

Septic Shock due to an Unknown organism

History of Presenting Illness:

- Fever; chills, rigors, anxiety
- Malaise, anorexia, fatigue
- Decreasing Level of Consciousness

Could be anything, could be nothing. The **ELDERLY** don't tend to have very many signs of sepsis, and may not even mount a fever.

The Significance of a TEMPERATURE: Especially in a child, THE ACTUAL TEMPERATURE is irrelevant- but THE PRESENCE OF A FEVER matters. I.e. it doesn't matter much whether you're 38.5 degrees or 41.5.

Extract some Salient Features from the History:

- How sudden the onset? (this may tell you a little bit about the likely source- eg. onset of a perforated-viscus-associated faecal sepsis will be more rapid than some sort of skin-related cellulitis)
- What could the pathogen be: **is there something pointing to a weird pathogen?**
 - IS THE PATIENT NEUTROPENIC, immune suppressed, on steroids?
 - IS THERE AN ENTRY POINT, eg. cannula, catheter, central line, peritoneal dialysis?

EXAMINATION FINDINGS: look at your patient!! Do they LOOK sick? → TACHY-EVERYTHING; Peripherally shut down

- A chatty rosy-cheeked grandma sitting up in bed is probably NOT septic.
- **LISTEN TO THE HEART: endocarditis?... New murmur?... Pericardial rub?...**
- **Look for characteristic disease-specific findings, eg. purpural rash of *N. Meningitidis***
- **Generalised erythema suggests a Staph Aureus or Strep Pyogenes toxic shock**

INCLUSION CRITERIA for SIRS: Systemic Inflammatory Response Syndrome.

SIRS: 2 of these ←

- Temperature **over 38 or under 36**
- Heart rate **over 90**
- Respiratory rate **over 20**
- Arterial PaCO₂ **under 32mmHg**
- White Cell Count **over 11 or under 4** (or more than 10% of immature forms)
- Sepsis of unknown origin and on IV antibiotics

SEPSIS is SIRS arising from a documented infection

JVP = immediate clue regarding hypovolemia. If there's a JVP, there's probably enough blood to go around.

Septic shock

- Systolic Blood Pressure **under 90- AFTER crystalloid fluid challenge-**
- of more than 20-30ml/kg over 30 minutes
- Blood Lactate **over 4mmol/L**
- Oliguria +/- acute deterioration of mental state
- Acute end-organ dysfunction

NOTE: blood cultures do NOT have to be positive at any point. Practically speaking, only 30% of the patients will grow anything at all

Got to ask yourself: what am I trying to achieve? What information do I need to treat this raging bacterial infection? DO I REALLY NEED TO KNOW WHICH MICROBE DID THIS? Do I need to correct metabolic abnormalities?... etc etc

INVESTIGATIONS:

- **FBC** will probably have WCCs elevated; use this to support a bacterial cause (neutrophils will be raised)
- **2 x Culture (aerobes + anaerobes)** mainly for completeness- The lab will do a quick gram stain; may help guide management...
- **ABGs** -alkalosis? Acidosis? Hypoxemia?? **Are they in ARDS?**
- **Lactate** will be raised secondary to peripheral hypoperfusion...
- **EUC** needed if you want to give them the heavy duty nephrotoxic aminoglycosides or macrolides
- **LFTs**
- **BSL**
- **Coagulation...? DIC already raging?** U.S. is good for biliary tree and gall bladder

METABOLIC ACIDOSIS: = the beginning of the end

The mighty PROCALCITONIN: a BETTER marker of infection than C-reactive protein or WCC.

IMAGING: Chest X-ray, Abdo ultrasound... don't delay treatment for CT availability

FIND THE ABSCESS: there is usually a focus of infection; DRAIN IT!! antibiotics won't get to the center of that pocket of pus. Think gallbladder, kidney, joints, pelvic STD, spine(epidural), meningitis...

EMPIRICAL MANAGEMENT OF THE SEPTIC PATIENT

Maintain vital signs first;
Definitive management second.

1) **AIRWAY, BREATHING, CIRCULATION.**

May need to intubate. **O² at 100%**

2) **venous access:** big cannula in each arm

Also consider **ARTERIAL CANNULA** to measure the MAP more accurately

3) take **bloods: management is concurrent with investigations**

4) **IV FLUIDS:** because the vessels are globally dilated, one must refill the new available space so that the heart may fill and beat again.

THUS: give 20 to 30 ml/kg over 30 minutes until their systolic BP gets over 90

+ TRANSFUSE BLOOD TO MAINTAIN Hb!

5) **Antibiotics** as per department guidelines (give together with first fluids)

Empiric antibiotics that cover the infecting organism, started early, is the only proven medical treatment, other than volume replacement

From the Oxford Textbook:
Empirical antibiotics of choice are
CEFUROXIME
GENTAMICIN
METRONIDAZOLE

6) insert **Urinary Catheter** (to measure output)

7) keep giving crystalloid bolus 500mls over 30min

GOALS OF THERAPY:

- Central venous pressure 8-12 mmHg
- Mean arterial pressure over 70 mmHg
- Hematocrit over 30
- **SaO₂ over 93%**
- Central venous O₂ saturation of over 70

INOTROPES IN SEPSIS:

The BP needs to go over 90.
The MAP needs to go over 70.

http://www.sccm.org/professional_resources/guidelines/table_of_contents/Documents/Hemodynamicsupport.pdf

SO: ONLY AFTER YOU TRIED FLUIDS FIRST:

DOBUTAMINE first:

Then watch the MAP and urine output;

If you got urine- good; avoid further inotropes

STILL NO URINE? MAP too low?

- Give **DOPAMINE** if a bit brady

- **NORADRENALINE** if a bit tachy

don't go crazy with the inotropes and vasopressors; your goal is to reperfuse the organs, but too much vasoconstrictor will actually collapse those arterioles and that's not what you want. Hence the constant MAP monitoring via an arterial line.

The infection site helps in determining the most likely cause of a patient's sepsis

Suspected Source of Sepsis					
	Lung	Abdomen	Skin/Soft Tissue	Urinary Tract	CNS
Major Community Acquired Pathogens	<i>Streptococcus pneumoniae</i>		<i>Streptococcus pyogenes</i>		<i>Streptococcus pneumoniae</i>
	<i>Haemophilus influenzae</i>	<i>Escherichia coli</i>	<i>Staphylococcus aureus</i>	<i>Escherichia coli</i>	<i>Neisseria meningitidis</i>
Major Nosocomial pathogens	<i>Legionella sp.</i>	<i>Bacteroides fragilis</i>	<i>Clostridium sp.</i>	<i>Klebsiella sp.</i>	<i>Listeria monocytogenes</i>
	<i>Chlamydia pneumoniae</i>		Polymicrobial infections	<i>Enterobacter sp.</i>	<i>Escherichia coli</i>
			Aerobic gram negative bacilli	<i>Proteus sp.</i>	<i>Haemophilus influenzae</i>
			<i>Pseudomonas aeruginosa</i>		
		Anaerobes			
			<i>Staphylococcus aureus</i>	Aerobic gram negative bacilli	<i>Pseudomonas aeruginosa</i>
	Aerobic gram negative bacilli	Aerobic gram negative bacilli	Aerobic gram negative bacilli	<i>Enterococcus sp.</i>	<i>Escherichia coli</i>
		Anaerobes			<i>Klebsiella sp.</i>
		<i>Candida sp.</i>			<i>Staphylococcus sp.</i>