ANESTHETIC IMPLICATIONS OF SEPSIS

Essay

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Abstract

Sepsis is a complex syndrome that is difficult to define, diagnose, and treat. It is a range of clinical conditions caused by the body's response to an infection. Systemic inflammatory response syndrome (SIRS) is the body response to a variety of clinical insults. In some septic patients immediate surgery is lifesaving, but resuscitation should be continued during anesthesia. Treatment of SIRS and multiorgan failure depends on , support of respiratory function, supplemental oxygen, mechanical ventilation, and volume infusion. Treatment beyond these supportive measures includes a combination of several antibiotics, removal or drainage of infected foci, treatment of complications, and pharmacologic interventions to prevent further harmful host responses.

Key Words: Sepsis is a complex syndrome-Systemic inflammatory response syndrome- Surgical drainage of abscess cavities- Septic shock- Multiorgen failure- Types of shock.

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List of Abbreviations

ACCP/SCCM:	American College of Chest Physicians/Society of Critical Care Medicine.
ACTH:	Adrenochronotrophic hormone
APACHE:	Acute physiology and chronic health evaluation
APC:	Activated protein C
ARDS:	Acute respiratory distress syndrome
ATN:	Acute tubular necrosis
BP:	Blood pressure
CO:	Cardiac output
COPD:	Chronic obstructive pulmonary disease
CRP:	C-reactive protein
CT:	Computed tomography
CVP:	Central venous pressure
CVVH:	Contiuous veno-venous hemofiltration
DIC:	Disseminated intravascular coagulation
DVT:	Deep venous thrombosis
ECG:	Electrocardiography
EEG:	Electroencephalography
EGDT:	Early goal directed therapy
ICU:	Intensive care unit
IL-1:	Interleukin-1
LMWH:	Low molecular weight heparin
LPS:	Lipopolysaccharide
MAP:	Mean arterial blood pressure
MI:	Myocardial infarction

MMDS:	Mitochondrial distress syndrome
MODS:	Multiple organ system failure
OPSI:	Overwhelming postsplenectomy infection
PAOP:	Pulmonary artery occlusive pressure
PCT:	Procalcitonin
PE:	Pulmonary embolism
PEEP:	Positive end expiratory pressure
PMNs:	Polymorphonuclear leukocytes
PPV:	Positive pressure ventilation
rhAPC:	Recombinant human activated protein
RV:	Right ventricle
SIRS:	Systemic inflammatory response syndrome
SPO2:	Oxygen saturation
SVR:	Systemic vascular resistance
TNF:	Tumor necrosis factor
TNF-a:	Tumor necrosis factor alpha
TPN:	Total parentral nutrition
UFH:	Unfractionated heparin
UTI:	Urinary tract infection

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Introduction

SEPSIS is a complex syndrome that is difficult to define, diagnose and treat, it is a range of clinical conditions caused by body systemic response to an infection,which if it develops in to severe sepsis,is accompanied by single or multiple organ dysfunction or failure leading to death.**(1)**.

When two or more of systemic inflammatory response syndrome criteria are met within evidence of infection,(e.g.pancreatitis).Crush patients may be diagnosed simply with SIRS.Patients with SIRS and acute organ dysfunction may be termed(Severe SIRS).Patients are defined as having(Severe sepsis) if they have sepsis plus signs of systemic hypoperfusion; either end-organ dysfunction or serum lactate greater than 4 mmol per dl.**(2)**

The most frequently cited categorization divides shock into three types. Hyperdynamic, cardiogenic, obstructive and hypovolemic. A patient with septic shock initially may present in a classic compensated high cardiac output (CO), low systemic vascular resistance (SVR) state . If this same septic patient's mechanisms of compensation fails , CO may decrease, SVR may increase, and the patient will no longer exhibit the classic picture diagnosed and treated rapidly before the physician considers other causes of shock. (3)

The time taken to improve a patient condition before surgery must be balanced against the urgency to surgically treat the underlying problems. Recent studies have shown the outcome from surgery in these high risk patients is improved if the patient condition is optimized preoperatively. When surgery can be delayed (even for a few hours), attempts should be made to resuscitate the patient to insure adequate oxygen delivery, cardiac output, and blood pressure. This is easiest done in theatre, recovery, or ICU. In a few patients immediate surgery is lifesaving and should be carried out as soon as practical. In these patients preparation time is limited, but initial resuscitation (airway, breathing, and circulation) should be completed during anesthesia. **(4)**

MODS is the presence of altered organ function in a patient who is acutely ill such as homeostasis cannot be maintained without intervention. May be at least one or more organ dysfunction.

