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Advanced Emergency Trauma Course

Shock

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Overview

- Introduction
  - Definition
  - Physiology
- Initial Patient Assessment
  - Recognize
- Types of Shock
- Classes of Hemorrhagic Shock
- Treating Hemorrhagic Shock
  - Fluid/Blood Resuscitation
  - Evaluating treatment of Shock

Introduction

- In order to treat shock appropriately, it must first be recognized, then identify the cause

- In order to recognize it, it is important to understand some of the physiology of the disease process

Definition

- A physiological state that results in inadequate organ perfusion and tissue oxygenation
- Downward spiral of impaired perfusion leading to impaired function
- Results in multiple organ failure and death

Basic Physiology

- Oxygen Delivery = CO x arterial content of O2
- Cardiac Output = HR x Stroke Volume
- Stroke Volume is a function
  - Preload
  - Afterload
  - Myocardial Contractility

Pathophysiology

- Blood loss
  - Release of endogenous catecholamines
    - Increase cardiac output
      - Increase heart rate
      - Vasoconstriction of less vital organs
        - skin, muscle
        - Results in higher diastolic BP (narrow PP)
    - Continue to perfuse vital organs as long as possible (brain, heart, kidney)

Initial Patient Assessment

- Recognition of Shock
  - Clinical signs and symptoms depends on the severity of the shock
  - Early manifestations include tachycardia and cutaneous vasoconstriction

Clinical Pathophysiology of Shock

- General / Vital signs
- Cardiovascular- tachycardia
- Skin- vasoconstriction vs. vasodilation
- Respiratory- increased RR
- Urinary- decrease urine output
- Neurologic- confusion, agitation
- Extremities- cold vs. warm

Clinical Endpoints of Shock

DECREASED BLOOD FLOW TO BRAIN AND HEART

Restless, agitated, confused, lethargy

Hypotension

Tachycardia

Tachypnea

END-STAGE SHOCK

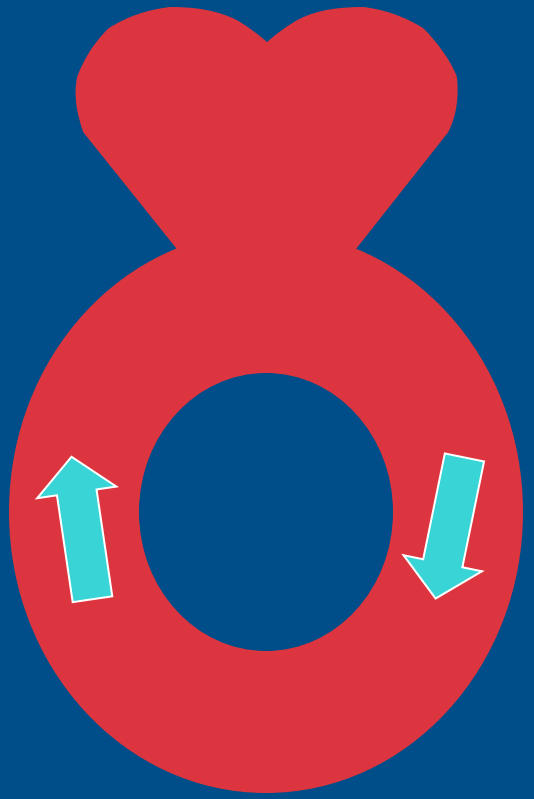
Bradycardia

Arrythmias

Death

Classifying Shock

- Hypovolemic
  - Hemorrhagic
- Distributive /Vasogenic
  - Sepsis, Anaphylactic
- Cardiogenic
- Neurogenic
  - Spinal cord injury



