Intern Boot Camp

Sepsis is SERIOUS !!

Asim Syed
PGY-3 :)

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Learning objectives

- Definition of Sepsis and Septic shock as per the latest guidelines
- Criteria's for identification
- Risk assessment scores in ICU setting and outside ICU settings
- Monitoring parameters
- Triage and Management

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Definitions over the years

[redacted]

1. Infection-invasion of normally sterile tissue by organisms resulting in infectious pathology and inflammation
2. SIRS: Systemic response to variety of process
3. Sepsis: infection + 2 or more SIRS criteria
4. Severe sepsis: Sepsis + organ dysfunction
5. Septic Shock: Sepsis + refractory hypotension
6. MODS: altered organ function requiring intervention, in an acutely ill patient

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[redacted]

- End of sepsis 2 they realized they dog't have any better measures than what was in Sepsis 1. But they did realize the overlap and the flaws in sepsis 1

[redacted]

More specific definitions with criteria

- Elimination of "severe sepsis"
- Introduction of qSOFA score to predict mortality outside the ICU
- Criteria for septic shock i.e MAPS <65 and lactate >2 even after adequate fluid resuscitation

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Sepsis

- A 2016 SCCM/ESICM task force has defined sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection

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Organ dysfunction

- Defined as an acute change in Total SOFA score ≥ 2 as a consequence of infection
- Baseline SOFA score can be presumed to be zero in patients not known to have pre existing organ dysfunction
- A SOFA score ≥2 reflects overall mortality risk of approx 10% in general hospital population with suspected infection and 40% in the ICU setting.

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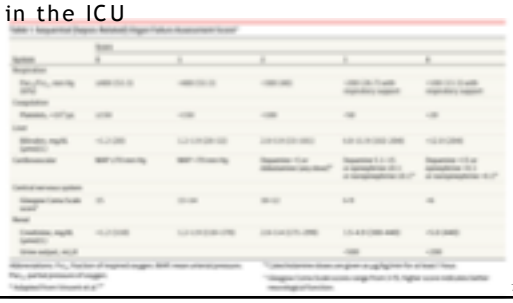
SOFA score for predicting mortality rate in the ICU



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qSOFA (quick Sequential Organ Failure Assessment). For patients outside the ICU setting

The qSOFA used as an assessment score to facilitate the identification of patients potentially at risk of dying from sepsis

- Respiratory rate ≥22/minute
- Altered mentation
- Systolic blood pressure ≤100 mmHg

*** Feb 2018 ***
A meta-analysis of 38 studies reported that among patients in a variety of settings (emergency departments, wards, and ICUs), qSOFA was less sensitive that SIRS for predicting mortality from sepsis (61 versus 88 percent) and that the qSOFA sensitivity was higher in ICU patients compared with non-ICU patients (87 versus 51 percent)

Thus, the qSOFA score needs further evaluation before it can be routinely used to predict mortality in any population with sepsis

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Systemic inflammatory response syndrome (SIRS)

- Temperature >38.3 C or <36.0 C
- Heart rate (pulse) >90
- Respiration >20 per minute
- White blood cell count >12,000 or <4,000 or >10% bands

** Does not include BP **

- SIRS may occur in several conditions related, or not, to infection. Noninfectious conditions classically associated with SIRS include autoimmune disorders, pancreatitis, vasculitis, thromboembolism, burns, or surgery.

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Septic Shock

- Clinically, this includes patients who fulfill the criteria for sepsis who, despite adequate fluid resuscitation, require vasopressors to maintain a mean arterial pressure (MAP) ≥65 mmHg and have a lactate >2 mmol/L (>18 mg/dL).
- Sepsis that has circulatory, cellular, and metabolic abnormalities
- Is a type of vasodilatory or distributive shock.

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Presence of severe sepsis may be identified based upon clinical criteria or provider documentation of severe sepsis:

3 clinical criteria must be met, A x1, B x2, or C x1 within 6 hrs. of each other:

A. Documentation of infection by Physician, APN, PA or nurse.

B. 2 SIRS criteria:
- Temperature >38.3 C or <36.0 C
- Heart rate (pulse) >90
- Respiration >20 per minute
- White blood cell count >12,000 or <4,000 or >10% bands

C. Organ dysfunction
- SBP <90, MAP <65, or SBP decrease of > 40 mmHg.
- Acute respiratory failure: intervention and documentation.
- Creatinine >2.0, or UOP <0.5 mL/kg/hour for 2 hours.
- Total Bili >2 mg/dL (34.2 mmol/L)
- Platelet count <100,000
- INR >1.5 or aPTT >60 sec
- Lactate >2 mmol/L (18.0 mg/dL)

