Management of the Septic Patient

Liverpool Heart and Chest Hospital NHS
NHS Foundation Trust

SEPSIS

e-LfH e-Learning for Healthcare

NHS Health Education England

ACUMEN The Acute Medicine Network

Inspected and rated Outstanding ☆ CareQuality Commission

Learning Objectives

This module is aimed at clinical staff to increase awareness and confidence in dealing with sepsis.

By the end of this e-learning you will be able to:

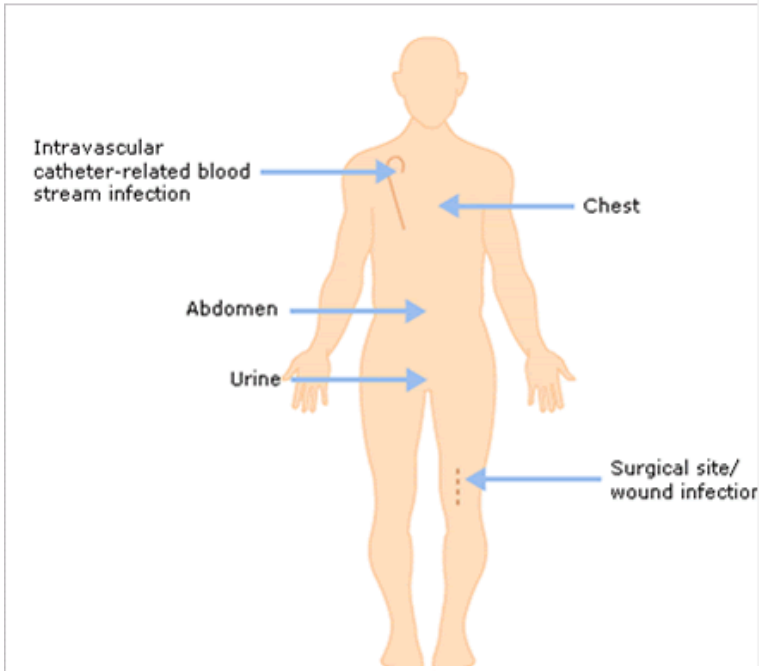
- Describe what sepsis is
- Identify the observations, in the context of infection, that suggest sepsis
- List the risk factors and predispositions to sepsis
- Explain the importance of timely action to prevent deterioration
- Demonstrate the appropriate pathway to correct action

Introduction

Sepsis is a life-threatening complication of an infection when the body's immune defences react in an extreme way. It occurs when the response of the immune system to infection damages the body.

Sepsis can occur as a result of problems spreading from other parts of the body, such as chest infections, urinary infections, ulcers bursting in the stomach, or cuts and bites on the skin.

Sepsis is sometimes referred to as septicaemia or blood poisoning, but strictly speaking septicaemia means invasion of bacteria into the bloodstream, whereas sepsis can affect organs inside the body without blood poisoning.



Sepsis Facts

- Millions of people worldwide die from sepsis
- There are 150,000 cases of sepsis in the UK each year
- Sepsis is responsible for 44,000 deaths each year which is more than deaths from breast, bowel and lung cancer combined.
- Sepsis treatments in the UK have an annual cost of £3 billion
- Each case of sepsis costs approximately £20,000

Data*: The Sepsis Trust*

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Sepsis Definition

Sepsis is a life threatening condition that arises when the body's response to an infection injures its own tissues and organs. Sepsis may lead to shock, multiple organ failure and death especially if not recognised early and treated promptly. Sepsis remains the primary cause of death from infection despite advances in modern medicine, including vaccines, antibiotics and acute care.

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How infections trigger sepsis

The body recognises the presence of harmful bacteria and triggers an immune response

The response is either proportionate e.g. a proportional response to a cut would be local inflammation with swelling, pain and redness

In sepsis-the response is not proportionate…it is systemic. This ‘all-over’ response causes damage to tissues and organs.

