



# **PATHOPHYSIOLOGY OF SEPSIS**

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# AIMS & OBJECTIVES...

- Define the term sepsis
- Understand the effects of sepsis
- Compare the old and new Sepsis 6
- Quiz with a star prize of **QUALITY STREET!!**



## DEFINITION

**‘Life threatening organ dysfunction caused by a dysregulated host response to infection’**

**Surviving Sepsis Campaign  
(2016)**



# SURVIVING SEPSIS CAMPAIGN

- The Surviving Sepsis Campaign is a joint collaboration of the [Society of Critical Care Medicine](#) and the [European Society of Intensive Care Medicine](#) committed to reducing mortality from severe sepsis and septic shock worldwide.
- Initiated in 2002
- Evidence-based guidelines
- ***Implementation of a performance improvement program***
- Analysis and publication of data from more than *30,000* patient charts collected around the world.



# INCIDENCE OF SEPSIS...

- Sepsis can be triggered by any infection, but most commonly occurs in response to bacterial infections of the lungs, urinary tract, abdominal organs or skin and soft tissues.
- **52,500** People lose their lives to sepsis annually
- **£2 billion** Is the estimated amount that sepsis costs the NHS annually



# DEVELOP A HIGH LEVEL OF SUSPICION....

- Caught early, outcomes are excellent. Untreated risks septic shock, multi-organ failure and death
- Increasing awareness and developing a high level of suspicion will save lives



# HOW TO SPOT SEPSIS IN ADULTS

Slurred speech or confusion

Extreme shivering or muscle pain

Passing no urine (in a day)

Severe breathlessness

It feels like you are going to die

Skin mottled or discoloured

Sepsis Trust UK (2019)



# HOW TO SPOT SEPSIS IN HOSPITAL

- Early warning score trigger
- Looks ill to a health professional or an unusually concerned relative
- Has any signs of infection

**Sepsis Trust UK (2019)**





## RED FLAGS

- Responds only to voice or pain / unresponsive
- Acute confusional state
- Systolic B.P  $\leq 90$  mmHg (or drop  $> 40$  from normal)
- Heart rate  $> 130$  per minute
- Respiratory rate  $\geq 25$  per minute
- Needs oxygen to keep  $SpO_2 \geq 92\%$
- Non-blanching rash, mottled / ashen / cyanotic
- Not passed urine in last 18 h / UO  $< 0.5$  ml / kg / hr
- Lactate  $\geq 2$  mmol / l
- Recent chemotherapy



# SO WHAT PROBLEMS DO WE SEE OUR PATIENTS DEVELOP....

- Hypotension
- Acute lung injury
- Acute kidney injury
- Coagulopathy
- Cerebral dysfunction
- Limb loss
- Reduced functional capacity
- Death



# PATHOPHYSIOLOGY OF SEPSIS...

At the cellular level, sepsis is characterized by changes in the function of;

- endothelial tissue (the endothelium forms the inner surface of blood vessels)
- in the coagulation process
- blood flow.



# PATHOPHYSIOLOGY OF SEPSIS...

- The pathophysiology of sepsis is complex and results from the effects of circulating bacterial products, mediated by cytokine release, caused by sustained bacteraemia.
- Cytokines are primarily responsible for the clinically observable effects of the bacteraemia in the host.



# PATHOPHYSIOLOGY OF SEPSIS...

- The substances, which include short-lived regulatory proteins known as cytokines interact with endothelial causing injury to the endothelium and possibly the death of endothelial cells.
- These interactions lead to the activation of coagulation factors.



# PATHOPHYSIOLOGY OF SEPSIS...

- In very small blood vessels the coagulation response, in combination with endothelial damage, may impede blood flow leading to blood vessels becoming leaky and clot formation
- As fluid and microorganisms escape into the surrounding tissues, the tissues begin to swell in the lungs can lead to pulmonary oedema, manifesting as shortness of breath

