Management of sepsis in Emergency Department (ED)

Gireesh Kumar. K. P*, Sreekrishnan T P*

ABSTRACT

Sepsis or sepsis syndrome is a life-threatening medical condition characterized by an infection and the body’s overwhelming inflammatory response to that infection. Sepsis remains the primary cause of death from infection despite advances in modern medicine, including vaccines, antimicrobials, and critical care. It may lead to shock, multiple organ dysfunction, and death, especially if not recognized early and treated promptly. Sepsis is a major clinical issue in Emergency Departments (EDs), as it is commonly seen first in the ED and is associated with a high mortality rate. Between one third and one half of patients with sepsis die. In the developing world, sepsis accounts for 60-80% of lost lives per year in childhood, killing more than 6 million neonates and children yearly and is responsible for more than 100,000 cases of maternal sepsis. Every hour, about 50 people die from sepsis. This article briefly outlines the clinical features, early diagnosis, evaluation and treatment of sepsis in Emergency and critical care settings.

Keywords: Sepsis, Shock, Ionotropes, Multi organ dysfunction syndrome, Antibiotics, Fluids, Early goal directed therapy.

INTRODUCTION

Sepsis or sepsis syndrome is a life-threatening medical condition characterized by an infection and the body’s overwhelming inflammatory response to that infection. Sepsis remains the primary cause of death from infection despite advances in modern medicine, including vaccines, antimicrobials, and critical care. It may lead to shock, multiple organ dysfunction, and death, especially if not recognized early and treated promptly. In the developed world, sepsis and sepsis related problems are increasing by an annual rate of 8 - 13% over the last decade, and now claims more lives than any other disease. Sepsis causes more deaths than prostate cancer, breast cancer and HIV/AIDS combined. Globally, an estimated 20 - 30 million cases of sepsis occurs each year. Reasons are multiple for this increase in morbidity and mortality, like increase in number of diabetic patients, aged population1,4, HIV infection, cancer, cancer chemotherapy / radiation therapy, granulocytopenia, cirrhosis, alcohol dependence, increasing use of immunosuppressant drugs like steroids, Increased use of invasive devices such as surgical prosthesis, inhalation equipment, and intravenous catheters and urinary catheters Indiscriminate use of antimicrobial drugs and the development of multi drug-resistant and more virulent varieties of infections. Sepsis in trauma also contributes to a significant proportion of mortality and morbidity in the age group of 15-45 years. Infections are the second most important cause of death in trauma patients. Despite advances in trauma care, deaths due to septicemia are increasing8.

In the developing world, malnourishment, poverty, lack of access to vaccines and timely treatment all contribute to death. The incidence of sepsis is also increasing in number due to mainly hospital acquired infections.

Sepsis starts when inflammatory mediators released into the bloodstream to fight against the microorganisms and this mediators trigger inflammation throughout the body. This inflammation can trigger a cascade of changes that can damage multiple organ systems of body and lead to mortality.

Sepsis is a major clinical issue in Emergency Departments (EDs), as it is commonly seen first in the ED and is associated with a high mortality rate. Between one third and one half of patients with sepsis die1,2. In the developing world, sepsis accounts for 60-80% of lost lives per year in childhood, killing more than 6 million neonates and children yearly and is responsible for more than 100,000 cases of maternal sepsis3. Every hour, about 50 people die from sepsis.

Diagnosis of sepsis is often delayed because the clinical symptoms and laboratory signs currently used (fever, tachycardia, abnormal white blood cell count etc.) are not specific enough. Sepsis is under-recognized and poorly understood due to confusion about its definition among patients and healthcare providers, lack of documentation of sepsis as a cause of death in emergency room or ICUs in case of early death, inadequate diagnostic tools, and inconsistent application of standardized clinical guidelines to treat sepsis4. As sepsis is a time dependent illness, mortality increases with delay in starting appropriate treatment.

This review begins with a brief summary of the terminologies related to sepsis, and then addresses the fundamental clinical aspects of identification and resuscitation of the septic patient in ED.