Sepsis Risk Factors

- Young (<1 year) and older people (>75 years)or people who are very frail
- Impaired immune systems because of illness or drugs, including:
- Those undergoing chemotherapy treatment for cancer
- People with impaired immune function (e.g. diabetics, post splenectomy or sickle cell disease)
- Use of long-term steroids
- Having an artificial (prosthetic) joint or heart valve or certain heart valve abnormalities
- Those taking immunosuppressant drugs to treat disorders such as rheumatoid arthritis
- People who have had surgery, or other invasive procedures, in the past 6 weeks
- Any breach of skin integrity (for example, cuts, burns, blisters or skin infections)
- Intravenous drug users
- People with indwelling lines or catheters.
- Women who have recently given birth or had a termination of pregnancy or miscarriage in the past 6 weeks

Sepsis New Information

- New definitions – NICE guidelines 2016 www.nice.org.uk/guidance/ng51
- **Non Life Threatening Infection –** Infection without evidence of organ dysfunction (e.g pneumonia with pyrexia and high WCC)
- **Sepsis** - a life-threatening organ dysfunction due to a dysregulated host response to infection or more simply SIRS (Systemic Inflammatory response syndrome)in the presence of proven or suspected infection
- **Septic shock** - a persisting hypotension requiring vasopressors to maintain a mean arterial pressure (MAP) of 65 mmHg or more and having a serum lactate level of greater than 2 mmol/l despite adequate volume resuscitation or more simply an infection associated with hypotension, hypo perfusion and/or organ-dysfunction
- **The term Severe Sepsis is no longer used**

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SIRS (Systemic Inflammatory Response Syndrome) IS NOT SEPSIS

SIRS is defined as two or more of the following:

Temperature	>38.5ºC or <35ºC
Heart rate (HR)	>90 beats/min
Respiratory rate (RR)	>20 breaths/min or PaCO2 <32 mmHg (4.3 kPa)
White blood cells (WBC)	>12 000 cells/mm3 (12 x 109/L), <4000 cells/mm3 (4 x 109/L)
Blood glucose	>7.7 mmol/L (in the absence of diabetes)

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Infection + Organ Dysfunction = SEPSIS

- Consider sepsis in any patient who looks unwell
- Screen for Sepsis Using LHCH Sepsis Screening Tool
- If Screening Tool identifies High Risk for Sepsis – Treat within one hour
- Patients with High Risk Sepsis have 10% mortality (higher than STEMI 8.1%)
- Early appropriate treatment Saves Lives

Does the patient have a MEWS of > 3 or look unwell?

Do you suspect an infection?

YES	NO
Potential source of infection: *Choose one or more* • Chest • UTI • Intraabdominal or abdominal pain • Wound or new skin signs • Indwelling device Other: *Please specify*	Re-assess in an hour and consider risk factors for Sepsis: • > 75y old • Immunosuppression, Steroids, Methotrexate • Surgery or procedure with 6 weeks • Diabetes • Indwelling devices • Prosthetic valve

LHCH Sepsis Pathway

Sepsis Risk Stratification

System	High Risk	High to Moderate Risk	Low Risk
History	Altered mental state	Deterioration in functional ability Impaired immunity e.g Steroids Trauma, Surgery, Procedure 6 weeks	Normal behaviour
Respiratory	RR ≥ 25 New need for O2 ≥ 40% to keep Sats ≥ 92% or ≥ 88% in COPD	RR 21 - 24 /min	No High Risk or Moderate to High Risk criteria met
CVS	Systolic BP 90mmHg or less OR 40mmHg below admission value HR > 130 / min HR	Systolic BP 90 - 100mmHg 90 - 130 / min	No High Risk or Moderate to High Risk criteria met
Renal	Not passed Urine for 18h OR U.O < 0.5ml/kg/h	Not passed Urine for 12 - 18h OR U.O 0.5 - 1 ml/kg/h	No High Risk or Moderate to High Risk criteria met
Temperature		Temperature < 36°C	
Skin	Mottled, cyanosis or non blanching rash	Wound redness / swelling / discharge Wound breakdown	No High Risk or Moderate to High Risk criteria met

LHCH Sepsis Pathway

Management			
	If meets 1 or more criteria	If meets 2 or more criteria	
Personnel	*Urgent* - Senior Clinical Decision maker	Clinical review within 1 hour	Re-assess as necessary
Investigations	Venous or Arterial blood samples for: • Blood gas including lactate • Blood Cultures • FBC, CRP, U&Es and Clottings	Venous blood samples for: • Blood gas including lactate • Blood Cultures • FBC, CRP, U&Es and Clottings	
Treatment	*Urgent* - Give Broad Spectrum Antibiotics Within 1h of diagnosis - Use Sepsis Bundle Order Set	Clinician to decide on need for targeted antibiotics	
Blood Pressure Management			
SBP < 90mmHg OR Lactate 2-4mmo/L	Give Crystalloid Fluid Bolus 500ml if < 70kg 1L > 70kg	Give Crystalloid Fluid Bolus 500ml if < 70kg 1L > 70kg	
Lactate < 2mmol/L	consider fluid bolus as above	Give Crystalloid Fluid Bolus 500ml if < 70kg 1L > 70kg	
Further Care	Urgent referral to Critical Care	Re-assess in an hour, if no improvement refer critical care	