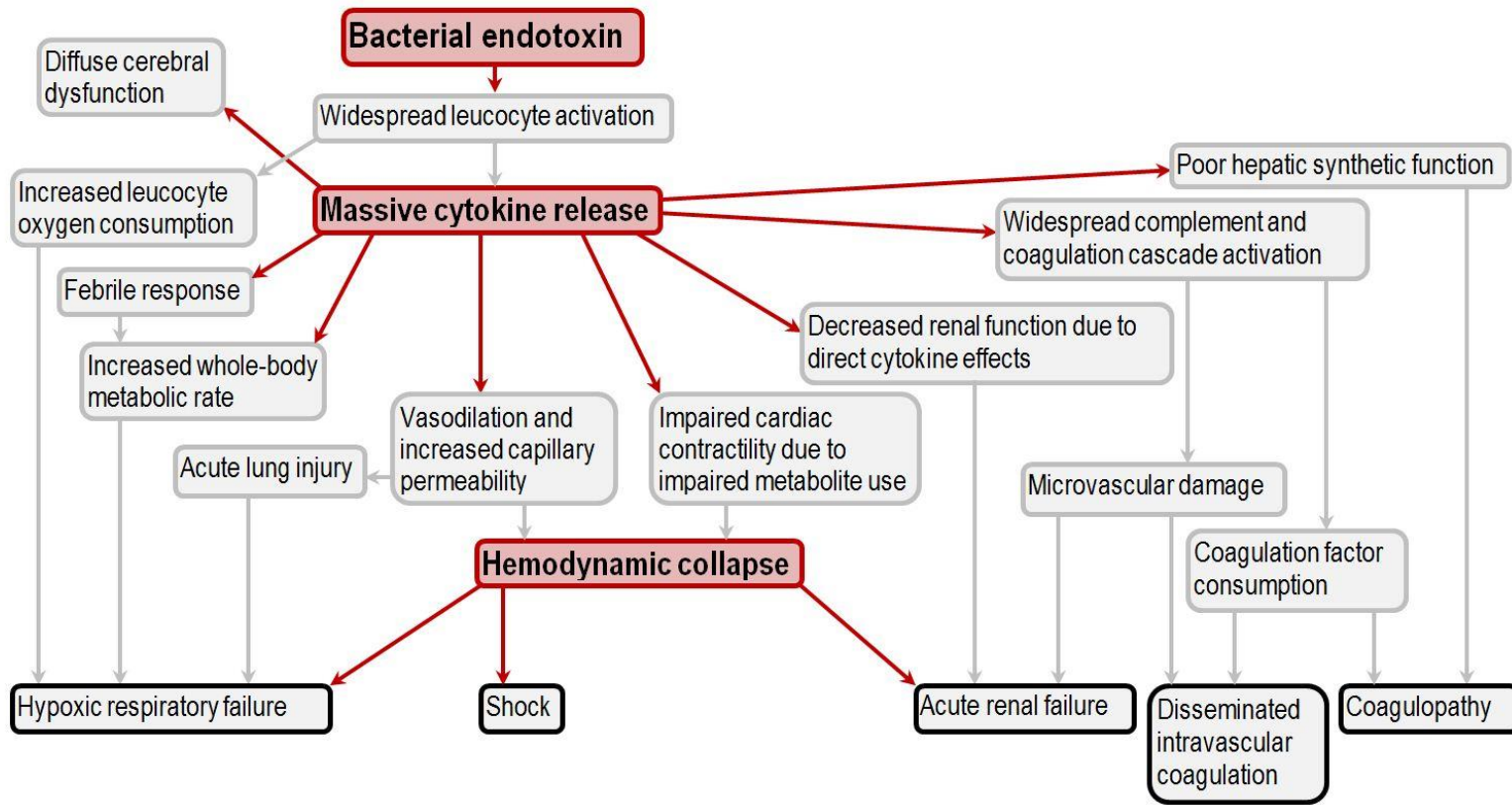


# PATHOPHYSIOLOGY OF SEPSIS...

- If coagulation proteins become exhausted, bleeding may ensue.
- Cytokines also cause blood vessels to dilate (widen), producing a decrease in blood pressure.
- Nitrous oxide which is key to blood pressure regulation is produced in an excessively, contributing to the widespread hypotension seen.



# PATHOPHYSIOLOGY OF SEPSIS...





## SEPTIC SHOCK

‘Septic shock should be defined as a subset of sepsis in which particularly profound circulatory, cellular, and metabolic abnormalities are associated with a greater risk of mortality than with sepsis alone.’

Gomes et al (2016)



# ORIGINAL SEPSIS 6

- Blood cultures
- Urine output
- Fluids
- Antibiotics
- Lactate
- Oxygen

UK Sepsis Trust (2005)



# SEPSIS 6 REVISED 2019

- Ensure a Senior Clinician Attends
- Oxygen if required
- Obtain IV Access / take bloods
- Give IV Antibiotics
- Give IV fluids
- Monitor

