

# *Lecture 4*

## *Sepsis and Septic Shock*

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تعديل من خلال

**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:  $>100.4\text{ F}$   
 $<96.8\text{ F}$   
RR:  $>20$   
HR:  $>90$   
WBC:  $>12,000$   
 $<4,000$   
 $>10\%$  bands  
PCO<sub>2</sub>  $<32\text{ mmHg}$

## SEPSIS

2 SIRS

+

Confirmed  
or suspected  
infection

## SEVERE SEPSIS

Sepsis +  
Signs of End  
Organ Damage  
Hypotension  
(SBP  $<90$ )  
Lactate  $>4\text{ mmol}$

## SEPTIC SHOCK

Severe Sepsis  
with persistent:

Signs of End  
Organ Damage  
Hypotension  
(SBP  $<90$ )  
Lactate  $>4\text{ mmol}$



## Box 1

### Systemic manifestations associated with sepsis

#### General variables

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

#### Inflammatory variables

- Leucocytosis (WBC count  $>12,000 \mu\text{l}^{-1}$ )
- Leukopenia (WBC count  $<4000 \mu\text{l}^{-1}$ )
- 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:  $\text{SaO}_2 <93\%$  on air or  $(\text{PaO}_2/\text{FiO}_2 <300)$
- Acute oliguria: urine output  $<0.5 \text{ ml/Kg/hr}$  or  $<45 \text{ ml}$  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  $>34 \mu\text{mol l}^{-1}$
- Hyperlactataemia  $>4 \text{ mmol l}^{-1}$
- Decreased capillary refill

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



WPS Office مفاجئ

## Box 2

### Signs of organ dysfunction associated with severe sepsis

- Sepsis-induced hypotension
- Lactate greater than  $4 \text{ mmol l}^{-1}$
- 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 O<sub>2</sub> 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 O<sub>2</sub> 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 DO<sub>2</sub> 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 O<sub>2</sub>
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



تسجيل من خلال