Shock

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Shock

What is Shock?

Shock

- **Inadequate oxygen delivery to meet metabolic demand**.
- Results in global tissue hypoperfusion and metabolic acidosis
- Shock can occur with a normal blood pressure, and hypotension can occur without shock

Shock

- Oxygen delivery is the function of the circulatory system.

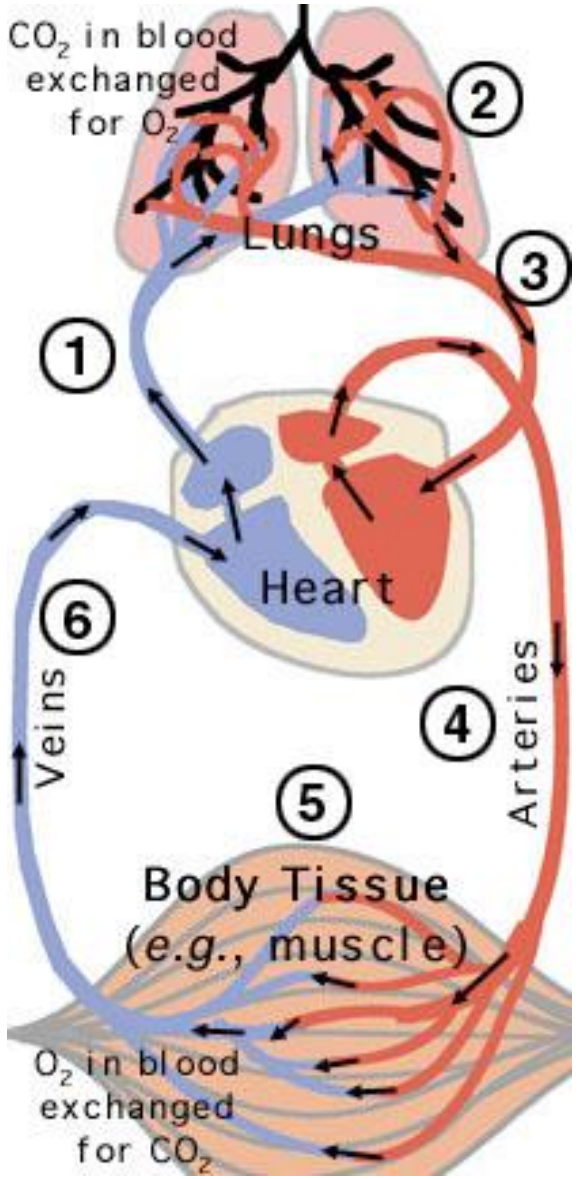
- This system is basically:

  - Pump (heart)

  - Pipes (vessels)

  - Solution (blood)

- Needs to function at adequate pressure, volume and carrying capacity.



Understanding Shock

- Inadequate systemic oxygen delivery activates autonomic responses to maintain systemic oxygen delivery

  - **Sympathetic nervous system**
    - NE, epinephrine, dopamine, and cortisol release
      - Causes vasoconstriction, increase in HR, and increase of cardiac contractility (cardiac output)
  - **Renin-angiotensin axis**
    - Water and sodium conservation and vasoconstriction
    - Increase in blood volume and blood pressure

Understanding Shock

- Cellular responses to decreased systemic oxygen delivery
  - ATP depletion → ion pump dysfunction
  - Cellular edema
  - Hydrolysis of cellular membranes and cellular death
- The body tries to maintain cerebral and cardiac perfusion
  - Vasoconstriction of splanchnic, musculoskeletal, and renal blood flow
- Global cellular reliance on anerobic glycolysis and increased lactate production.
- Systemic metabolic lactic acidosis

Multiorgan Dysfunction Syndrome (MODS)

- Progression of physiologic effects as shock ensues
  - Cardiac depression
  - Respiratory distress
  - Renal failure
  - DIC

- Result is end organ failure

Types Of Shock

Low Cardiac Output states

- Hypovolemic shock (↓↓ solution)
  - bleeding
  - Dehydration
- Cardiogenic shock (↓↓ pump)
  - Impaired inflow
  - Primary pump dysfunction
  - Impaired outflow

- **Low peripheral resistance states** (↑↑pipes)
  - Neurogenic shock
    - Loss of sympathetic tone
  - Vasogenic Shock
    - Septic
    - Anaphylactic

