THE ROLE OF IMMEDIATE FLUID RESUSCITATION IN MANAGING PATIENTS OF SEPSIS IN CRITICAL CARE SETTING: A LITERATURE REVIEW

ABSTRACT

Among the various critical care patients admitted to an ICU or CCU, several patients develop sepsis during their stay at the hospital. In another common scenario, it is also a very normal fact for patients to be brought to the hospital when they are suffering from sepsis. Sepsis is more common than it is thought of, and with no proper diagnosis or management done, it could compromise the patient's life. In many severe cases, the patient suffering from sepsis may also develop septic shock, which is even more lethal and could cause death sooner than expected in sepsis patients. Therefore, it is evident that these patients require the highest forms of care and management protocols, depending upon the severity of their situation.

However, in case all forms of treatment start failing and a poor prognosis becomes evident, then it is the need of time to intervene with resurrection measures and try their level best to help save the life of the patient. Resuscitation protocols are only seen to be effective when brought into action within the right time span. If it has already been too late, then there is little that could be done to help the patient.

This review focuses on the various resuscitation techniques that are followed amidst an emergency related to sepsis patients. The motive is to explore how effective these fluid resuscitation maneuvers are for improving the overall prognosis of the patient. It is already evident that whatever protocols or maneuvers would be followed, would be aggressive since the patient under consideration is already in a compromised state.

Keywords: sepsis, septic shock, resuscitation, emergency, critical care, ICU settings

INTRODUCTION

The invasion of an otherwise sterile part of the body by microbes is referred to as ‘sepsis’. It is a systemic illness that affects the whole system of a person’s body. The component of ‘microbial invasion’ is significantly important, as it helps differentiate those conditions that arise due to non-microbial invasions, yet are considered to be an infectious illness affecting a particular body system. (1)

There have been several attempts made to define sepsis and its scope. Currently, the widely accepted definition is the one that was proposed in the 1990s and it enlists the various categories, or more appropriately, the stages through which sepsis passes forward.

According to this definition, sepsis refers to ‘a non-specific inflammatory response of the body to unconfirmed microbial invasion’. Subsequently, when this inflammatory response is accompanied by clinically evident hypoperfusion or dysfunctioning of at least one organ system, it gets labeled as ‘severe sepsis’. (2)

Furthermore, this situation gets even more complicated when severe sepsis is accompanied by hypotension that might be severe enough to render the need for vasopressors, despite the individual having an adequate amount of fluid resuscitation present. This is when the affected person is said to have ‘septic shock’. (3) It is at this stage that the majority of the mortality sprouting from sepsis is seen to come into action. Within a short time and usually, when left to get treated inadequately, this turns into septicemia, which majorly results in the death of a person. Therefore, it is not hard to see that septic usually follows a very crucial course that ultimately results in the death of a patient if they are not diagnosed on time, or left without any proper management. (4)

Sepsis typically begins with an infection, most commonly bacterial, but it can also result from fungal or viral infections. The source of infection can be in any part of the body, such as the lungs (pneumonia), urinary tract (UTI), abdomen (peritonitis), or skin (cellulitis). (5) When the body detects the infection, the immune system responds by releasing signaling molecules (cytokines) and activating immune cells, such as macrophages and neutrophils, to fight the invading pathogens. In sepsis, the immune response can become dysregulated, leading to an excessive release of pro-inflammatory cytokines. This "cytokine storm" contributes to widespread inflammation and tissue damage. Inflammatory mediators, such as cytokines and nitric oxide, can disrupt the function of endothelial cells lining blood vessels. This dysfunction can lead to increased vascular permeability, causing fluids and proteins to leak into surrounding tissues, resulting in edema and hypotension. The inflammation, hypoxia (oxygen deficiency), and altered blood flow associated with sepsis can lead to dysfunction in various cell types and organs, including the heart, liver, kidneys, and lungs. This dysfunction can result in organ failure. (6)

As expected, there are several ways of managing sepsis, with each management plan differing from the other on the basis of patient factors, the severity of the disease, and any underlying factors that might be present to complicate or deteriorate the patient's condition. (7)

Therefore, this review will reflect upon the main fluid resuscitation techniques or protocols used for managing sepsis patients. It is also important to note which types of patients are suitable to undergo any management or treatment without the risk of further exacerbating the severity of their condition. This review will serve as a guide to highlight all such measures that are commonly carried out in the hospitals for these patients.