SIRS

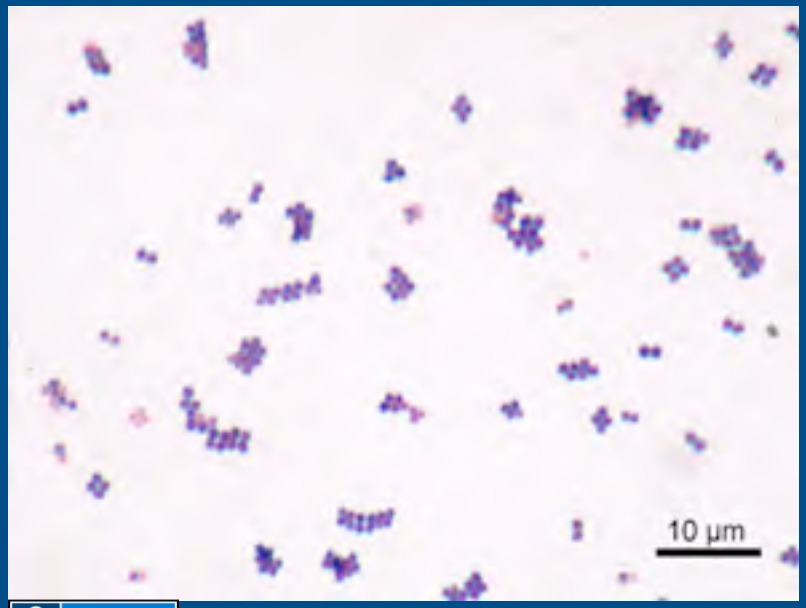
- Systemic Inflammatory Response Syndrome -SIRS
  - Defined by the presence of two or more of the following:
    - Body temp < 36 °C (97 °F) or > 38 °C (100 °F)
    - Heart Rate > 90 bpm
    - RR > 20 bpm
    - WBC < 4,000 cells/mm^3 or > 12,000 cells/mm^3 (< 4×10^9 or > 12×10^9 cells/L), or greater than 10% band

Sepsis and Septic Shock

- Sepsis- Defined as SIRS in response to a confirmed infectious process.
- Septic shock- Defined as sepsis with refractory arterial hypotension or hypoperfusion abnormalities in spite of adequate fluid resuscitation.

Septic Shock

- A blood borne infection widely disseminated to many areas of the body
- Common features are high fever, vasodilatation (especially in affected tissues)
- Sludging of the blood, and RBC agglutination resulting in DIC



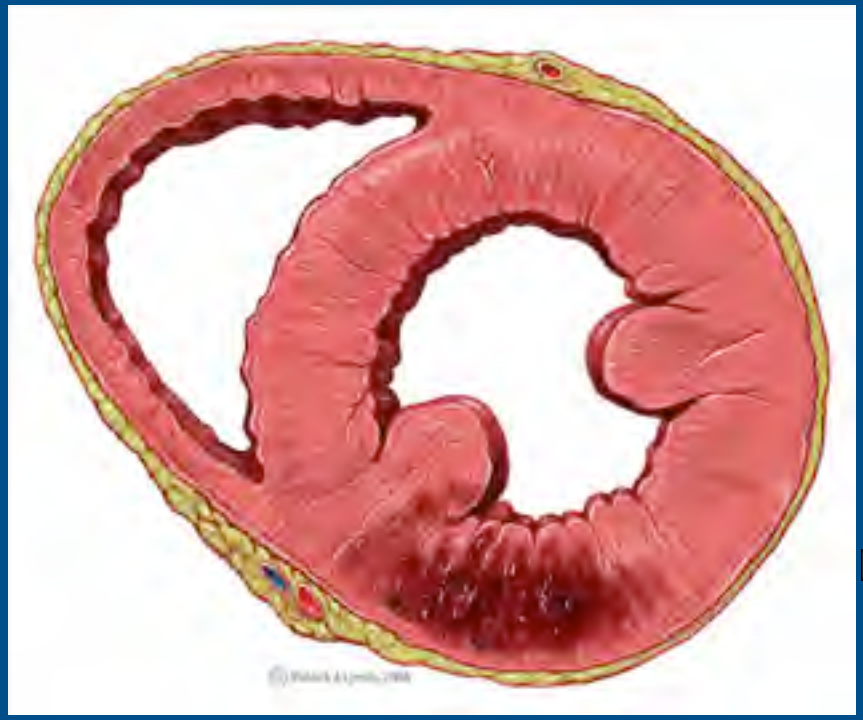
http://en.wikipedia.org/wiki/File:Staphylococcus_aureus_Gram.jpg

Anaphylactic Shock

- An IgE mediated event that triggers massive release of immune response mediators
- Results in widespread peripheral vasodilation, bronchial smooth muscle contraction, and local vascular dilatation

Cardiogenic Shock

- Key elements are hypotension (SBP < 90) **and** hypoperfusion with pulmonary congestion
- Mortality is 50 - 80% before reperfusion therapy
- Acute myocardial ischemia is most common cause



Patrick J. Lynch, medical illustrator;
C. Carl Jaffe, MD, cardiologist
(Wikipedia)

Neurogenic Shock

- Result of spinal cord injury
- Loss of sympathetic tone
- Decreased vasomotor tone
- Results in hypotension and bradycardia
- Patients may remain alert, warm, and dry despite the hypotension

PD-SELF

Photo of Christopher Reeve taken by gunkyboy (Wikipedia)