Types Of Shock

Shock type	Examples	HR	BP	CO	Capillary refill	Extremity temperature	SVR	Treatment
Hypovolemic	Hemorrhage Dehydration	↑	↓	↓	Delayed	Cool	High	Stop bleeding Fluid resuscitation
Cardiogenic	Myocarditis Dysrhythmia	↑	↓	↓	Delayed	Cool	High	Inotropes Caution with fluids ECMO
Distributive	Sepsis Anaphylaxis	↑	↓	↓ or ↑	Flash or delayed	Warm or cool	Low or high	Antibiotics, fluids Epinephrine
Neurogenic	Spinal cord injury Traumatic brain injury	↓	↓	↓	Flash or normal	Warm	Low	Fluid resuscitation Vasopressors
Obstructive	Tamponade Tension pneumothorax	↑	↓	↓	Delayed	Cool	High	Pericardiocentesis Chest tube
Dissociative	Carbon monoxide Cyanide	↑	Normal or ↑	↑	Normal	Normal	Low to normal	Antidotes Hyperbaric therapy

HR, heart rate; BP, blood pressure; CO, cardiac output; SVR, systemic vascular resistance.

	I	II	III	IV
Blood loss (mL)	Up to 750	750–1500	1500–2000	> 2000
Blood loss (% blood volume)	Up to 15	15–30	30–40	> 40
Pulse rate (per minute)	< 100	100–120	120–140	> 140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure (mm Hg)	Normal or increased	Decreased	Decreased	Decreased
Respiratory rate (per minute)	14–20	20–30	30–40	> 35
Urine output (mL/hour)	> 30	20–30	5–15	Negligible
Central nervous system/ mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic

Classes of Hypovolemic Shock

Treatment of Shock

Goal: Restore perfusion

Method: Depends on type of Shock

Reverse the cause.

End Points of Resuscitation in Shock management

Normal vital signs (can be misleading)

Normal serum lactate levels

Evidence of adequate tissue perfusion!!

- **normal mental status.**
- **normal urine output.**
- normal liver function.

etc.

What Type of Shock is This?

68 yo M with hx of HTN and DM presents to the ER with abrupt onset of diffuse abdominal pain with radiation to his low back. The pt is hypotensive, tachycardic, afebrile, with cool but dry skin.

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Hypovolemic shock

Hypovolemic Shock Management

- ABCs
- Establish 2 large bore IVs or a central line
- Crystalloids
  - Normal Saline or Lactate Ringers
- PRBCs
  - O negative or cross matched
- Control any bleeding
- Arrange definitive treatment

Evaluation of Hypovolemic Shock

- CBC
- ABG/lactate
- Electrolytes
- BUN, Creatinine
- Coagulation studies
- Type and cross-match

- As indicated
  - CXR
  - Pelvic x-ray
  - Abd/pelvis CT
  - Chest CT
  - GI endoscopy
  - Bronchoscopy
  - Vascular radiology

IV Resuscitation

Flow Rates in IV/IO Access

Gauge	Approximate Flow Rate to Gravity (mL/min)	Time to Infuse 1L (min)
14G	250	4
16G	150	7
Cordis	130	8
18G	100	10
15G Humeral IO	80	13
16G Distal Port Triple Lumen	70	15
15G Tibial IO	70	15
20G	60	17
22G	35	29
18G Prox Port Triple Lumen	30	34

REBEL REVIEWS

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What Type of Shock is This?

A 34F presents to the ER after dining at a restaurant where shortly after eating the first few bites of her meal, became anxious, diaphoretic, began wheezing, noted diffuse pruritic rash, nausea, and a sensation of her “throat closing off”. She is currently hypotensive, tachycardic and ill appearing.

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Anaphylactic

Anaphylactic Shock- Diagnosis

- Clinical diagnosis
  - Defined by airway compromise, hypotension, or involvement of cutaneous, respiratory, or GI systems
- Look for exposure to drug, food, or insect
- Labs have no role