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Management

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2012

SURVIVING SEPSIS CAMPAIGN CARE BUNDLES

TO BE COMPLETED WITHIN 3 HOURS:
1) Measure lactate level
2) Obtain blood cultures prior to administration of antibiotics
3) Administer broad spectrum antibiotics
4) Administer 30 mL/kg crystalloid for hypotension or lactate ≥ 4 mmol/L

TO BE COMPLETED WITHIN 6 HOURS:
5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥ 65 mm Hg
6) In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥ 4 mmol/L (36 mg/dL):
- Measure central venous pressure (CVP)*
- Measure central venous oxygen saturation ($ScvO_2$)*
7) Remeasure lactate if initial lactate was elevated*

*Targets for quantitative resuscitation included in the guidelines are CVP of ≥8 mm Hg, $ScvO_2$ of ≥ 70%, and normalization of lactate.

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Early Goal Directed Therapy (Rivers et al 2001) & Surviving sepsis guidelines 2016

Resuscitation within the first 6 hours of patients with sepsis-induced tissue hypoperfusion and assess fluid responsiveness:

1. MAP ≥ 65 mmhg
2. UOP≥0.5 mL/kg per hour
3. Lactate clearance- q 6hrs—trend
4. CVP- 8-12
5. Svo2 ≥ 70%
6. passive leg raising

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Sepsis Early Management Bundle:

1. Lactate within 3 hours of triage time or sepsis diagnosis
   - A serum lactate level ≥4 mmol/L is consistent with, but not diagnostic of, septic shock.
   - Although arterial and venous lactate correlate, arterial lactate measurements are more accurate and preferred
2. Blood Cultures drawn within 3 hours (before antibiotics started)
3. Broad spectrum antibiotics started within 3 hours (after blood Cx)
4. IV fluids initiated to total 30 mL/kg, final bag to start within 3 hours

*** As per CMS [redacted] compliance perspective, if any of these 4 are not completed, the early bundle fails as a whole ***

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[redacted]

- given at 30 mL/kg within the first three hours following presentation.
- [redacted] - Among patients with sepsis, several randomized trials and meta-analyses have reported no difference in mortality when albumin was compared with crystalloids, although one meta-analysis suggested benefit in those with septic shock
- In the [redacted] trial performed in critically ill patients, there was no benefit to albumin compared with saline even in the subgroup with severe sepsis, who comprised 18 percent of the total group .Among the crystalloids, there are no guidelines to suggest that one form is more beneficial than the other.

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Broad spectrum antibiotics

- There is growing recognition that methicillin-resistant *S. aureus* (MRSA) is a cause of sepsis not only in hospitalized patients, but also in community dwelling individuals without recent hospitalization
- It is favorable to combine Vancomycin with one of the following:
- Cephalosporin, 3rd generation (eg, [redacted]) or 4th generation ([redacted]), or
- Beta-lactam/beta-lactamase inhibitor (eg, [redacted]), or
- Carbapenem (eg, [redacted])

*** The organizational standard at UH is to give antibiotics within 1 hour****

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Broad Spectrum Antibiotics Administered FIRST

Ceftriaxone, Cefepime, Piperacillin-Tazobactam, Ampicillin-Sulbactam, Meropenem,

Levofloxacin*

Organism Specific Coverage

Atypical Organisms (CAP)
Azithromycin, Levofloxacin
Listeria (Ceftriaxone, Cefepime, Piperacillin-Sulbactam, Meropenem, Levofloxacin*meningitis)
Ampicillin, SMP/TMX

Anaerobic Organisms
Metronidazole

Clindamycin

Organism Specific Coverage

MRSA
Vancomycin

Linezolid

Gram Negative (*P. aeruginosa* risk)
Aztreonam, Tobramycin, Gentamicin
Levofloxacin

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Invasive fungal infections

The **routine** administration of empirical antifungal therapy is not generally warranted in **non-neutropenic** critically-ill patients.

- Strong suspicion of Candidal infection use – **Voriconazole**.
- **Micafungin** for everything else

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Pressor's

- 1st choice is Levoped (Norepinephrine)
- Vasopressin as 2nd agent (May 2018)
  - Does not decrease mortality but decreases arrhythmias.
- Glucocorticoids if all else fails. Hydrocortisone (100mg q8 or 50mg q6hrs)

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Case 1

A 67-year-old man is evaluated for a productive cough of 5 days duration, progressive shortness of breath, and increasing lethargy. He has loose stools and subjective fevers without chills. His oral intake has decreased for the last 3 days, and his wife reports that he has been sleeping frequently. He has a history of COPD. Medications are tiotropium and an albuterol inhaler as needed.

