

Use of Acetate for the Management of Patients with Staphylococcus Aureus Sepsis

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ABSTRACT

Staphylococcus aureus is an opportunistic pathogen that normally colonizes the anterior nostrils of humans. Sepsis is one of the most common critical care problems with high morbidity and mortality, it is the main cause of acute kidney injury. Intravenous fluids are the mainstay of treatment in patients with hypovolemia due to severe sepsis, we currently have colloid and crystalloid solutions for the management of electrolyte therapy. We can highlight the use of sodium acetate; this acts through the Grp43 receptor where it causes apoptosis of neutrophils and therefore the resolution of inflammation.

Keywords: Staphylococcus Aureus; Sepsis; Acetate

Introduction

Staphylococcus aureus is an opportunistic pathogen that normally colonizes the anterior nostrils of humans, it is one of the most frequent causes of local infections in the skin, where it becomes an entrance to the deeper tissues, where it could give rise to infections fatalities such as sepsis and / or endocarditis [1]

Sepsis is the systemic inflammatory response to infection. There are risk factors associated with Staphylococcus aureus sepsis, advanced age, infants, the presence of additional comorbidities such as diabetes, kidney disease, HIV infection, presence of medical devices, application of parenteral drugs Staphylococcus aureus

produces clearance from the bloodstream by the immune system, and how this pathogen hijacks the host's coagulation and defense systems and interacts more with the endothelium of blood vessels where the vessel wall allows the invading pathogen to directly damage the endothelium for its secreted toxins, such as alpha-toxin and superantigens that activate the endothelium, further increasing endothelial dysfunction, aberrant clotting, and vascular leakage [1]. The annual incidence of sepsis caused by this pathogen has been increasing in recent years is 4.31 to 38.22 per 100,000 person years in the United States. Their mortality can be 20% despite treatment [2]. In the management of fluid resuscitation plays an important role the emergence of the use of crystalloid solutions have predictive benefits and effects on the health of the patient. The objective of our work is to analyze acetate management in patients with *Staphylococcus aureus* septicemia.

Methodology

A detailed bibliographic search of information published in the databases pubmed, Elsevier, scielo, national and international libraries is carried out. The following descriptors were used *Staphylococcus aureus*, sepsis, acetate. The search for articles was carried out in Spanish and English, it was not limited by year of publication.

Results



Figure 1: *Staphylococcus aureus* in clusters.

Staphylococcus are a large group of gram positive bacteria, these are distinguished by their groupings that resemble bunches of grapes (Figure 1), this genus of bacteria is characterized by its great adaptability and easy spread [3]. *Staphylococcus aureus* is part of the normal human flora, between 25 and 50% of the healthy population is colonized by this bacterium, constituting a risk due to its dissemination [4]. The pathogenicity of the *Staphylococcus aureus* species is related to the components of its surface, the pathogenesis caused by the microorganism is due to the decrease in host immunity and virulence factors (that is, the ability to inflict damage to the Guest) [1]. They are the most frequent cause of

infections in the skin and soft tissues, the majority are usually self-limited although sometimes it becomes the pathway of entry of the pathogen to deeper tissues and the bloodstream, the presence of *Staphylococcus aureus* in the bloodstream can lead to sepsis where there is an immunosuppressive response accompanied by inflammation.

In the human body, there is a series of defense mechanisms at the time when *staphylococcus aureus* enters the bloodstream, it is initially eliminated by the kupffer cells (hepatic macrophages) this process occurs with the help of circulating platelets that they do is bind to the surface of the macrophage, enclosing it for the phagocytization process to be effective. There are strains of *Staphylococcus aureus* that can evade this process, they can survive and multiply in the macrophage, becoming a source of dissemination [1]. The second line of defense of phagocytosis is activated portal circulation neutrophils, where a small percentage of bacteria can survive intracellularly, thus giving a systemic spread [1]. Later in *staphylococcus aureus* sepsis, there is an activation of prothrombin and other clotting factors, by the bacteria binding to fibrinogen and using it to cross-link individual cells to form large fibrinogen-coated clumps [1].

Endothelial damage occurs, the microorganism has the ability to adhere to the endothelium, this allows the invading pathogen to directly damage the wall of the vessel by its secreted toxins, such as alpha-toxin and superantigens that activate the endothelium, which further increases dysfunction endothelial, aberrant coagulation and vascular leak [1]. Sepsis is one of the most common critical care problems with high morbidity and mortality, it is the main cause of acute kidney injury. Treatment must be essential for the patient to lead to improvement and have less risk and adverse effects [5]. Intravenous fluids are the mainstay of treatment in patients with hypovolemia due to severe sepsis, we currently have colloid and crystalloid solutions for the management of electrolyte therapy. But a controversy has arisen in which we should use, which will bring the best benefit for these patients [5]. Colloids such as dextrans, hydroxyethyl starch, are plasma volume expanders and have been associated with adverse effects such as renal failure with the need for renal replacement techniques, even increasing the risk of death. On the other hand, we found that crystalloid solutions such as Ringer's Acetate, a clinical benefit with crystalloid is demonstrated in various studies, they contain less concentration of chlorine and sodium [6,7].

Discussion

It has been shown that part of the action of acetate can occur through the activation of the G-protein-coupled receptor, Gpr43 [8]. These receptors are commonly activated by short-chain fatty acids acetate, propionate and butyrate, ligands that originate from

bacteria. anaerobic in the intestine as by-products of fermentation [9], the activation of these receptors allows neutrophils to trigger an antimicrobial response after an additional pro-inflammatory stimulation [10], in addition, the increase in the expression of GPR43 in blood cells is related to a longer survival of septic patients [11]. Through acetate treatment, neutrophils are prepared in a GPR43-dependent manner, leading to increased neutrophil chemotaxis, bacterial death, and better resolution of inflammation and the outcome of sepsis [12]. A study reported that through the action of Gpr43, the apoptosis of neutrophils was induced and the resolution of inflammation, it was also evidenced that acetate regulates acute inflammation by promoting caspase-dependent apoptosis of neutrophils, efferocytosis and leading to a decrease in the inflammatory process inflammation. Resolution of neutrophilic inflammation was associated with decreased NF- κ B activity and increased production of anti-inflammatory mediators, including IL-10, TGF- β , and annexin A1 [8].

Conclusion

Staphylococcus aureus sepsis has a high incidence, mortality, and morbidity rate. Currently there are new drug therapies that can help to have a better evolution of those who suffer from it, where we can highlight the use of sodium acetate; This acts through the Grp43 receptor where it causes apoptosis of neutrophils and therefore the resolution of inflammation. Its use should be more implemented.

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