

Sepsis Management Protocol

General principles

- Treatment guidelines follow those recommended by the Surviving Sepsis Campaign
- Definitions:
 - *SIRS (Systemic inflammatory response syndrome)*: The clinical syndrome that results from a deregulated inflammatory response or to a noninfectious insult.
 - *Sepsis*: SIRS that is secondary to infection that has been diagnosed clinically. Positive cultures add to the validity but are not required for the diagnosis.
 - *Severe Sepsis*: Sepsis plus at least one sign of hypoperfusion or organ dysfunction (see below), that is new, and not explained by other known etiology of organ dysfunction.
 - *Septic Shock*: Severe sepsis associated with refractory hypotension (BP<90/60) despite adequate fluid resuscitation and/or a serum lactate level ≥ 4.0 mmol/L.

Sepsis Protocol

I. Recognition

- Sepsis is defined as at least two of the following signs and symptoms (SIRS) that are both present and new to the patient and suspicion of new infection
 - Hyperthermia $>38.3^{\circ}\text{C}$ or Hypothermia $<36^{\circ}\text{C}$
 - Tachycardia >90 bpm
 - Leukocytosis ($>12,000 \mu\text{L}^{-1}$) or Leukopenia ($<4,000 \mu\text{L}^{-1}$) or $>10\%$ bands
 - Acutely Altered Mental Status
 - Tachypnea >20 bpm
- Severe sepsis includes SIRS and at least one of the following signs of hypoperfusion or organ dysfunction that is new and not explained by other known etiology of organ dysfunction
 - Hypotension ($<90/60$ or MAP <65)
 - Areas of mottled skin or capillary refill
 - Lactate > 2 mMol/L
 - Creatinine > 2 mg/dl

- >3 seconds
 - Disseminated intravascular coagulation (DIC)
 - Acute renal failure or urine output <0.5 ml/kg/hr for at least 2 hours
 - Cardiac dysfunction
 - Platelet count <100,000
 - Hepatic dysfunction as evidenced by Bilirubin >2 or INR >1.5
 - Acute lung injury or ARDS
- New septic shock is defined as severe sepsis associated with refractory hypotension (BP<90/60) despite adequate fluid resuscitation and/or a serum lactate level ≥ 4.0 mmol/L
 - Screening: Patients are screened for severe sepsis upon admission and daily thereafter using paper screening sheet (see below)

II. Resuscitation

Septic Shock Resuscitation Bundle

A. To be completed within 3-Hours

1. Measure Lactate level
2. Obtain blood culture prior to administration of antibiotic
3. Early and appropriate broad-spectrum antibiotic administration Timely re-evaluation of antibiotic therapy based on causative agent and susceptibilities is recommended
4. Administer 30 mL/kg crystalloid for hypotensive or lactate ≥ 4 mmol/L

B. To be completed within 6 hours

1. Apply vasopressors for hypotensive that does not respond to initial fluid resuscitation to maintain mean arterial pressure ≥ 65 mmHg
2. In the event of persistent arterial hypotension despite volume resuscitation or initial lactate ≥ 4 mmol/L (36 mg/dL)
 - a. Maintain adequate central venous pressure (Target > 8 mmHg)
 - b. Maintain adequate central venous saturation (Target > 70%)

Fluid responsiveness can be measured by dynamic parameters

- In patients who require large volume of resuscitation, dynamic hemodynamic monitor can be used

- Dynamic parameters are pulse pressure variation (PPV), stroke volume variation (SVV), and inferior vena cava (IVC) distensibility index.
 - Mechanically ventilated patients:
 - $PPV = \frac{PP_{max} - PP_{min}}{PP_{mean}} > 13\%$ indicates fluid responsiveness and more fluid can be given
 - To measure PPV the Tidal volume should be ≥ 8 mL/Kg and no significant dysrhythmias exist
 - IVC distensibility index $(\text{max-min})/\text{min value} > 18\%$.
 - Spontaneous breathing patients
 - Utilize passive leg raising test (PLR) together with measuring SV by Doppler or VTI by transthoracic echo TTE. Increase these indices by 15% or more indicate fluid responsiveness. See figure 2

