

SEPSIS

(Last updated 07/23/2019; Reviewed by: Kirtivardhan Vashistha, MBBS)

PRESENTING COMPLAINT: Fever, altered mental status

FINDINGS

- **A** Check airway
- **B** ↑ RR, ↑ work of breathing, dyspnea if pneumonia
- **C** ↓ BP, ↑ HR, Hyper dynamic pulse
- **D** Variable altered (V,P,U,D)*
- **E** Warm, flushed skin, cyanosis or mottling in shock
- **L_{PC}** ↑N/↓ WBC; ↑ Glucose, ↓ PaO₂; ↓ Urine Output, ↑ Creatinine, ↓ Spo₂, ↑ PT/INR/aPTT; ↑ Lactate; ↓ Platelet count; ↑N/↓ Electrolytes (Na/K/Ca/Mg)
- **U_{PC}** Collapsed IVC, hyperdynamic LV/RV, LV dysfunction later in the course, evaluate and exclude source of infection (empyema, pneumonia, hydronephrosis, ascites, abscess, cholecystitis)

***V** (verbal), **P** (pain), **U** (unconsciousness), **D** (delirious)

U_{PC} (point of care ultrasound) **L_{PC}** (point of care labs)

DEFINITIONS

- **2001-Definition**
 - **Sepsis:** infection + SIRS (≥ 2 of 4: RR > 20, WBC < 4000 or > 12000, HR > 100, Temperature < 36 or > 38.3°C)
 - **Severe:** if signs of tissue hypoperfusion (i.e., elevated serum lactate) or organ dysfunction (e.g. elevated serum creatinine, bilirubin, INR; UOP < 0.5mL/kg/h, AMS)
 - **Septic shock:** if hypotension despite adequate fluid resuscitation
- **2016-Definition (Sepsis-3)**
 - **Sepsis:** ‘life-threatening organ dysfunction caused by a dysregulated host response to infection,’ identified clinically as [infection + organ dysfunction identified as an acute change in SOFA score ≥ 2 (in ICU settings) **or** qSOFA score* ≥ 2 of 3 (in non-ICU settings)] with in-hospital mortality >10%
 - *qSOFA: RR ≥ 22 /min, altered mentation (GCS <15), or systolic BP ≤ 100 mmHg
 - **Septic shock:** a subset of sepsis with hypotension requiring vasopressors **and** serum lactate > 2 mmol/L (18 mg/dL) after adequate fluid resuscitation

OTHER HISTORY

- **Predisposing conditions:** Old or very young, h/o immunosuppression (diabetes, malignancy), cold and clammy skin (when in septic shock), skin infections (abscess, cellulitis), gastrointestinal infections (abdominal pain, diarrhea, vomiting, decreased bowel movements), genitourinary infections (dysuria, pyuria, decreased bladder movements), hepatic dysfunction (fatigue, jaundice), pulmonary/cardiac dysfunction (sore throat, cough, lymphadenopathy, chest pain)

DIFFERENTIAL DIAGNOSIS

- Cardiogenic/Anaphylactic/Hypovolemic shock, hematologic malignancy, rheumatologic disorders, vasculitis, acute pulmonary embolus, acute myocardial infarction, adrenal insufficiency, acute pancreatitis, transfusion reaction

OTHER INVESTIGATIONS

- **Cultures:** Should be taken **as soon as possible** and **preferably before antimicrobial therapy**
 - At least take blood cultures from peripheral vein and urine culture
- **Labs:** Lactate, CBC, coagulation, ESR/CRP, procalcitonin, bilirubin, AST,ALT, GGT, ALP, BUN/Cr, serum electrolytes, urinalysis, ABG
- **Monitoring:** Blood pressure (consider invasive measuring), skin perfusion, urine production, ECG, SpO₂, PaO₂/FiO₂
- **Imaging:** Consider bedside ultrasound

THERAPEUTIC INTERVENTIONS

- **Initial Actions**
 - **Follow a locally agreed upon algorithm**
 - **For infection: Antibiotics** should be initiated **as soon as possible** according to likely pathogen and adjusted for local resistance patterns, site of infection, immune status, and allergy; if possible, start after cultures, however, do not postpone antimicrobial therapy if cultures cannot be taken right away. **Source control:** remove dead tissue, pus, or possibly infected device(s)
 - **For Hypotension/Shock:**
 - **Fluid challenge:** Start fluid bolus, crystalloids only, ~30ml/kg; albumin may be considered. Repeat as needed to achieve adequate tissue perfusion, taking into consideration fluid responsiveness; dynamic measures i.e. passive leg raising, better than static

