

Septic Shock:

Step 1: Obtain medical history and perform clinical examination: An adult patient suspected of sepsis usually complains of Fever (usually $>101^{\circ}\text{F}$ [38°C]), chills, and rigors, Confusion, Anxiety, Difficulty breathing, Fatigue and malaise, Nausea and vomiting. Pallor or grayish or mottled skin are signs of poor tissue perfusion seen in septic shock. Petechiae or purpura might be observed progressively over the whole body. If the patient is suffering from high fever there is a high risk of fungal infection. Hence elicit a history of immunosuppressant treatment, total parenteral nutrition, Neutropenia, previous long stay in ICU, severe renal failure, HIV infection, diabetes, previous Gastrointestinal surgery or organ transplant history

Step 2: If suspected of Septic shock do the following things simultaneously

- A) Screen for Modified early warning score (MEWS) which includes heart rate, Blood pressure, respiratory rate, Axillary body temperature, mental status, urine output.
- B) Start the screening for infection to rule out noninfectious diseases example intracranial infarcts or hemorrhages, drug reaction
- C) Admit the patient to the ICU within 6 hours of admission/presentation
- D) Initiate continuous monitoring of Airway, Breathing and circulation simultaneously
 - (i) Airway: High oxygen flow using oxygen mask or non invasive ventilation
 - (ii) Breathing: Pulse oximeter
 - (iii) Circulation: Insert central line/ large bore cannula and monitor mean arterial pressure

Step 3: Obtain lab investigations, perform imaging studies to identify source of infection and measure S/lactate simultaneously

- (A) Lab investigations : complete haemogram, liver function test including s. albumin, kidney function test, PT, INR, blood culture sampling or, bronchoalveolar lavage sampling before the first intravenous systemic and empirical antibiotics
- (B) Imaging studies : chest x ray, ultrasound abdomen, other as suggested from clinical examination
- (C) Serum lactate: $>2\text{mmol/L}$
- (D) Arterial blood gas analysis and venous blood gas analysis

Step 4: Initiate Goal Directed Therapy and do the following things simultaneously.

- (A) Fluid Resuscitation: Start crystalloids preferably balanced crystalloids instead of normal saline as first choice (30ml/kg) over 30 mins . Perform S Lactate every 30 mins . Then check the following:
 - (i) Patient is responsive: MBP $> 65\text{ mmHg}$ and S lactate level starts falling to normal range, trend is important to note.

(ii) Patient is not responsive: MBP < 65 mmHg. Do the following sequentially

(a) Start Albumin 100ml to those who have received large volume of crystalloids >2 litres to bring MBP >65 mmHg. If not responsive (MBP <65 mm Hg) move to next

(b) Start Norepinephrine: 0.03 units/min. If not responsive (MBP <65 mm Hg) stop norepinephrine move to next

(c) Start Vasopressin: 0.25-0.5 ug/kg/min. If not responsive (MBP <65 mm Hg) stop vasopressin and move to next

(d) Start Dobutamine: 3-20ug/kg/min. If not responsive (MBP <65 mm Hg) stop dobutamine and move to next

(e) Start Epinephrine: 0.01 to 20ug/kg/min.

(B) Monitor BP: Using Central line to determine if MBP > 65 mmHg. If central line is not present consider peripheral lines with large bore starting from 18 G cannula

(C) Ventilation: Use High Nasal Flow O2. Also do the following simultaneously. If the patients GCS is less than or Equal to 8, endotracheal intubation should be performed.

(i) There is a high risk of ARDS in which the tidal volume is low (6ml/kg), at the same time there is high plateau pressure (30cmH2O). In these patients prone ventilation for >12 hours per day is recommended

(ii) Also give intermittent NMBA bolus, preferably Atracurium 0.1 to .2 mg per kg or Cis atracurium 0.01 mg per kg in consultation with the Intensivist .

(D) Antimicrobial therapy to be started as per the following protocol:

(i) If shock is present (MBP < 65 mm Hg) and sepsis is also present: Start antibiotics immediately. piperacillin tazobactam 4.5gm or base on the anatomical lesion suspected covering both gram positive and gram negative organisms for short duration

(ii) If shock is absent (MBP > 65 mmHg) but sepsis is present: Start antibiotics immediately. piperacillin tazobactam 4.5gm or base on the anatomical lesion suspected covering both gram positive and gram negative organisms for short duration

(iii) If shock present and sepsis is not yet diagnosed: Start antibiotics immediately. piperacillin tazobactam 4.5 gm OR ceftriaxone 1gm OR meropenem 500 mg

(iv) If shock absent and sepsis is not yet diagnosed: Hold on to administer antibiotics but start immediately if concern persists

(E) Start antifungal therapy if patient has high risk of fungal infection has been identified based on history. Injection fluconazole 200 mg

(F) General Measures to be performed simultaneously:

(i) Regular blood sugar testing (144-180 mg/dL) done from arterial blood sample or bed side capillary blood sample from central laboratory. Start insulin therapy if > 180 mg/dL 1unit/kg and adjust with blood sugar levels

(ii) If hemoglobin is below 7gm/dL: perform blood transfusion

(iii) Consider corticosteroids 50 mg intravenous thrice daily

(iv) If there is Acute Kidney injury (oliguria say less 1ml/kg and high creatinine value) (How do you diagnose this) initiate continuous or intermittent renal replacement therapy by intermittent dialysis

(v) Monitor pH level. If $\text{pH} < 7.2$ it is metabolic acidosis alongwith Acute Kidney injury start Bicarbonate therapy (dose)

(vi) It is recommended that oral nutrition is started immediately within 72 hours of admission

Questions:

Within how many hours should a patient suspected of severe sepsis be admitted to the ICU?

A: A patient suspected of severe sepsis should be admitted to the ICU within 6 hours of presentation.

How should we monitor the blood pressure?

A: The blood pressure should be monitored using Central line to determine if the mean blood pressure is greater than 65 mmHg. If central line is not present, consider peripheral lines with large bore starting from 18 G IV cannula.

What are the lab investigations that should be immediately ordered once the patient is admitted to an ICU?

A: Once a patient suspected of severe sepsis is admitted to the ICU, the following lab investigations need to be ordered:

1. Complete Haemogram
2. Liver Function Test including Serum Albumin
3. Kidney Function Test
4. PT, INR

5. Blood Culture sampling or Bronchoalveolar Lavage sampling before the first intravenous systemic and empirical antibiotics

What level of Serum lactate level is considered indicative of septic shock?

A: A Serum Lactate level greater than 2mMol per Litre is considered indicative of septic shock.

What are the arterial blood gas levels that I should focus on while treating a patient with septic shock?

A:

What are the questions I should ask to determine the risk of fungal infection being present?

A: A patient suffering from high fever is at high risk of fungal infection. It is important to elicit a history of:

1. Immunosuppressant treatment
2. Total Parenteral Nutrition(TPN)
3. Neutropenia
4. Previous long stay in ICU
5. Severe Renal Failure
6. HIV infection
7. Diabetes mellitus
8. Previous Gastrointestinal surgery or organ transplant history

What are the venous blood gas levels that I should focus on while treating a patient with septic shock?

A:

What is the first fluid that needs to be administered to a patient with septic shock?

A: The first fluid that needs to be administered to a patient with septic shock are crystalloids, preferably balanced crystalloids instead of normal saline as the first choice given as 30mL per Kg infusion over 30 minutes. Monitor Mean Blood Pressure and perform Serum Lactate every 30 minutes.

What is the dose of crystalloids that needs to be administered to a patient with septic shock?

A: The dose of crystalloids to be administered to a patient with septic shock is a 30mL per Kg infusion over 30 minutes.

If the patient with septic shock is not responding to crystalloids and MBP is <65 mmHg then what should I administer next?

A: If the patient is not responding and MBP is less than 65 mmHg, start Albumin 100ml to those who have received large volume of crystalloids >2 litres to bring MBP > 65 mmHg.

What is the dose of albumin that should be administered?

A: Albumin should be administered in a dose of 100 mL to those who have received large volume of crystalloids (more than 2 litres)

If the patient with septic shock is not responding to albumin and MBP is <65 mmHg then what should I administer next?

A: If the patient is not responding to albumin infusion and MBP is less than 65 mmHg, stop Albumin and start Norepinephrine given in a dose of 0.03 units/mins.

What is the dose of norepinephrine that should be administered?

A: Norepinephrine is given in a dose of 0.03 units/mins.

If the patient with septic shock is not responding to norepinephrine and MBP is <65 mmHg then what should I administer next?

A: If the patient is not responding to norepinephrine and MBP is less than 65 mmHg, stop Norepinephrine and start Vasopressin given as an infusion of 0.25-0.5 ug/kg/min.

What is the dose of vasopressin that should be administered?

A: Vasopressin should be given as an infusion of 0.25-0.5 ug/kg/min.

If the patient with septic shock is not responding to vasopressin and MBP is <65 mmHg then what should I administer next?

A: If the patient is not responding to vasopressin and MBP is less than 65 mmHg, stop Vasopressin and start Dobutamine given as an infusion of 3-20ug/kg/min.

What is the dose of dobutamine that should be administered?

A: Dobutamine should be given as an infusion of 3-20ug/kg/min.

If the patient with septic shock is not responding to dobutamine and MBP is <65 mmHg then what should I administer next?

A: If the patient is not responding to dobutamine and MBP is less than 65 mmHg, stop Dobutamine and start Epinephrine given as an infusion of 0.01 to 20ug/kg/min.

What is the dose of epinephrine that should be administered?

A: Epinephrine should be given as an infusion of 0.01 to 20ug/kg/min.

When should I consider intubating the patient?