Case 1

- 29 y/o male, PVA while crossing the street, awake, complaining of severe back pain, and inability to move or feel his legs

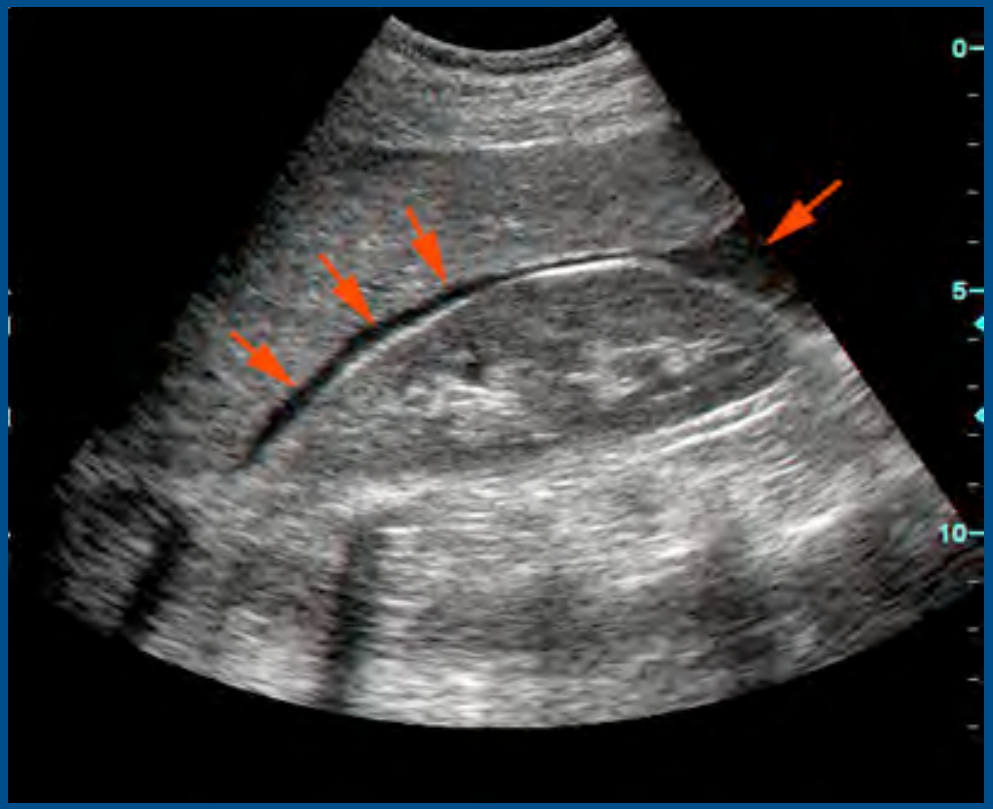
- HR 45 RR 25 BP 100/45 Sa02 98% T34.0

What do we do next?

- Maintain ventilation
- Enhance perfusion
- Treat underlying cause

What studies or labs can help you immediately?

- X-rays
- FAST exam
- Frequent vital signs
- Continuous cardiac and oxygen monitoring



PD-INEL

http://en.wikipedia.org/wiki/File:Morrisons-with-fluid.jpg

X-rays from the trauma bay

PD-INEL Source Undetermined

PD-INEL Source Undetermined

Neurogenic Resuscitation

- Adequate oxygenation
- Assess breathing
- Maximize circulation
  - IV fluids or blood
  - Pressors if necessary
- Support heart rate if needed
  - Atropine
- Prepare for the OR

Hypovolemic

- Hemorrhagic
  - Mostly traumatic
  - Focus of today
- Severe burn
- GI losses
  - vomiting and diarrhea
- Urinary
  - DKA

Classes of Hypovolemic Shock

CLASS	I	II	III	IV
BVL	< 15%	15 - 30%	30 - 40%	> 40%
AMOUNT	750 cc	750 - 1500 cc	1500 - 2000 cc	> 2000 cc
PULSE	<100	> 100	>120	>140
BP	No change	Narrowed pulse pressure	Consistent decrease in SBP	Decreased SBP and narrowed pulse pressure or no DBP
RESP	No change	20-30	30-40	>35
CNS	No change	Anxiety	Anxious, confused	Confused. lethargic
Urine	>30cc per hr	20-30cc per hr	5-15cc per hr	negligible
TX	Replace fluid loss	2L NS IV	2 L NS IV, usually requires blood transfusion	Rapid transfusion of blood and NS, requires immediate intervention to stop hemorrhage

Treating Hemorrhagic Shock

- As always ABC's
  - Airway and Breathing
    - Would prefer O2 sat greater than 95%
    - Placing O2 on the patient
  - Circulation
    - Hemorrhage Control
    - Vascular Access, Large bore IV x 2

Monitoring

- Continuous monitoring
- Oxygen Saturation
- Urine output

PD-INEL Source Undetermined

PD-INEL LR Hopson, 2005

Treating Hemorrhagic Shock

- Identify & reverse the cause
- Restore tissue perfusion
- Restore organ function

Initial Fluid Therapy

- Adult with normal Cardiac Function
  - 1 to 2 Liters of LR or NS rapidly
- Pediatric
  - 20ml/kg of LR or NS rapidly
- Evaluate patients response to fluid

Evaluation of Treatment

- Assess organ perfusion
  - Urinary output
  - Mental Status
  - Skin exam
  - Vitals

Response to Initial Fluid

	Rapid Response	Transient Response	No Response
Vitals	Return to normal	Transient improvement with return to previous	Remain Abnormal
Estimated Blood loss	10-20%	20-40% with ongoing likely	Severe >40%
Need for more Fluid	Low	High	High
Need for Blood	Type and cross	Type specific	O neg
Need for surgery	Possible	Likely	Highly likely

Case 2

- 25 year old male in a head on motor vehicle accident. He has sustained obvious chest and abdominal trauma and has a GCS of 13.
- VS: HR 125 RR 28 BP 100/50 T 36.0 Sa02 93% on 100%
- Patient is agitated and confused.

What class of Shock?

- Class III
- ABC
- IV Access
- 2 liters of NS

Case #2 cont

- Patients Vitals after 2 liters:
  - HR 95 RR 25 BP 110/70

Case #3

- 17 y/o male cuts his inner thigh with a sickle
  - Presents hemorrhaging from left groin area
  - Awake and Alert
  - VS: BP 120/60 HR 120 RR 30 Sat 98% on RA
  - Pt has pulse distally in Lt Leg

What to do?

- ABC
  - Direct Pressure to bleeding area
  - IV Access
  - 2 Liters NS

Case #3

- After 2 Liters
  - Having difficulty controlling bleeding
  - Vital Signs
    - HR 130 BP 85/60 RR 30 Sat 100% on NC

Case #3

- What Next?
  - More Fluid
  - Blood
  - Surgeon?

Which Pressor should I choose?

- Hypovolemic shock
  - Fluids and Blood
- Cardiogenic shock
  - Dobutamine - B1 agonist
    - Increases squeeze and heart rate
- Neurogenic shock
  - Fluids, phenylephrine, Levophed, look for another type of shock if it is persistent
- Anaphylactic shock
  - Fluids and epinephrine
- Septic shock
  - Neosynephrine - alpha agonist
    - Increases SVR by arteriolar constriction
  - Norepinephrine/Levophed - alpha and beta agonists
- Dopamine
  - Low Dose - increases renal blood supply
  - Medium Dose - beta effects (increases heart rate and squeeze)
  - High Dose - alpha effects (arteriolar constriction)

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Questions?

References

- Rivers, E., Otero, R., Nguyen, H. Approach to the patient in shock, in *Emergency Medicine: A Comprehensive Guide*. Tintinalli, Editor. 2004, McGraw-Hill. p. 219-225.
- Manning, J.Fluid and Blood Resuscitation, in *Emergency Medicine: A Comprehensive Guide*. Tintinalli, Editor. 2004, McGraw-Hill. p. 225-231.
- Jui, J. Septic Shock, in *Emergency Medicine: A Comprehensive Guide*. Tintinalli, Editor. 2004, McGraw-Hill. p. 231-242.
- Peacock, W., Weber, J. Cardiogenic Shock, *in Emergency Medicine: A Comprehensive Guide*. Tintinalli, Editor. 2004, McGraw-Hill. p. 242-247.
- Rowe, B., Carr, S., Anaphylaxis and Acute Allergic Reactions, in *Emergency Medicine: A Comprehensive Guide*. Tintinalli, Editor. 2004, McGraw-Hill. p. 242-252.
- Euerle, B., Scalea, T. Neurogenic Shock, in *Emergency Medicine: A Comprehensive Guide*. Tintinalli, Editor. 2004, McGraw-Hill. p. 219-255.
- American College of Surgeons. Shock, *in Advanced Trauma Life Support for Doctors 7th edition*. 2004. p. 62-102.
- Mills, T. Trauma Resuscitation, *in Emergency Medicine*. Adams, Editor. 2008, Saunders Elsevier. p. 77-84