Aim of the work

- Definitions of sepsis and related syndromes (SIRS, septic shock, MODS, bacteriemia and inflammation).
- Pathogenesis and diagnosis of SIRS.
- Pathphysiology and diagnosis of MODS.
- Classification of shock.
- Perioperative management of patient in sepsis and septic shock.
- Treatment of SIRS and MODS
- Early goal directed therapy for management of sepsis.

Sepsis and related syndromes

Sepsis is a complex syndrome that is difficult to define, diagnose and treat. It is a range of clinical conditions caused by the body's systemic response to an infection, which if it develops in to severe sepsis, is accompanied by single or multiple organ dysfunction or failure leading to death [(1)].

Definitions:

Bacteremia:

Is the presence of viable bacteria in the blood.

Infection:

Is a microbial phenomenon in which an inflammatory response to the presence of microorganisms or the invasion of normally sterile host tissue by these organisms is characteristic.

Systemic inflammatory response syndrome (SIRS):

SIRS is defined as two or more of the following variables:

- Tempreture of more than 38˚C or less than 36˚C .
- Heart rate of more than 90 beats per minute.
- Respiratory rate of more than 20 breath per minute or a PaCO2 level of less than 32mmHg.
- Abnormal white blood cell count(> 12,000/uL or < 4000/uL).

When two or more of systemic inflammatory response syndrome criteria are met without evidence of infection, (e.g pancreatitis), crush patients may be diagnosed simply with SIRS [(2)].

Severe sepsis :

Is sepsis plus at least one of the following signs of organ hypoperfusion or dysfunction. Areas of mottled skin, capillary refilling requires three seconds or longer, urine output <0.5 mL/kg for at least one hour, or renal replacement therapy, Lactate >2 mmol/L, abrupt change in mental status, abnormal electroencephalographic (EEG) findings, platelet count <100,000 platelets/mL, disseminated intravascular coagulation, acute lung injury or acute respiratory distress syndrome (ARDS),and cardiac dysfunction, as defined by echocardiography or direct measurement of the cardiac index [(5)].

Septic shock:

Is severe sepsis plus one or more of the following: Systemic mean blood pressure is <60 mmHg (or <80 mmHg if the patient has baseline hypertension) despite adequate fluid resuscitation. Maintaining the systemic mean blood pressure >60 mmHg (or >80 mmHg if the patient has baseline hypertension) requires dopamine >5 mcg/kg per min, norepinephrine <0.25 mcg/kg per min, or epinephrine <0.25 mcg/kg per min despite adequate fluid resuscitation.

Adequate fluid resuscitation is defined as infusion of 20 to 30 mL/kg of starch, infusion of 40 to 60 mL/kg of saline solution, or a measured pulmonary capillary wedge pressure (PCWP) of 12 to 20 mmHg.Septic shock is one type of vasodilatory or distributive shock. It results from a marked reduction in

systemic vascular resistance, often associated with an increase in cardiac output[6].

Refractory septic shock :

It exists if maintaining the systemic mean blood pressure >60 mmHg (or >80 mmHg if the patient has baseline hypertension) requires dopamine >15 mcg/kg per min, norepinephrine >0.25 mcg/kg per min, or epinephrine >0.25 mcg/kg per min despite adequate fluid resuscitation [7].

Multiorgan system failure (MODS) :

Is the presence of altered organ function in a patient who is acutely ill such that homeostasis cannot be maintained without intervention. Primary MODS is the direct result of a well-defined insult in which organ dysfunction occur early and can be directly attributable to the insult itself. Secondary MODS develops as a consequence of a host response and is identified within the context of SIRS. The inflammatory response of the body to toxins and other components of microorganisms causes the clinical manifestations of sepsis [8].