A: If the patients Glasgow Coma Scale (GCS) score is less than 8, you should consider intubating the patient.

When should I give muscle relaxants?

A: If the patients Glasgow Coma Scale (GCS) score is less than 8, give intermittent muscle relaxant bolus, preferably Atracurium 0.1 to 0.2 mg per kg or Cis-Atracurium 0.01 mg per kg in consultation with the Intensivist.

What is the dose of atracurium and cis-atracurium?

A: The dose of Atracurium is 0.1 to 0.2 mg per kg, and for Cis-Atracurium it is 0.01 mg per kg, to be administered in consultation with the Intensivist.

When should the patients be put in prone position?

A: In patients with a GCS Score of less than 8, there is a high risk of ARDS in which the tidal volume is low (6ml/kg), at the same time there is high plateau pressure (30 cm H₂O). In these patients, prone ventilation for more than 12 hours per day is recommended.

What is the antibiotic to start when the patient has MBP <65mmHg and sepsis is diagnosed?

A: When the patient has MBP less than 65 mmHg and sepsis is diagnosed, the following antibiotics are to be started: Piperacillin-Tazobactam 4.5gm or base on the anatomical lesion suspected covering both gram-positive and gram-negative organisms for a short duration.

If fungal infection is suspected what is the drug administered?

A: If fungal infection is suspected, injection Fluconazole 200 mg is administered.

What is the blood sugar level beyond which we should start insulin therapy?

A: Regular blood sugar level testing is done from arterial blood sample or bed side capillary blood sample from central laboratory. Start insulin therapy if blood sugar levels are greater than 180 mg/dL.

When should I start insulin therapy?

A: Insulin therapy is started when blood sugar levels are greater than 180 mg/dL.

What is the dose of insulin?

A: Insulin is started at 1unit/kg and adjusted with blood sugar levels.

How does the patient with septic shock present most commonly?

A: An adult patient suspected of sepsis usually presents with:

1. Fever (usually $>101^{\circ}\text{F}$ [38°C]) with chills and rigors
2. Confusion
3. Anxiety
4. Difficulty breathing
5. Fatigue and malaise
6. Nausea and vomiting
7. Pallor/grayish/mottled skin - signs of poor tissue perfusion
8. Petechiae or purpura

When should the patients be suspected of septic shock?

A: Patients should be suspected to be in septic shock when they present with:

1. Fever (usually $>101^{\circ}\text{F}$ [38°C]) with chills and rigors
2. Confusion
3. Anxiety
4. Difficulty breathing
5. Fatigue and malaise
6. Nausea and vomiting

7. Pallor/grayish/mottled skin - signs of poor tissue perfusion
8. Petechiae or purpura

What should be done after identifying a patient with possible severe sepsis or septic shock?

A: If the patient is suspected of Septic shock do the following things simultaneously:

1. Screen for Modified early warning score (MEWS) which includes heart rate, Blood pressure, respiratory rate, Axillary body temperature, mental status, urine output.
2. Start the screening for infection to rule out noninfectious diseases example intracranial infarcts or hemorrhages, drug reaction
3. Admit the patient to the ICU within 6 hours of admission/presentation
4. Initiate continuous monitoring of Airway, Breathing and circulation simultaneously
 - a. Airway: High oxygen flow using oxygen mask or non invasive ventilation
 - b. Breathing: Pulse oximeter
 - c. Circulation: Insert central line/ large bore cannula and monitor mean arterial pressure

What are the steps to follow if the patient's blood oxygen saturation level is <90% on high FiO2 supplemental oxygen (non-rebreather mask)?

A:

How should I assess if the patient with severe sepsis is responding to fluid administration?

A: To assess response to fluid resuscitation in severe sepsis, ensure that the MBP is greater than 65 mmHg and Serum Lactate level starts falling to normal range. The trend is important to note.

When should blood transfusion be considered?

A: Blood Transfusion should be considered when patient's hemoglobin is below 7 gm/dl.

When should corticosteroids be considered?

What is the dose of corticosteroids to be administered?

When should I suspect Acute kidney injury?

A: You can suspect Acute Kidney injury when the patient presents with oliguria, less than 1ml/kg urine output and high creatinine value.

What should I do if Acute kidney injury is suspected?

A: If suspecting Acute Kidney Injury, initiate continuous or intermittent renal replacement therapy by intermittent dialysis.

When should I suspect metabolic acidosis?

A: If the blood pH falls below 7.2 , you should suspect Metabolic Acidosis.

When should I start bicarbonate therapy?

A: Bicarbonate therapy should be started if the blood pH falls below 7.2

When should oral nutrition be started?

A: Oral nutrition should be started within 72 hours of admission.

The patient has a history of organ transplant. Is there any specific medicine I should administer?

A: if the patient has a history of organ transplant, administering antibiotics like Piperacillin-Tazobactam 4.5gm or based on the anatomical lesion is recommended.