Vasopressors

- The vasopressor of choice is noradrenaline
 - Dose 0.02-0.7 $\mu\text{g}/\text{kg}/\text{min}$
- IV dopamine or adrenaline can be added if blood pressure is poorly responsive to noradrenaline
 - Dopamine dose 10-20 $\mu\text{g}/\text{kg}/\text{min}$
 - Adrenaline dose 0.01-0.2 $\mu\text{g}/\text{kg}/\text{min}$
 - Caution: Adrenaline may worsen acidosis and increase the lactate
 - Dopamine may cause serious cardiac dysrhythmia and should be used in patient with low risk of dysrhythmia
- Consider adding IV hydrocortisone 50 mg every 6 hours in refractory shock (norepinephrine dose exceeding 0.2 $\mu\text{g}/\text{kg}/\text{min}$)

Sepsis screening tools

Evaluation for severe sepsis screening tool

1. Is the patient's history suggestive of a New infection?

- Pneumonia, Empyema
- Urinary tract infection
- Acute abdominal infection
- Meningitis
- Soft tissue infection
- Bone, joint infection
- Wound infection
- Blood stream catheter infection
- Endocarditis
- Implantable device infection
- Others

Yes No

2. Are any two of the following signs and symptoms of infections both present and new to the patients?

- Hyperthermia > 38 °C
- Hypothermia < 36 °C
- Tachycardia > 90 bpm
- Tachypnea > 20 bpm
- Acute altered mental status
- Leukocytosis (WBC > 12.000)
- Leukopenia (WBC < 4.000)
- Hyperglycemia (Blood glucose >120 mg/dl) in absence of diabetes

Yes No

If the answer is yes to both questions 1 and 2 suspicious of infection is present

- Obtain: Blood lactate, Blood culture, CBC with differential, and basic chemistry lab including bilirubin
- At the physician discretion obtain: chest x-ray, CRP, CT scan, amylase, lipase

3. Are any of the following organ dysfunction criteria present at the site remote from the site of infection that are not considered to be chronic condition?

- SBP < 90 mmHg or MAP < 65 mmHg
- SBP decrease > 40 mmHg from baseline
- Bilateral pulmonary infiltrate with a new oxygen requirement to maintain SPO2 > 90%
- Creatinine > 2 mg/dl or urine output < 0.5 ml/kg/hour for > 2 hours
- Bilirubin > 2 mg/dl
- Platelet count < 100.000
- Coagulopathy (INR > 1.5)
- Lactate > 2 mmol/L (18 mg/dl)

If the suspicion of infection is present AND organ dysfunction is present, the patient meets the criteria for **SEVERE SEPSIS** and should be entered into severe sepsis protocol.

