

Chapter 5: Sepsis

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Introduction

Sepsis and its consequence are the bread and butter of intensive care medicine and management of it is time critical. This chapter will discuss the definitions, signs, symptoms, investigation and management of this condition.

Definitions

In the ICU, we are generally only involved in patients with severe sepsis and those in septic shock. In February 2016, the surviving sepsis guidelines changed their definitions for sepsis.

Old definitions

This is included for your reference (1).

- **Bacteraemia:** the presence of bacteria within the bloodstream
- **Sepsis:** The presence of bacteria within the bloodstream with systemic inflammatory response syndrome (SIRS)
- **SIRS (systemic inflammatory response syndrome):** Syndrome which includes
 - Temperature >38.3C or <36C
 - Heart rate > 90beats/min
 - Tachypnea
 - WCC > 12, <4
- **Severe sepsis:** Sepsis with evidence of organ hypoperfusion, such as
 - Altered mental state
 - Acute renal impairment
 - Peripherally shutdown, decreased capillary refill
 - Ileus
 - Haematological derangements
 - Liver dysfunction
- **Septic shock:** Sepsis with hypotension despite adequate fluid resuscitation

2016 Definitions

The expert consensus (2) is that sepsis be defined as “life-threatening organ dysfunction caused by a dysregulated host response to infection”. Organ dysfunction is defined as increased in 2 or more points of the SOFA score (Sequential Organ Failure Assessment score).

The SOFA score is based on PaO₂, mechanical ventilation, FiO₂, platelets, bilirubin, GCS, MAP and used of pressors, creatinine, and urine output.

The new definition move away from SIRS, as there are too many other causes of SIRS other than sepsis. They have also moved away from a definitive microbial diagnosis to clinical suspicion of infection. This is to increase sensitivity of identification and treatment of patients at risk of sepsis related death.

Resuscitation

Remember that the first line therapy of all critically unwell patients is to ensure ABCs. Once this is established, you will have time to consider further assessment and therapies.

Clinical signs and symptoms

The general symptoms of sepsis are that of SIRS, with systemic symptoms of tachycardia, tachypnoea, and pyrexia. Depending on the severity, organ function and hypotension may also be present. Sepsis is the syndrome, not the diagnosis. A careful assessment of the patient is needed to:

- Find the source of infection
- Rule out differential diagnosis

Source of infection

This is important, as key to the management of sepsis is source control and appropriate antibiotics. An infection can occur in almost anywhere in the body, but common sources include genitourinary, gastrointestinal, lung, brain, soft tissue, joints and bone.

Salient information from history and examination

- History of symptoms and duration
- Comorbidities, in particular immunosuppression e.g. chemo, HIV status, immunosuppressant therapy
- Contact history, e.g. travel history, frequent/recent hospital admissions
- Head to toe examination, especially if source is unclear

Differential diagnosis

There are many diagnosis that mimics sepsis. Remember that sepsis is SIRS with infection, but that SIRS can occur in a variety of non-infective conditions.

- Pulmonary embolus
- Primary hyperthermia
- Myocardial infarction
- Endocrine
 - DKA/HONK
 - Thyrotoxic storm
 - Adrenal insufficiency
- Malignancy

- Pancreatitis
- Vasculitis/inflammatory conditions
- Anaphylaxis
- Haemorrhage

Investigations

The investigations are classed into 3 groups. Diagnosing source, diagnosing infection/SIRS, and those that look at organ function (also a marker of severity).

Diagnosing septic source

- Cultures
 - Sputum
 - Urine
 - Blood
 - Pus swabs
 - Lumbar puncture
- PCR/antigens/serology
- Imaging
 - X rays
 - USS
 - CT-scan
 - MRI
 - Bone scans
 - Echocardiogram

Diagnosing sepsis, SIRS

- WCC, Platelets
- CRP
- Procalcitonin (3) (specific to sepsis)

Organ perfusion and function markers

- renal function
- liver function
- coagulation
- Lactatic acid (4)
- ABG

Management

As mentioned, the first and foremost management should be the ABCs. While any of ABCs can be compromised, the most common initial problem is that of circulation. Hence the usual management pathway is:

1. IV fluid therapy. This is because it is an easy method of maintaining blood pressure and organ perfusion by expanding the extracellular fluid. It is also very likely that patients with severe sepsis will have reduced intravascular volume due to:
 - Dehydration due to reduced intake
 - 3rd spacing, which means leaking of the intravascular fluid into the extracellular space due to increase in capillary permeability (i.e. capillary leak)

Either crystalloid or albumin 4% can be used, and there is no evidence that either is better. (5)

2. Early IV antibiotics (6). The key points in antibiotics include:
 - **Selection:** The right antibiotics should be given at the earliest time possible. Give the antibiotics which will mostly likely to cover the organs that you think are involved. There is recommendations by infectious diseases on the intranet. If the source is unknown, broad spectrum antibiotics should be given. Consideration in antibiotic selection should also take into account whether the patient has immunosuppression, travel history, recent/recurrent hospital admissions in which atypical organisms needs to be covered.
 - **Right dose:** Patients are likely to have organ dysfunction, in particular renal and sometimes hepatic dysfunction. In these instances, a dose reduction is required. On the other hand, a dose may need to be increased in order to achieve adequate antibiotic concentrations within the organ of interest (e.g. high dose in meningitis, where the drug need to cross the blood brain barrier).
3. Source control. This is treating the underlying cause. Some infections can be treated with antibiotics alone, but in the ICU population, many of them require an intervention to achieve this. Example of those includes laparotomy and percutaneous radiological procedures (7).
4. Organ support
 - Cardiovascular: Shock despite adequate fluid resuscitation would require the use of vasopressors and inotropes. In septic shock, the most common form is distributive shock earlier on, with vasodilation. Hence the most appropriate therapy is the use of vasopressors. The first line therapy is usually noradrenaline. In late shock, septic cardiomyopathy can occur and some have advocated for the use of inotropes as well.
 - Respiratory: Lung failure may occur in the form of acute respiratory distress syndrome (ARDS) which essentially is the inflammation of the lungs. This is manifested in the form of hypoxic and require intubation and mechanical ventilation.
 - Renal: Acute renal impairment may resolve with fluid therapy and inotropic support. However, renal replacement maybe required.
 - Nutritional and GI: Nasogastrics are usually placed early with feeding commenced with 24-48hrs unless there is a contraindication. Gastric stasis is common and hence prokinetics are often required in the form of

metocloperamide and erythromycin. In a mechanical ventilated patient that is starved, Omeprazole is often given as a GI bleed prophylaxis.

- Endocrine: Hyperglycaemia is common, but tight control can be harmful (8). Insulin therapy is given to aim for blood sugar less than 11 mmol/L.
- Haematological: Patient with sepsis may have coagulopathy and prolonged INR and APTT but they are actually prothrombotic due to their inflammatory state. Mechanical DVT prophylaxis is applied, but once platelets and coagulation starts to improve, LMWH is started.

References

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