Basics of Shock

Educational Reinforcement Material
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Critical Care Fundamentals: Basics of Shock

Pre-Test Questions

1. What is the definition of shock?
   a. Systolic blood pressure < 65 mm Hg
   b. Lactic acid production due to anaerobic metabolism
   c. Metabolic supply to tissues does not meet demand
   d. When you are scared of something

2. What are the two pathways that pyruvate can take?
   a. Krebs cycle or gluconeogenesis
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3. Why does shock have increased lactic acid production (besides anaerobic metabolism)?
   a. Epinephrine activation of beta 2 receptors
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4. How is lactate cleared?
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   c. It is changed back into pyruvate to go into the Krebs cycle
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5. Cold shock is defined by…?
   a. Decreased effective intravascular volume
   b. Increased systemic vascular resistance
   c. Decreased or inadequate stroke volume
   d. Vasoconstriction (both venous and arterial)

6. Warm shock is defined by…?
   a. Decreased afterload
   b. Increased preload
   c. Narrow pulse pressure
   d. Decreased systemic vascular resistance

7. What are the components of stroke volume?
   a. Preload, afterload, and heart rate
   b. Preload, contractility, and systemic vascular resistance
   c. Preload, afterload and contractility
   d. Afterload and contractility

8. Which one does not cause a decrease in preload?
   a. Hemorrhage
   b. Myocarditis
   c. GI bleed
   d. Vasodilation

9. Which one does not cause a decrease in contractility?
   a. Aortic stenosis
   b. Cardiac ischemia
   c. Myocarditis
   d. Congenital heart disease

10. Which one does not cause increased afterload?
    a. Hypertensive emergency
    b. Left Ventricular outflow obstruction
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11. What correlates with systolic blood pressure?
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13. What is the first compensation for a decrease in stroke volume to maintain cardiac output?
   a. Increase heart rate
   b. Increase peripheral vascular resistance
   c. Epinephrine
   d. Decreased urine output

14. What is the next step if an increase in heart rate is inadequate to maintain cardiac output?
   a. More increased heart rate
   b. Decreased urine output
   c. Increase systemic vascular resistance
   d. Increased contractility

15. What is cold shock?
   a. Decrease in cardiac output
   b. Increased in systemic vascular resistance leading to bradycardia
   c. Increase in afterload
   d. Decrease in stroke volume leading to increased systemic vascular resistance

16. What happens to the pulse pressure in cold shock?
   a. Increases
   b. Stays the same
   c. Decreases
   d. Depends on the cause of cold shock

17. What are the three types of cold shock?
   a. Cardiogenic, hypovolemic, obstructive
   b. Hypovolemic, septic, neurogenic
   c. Cardiogenic, obstructive, neurogenic
   d. Hypovolemic, neurogenic, septic

18. What type of shock is tamponade?
   a. Cardiogenic
   b. Obstructive
   c. Hypovolemic

19. What is warm shock?
   a. Decrease in cardiac output
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   c. Increase in afterload
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20. What happens to the pulse pressure in warm shock?
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21. What is another name of warm shock?
   a. Distributive shock
   b. Sepsis
   c. Hypovolemic

22. What type of distributive shock has bradycardia?
   a. Septic
   b. Obstructive
   c. Neurogenic
   d. Cardiogenic
Critical Care Fundamentals: Basics of Shock

Shock 0045

When supply does not meet demand

The metabolic supply to tissue, and thereby organ systems, does not meet the demand

It is NOT defined by a blood pressure

___________ metabolism: Less efficient energy production, lactate production

Lactate Production 0250

Glycolysis and Pyruvate

Krebs cycle

Lactate production in normal circumstances is due to __________ oxygen supply

Lactate production in shock is due to __________ stimulation of the __________ by epinephrine leading to increased __________

Lactate production as energy source

Normally always have low levels of lactate production that is cleared by the kidneys and the liver

Causes of Hyperlactatermia

× Liver Disease
× Accelerated glycolysis (increased metabolism): fever, adrenalin, hyperthyroidism, albuterol use
× Mitochondrial dysfunction (Inborn errors of metabolism)
× Thiamine deficiency (malnutrition, chronic alcoholism)
× Anaerobic metabolism (ischemic gut)
× Carbon monoxide and cyanide toxicity: alter oxidative phosphorylation
× Metformin
× Hyperventilation (alkalemia)
× Sepsis (multifactorial)

Categories of shock 0638

Cold shock 0710

× __________ stroke volume
× __________ preload, contractility
× __________ afterload
× __________ pulse pressure due to compensatory __________ and __________ in systemic vascular resistance

Warm shock

× __________ systemic vascular resistance
× Movement of blood flow from vital organs to non-vital organs (e.g. skin and muscles)
× __________ pulse pressure due to the __________ systemic vascular resistance

Stroke Volume 0829

× The amount of blood pumped out of the heart with each heartbeat
Critical Care Fundamentals: Basics of Shock

Preload:
- The volume of blood present in the ventricle at ______________
- Causes for ______________ in preload – hypovolemia, hemorrhage or vasodilation

