

Lecture 4

Sepsis and Septic Shock

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Sepsis is infection with systemic manifestations(Box1) .

Severe sepsis is when sepsis induces significant organ dysfunction or tissue hypoperfusion(Box2) .

Septic shock is when there is induced hypotension that persists despite adequate fluid resuscitation.

Systemic inflammatory response syndrome(SIRS) is a syndrome of two or more of the general variables shown in(Box1) .

It does not mean the patient is septic.

* sepsis can be defined as ' ,SIRS with evidence of infection.



SEPSIS STEPS

SIRS

T: >100.4 F
< 96.8 F
RR: >20
HR: >90
WBC: >12,000
<4,000
>10% bands
PCO2 < 32 mmHg

SEPSIS

2 SIRS

+

Confirmed
or suspected
infection

SEVERE SEPSIS

Sepsis +

Signs of End
Organ Damage

Hypotension
(SBP <90)

Lactate >4 mmol

SEPTIC SHOCK

Severe Sepsis
with persistent:

Signs of End
Organ Damage

Hypotension
(SBP <90)

Lactate >4 mmol



Box 1

Systemic manifestations associated with sepsis

General variables

- Core temperature $>38.3^{\circ}\text{C}$ or $<36^{\circ}\text{C}$
- Heart rate >90 bpm
- Tachypnoea (may not feel respiratory distress but a rate >30 pm)
- Significant oedema or positive fluid balance (>20 ml/kg over 24 hours)
- Hyperglycaemia-plasma glucose >7.7 mmol l $^{-1}$. Diabetics are higher risk

Inflammatory variables

- Leucocytosis (WBC count $>12,000$ μl^{-1})
- Leukopenia (WBC count <4000 μl^{-1})
- Plasma C-reactive protein: 2 SD above the normal value
- Plasma procalcitonin: 2 SD above the normal value (not routine in all hospitals)



Haemodynamic variables

- Arterial hypotension: SBP <90 mmHg; MAP <65 mmHg

Organ dysfunction variables

- Arterial hypoxaemia: SaO_2 <93% on air or ($\text{PaO}_2/\text{FiO}_2$ <300)
- Acute oliguria: urine output <0.5 ml/Kg/hr or <45 ml in 2 hours, despite fluid resuscitation
- Creatinine increase: $>44 \mu\text{mol l}^{-1}$ in 24 hours
- Coagulation abnormalities: INR >1.5 or APTT >60 seconds
- Ileus (absent bowel sounds)
- Thrombocytopenia: platelet count $<100,000 \mu\text{l}^{-1}$
- Hyperbilirubinaemia: plasma total bilirubin $>34 \mu\text{mol l}^{-1}$
- Hyperlactatemia $>4 \text{ mmol l}^{-1}$
- Decreased capillary refill

WBC, white blood cell; SBP, systolic blood pressure; MAP, mean arterial blood pressure



Box 2

Signs of organ dysfunction associated with severe sepsis

- Sepsis-induced hypotension
- Lactate greater than 4 mmol l^{-1}
- Urine output $<0.5 \text{ ml/kg/hr}$ for >2 hours, despite fluid resuscitation
- ALI with $\text{PaO}_2/\text{FiO}_2 < 250$ in the absence of pneumonia as infection source
- ALI with $\text{PaO}_2/\text{FiO}_2 < 200$ in the presence of pneumonia as infection source
- Creatinine $>176 \text{ mmol l}^{-1}$
- Bilirubin $>34 \text{ mmol l}^{-1}$
- Platelet count $<100,000 \mu\text{l}^{-1}$
- Coagulopathy INR >1.5

ALI, acute lung injury; INR, international normalized ratio.



RISK FACTORS for SEPTIC SHOCK

SUPPRESSED IMMUNE SYSTEM



EXTREME AGE (INFANTS or ELDERLY)



PROCURED ORGAN (TRANSPLANT)



SURGICAL PROCEDURE



INDWELLING DEVICES

SICKNESS



Clinical Signs

The clinical features of shock relate to a critically inadequate circulation and insufficient O₂ delivery and/or utilization.

1] Hypotension is a sentinel feature of shock and signifies circulatory failure.

2] Tachycardia is an early compensatory sign of shock.

3] Oliguria is secondary to reduced glomerular filtration and increased filtrate reabsorption.

4] Altered mental status is a common feature of shock as cerebral function is very sensitive to altered O₂ delivery.

5] Cool, clammy peripheries with pale or mottled skin are suggestive of hypovolemic or cardiogenic shock.

*** warm peripheries are suggestive of distributive shock.**



Management

Resuscitation of shock is a medical emergency.

_ The aim of therapy is to rapidly and effectively restore systemic DO₂ and improve tissue perfusion.

_ History ,examination and investigation must occur concurrently with resuscitation.

_The usual resuscitation principles of airway ,breathing ,circulation are apply.

The principles of management of shock are:

1. Supply O₂
2. Vascular access
3. Volume resuscitation
- 4 . Vasoactive agents
5. Manage precipitating illness or injury
6. Monitoring.



Monitoring

- _ Clinical monitoring involves frequent assessment of heart rate ,blood pressure ,respiratory rate ,conscious state ,urine output ,peripheral perfusion and temperature.
- _ An arterial cannula provides beat-to-beat measurement of systemic pressure and is particularly useful for measuring blood pressure when clinical techniques become difficult and unreliable.
- _ Arterial cannula also allows ready sampling for blood gas and lactate measurement.
- _ A central venous cannula allows measurement of central venous pressure (CVP) which is often used as an estimate of venous volume ,and preload.



_ CVP bears a variable relationship to venous volume ,as it is dependent on location of the catheter to the right atrium ,intrathoracic pressures ,venous compliance ,position of the patient and tricuspid valve competence.

_ CVP is a guide to the pressure status of the venous system rather than a measure of intravascular volume and preload.

_ CVP correlates poorly with fluid response to shock.

_ Echocardiographic assessment of end-diastolic ventricle volume may better a predictor of preload than invasive pressure measurement but the technique is operator -and patient-dependent.



Long-term outcomes and complications

- 1) **Post-sepsis syndrome** :This is a set of physical and emotional symptoms that can last for months or years after recovery.
- 2) **Physical impairment** :Chronic fatigue ,muscle weakness ,and recurring infections are common.
- 3) **Cognitive difficulties** :Sepsis can cause memory loss ,impaired concentration ,and cognitive decline.
- 4) **Mental health issues** :Anxiety ,depression ,and post-traumatic stress disorder(PTSD)are frequently reported.
- 5) **Cardiovascular complications** :Sepsis survivors have an increased risk of future cardiovascular events ,such as heart attack and heart failure.
- 6) **Increased mortality** :Long-term mortality remains high ,with studies reporting persistent high risk years after hospitalization.
- 7) **Readmission to the hospital** :Sepsis survivors often have a higher risk of being readmitted to the hospital in the year following their illness.



Thank
You