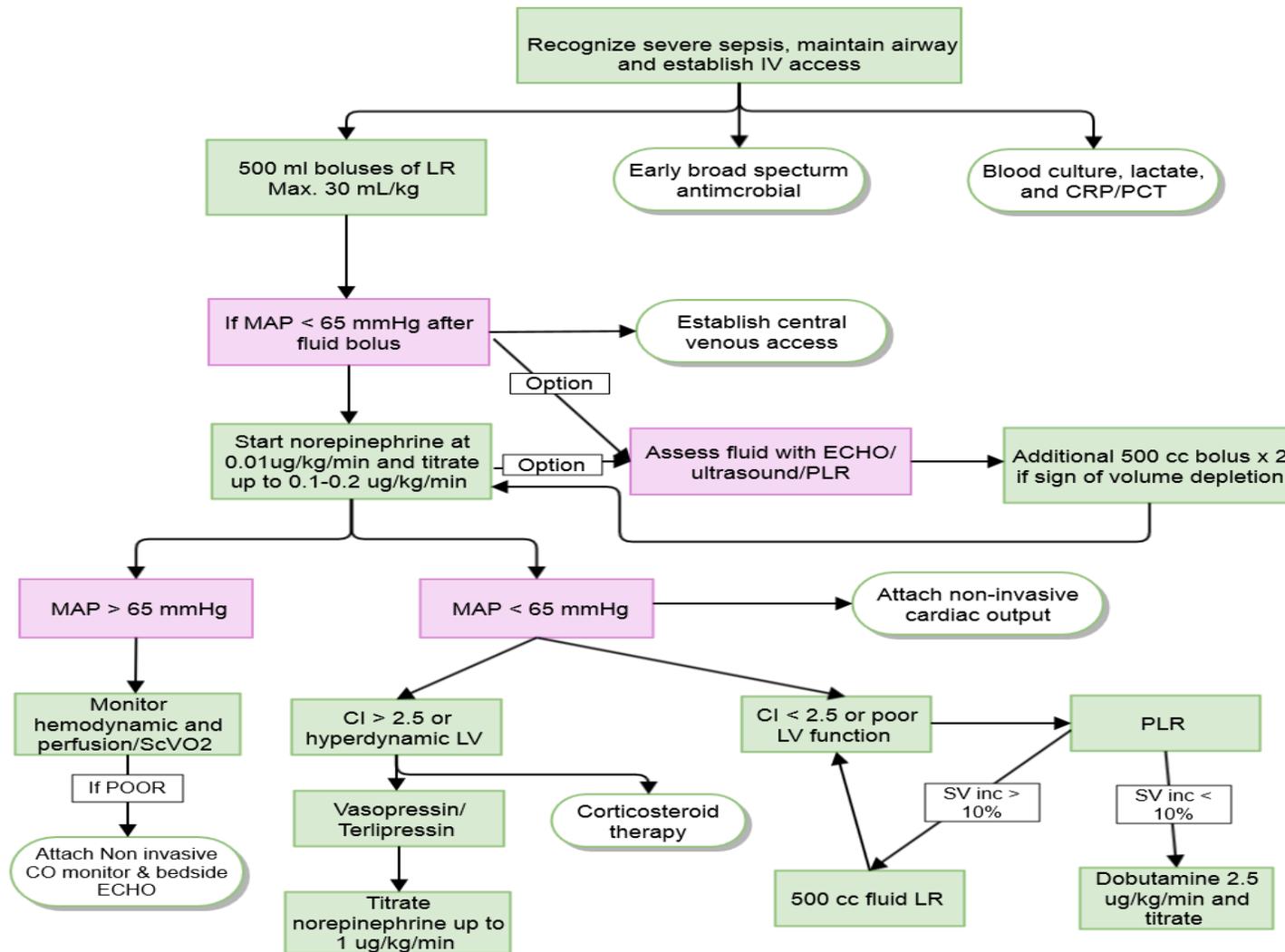


Figure 8: Severe sepsis and septic shock Resuscitation Algorithm ⁽³⁾

References

2. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, Sevransky JE, Sprung CL, Douglas IS, Jaeschke R, Osborn TM, Nunnally ME, Townsend SR, Reinhart K, Kleinpell RM, Angus DC, Deutschman CS, Machado FR, Rubenfeld GD, Webb SA, Beale RJ, Vincent JL, Moreno R; Surviving Sepsis Campaign Guidelines Committee including the Pediatric Subgroup. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2012. Crit Care Med. 2013;41:580-637.
3. Seif D, Perera P, Mailhot T. Bedside ultrasound in resuscitation and therapid ultrasound in shock protocol. Crit Care Res Pract.2012;2012:503254.
4. Marik PE. Early management of severe sepsis: concepts and controversies. Chest. 2014;145:1407-18.