Contractility:
- The strength of ______________
- Causes for ______________ contractility- ischemia, toxins, myocarditis, congenital heart disease

Afterload:
- ______________ against the ventricular contraction
- Causes for ______________ afterload- hypertensive emergency, increased vasoconstriction

Defining Blood Pressures 0947

Systolic Blood pressure
- Determined by the blood volume in the arteries + aortic compliance
- Systolic Blood Pressure ~ ____________

Diastolic Blood Pressure
- As the ventricle is relaxing, tissue perfusion determined by systemic vascular resistance
- Diastolic Blood Pressure ~ ______________________

Chronically low diastolic blood pressure, therefore an increased pulse pressure, could be associated with aortic regurgitation

Compensation for Shock 1150

________ stroke volume->. Low cardiac output state and decreased tissue perfusion

1. Increase heart rate
2. Increase systemic vascular resistance (if heart rate is inadequate)

Determinates of vascular tone
- ______________: catecholamines that cause vasoconstriction
- ______________: (+) RAAS -> angiotensin II and aldosterone release

Categories of shock 1424

Cold shock:
Decrease stroke volume (i.e. decreased SBP) + increased systemic vascular resistance (i.e. increased DBP)=> narrow pulse pressure

Cardiogenic shock:
- Trouble with ______________
- Examples: ischemia, congenital heart disease, toxins
- Note: increasing the systemic vascular resistance will increase the ____________, thereby making it worse by further decreasing the stroke volume

Hypovolemic shock:
- Trouble with ______________
Critical Care Fundamentals: Basics of Shock

- Examples: hemorrhage, gastrointestinal losses, venodilation (most of the blood volume is in the venous vasculature) leading to relative hypovolemia

Obstructive shock (SICK):
- Mechanism: Decreased ____________/ increased ___________; normal ____________
- Examples: Massive pulmonary embolism, cardiac tamponade, tension pneumothorax, HTN crisis, aortic dissection, restrictive/ constrictive pericarditis, very high positive end expiratory pressure (PEEP), abdominal compartment syndrome

Warm shock:

Distributive shock (meaning the problem is the “distribution” of blood flow)= ___________ stroke volume (i.e. decreased SBP) << ________________ systemic vascular resistance (i.e. decreased DBP) => _____________ pulse pressure

1. ______________ - Increase in venous capacitance leading to blood pooling in the venous system
2. Increased capillary permeability - leading to loss of plasma volume into the interstitial space (so has a component of hypovolemic shock)
3. Increased heart rate + increased contractility(compensation)
   - Sepsis, ____________, ____________, ______________
   - Sepsis - myocardial dysfunction due to cytokine release

Decreased/ normal heart rate
- ______________ shock (unopposed vagal tone)
Critical Care Fundamentals: Basics of Shock

Post Test Questions

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   c. Increase systemic vascular resistance
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Critical Care Fundamentals: Basics of Shock

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   b. Obstructive
   c. Neurogenic
   d. Cardiogenic

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   c. Cardiogenic, obstructive, neurogenic
   d. Hypovolemic, neurogenic, septic

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   a. Epinephrine activation of beta 2 receptors
   b. All of it is from anaerobic metabolism from tissue ischemia
   c. Epinephrine activation of alpha 2 receptors
   d. Decreased clearance so no increased production

21. What happens to the pulse pressure in warm shock?
   a. Increases
   b. Stays the same
   c. Decreases

22. What is another name of warm shock?
   a. Distributive shock
   b. Sepsis
   c. Hypovolemic
**Critical Care Fundamentals:** Basics of Shock

**Pre-Test Questions and Answers**

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   d. Hoffman degradation

5. Cold shock is defined by…? 0710
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   c. Decreased or inadequate stroke volume
   d. Vasoconstriction (both venous and arterial)

6. Warm shock is defined by…? 0742
   a. Decreased afterload
   b. Increased preload
   c. Narrow pulse pressure
   d. Decreased systemic vascular resistance

7. What are the components of stroke volume? 0829
   a. Preload, afterload, and heart rate
   b. Preload, contractility, and systemic vascular resistance
   c. Preload, afterload and contractility
   d. Afterload and contractility

8. Which one does not cause a decrease in preload? 0844
   a. Hemorrhage
   b. Myocarditis
   c. GI bleed
   d. Vasodilation

9. Which one does not cause a decrease in contractility? 0905
   a. Aortic stenosis
   b. Cardiac ischemia
   c. Myocarditis
   d. Congenital heart disease

10. Which one does not cause increased afterload? 0927
    a. Hypertensive emergency
    b. Left Ventricular outflow obstruction
    c. Increased vasodilation
    d. Aortic stenosis

11. What correlates with systolic blood pressure? 0954
    a. Cardiac output
    b. End diastolic volume
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12. What correlates with diastolic blood pressure? 1039
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   c. Epinephrine
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14. What is the next step if an increase in heart rate is inadequate to maintain cardiac output? 1234
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15. What is cold shock? 1448
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18. What type of shock is tamponade? 1850
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