Bacteremia and inflammation:

Bacteremia is the presence of bacteria within the blood stream, but this condition does not always lead to SIRS or sepsis. Sepsis is the systemic response to infection and is defined as the presence of SIRS in addition to a documented or presumed infection as shown in **(figure 1).** Severe sepsis meets the mentioned criteria and is associated with organ dysfunction, hypoperfusion, or hypotension. Sepsis-induced hypotension is defined as "the presence of a systolic blood pressure of less than 90 mm Hg or a reduction of more than 40 mm Hg from baseline in the absence of other causes of hypotension." Patients

meet the criteria for septic shock if they have persistent hypotension and perfusion abnormalities despite adequate fluid resuscitation. Mutiorgan system failure as shown in **(figure 1)** is a state of physiological derangements in which organ function is not capable of maintaining homeostasis [(9)].

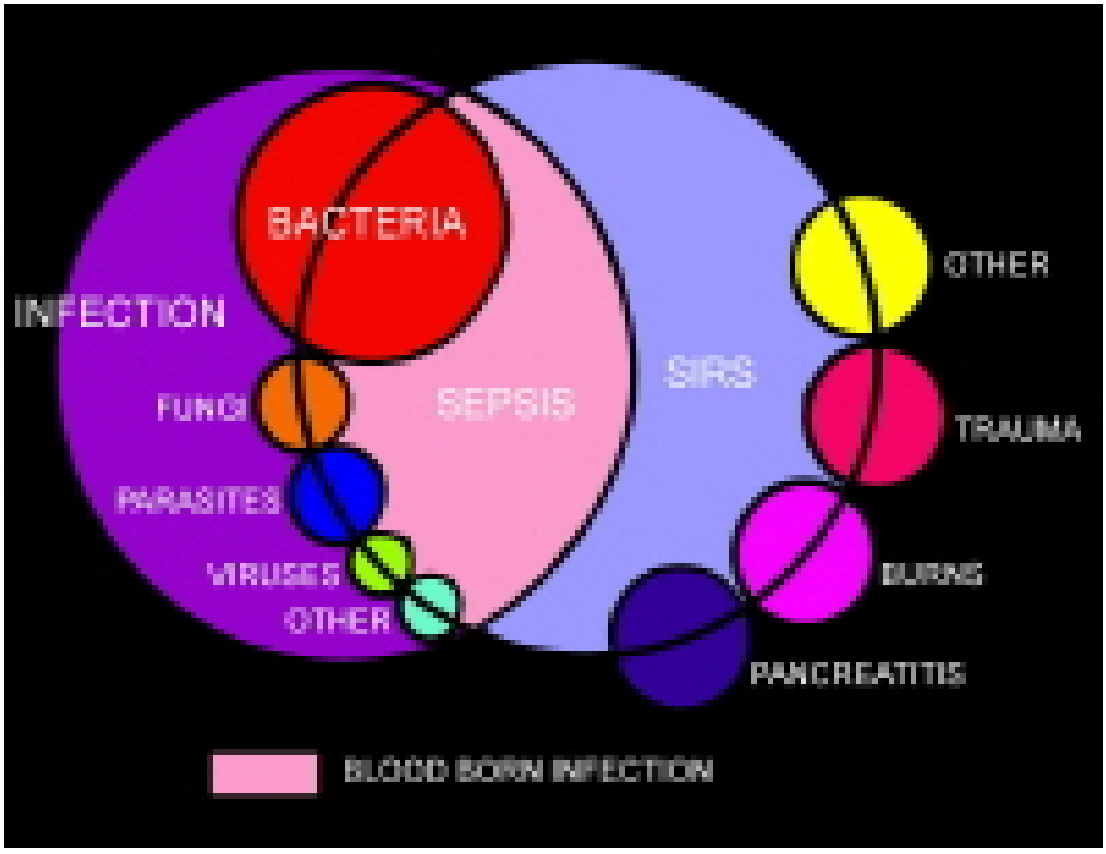

Fig.(1):Venn diagram showing overlap of infection, bacteremia, sepsis, systemic inflammatory response syndrome (SIRS), and multiorgan dysfunction [(5)]

The outcome of sepsis due to serious infection has a number of determinants, including defense mechanisms, the environment, and the specific bacteria involved been associated with blood stream infections due to *Candida specie* and Pseudomonas organisms also contribute to morbidity; for example, infections with *Candida species*, *P pneumoniae*, *Enterobacter*, and *Serratia marcescens* are predictors of the clinical parameters [(9)].