Recognising the Septic Patient
Clinical Features

Hypotension

Absolute (SBP <90 mmHg) or relative (drop in SBP >40 mmHg)
Postural hypotension is an early sign (drop in SBP >20 mmHg or DBP >10 mmHg after 2-5 minutes of standing from the lying position)

(SBP/DBP – systolic/diastolic blood pressure)

Flushed hyperaemic skin

Seen in early septic shock due to a hyperdynamic circulatory state

Signs of poor end-organ perfusion

Oliguria (urine output <0.5 mL/kg/h)
Poor skin turgor
Dry mucous membranes
Decreased capillary refill (>2 seconds)
Change in mental status (may progress from agitation to confusion and coma)
Cool, clammy skin

The Golden Hour: The Sepsis Six

- High flow oxygen
- Blood Cultures
- Antibiotics
- Lactate
- IV Fluids
- Urine Output

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Disorders that mimic sepsis include:

- Acute myocardial infarction (cardiogenic shock)
- Acute pulmonary embolus
- Acute pancreatitis (distributive shock)
- Fat embolism
- Acute adrenal insufficiency (Addisonian crisis)
- Acute gastrointestinal haemorrhage (hypovolaemic shock)
- Transfusion reactions
- Adverse drug reactions (anaphylactic shock)

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SEPSIS KILLS

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Apply the ABCDE method for immediate assessment and management.

A – Airway

- Administer high flow oxygen to patients
- Monitor oxygenation continuously with pulse oximetry
- Assess airway patency and level of consciousness
- Is the airway protected?
- If not, consider securing the airway (airway devices including endotracheal intubation)

B – Breathing

- Assess work of breathing
  - Respiratory Rate
  - Use of accessory muscles of respiration
  - Consider respiratory support (non-invasive or invasive mechanical ventilation; discuss with senior clinician)

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C – Circulation

- Assess perfusion
  - BP (young patients may compensate well and be normotensive at presentation; diastolic BP falls first)
  - Pulse rate (elderly patients and those on beta-blockers may not have a tachycardia)
  - Nature of the pulse (early – bounding pulse / late – weak thread pulse)
  - Capillary refill time
  - Skin turgor
  - Hydration of mucus membranes
  - Monitor urine output
- Initial fluid resuscitation
  - Boluses to a volume of 20–60 mL/kg (deliver in aliquots of 1 L of crystalloid or 500 mL of colloid over <30 min)
  - Monitor response frequently

D – Disability

- Assess level of consciousness - AVPU or GCS
- Monitor blood glucose levels

E - Environment and exposure

- Monitor temperature
- Expose the patient: look for rash

Obtain relevant history from the patient or relatives (in unconscious patients) to assist in establishing a diagnosis of the cause of the sepsis.

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The Golden Hour: The Sepsis Six

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Medical Management

After your initial assessment and management, carry out a secondary, systemic examination.

Your systemic examination should include:

- Neurology
- Cardiovascular
- Respiratory
- Abdominal
- Gynaecology

Signs of occult or unusual infection, such as biliary sepsis, endocarditis or deep tissue infection (i.e. discitis) should be looked for.

Management Investigations

Investigations for sepsis include:

Haematology

- Full blood count
- Coagulation screen

Biochemistry

- Renal function tests
- Liver function tests
- Thyroid function tests
- Amylase
- Creatinine kinase (if rhabdomyolysis is suspected)

Arterial blood gas

- Oxygenation (PO2) and ventilation (PCO2)
- Acid-base status (HCO3, base excess and lactate)

Electrocardiogram

To exclude cardiac causes of hypotension and identify associated arrhythmias

Chest radiograph

To confirm clinical findings or identify underlying lung disease

Microbiological cultures

- Blood
- Urine
- Sputum
- Cerebrospinal fluid
- Stool
- Nasopharyngeal swabs
- Wound swabs
- High vaginal swabs

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Management Sepsis Six

Ensure that the 'Sepsis Six' are implemented within 1 hour of presentation

1. Deliver high flow oxygen

2. Take microbiological cultures (blood, urine, other) and consider source control

3. Administer empirical IV antibiotics

4. Measure serum lactate

5. Start IV fluid resuscitation

6. Monitor accurate urine output measurements

Additionally:

Aim to identify the source of infection and drain within 6 hours if an appropriate collection is identified, e.g. peri-anal abscess

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Management Early Goal-directed Therapy

Early goal-directed therapy improves outcomes for patients who remain hypotensive or who have persistently raised lactate levels (>4 mmol/L) despite initial fluid resuscitation.

