Rationale:

Patients found to be hypotensive require rapid assessment to determine the cause. This protocol is written for the prompt recognition and intervention of the patient experiencing Systemic Inflammatory Response Syndrome (SIRS), sepsis, severe sepsis, or septic shock. The goal is to maximize oxygen delivery and perfusion to maintain cellular, tissue and organ function.

Procedure:

1. Secure the airway. Utilize adjuncts as indicated and be prepared to intubate. If the patient is intubated and placed on mechanical ventilation, utilize low tidal-volume ventilations at 6 ml/kg. If CPAP is indicated, utilize the lowest pressure settings that will still provide adequate oxygenation to avoid the potential for lung injury.
   ♦ Avoid the use of Etomidate with RSI with any patient that may be hemodynamically compromised. Etomidate inhibits adrenal steroid production and the patient’s ability to respond to stress or hypoperfusion. The use of Etomidate is associated with higher rates of mortality in sepsis.
   ♦ Consider the use of Ketamine if sedation is required. Midazolam (Versed) may also be considered, but may be associated with worsening hypotension.

2. Administer oxygen as indicated and monitor etCO$_2$. If cellular perfusion and metabolism is reduced, carbon dioxide production will also be reduced. An etCO$_2$ of 32 mmHg less may be an indication of anaerobic metabolism. An etCO$_2$ of 25 mmHg without tachypnea has been associated with lactate levels of 4 mmol/L or higher.

3. Ascertain history of present illness and past medical history. Determine nature of illness and treat appropriately.

4. Perform a physical assessment and observe for signs of SIRS. Assess vital signs, pulse oximetry, etCO$_2$, and temperature. When considering SIRS criteria, make note of the patients recent medication regimen (antipyretics, beta-blockers, narcotics) and the anticipated actions for each such as lowered temperature, decreased HR, decreased RR. Also, note any routes or potential sources of infection including but not limited to mechanical ventilation, in-dwelling catheters, open sores, and decubitus ulcers.

SIRS criteria includes:
   ♦ A heart rate greater than 90 bpm.
   ♦ A respiratory rate greater than 20.
   ♦ A temperature greater than 100.4°F or less than 96.8°F.
   ♦ Suspected or documented infection.

Septic Shock is defined as the presence of SIRS criteria plus:
   ♦ Signs of hypoperfusion and/or elevated lactate levels.
   ♦ Systemic (mean arterial) pressure less than 60 mmHg despite adequate fluid resuscitation of 40 – 60 mL/kg of isotonic solution requiring vasopressor support.

In infants and pediatrics, look for signs of lethargy, weakness, malaise, decreased urine output, delayed capillary refill, weak peripheral pulses, or cool extremities.
5. Apply ECG and document rhythm. Acquire 12-Lead ECG as time permits. Treat arrhythmias such as bradycardia or tachycardia per the appropriate treatment algorithm.

6. Initiate large bore IVs/IO of 0.9% NS. Consider placing a second large bore IV as time permits.
   ♦ Initiate fluid resuscitation of 30 mL/kg up to 3000 mL.
   ♦ In pediatrics, initiate a fluid bolus at 20 ml/kg or 10 ml/kg in infants and newborns. Reassess and repeat as indicated.

7. Assess blood sugar from IV start or finger stick and treat hypoglycemia per protocol. Due to the physiologic stress and metabolic derangement caused by anaerobic metabolism, hyperglycemia is a common finding.

8. Determine blood chemistry and lactate levels from blood draw or IV start if available. If possible, draw blood cultures for processing at the receiving facility.

9. If the lactate level is ≥ 4.0 mmol/L with SIRS criteria (normal levels are 0.5 – 1 mmol/L):
   ♦ Support oxygenation and ventilation to meet metabolic demands.
   ♦ Continue fluid resuscitation of 30 mL/kg up to 3,000 mL IV. Use caution in the presence of cardiovascular compromise or heart failure.
   ♦ Consider transport of adult patients to a receiving facility that utilizes Early Goal Directed Therapy (EGDT) as a Sepsis Alert if no contraindications exist (#14).

10. If patient remains hypotensive following initial treatment and fluid boluses, initiate vasopressor support with norepinephrine (the preferred pressor agent) or dopamine.

    Administer norepinephrine (Levophed) at 2 – 20 mcg/min per IV/IO infusion. Initiate infusion at 2 mcg/min and titrate to maintain systolic blood pressure at 90 – 100 mmHg or MAP at 65 – 70 mmHg. (See dosing chart.)

    -OR-

    Administer dopamine at 5 - 20 mcg/kg/min per IV/IO infusion. Initiate infusion at 5 mcg/kg/min and titrate to maintain systolic blood pressure at 90 - 100 mmHg or MAP 65 – 70 mmHg.

11. Closely monitor for any change or signs of congestive heart failure with treatment. Adjust fluid infusion as appropriate.

12. ☑ Consider the administration of Levaquin (Levofloxacin) either IV or PO.
    ♦ Adult dose: the adult IV dose for patients over 50 kg is 750 mg IV as a slow infusion over 60 minutes. The oral dose is one 750 mg tablet.
    ♦ Children, adolescents, and small adults less than 50 kg: the dose is 500 mg IV as a slow infusion over 60 minutes.
    ♦ Pediatric dose: the infant and pediatric dose for children up to age 8 and less than 50 kg is 8 mg/kg IV as a slow infusion over 60 minutes. Total dose not to exceed 250 mg.
13. **Low-dose corticosteroids are associated with faster recovery from septic shock and weaning from vasopressors. It promotes shock reversal by protecting vascular tone, improving vascular response to catecholamines, and reducing exaggerated inflammatory response. After 60 minutes of pressor support, administer methylprednisolone 125 mg IV.**

14. Adult patients in severe sepsis and septic shock should be transported to a receiving facility that aggressively utilizes Early Goal Directed Therapy (EGDT) in the treatment of sepsis. EGDT includes the ability to monitor central venous pressure and venous oxygen saturation. Goals for treatment include a CVP of 8 – 12, $S_{cO_2}$ of > 70% and a MAP of > 65 mmHg.

Transport to the appropriate facility should occur unless any of the following contraindications or circumstances are present:

- STEMI, CVA, or other time-critical diagnosis.
- Overriding traumatic injury meeting trauma system criteria.
- Inability to manage the airway or maintain circulatory status throughout transport.
- The known or expressed desire for no aggressive resuscitation measures.
- Patient or family member refuses transport to the recommended hospital.
- Paramedic judgment that extended transport time would be detrimental to patient condition or outcome.

**Norepinephrine (Levophed) Dosage and Infusion Rate.**

Mix 4 mg/250 ml = 16 mcg/ml

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