- **Vasopressors:** Add for persistent shock despite fluid resuscitation. First choice is norepinephrine: add vasopressin when an additional agent is needed, add epinephrine or dobutamine if cardiac dysfunction. Consider **central venous access**
- **Steroids:** Add for persistent shock despite vasopressors or as indicated for specific infections (severe pneumonia, meningitis, etc.)
- **Reduce oxygen consumption:** Consider mechanical ventilation; use lung protective ventilation (i.e. tidal volumes < 6 ml/kg predicted body weight, NOT actual body weight)
 - Use analgesics, sedatives and neuromuscular blockers as appropriate

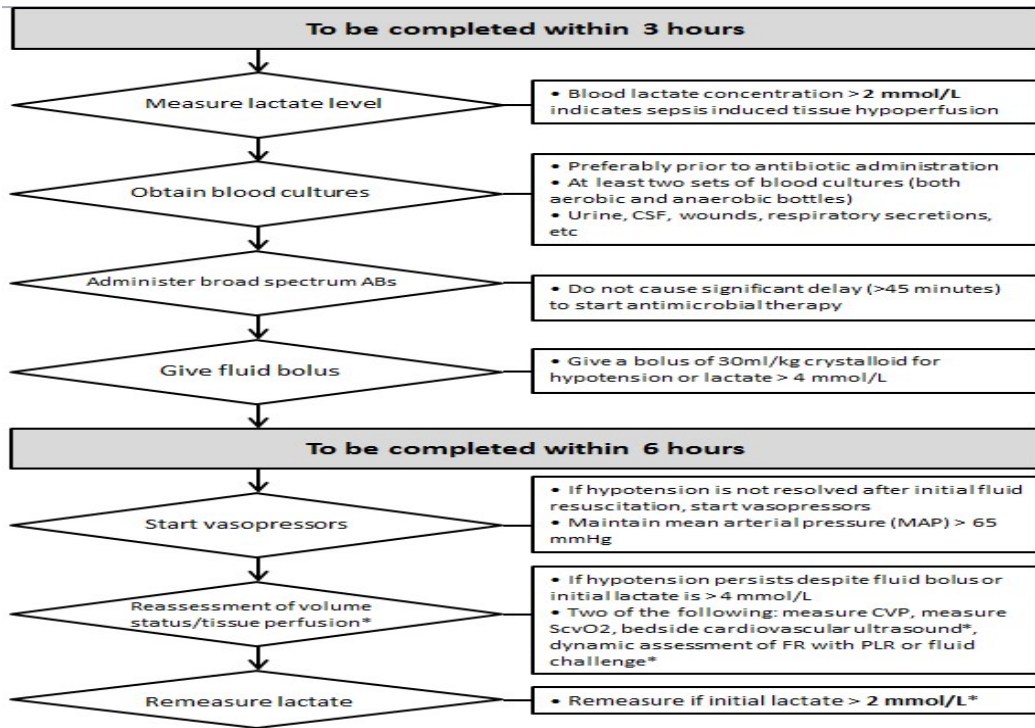
ONGOING MANAGEMENT

- **Ventilatory support:** Lung-protective settings: ideal volume 6 to 8 ml/kg PBW; PEEP \geq 10 cm H₂O if ARDS
- **Further Treatment:** De-escalate antibiotics according to culture results and clinical course
 - Glucose control: keep blood glucose <180 mg/dl, though, in centers with experienced nurses and the possibility of extensive blood glucose monitoring, lower targets could be aimed for
- **Prophylaxis: VAP bundle, if intubated:** Head-of-bed elevation (preferably 45 degrees), DVT prophylaxis, ulcer prophylaxis, analgosedation instead of hypnosedation, nurse-driven sedation protocol, use of sedation scales, and eventually daily sedation breaks; spontaneous breathing trials to assess extubation readiness; daily oral care with chlorhexidine
- **Nutrition:** Start feeding patient oral/enteral, as tolerated, instead of complete fasting or administering IV glucose infusion within 48 hours; Feed with low caloric diet (up to 500 kcal/day), if tolerated especially within the first week. IV glucose and enteral nutrition is superior than total parenteral nutrition alone within the first week
- **Goals of care:** Discuss with patient/family

CAUTIONS

- **Complications:** ARDS
- **Do not use** Immunoglobulins (unless specific circumstances [i.e. toxic shock]), selenium, anti-coagulation other than for DVT, neuromuscular blocker infusion, if possible; immunomodulating supplements
- Weigh risks and benefits of blood transfusions

ALGORITHM



*Where changes are made from the previous algorithm.

REFERENCES & ACKNOWLEDGMENTS

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Surviving Sepsis Campaign responds to Sepsis-3.

<http://www.survivingsepsis.org/SiteCollectionDocuments/SSC-Statements-Sepsis-Definitions-3-2016.pdf>

Surviving Sepsis Campaign Statement updated bundles in response to new evidence.

http://www.survivingsepsis.org/SiteCollectionDocuments/SSC_Bundle.pdf Surviving Sepsis Campaign:

International Guidelines for Management of Severe Sepsis and Septic Shock: 2012

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