PREVALENCE AND DIAGNOSIS OF SEPSIS PATIENTS

For the survival of confirmed sepsis patients, early management is considered crucial. It was established earlier that both cases of severe sepsis and septic shock emerge as a consequence of infections. It is essential to realize that these infections could have arisen both due to acquisition from within the community or from any hospital or healthcare setting (nosocomial). (8)

It is also important for the attending physicians to be aware of the danger signs and symptoms that point toward the obvious diagnosis of sepsis in the patients. Although there are several pointers that favor the diagnosis of sepsis or septic shock in an adult, any fever that exceeds 38 degrees Celsius, along with the patient experiencing a continuous episode of breathlessness, paleness, a general feeling of unwellness, and lethargy, heavy or profuse sweating, loss of appetite, a respiratory rate of 22 breaths per minute or more, changes in mental alertness, rapid heart rate, and inadequate oxygen levels, should be enough to direct the possible diagnosis towards septic in the affected patient. (9) (10)

In cases where sepsis arises from pneumonia, there are additional signs such as body temperature drops below 36 degrees Celsius, abnormal sounds of breathing, abnormal breathing patterns, and the production of sputum. It is essential to realize that not all symptoms would be present in a patient and not all patients would display the same symptoms at all times. (11)

It has been found that pneumonia is the most frequent initial source of sepsis, accounting for nearly half of all cases of sepsis. Other causes might include urinary tract infections or infections involving the intra-abdominal region. Consequently, the main organisms that are involved in the pathogenesis of this disease include prevalent gram-positive strains like *Staphylococcus aureus* and *Streptococcus pneumoniae*, while dominant gram-negative strains encompass *Escherichia coli*, various *Klebsiella* species, and *Pseudomonas aeruginosa*. (12)

The susceptibility to sepsis and septic shock undergoes a complex pattern influenced by various factors. While age plays a significant role, the risk distribution follows a bimodal pattern, being more elevated in newborns, diminishing in young individuals, and then resurging after the age of 60. This variation can be attributed to both the underdeveloped immune systems of newborns and the declining immunity seen in older adults due to aging. (13)

Gender is another important determinant, as males exhibit a higher risk of experiencing sepsis and septic shock. This could be linked to the protective effects of estrogens on immune response and cardiovascular health, potentially accounting for the comparatively lower risk observed in females. However, this distribution between the two genders is not a confirmed theory; it is merely based on popular findings and speculations. (14)

The presence of underlying health conditions and the use of immunosuppressive medications increase the vulnerability to sepsis and septic shock. Interestingly, the occurrence of these conditions seems to follow a seasonal trend, with higher prevalence during the winter months. This can be attributed to the increased instances of respiratory infections in colder seasons, which serve as risk factors for sepsis. Moreover, additional factors such as malnutrition, poverty, limited education, delayed onset of sepsis treatment, and instances of misdiagnosed infections, are important factors that complicate and deteriorate the situation.

RESUSCITATIVE MANAGEMENT AND TREATMENT PROTOCOLS FOR SEPSIS PATIENTS

Once a patient has been diagnosed as having sepsis, the next action should be nothing but the initiation of treatment to help reverse whatever damage has been developed by the patient. It is recommended that the first line of treatment should be the prophylaxis of an empirical antibiotic

therapy so that even if there is no microbial cause present, the patient could be prophylactically given an antibiotic to prevent them from contracting further illnesses and infections. (15)

All suspected and confirmed cases of sepsis are seen to greatly benefit from this first dose of prophylactic antibiotic as it helps with the control of infection along with containing and limiting the infection in the affected tissues or organ systems. (16)

Sooner or later, the patients might start developing symptoms of shock. This could include the presence of cool extremities, a clammy body, and rapidly deteriorating or worsening vital signs. The patient might become hypotensive or pulseless soon, and therefore, the next step is to make sure that this does not happen.

The goal at this point is simply to restore the venous pressure reading of the patient to about 8-20 mm of Hg, and the mean arterial blood pressure above 65 to help restore the circulatory shock. The patient must be given oxygen support if needed while making sure that the oxygen saturation rate does not drop to as low as 75%, which is indeed a warning sign that the patient's condition is not stable. All of this is achieved by giving the patient aggressive prophylactic fluid rehydration through crystalloid and colloid solutions. In cases of extreme severity, the patient might also need mechanical ventilation along with the addition of a vasoactive agent such as epinephrine to help restore their normal vital signs. Other vasoactive agents such as dopamine are usually avoided in these cases because they have been seen to disrupt the normal immune function through their actions on the hypothalamus. (15)

In a sequential turn of events, it is also recommended that the patients should be administered a potent corticosteroid such as vasopressin to cope with the disrupted or extremely low cortisol levels. At this stage, it is also seen that some patients get a central venous pressure line (CVP line) placed to help with the whole resuscitation situation. (17)

It is commonly seen that time plays a crucial role in improving or deteriorating the condition of a patient. However, since these steps are some of the initial ones that are done to make sure that the patient does not collapse, it is vital to ensure that the choice of antibiotics is based on factors that directly influence their efficacy. These factors that are to be kept in consideration include patient age, source of infection, prior antibiotic use, comorbidities, the presence of multi-drug resistant organisms, severity of septic shock, and patient immune status. Adequate dosing is also important to keep in mind. Usually, an initial higher dose is often recommended to sustain therapeutic blood levels of the drug. (18)

The importance of fluid resuscitation in patients with sepsis could be released from the fact that when 1866 patients who had suffered from septic shock were administered intravenous fluid at a rate of 30 milliliters per kilogram, there was a significant reduction in the rate of mortality among them. Another study, focusing on the same subject, discovered that a higher initial volume of intravenous fluids exhibited an association with enhanced survival outcomes, even after accounting for potential variables. (19)

However, the results are not uniformly in favor of such associations. A multicenter retrospective analysis did not uncover a substantial link between mortality and the duration taken to complete a fluid bolus, particularly up to the span of 12 hours. (20)

Another Australian study involving patients presenting to the emergency department with infections illuminated a connection between a larger volume of intravenous fluid administered within the initial 24 hours and a reduction in in-hospital mortality rates. In contrast, a Chinese observational study unveiled that among septic shock patients, the most favorable mortality outcomes were associated with the receipt of an initial intravenous fluid volume ranging from 20

to 30 mL/kg. This was in comparison to both the group that received less than 20mL/kg and the one that received more than 30mL/kg. (21)

Therefore, from these studies, it is evident that fluid resuscitation indeed plays a favorable role for patients suffering from sepsis or septic shock. The earlier this process of rehydration begins, the better it is for the prognosis of the patient. However, great importance has been laid on considering several factors when starting any form of treatment on the patients, as it might help in adjusting the dose for such patients. (22)

CONCLUSION

Sepsis is a life-threatening condition. It manifests in different forms, however, nearly all the forms are severe enough to cause the death of a patient if they are not given urgent treatment. The purpose of this review was to realize the importance of early and aggressive treatment in sepsis patients. When a patient is already on the verge of developing shock, it is important that they are given both empirical and prophylactic treatment to help prevent further complications from taking place.

It is recommended that antibiotics should be given empirically in suspected sepsis patients as they may help in preventing or containing bacterial infections. Moreover, fluid hydration is

recommended to be started at a slow but steady rate to ensure that the patient's vital signs are not deteriorating and that they are not going into a state of shock. All these measures greatly help in avoiding and reducing mortality rates among patients.

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