Such cases require the insertion of a central venous catheter and monitoring of the CVP. Insertion of a central venous line should be performed in an appropriate setting by skilled personnel. This setting will vary between different units but will usually be in A&E resuscitation areas, high-dependency medical units or intensive care units.

Treatment

Give fluid challenges to achieve a target CVP of >8 mmHg (>12 mmHg in ventilated patients)

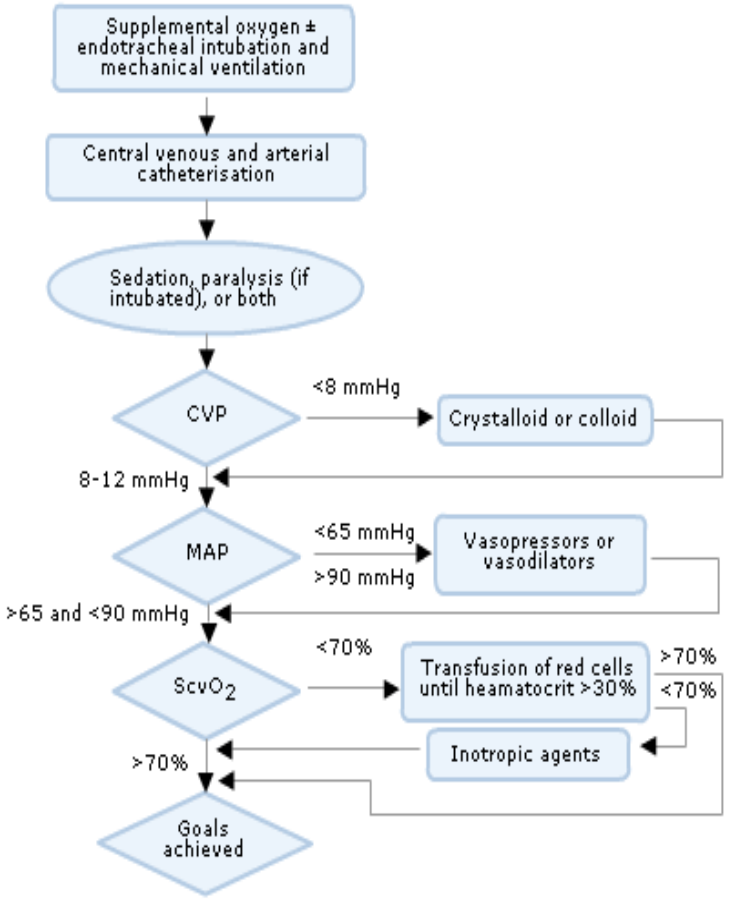
- Monitor for clinical signs of fluid overload

If the patient remains hypotensive, start an infusion of noradrenaline to achieve a target SBP >90 mmHg or mean arterial pressure (MAP) >65 mmHg

(In most cases this will require admission to the intensive care unit, as continuous monitoring and expert knowledge is required.)

Measure central venous oxygen saturation (ScvO2)

- If ScvO2 <70% and Hb <7 g/dl, administer blood transfusion
- If ScvO2 <70% and Hb >7 g/dl, start infusion of dobutamine (5 g/kg/min)



Management Vasopressors

Vasopressors are useful when the patient no longer maintains perfusion pressures despite adequate fluid resuscitation. There is no evidence that one vasopressor is better than another, but most centres favour using noradrenaline as a first-line treatment

Treatment

The Surviving Sepsis Campaign recommends either noradrenaline or dopamine as first-line. Dopamine should not be used for renal protection

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Management IV Fluids

There is no evidence to support the use of crystalloids rather than colloids, or vice versa; the important factor is that patients receive appropriate amounts of fluid. Crystalloids are generally preferred due to their lower cost and safety profile. Of the crystalloids, Ringer's lactate or Hartmann's solution tend to be used mostly, as they avoid the hyperchloraemic metabolic acidosis seen when large volumes of sodium chloride 0.9% are used

Colloids have the advantage of giving greater volume expansion for less fluid administered, but they are expensive and have been associated with renal dysfunction and increased risk of harm

Bicarbonate is not recommended for the purpose of improving haemodynamics or reducing vasopressor requirements in septic patients

Treatment

Fluid challenges should be administered rapidly and in defined aliquots (500 mL – 1 L). Importantly, volume status and perfusion should be assessed before and after each fluid bolus. When the circulatory system is no longer responsive to fluid challenges, or the patient develops pulmonary oedema, then vasopressor support should be considered.

Management Corticosteroids

Initial trials suggested a survival benefit when steroids were used within 8 hours in the treatment of patients with severe septic shock. Later, the larger CORTICUS study did not demonstrate any improvement in 28-day mortality with steroid use, but did show faster reversal of shock in the hydrocortisone group.

However, this latter trial recruited less severely ill patients within 72 hours, so direct comparison between the two trials cannot be easily made.

Treatment

The Surviving Sepsis Campaign guidelines recommend that IV hydrocortisone (preferred instead of dexamethasone) should be considered only for adult patients with severe septic shock, when hypotension is unresponsive to adequate fluid resuscitation and vasopressors.

It is also recommended that steroid therapy may be weaned once vasopressors are no longer required and the dose of hydrocortisone should be <300 mg/day. The recommended dose of hydrocortisone is 200–300 mg/day for 7 days, in three or four divided doses or by continuous infusion.

Management Glucose Control

Hyperglycaemia in septic patients is associated with poor outcomes

Treatment

The Surviving Sepsis Campaign guidelines recommend IV insulin to control hyperglycaemia in patients admitted to intensive care, aiming for a blood glucose level of less than 8.3 mmol/L. The blood glucose should be monitored every 1-2 hours until stable, then 4 hourly.

The largest trial looking at glycaemic control in critically ill patients was the NICE-SUGAR trial; it demonstrated that intensive insulin therapy associated with tight glycaemic control was associated with a higher incidence of severe hypoglycaemia and increased 90-day mortality.

Most centres will now aim for a blood glucose target of 7.7-10 mmol/L instead of tighter glycaemic control (4.4-6.1 mmol/L).

Septic patients are in a pro-thrombotic and anti-fibrinolytic state. This puts them at risk of deep vein thrombosis (DVT) and thromboembolism.

Treatment

The Surviving Sepsis Campaign recommends either low-dose unfractionated heparin or low-molecular weight heparin for DVT prophylaxis.

Mechanical prophylactic devices should be used when heparin is contraindicated.

Management Recombinant Human Activated Protein C

Recombinant human activated protein C (rhAPC) is no longer recommended for the treatment of severe sepsis.

Xigris (drotrecogin alfa (activated)has been removed from the market as the results from the PROWESS-Shock study did not show improvement in 28-day mortality, contradicting their initial study which did demonstrate a reduction in 28-day mortality

The results of a recent Cochrane meta-analysis on the use of rhAPC in severe sepsis concluded: “APC should be used for treating patients with severe sepsis or septic shock” and “APC is associated with a higher risk of bleeding” This is consistent with a previous meta-analysis

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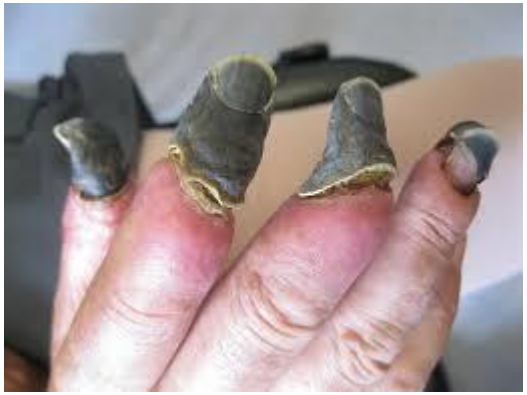
Complications of Sepsis

- Death (mortality rate for septic shock is almost 50%)
- Multiple organ failure
- Tissue damage
- Disseminating Intravascular Coagulation (DIC)
- Weakened immune system



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Key Points

- Identify sepsis correctly using LHCH Sepsis Screening Tool
- Start the management early, alongside the assessment
- **Complete the components of the 'Sepsis Six' within 1 hour**
- Get senior support early and refer to specialist critical care review early if the patient is not responding to initial management