASE REPORT

An 11-year-old Shih-tzu canine patient was indicated to undergo a surgical procedure for the placement of an esophageal tube due to total loss of appetite due to chemotherapy treatment for multicentric lymphoma.

The esophageal tube was placed on the right side of the cervical, on August 8, 2024, at a veterinary hospital in Espírito Santo. The procedure was quick, but the patient had to remain hospitalized to monitor his general condition, since he was an oncology patient undergoing treatment and with side effects, who needed intravenous medications.

After 8 days, the patient was discharged from the veterinarian and continued treatment and tube feeding at home.

However, 15 days after the surgical procedure, a yellowish secretion was observed at the surgical wound site during one of the dressing changes. The site was sanitized again using topical antiseptics and antibiotics, but the next day the secretion continued to drain.

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The patient was taken to the hospital for the removal of the esophageal tube, and the secretion together with the tube were sent for Culture and Antibiogram examination, obtaining as a result after 5 days the presence of the bacterium *Klebisiella pneumoniae,* whose only sensitive antibiotic was Meropenem. In this removal, an intense hematoma was formed in the region, with extreme painful sensitivity by the patient.

As a result, intravenous antibiotic therapy at a dose of 24 mg/kg was immediately instituted, every 12 hours, until the next negative culture. After 10 days of treatment, the first bacterial culture was performed and the bacteria was still present, so the systemic medication was maintained, but the patient was nauseated and started with vomiting episodes, even with antiemetic medications.

Thus, a treatment protocol associated with photobiomodulation was initiated in the surgical wound where the esophageal tube was located. Blue LED was used for 60 seconds, and red light at a power of 2J/cm² was used only in the first session, since the cancer patient has no indication to use red light due to the cell multiplication effect. The equipment used was from ECCO VET.®

After 4 sessions with a 48-hour interval between them, the surgical wound healed completely, the fur began to grow around it and in the new bacterial culture there was no more microbial growth.

RESULTS AND DISCUSSION

As this patient was indicated to remain in a hospital environment through hospitalization, due to the general picture of apathy and loss of appetite, he ended up being affected by the opportunistic infection of the Klebisiella bacterium through the surgical access of the esophageal tube, which was the gateway for this bacterium to reach the bloodstream. According to the result of the culture and antibiogram, the only drug capable of eliminating this bacterium was Meropenem, and according to the World Health Organization (WHO), which warns of the occurrence of the post-antibiotic era, infections will become increasingly difficult to control and treat due to the ineffectiveness of current antimicrobials (1). The frequent and inappropriate use of antimicrobials has further accelerated the incidence of microbial resistance, and Klebsiella species are becoming important pathogens for humans and animals, causing an increase in morbidity and evolving to mortality (1).

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The antibiotic used, Meropenem, which was the only sensitive one as a treatment option, is explained in the literature, since it is observed in domestic and wild animals, the increase of antimicrobial resistance in isolates of *K. pneumoniae*, especially to β-lactams, such as amoxicillin and ampicillin, because they have the ability to produce hydrolytic enzymes that inactivate antimicrobials of this class, being one of the most important bacterial resistance mechanisms (2). On the other hand, the class of carbapenems still has a low rate of resistance, as this class is still little used in veterinary medicine, being used in companion animals with severe and hospital infections (2).

The choice of photobiomodulation as a form of treatment for the infection was due to its rapid response and without side effects, as the low-intensity laser and LED-diode emitting light act by stimulating physical, chemical and biological processes at the mitochondrial level, increasing cell metabolism, generating healing, relieving pain and draining inflammation (3), and the positive evolution with the photobiomodulation treatment can be confirmed in Figures 1 to 3.

Figure 1: A – surgical wound of the esophageal tube with the presence of purulent secretion and extensive hematoma. B – Laser pen emitting red light at a power of 2 J for 13 seconds with a healing, analgesic and bactericidal effect. C – LED pen emitting blue light for 60 seconds with bactericidal effect.

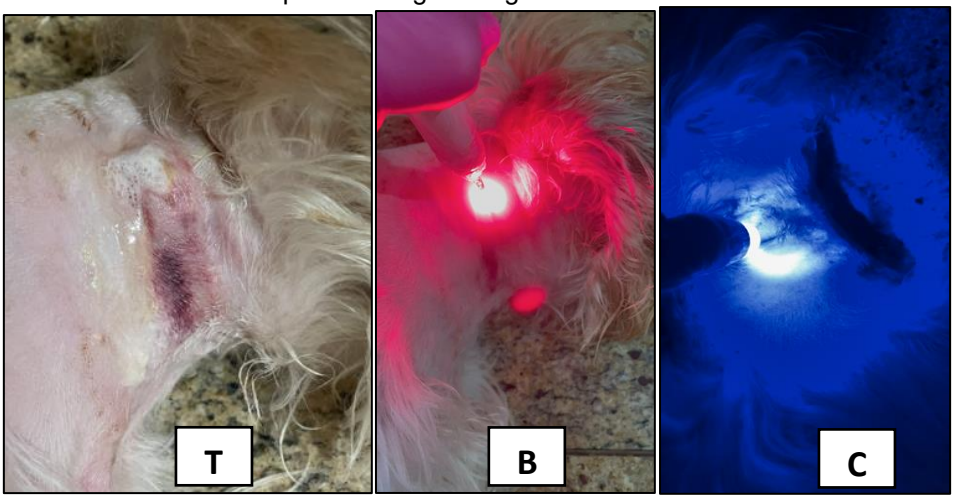

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Figure 2: A – After the first session with a hematoma disappearing and the wound beginning to heal, with no purulent discharge. B – After the second session without bruise and partially healed wound.

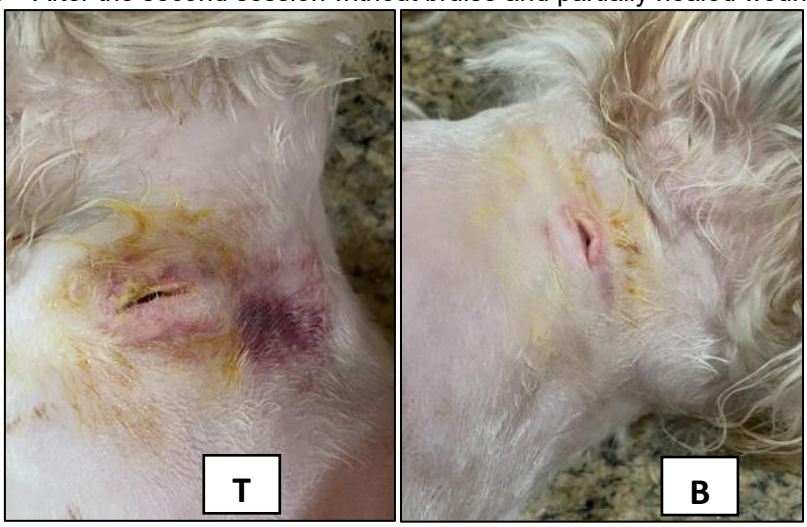

Figure 3: A – After the third session with almost complete healing and negative bacterial culture. B – After the fourth session with complete healing.

CONCLUSION

It is concluded that hospital environments need adequate daily disinfection, in addition to the professionals who are present there maintaining hygiene between the handling of hospitalized or treated patients. It is possible to treat other forms that are less invasive and without side effects, such as photobiomodulation. In addition, bacteria resistant to conventional therapies do not have the same resistance to integrative treatments, so it is a first-choice option in order to avoid complications and reduce morbidity and mortality of patients.

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