**Sepsis Trust UK (2019)**



<b>Staff member completing form:</b> Date (dd/mm/yyyy): Name (print): Designation: Signature:	
<b>Important:</b> Is an end of life pathway in place? Yes <input type="checkbox"/> No <input type="checkbox"/> Is escalation clinically inappropriate? Yes <input type="checkbox"/> No <input type="checkbox"/> Initials: <input type="text"/> Discontinue pathway	
<b>1. Is NEWS 5 or above? Or 1 single parameter =3 AND/OR Patient look sick?</b>	
Yes <input type="checkbox"/> No <input type="checkbox"/>	Low risk of sepsis Use standard protocols, review if deteriorates. Consider diagnosis
<b>2. Could this be due to an infection?</b>	
Yes, but source unclear at present Pneumonia Urinary Tract Infection Abdominal pain or distension Cellulitis/ septic arthritis/ infected wound Device-related infection Meningitis Other (specify: _____)	<b>4. Any Amber Flag criteria/MODERATE RISK</b>
Yes <input type="checkbox"/> No <input type="checkbox"/>	Relatives concerned about mental status Acute deterioration in functional ability Immunosuppressed Trauma/ surgery/ procedure in last 6 weeks Respiratory rate 21-24 Systolic B.P 91-100 mmHg Heart rate 91-130 OR new dysrhythmia Not passed urine in last 12-18 hours Temperature < 36°C Clinical signs of wound, device or skin infection
<b>3. Is any ONE Red Flag present/HIGH RISK</b>	
Responds only to voice or pain/ unresponsive Acute confusional state Systolic B.P < 90 mmHg (or drop >40 from normal) Heart rate > 130 per minute Respiratory rate > 25 per minute Needs oxygen to keep SpO <sub>2</sub> >92% (88% in COPD) Non-branching rash, mottled/ ashen/ cyanotic Not passed urine in last 18 h/ UO <0.3 ml/kg/hr Lactate >2 mmol/l Result <input type="text"/> Time <input type="text"/> Recent chemotherapy	Send bloods to include FBC, U&Es, CRP U&Es, clotting etc as per NICE/centre Aim for Doctor review WPMW 2 Hour use SBAR
Is AKI present or Lactate >2? Yes <input type="checkbox"/> No <input type="checkbox"/>	
Clinician to make antimicrobial prescribing decision within 3h Time complete <input type="text"/> Initials <input type="text"/>	
<b>Sepsis!! Start Sepsis 6 pathway NOW (see overleaf)</b> This is time critical, immediate action is required.	

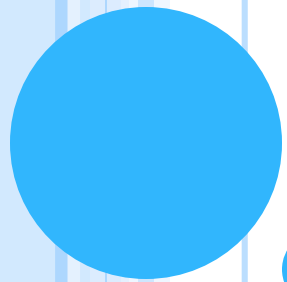
Make a treatment escalation plan and decide on CPR status  
 Inform Registrar (use SBAR) patient has HIGH RISK Sepsis Time seen  Consultant informed? (Y/N)  Initials

Action (complete ALL within 1 hour) Reassess not done/verbalise

- 1. Administer oxygen**  
 Aim to keep saturations > 94% (88-92% if at risk of CO<sub>2</sub> retention e.g. COPD)  
 Time complete  Initials
- 2. Take blood cultures**  
 At least a peripheral set. Consider e.g. CSF, urine, sputum  
 Think source control! Call surgeon/ radiologist if needed  
 CXR and urinalysis for all adults  
 Time complete  Initials
- 3. Give IV antibiotics**  
 According to Trust protocol antimicrobial poster  
 Consider allergies prior to administration  
 Time complete  Initials
- 4. Give IV fluids**  
 If hypotensive/lactate >2mmol/l, 500 ml stat of crystalloid. May be repeated if clinically indicated- do not exceed 30ml/kg  
 Time complete  Initials
- 5. Check serial lactates**  
 If lactate >4mmol/L, out Critical Care and recheck after each 10ml/kg challenge  
 Time complete  Initials  Not applicable- initial lactate
- 6. Measure urine output**  
 May require urinary catheter  
 Ensure fluid balance chart commenced & completed hourly  
 Time complete  Initials

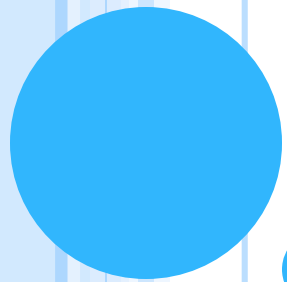
If after delivering the Sepsis Six, patient still has:  
 • systolic B.P <90 mmHg  
 • reduced level of consciousness despite resuscitation  
 • respiratory rate over 25 breaths per minute  
 • lactate not reducing  
 Or if patient is clearly critically ill at any time  
 Then call Critical Care Outreach ICU Registrar immediately!

Notes:



**ANY QUESTIONS?**





**NOW FOR MY QUESTIONS...**



# REFERENCES

McGloin s, McLeod A (2010) *Advanced Practice In Critical Care: A Case Study Approach*. Wiley Blackwell: Oxford.

Dunkley S, McLeod A (2015) 'Neutropenic Sepsis: Assessment, pathophysiology & nursing care'. *British Journal of Neuroscience Nursing*. Vol 11 (2) pp79-87

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