DEFINITIONS

Sepsis has been defined as a clinical syndrome that results from a dysregulated systemic inflammatory response to an infection. There should be a presence of probable or documented evidence of infection...
with systemic manifestations. Sepsis is characterized by the cardinal signs of inflammation (vasodilatation, leukocyte accumulation, increased microvascular permeability) of tissues.

Severe sepsis refers to sepsis-induced tissue hypoperfusion or organ dysfunction with any of the following thought to be due to the infection: Sepsis induced hypotension, Lactate above upper limits of laboratory normal, Urine output <0.5 mL/kg/hr for more than two hours despite adequate fluid resuscitation, Acute lung injury with PaO2/FiO2 < 250 in the absence of pneumonia as infection source, Acute lung injury with PaO2/FiO2 < 200 in the presence of pneumonia as infection source, Creatinine > 2 mg/dL, Bilirubin > 4 mg/dL, Platelet count < 100,000 microL–1 and Coagulopathy (INR > 1.5).

Septic shock is defined as sepsis-induced hypotension persisting even after adequate fluid resuscitation, which may be defined as infusion of 30 mL/kg of crystalloids (a portion of this may be albumin equivalent)

Multiple organ dysfunction syndrome (MODS): MODS is the presence of altered organ function in an acutely ill patient such that homeostasis cannot be maintained without intervention.

ARDS

Respiratory symptoms within one week of clinical insult and bilateral pulmonary oedema not related to cardiac failure or fluid overload

Patient should have moderate to severe impairment of oxygenation, as defined by the ratio of arterial oxygen tension to fraction of inspired oxygen (PaO2/FiO2) < 300 mm Hg.

COMMON ORGANISMS

Although septic shock can be caused by various viruses and fungi, most of the cases are due to bacterial infections predominantly due to gram negative bacteria. Common gram-negative bacteria causing septic shock are Escherichia coli, Klebsiella species, Enterobacter species, Proteus species and Pseudomonas aeruginosa. The most common obligate anaerobe to cause sepsis is Bacteroides fragilis. Approximately 45% of the cases of septicaemia are due to gram-negative bacteria.

Common gram positive bacteria causing septic shock include Staphylococcus aureus, Streptococcus pneumoniae, Enterococcus species that are normal flora of the intestines, and Streptococcus pyogenes. The most common cause of neonatal sepsis is Group B Streptococcus (GBS). Approximately 45% of the cases of septicemia are due to gram-positive bacteria.

Approximately 10% of the cases of septicemia are due to fungi, mainly the yeast Candida.

Clinical Features of Sepsis

General findings of sepsis: Since sepsis can start from different parts of the body, it can have many different symptoms. Symptoms of sepsis are usually nonspecific and include fever, chills, and constitutional symptoms of fatigue, malaise, anxiety, or confusion. These symptoms are not limited to infection and may be seen in a variety of noninfectious inflammatory conditions. Rapid breathing and a change in mental status, such as drowsiness, altered sensorium or confusion, may be the earliest findings of sepsis.

Other common findings include: Temperature > 38.3 or < 36°C, Heart rate > 90 bts/min, Respiratory rate > 20 breaths/min, Significant fluid overload, and High blood sugar

Most of the patients with sepsis may have variety of lab findings suggestive of systemic inflammation like leukocytosis (WBC > 12,000 c/mm3) or leukopenia (WBC < 4000 c/mm3) or normal WBC with > 10% immature cells and an elevated CRP.

Patients with bacterial infection will have increased plasma procalcitonin (PCT). PCT is a specific marker of bacterial infections. Normal value of PCT is < 0.25 µg/L. PCT levels in sepsis are generally > 1-2 µg/L and often reach between 10 and 100 µg/L in severe illnesses.

Hemodynamic changes like hypotension and tachycardia are seen in many patients. Arterial hypotension in sepsis is defined as SBP < 90 mmHg and or MAP < 70 mmHg, or an SBP decrease > 40 mmHg in adults.