Anaphylactic Shock- Treatment

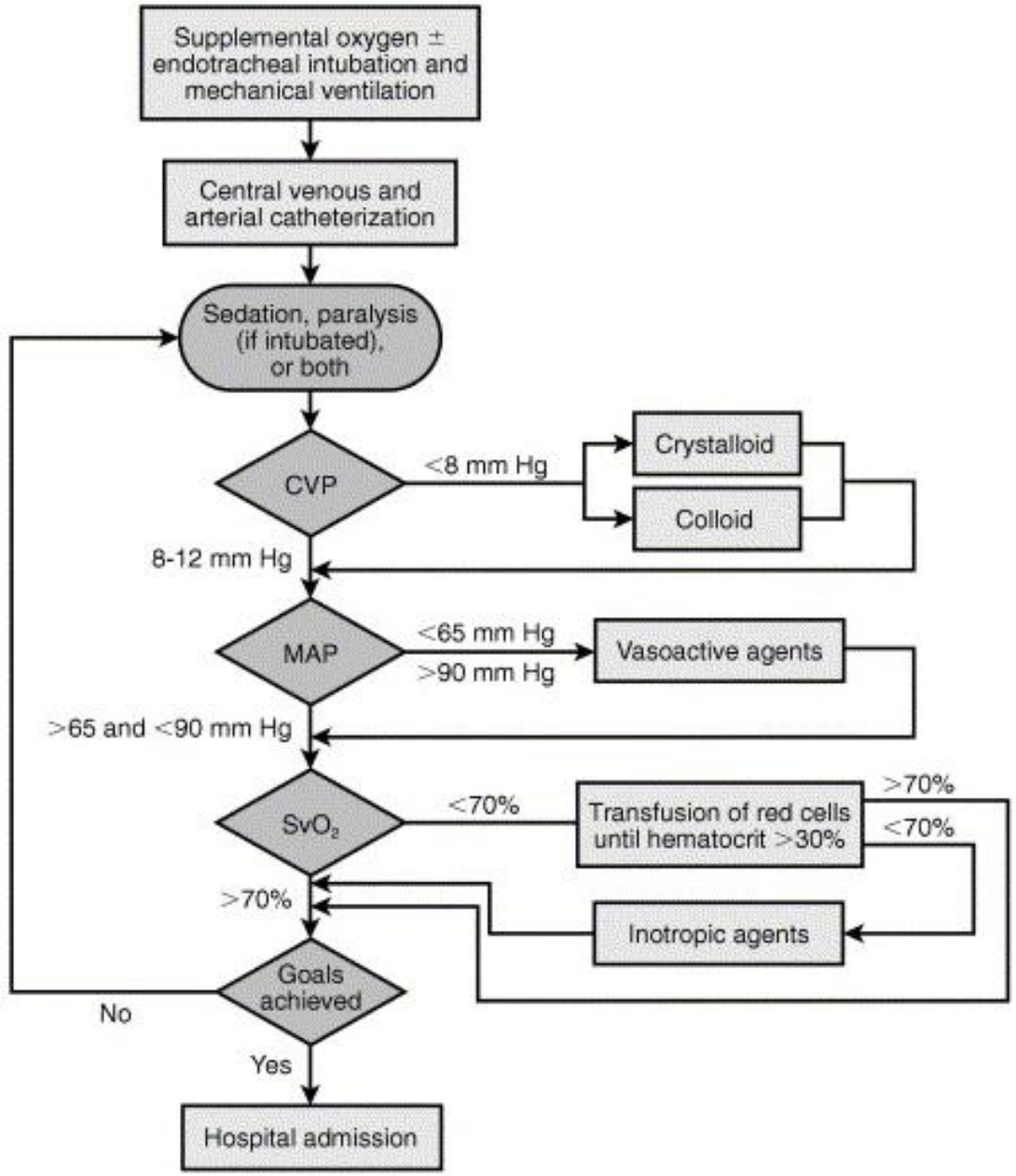
- ABC's
  - Angioedema and respiratory compromise require immediate intubation
- IV, cardiac monitor, pulse oximetry
- IVFs, oxygen
- **Epinephrine**
- Second line
  - Corticosteriods
  - H1 and H2 blockers

What Type of Shock is This?

A 73 year old lady with a history of ischemic heard disease, HTN, DM II presents to the ED with altered mental status. She is febrile to 39.4, hypotensive with a widened pulse pressure, tachycardic, with warm extremities and decreased urine output.

Treatment of Septic Shock

- 2 large bore IVs, fluid resus.
- Supplemental oxygen
- Broad spectrum IV antibiotics, based on suspected source, as soon as possible.
- Goal directed therapy.



Treatment Algorithm

Rivers E et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock N Engl J Med. 2001:345:1368-1377.

Summary

- Shock is inadequate tissue oxygenation.
- Can be a result of a variety of conditions.
- First step in management is to detect patients in shock.
- Management is mainly reversing the cause, while supporting vital functions in the meantime.
- If left untreated, will lead to death.

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