On physical examination, temperature is 38.9 °C (102 °F), blood pressure is 80/46 mm Hg, pulse rate is 115/min, and respiration rate is 28/min. Oxygen saturation is 88% breathing ambient air. He is weak and toxic appearing. He is in respiratory distress with accessory neck muscle use. Pulmonary examination reveals coarse crackles in the right posterior lung base on auscultation with

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Laboratory results:

Leukocyte count - 16,900/μL (16.9 x 109/L)
Neutrophil count - 75% with 11% bands

Blood hemoglobin- 12.1 g/dL (121 g/L)

Plasma lactate - 4.2 mEq/L (4.2 mmol/L)

Serum creatinine - 3.5 mg/dL (309.4 μmol/L)

Chest radiograph reveals opacification of the right lower lobe with consolidation and air bronchograms. The right

Which of the following would increase the risk of mortality for this patient?

A Delayed administration of crystalloid infusion bolus

B Delayed administration of empiric antibiotics

C Delayed admission to the ICU

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Case 2

A 47-year-old woman is evaluated in the emergency department for progressive lethargy and confusion. Her husband reports a 3-day history of subjective fever and chills, and the development of right-sided lower back pain during the last 24 hours. She collapsed without loss of consciousness 4 hours ago after rising from a chair. She has noted blood in the urine for about 6 days, was recently diagnosed with a urinary tract infection, and began treatment with empiric oral cephalexin. She has a history of kidney stones but no chronic kidney disease, hypertension, or other chronic medical conditions.

On physical examination, temperature is 39.4 °C (102.9 °F), blood pressure is 65/35 mm Hg, pulse rate is 135/min, and respiration rate is 34/min. Weight is 132 lbs (60 kg). Oxygen saturation is 95% breathing ambient air. She appears fatigued, has moderate respiratory

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Laboratory results:

Urine leukocyte count	103,000/µL (103 x 109/L)
Urine leukocyte esterase	positive
Urine nitrites	positive
Multiple bacteria are observed on microscopic examination of the urine.	
Leukocyte count	23,100/µL (23.1 x 109/L)
Neutrophil count	74% with 15% bands
Blood hemoglobin	8.1 g/dL (81 g/L)
Platelet count	115,000/µL (115 x 109/L)

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Based on the laboratory studies, the patient is started on two empiric antibiotics intravenously. She is given 2L (approximately 30 ml/kg) normal saline during the first 3 hours. Her blood pressure after initial intravenous fluid bolus is 70/35 mm Hg and repeat plasma lactate is 4.7 mEq/L (4.7 mmol/L). A CT scan of the abdomen is ordered but will not be performed for 60 minutes.

Which of the following is the most appropriate management?

A. Crystalloid infusion and titration for target central venous pressure of 14 mm Hg

B. Dopamine infusion and titration to mean arterial pressure greater than 65 mm Hg

C. Norepinephrine infusion and titration to mean arterial pressure greater than 65 mmHg

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Case 3

A 58-year-old woman was hospitalized 1 week ago for acute-on-chronic kidney injury. Since her hospitalization, she has been receiving hemodialysis through a temporary femoral vein catheter. Last night, she developed a fever of 38.7 °C (101.7 °F).

On physical examination today, she is confused. Blood pressure is 76/40 mm Hg and pulse rate is 108/min. Weight is 60 kg (132 lb). She has adequate peripheral venous access and is given a 1000-mL bolus of intravenous normal saline over 30 minutes. After receiving the fluid bolus, blood pressure is 78/44 mm Hg. Oxygen saturation is 96% breathing ambient air. Cardiac examination reveals an S1 and S2 with regular tachycardic rhythm. There is no jugular venous distention, murmur, or gallop. The chest is clear to auscultation. Erythema without purulent

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Laboratory studies:

Hemoglobin	9.8 g/dL (98 g/L) (baseline 10 g/dL [100 g/L])
Leukocyte count	16,000/µL (16 × 109/L)
Creatinine	2.6 mg/dL (229.8 µmol/L)

A blood culture obtained yesterday is growing gram-positive cocci.

A chest radiograph is normal. Electrocardiogram shows sinus tachycardia and no acute ischemic changes.

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In addition to replacing the hemodialysis catheter, which of the following is the most appropriate next step in treatment?

A Administer another 1000-mL normal saline fluid bolus

B Initiate dobutamine infusion

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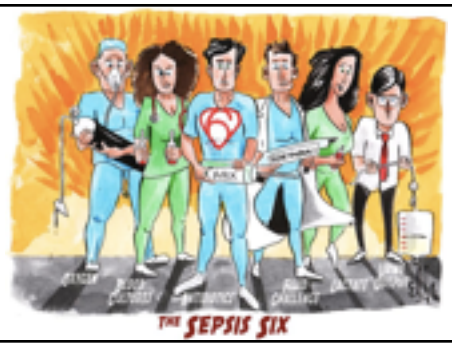

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