Findings suggestive of organ dysfunction are seen in many sepsis patients like Arterial hypoxemia (arterial oxygen tension [PaO2] / fraction of inspired oxygen [FiO2] < 300) (Ratio of PaO2 / FiO2 < 300), Acute oliguria (urine output < 0.5 mL/kg/hr for at least 2 hours despite adequate fluid resuscitation), Creatinine > 1.5 mg/dL, Coagulation abnormalities (INR > 1.5 or aPTT > 60 seconds), Thrombocytopenia (platelets < 100,000 cells/mm3) and hyperbilirubinemia (due to liver disorder or hemolysis).

Hyperlactemia (> 1 mmol/L) and lactic acidosis are the key lab findings suggestive of low tissue perfusion, which is one of the most important complications of sepsis induced anaerobic metabolism. Serum lactate level ≥ 4 mmol/L is consistent with severe sepsis. There is some evidence that lactate levels carry prognostic value. Patients with a lactate of > 4 mmol/L had a mortality of 40%, compared with < 15% mortality for patients with a lactate of < 2 mmol/L.

Management of Sepsis in Emergency Department

Diagnosis of septic shock: Hypotension is the most common indicator of tissue hypoperfusion. Hypotension
may not be seen in early phase of sepsis, so other features of hypoperfusion must be looked in early sepsis cases. Common signs of hypoperfusion are cool, vasoconstricted skin due to redirection of blood flow to core internal areas, tachycardia > 90/min, altered behaviour or restlessness, and oliguria or anuria.

Fluid management of septic shock: Crystalloids (Normal saline, Ringer's lactate) are the treatment of choice. An initial bolus of 30 ml/kg crystalloid must be started in ED itself, then start an infusion of 2 litres over 30-60 minutes with target CVP of 8 - 12 cm H2O. 1 litre of crystalloid can expand the plasma volume by 300 ml where as 1 litre of colloid expands the plasma volume by 1000 ml (colloid like starch preparations are not recommended in sepsis patients, but 5% Albumin is a colloid that is safe for fluid resuscitation in severe sepsis). Most of the patients with septic shock requires 1 - 2 Litters of colloid or 4 - 8 L crystalloid to restore the circulatory volume. Colloids (Albumin) are better choice in patients with pulmonary edema.

Noradrenaline: After initial fluid correction, if BP is not improving adequately, patient should be treated with noradrenaline infusion. Noradrenaline infusion should be started at 0.05 to 3.3/kg/min. The combination of noradrenaline and dobutamine gives better outcome in septic shock therapy, especially patient has lactic acidosis.

Steroids: If the patient is in septic shock not responding to above strategies, initiate steroids in a dose of 200 /day of hydrocortisone IV (50 mg every six hours), continued for 5-7 days and tapered slowly depending on clinical response.

Antibiotics: Most appropriate antimicrobial must be started in one hour in ED after appropriate cultures have been obtained.

GOALS OF INITIAL RESUSCITATION (EARLY GOAL-DIRECTED THERAPY) IN FIRST 6 HOURS IN ED

- CVP 8 - 12 mmHg
- Central venous (superior vena cava) or mixed venous oxygen saturation (ScvO2 or SvO2) > 70 or 65%, respectively
- MAP≥65 mmHg
- Urine output ≥0.5 mL/kg/hour or about 30-50 mL/h
- Lowering of the serum lactate to near normal range

CONCLUSION

Sepsis and septicemic shock are major issues in patients admitted through ED. The knowledge about the clinical spectrum and timely interventions of complications are very critical in the management of this type of cases and an emergency physician should have solid grip on fine aspects of this subject for better clinical outcome. Rapid initiation of simple, timely interventions, including intravenous fluids, noradrenaline, steroids and antimicrobials, can reduce the risk of death by half. Early and effective management of sepsis in ED is cost effective, and reduces the number of hospital and ICU days for patients. Unfortunately, sepsis is still often overlooked and recognized too late.

ED – Emergency department, CVP- Central venous pressure, BP–Blood pressure, SBP – Systolic blood pressure, MAP – Mean arterial pressure, INR- International normalized ratio for a prothrombin time, aPTT - activated partial thromboplastin time.

REFERENCES:


