MANAGEMENT OF SHOCK

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SHOCK

• Clinical syndrome that results from circulatory failure, reduction in oxygen delivery, inadequate peripheral tissue and oxygen perfusion leading to cellular hypoxia.

• Shock clinically is characterized by hypotension, SBP<90 mmhg or < 30 mmhg, mean arterial pressure< 655 mmhg, Oliguria, Altered mental status, organ failure.

**Stages of Shock**

1. Compensated (non-Progressive) shock
2. Uncompensated (Progressive) shock
3. Irreversible (refractory) shock
• Compensated is reversible stage during which compensatory mechanisms are effective and homeostasis is maintained, Metabolism changes at the cellular level from aerobic to anaerobic causing the lactic acid builds up which is removed by liver, but needs oxygen.

• Uncompensated stage begins when the body’s compensatory mechanisms fail, Aggressive interventions are needed to prevent MODS Syndrome.

• Irreversible is the final stage of shock, decreased perfusion, decreased cardiac output, exacerbate anaerobic metabolism, Lactic acid accumulates. Increased capillary permeability allows fluid to move into interstitial spaces.
Classification of shock:

- Hypovolemic
- Cardiogenic
- Obstructive
- Distributive
  - Septic
  - Anaphylactic
  - Neurogenic
Hypovolemic Shock

• Resulting from a decreased circulating blood volume.

• **Caused by** diarrhoea,
• vomiting, dengue, DKA,
• acute perforated appendicitis,
• Abdominal open trauma,
• closed fracture, APH, PPH,
• Hyperemesis gravid arum,
• Excessive diuresis,
• Major open surgeries
<table>
<thead>
<tr>
<th></th>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
<th>Class IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood loss mL</td>
<td>&lt;750</td>
<td>750-1500</td>
<td>&gt;1500-2000</td>
<td>&gt;2000</td>
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<tr>
<td>%</td>
<td>&lt;15</td>
<td>15-30</td>
<td>&gt;30-40</td>
<td>&gt;40</td>
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<tr>
<td>Heart rate (beat/min)</td>
<td>&lt;100</td>
<td>&gt;100</td>
<td>&gt;120</td>
<td>&gt;140</td>
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<tr>
<td>Systolic blood pressure</td>
<td>Normal</td>
<td>Normal</td>
<td>Decreased</td>
<td>Decreased</td>
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<tr>
<td>Pulse pressure</td>
<td>Normal</td>
<td>Decreased</td>
<td>Decreased</td>
<td>Decreased</td>
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<tr>
<td>Capillary refill normal</td>
<td>Delayed</td>
<td>Delayed</td>
<td>Delayed</td>
<td>Delayed</td>
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<tr>
<td>Respiratory rate (min)</td>
<td>14-20</td>
<td>20-30</td>
<td>30-40</td>
<td>&gt;35</td>
</tr>
<tr>
<td>Urine output (mL/h)</td>
<td>&gt;30</td>
<td>20-30</td>
<td>5-15</td>
<td>Minimal</td>
</tr>
<tr>
<td>Mental</td>
<td>Slightly impaired</td>
<td>Anxious</td>
<td>Confused</td>
<td>Confused</td>
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<tr>
<td></td>
<td>COMPENSATED</td>
<td>DECOMPENSATED</td>
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<tr>
<td><strong>Mental status</strong></td>
<td>Anxiety</td>
<td>Lethargy</td>
<td></td>
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<tr>
<td><strong>Skin</strong></td>
<td>Pale</td>
<td>Pale, cold, sweaty</td>
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<tr>
<td><strong>Breathing</strong></td>
<td>&lt;30/min</td>
<td>&gt;30/min</td>
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<tr>
<td><strong>Pulse</strong></td>
<td>&lt;120/min</td>
<td>&gt;120/min</td>
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<tr>
<td><strong>Blood pressure</strong></td>
<td>&gt;100 mm Hg</td>
<td>&lt;100 mm Hg</td>
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</tr>
<tr>
<td><strong>First aid</strong></td>
<td>1. Lying position</td>
<td>1. Lying, elevated legs</td>
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<td></td>
<td>2. Stop bleeding</td>
<td>2. Stop bleeding</td>
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<td></td>
<td>3. I.V. fluid</td>
<td>3. I.V. fluid (NOT oral),</td>
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<tr>
<td></td>
<td></td>
<td>blood transfusion</td>
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<td></td>
<td>4. Oxygen mask</td>
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<td>5. Prevent hypothermia</td>
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Fluid administration

- **Crystalloids**: increase intravascular volume through actual volume administered
- **Colloids**: pull fluid into the vascular space through osmosis

Fluid administration

- **Isotonic**: similar in composition to body fluid. Provides greater intravascular volume due to more fluid staying in the vascular space
- **Hypotonic fluid**: shift fluid into intracellular spaces. Useful in preventing cellular dehydration. They deplete circulatory volume
- **Hypertonic**: move fluid from cells to extravascular space, may be used to replace electrolytes and promote diuresis

Blood products (natural colloids)

- **Fresh frozen plasma**: contains all clotting factors. Used as a blood volume expander
- **Albumin**: preferred as volume expander when risk from producing interstitial edema is great (pulmonary and heart disease)

Blood products (natural colloids)

- **Packed Red blood cell’s**: Administer with normal saline
  - Increases oxygen affinity for hgb, and decrease oxygen delivery to the tissues
  - May cause: hypothermia, hyperkalemia, or hypocalcemia
- **Whole blood**: can be administered without normal saline, reduces donor exposure
  - May require greater amount than packed RBC’s to increase oxygen-carrying capacity of blood
  - Not cost effective. Rarely used
Fluid Resuscitation

Fluids loss

- Fluids replacement: (NS) to restore the circulatory volume
  - Adult: at least 1000ml over 30 minutes bolus
  - Pediatrics – 20ml/kg
- Calculating the % loss
  - According to the sign and symptom
  - Dehydration – mild moderate severe
  - Blood loss – class I, II, III, IV
  - According to weight loss
    - (Previous healthy weight – current body weight) \times 100\%

Fluids maintenance

- Fluids maintenance: daily fluid loss (about 2L) + additional fluid deficit + ongoing loss
  - (fever – increase in 1 degree Celsius = 10ml/hr loss)
- Paediatrics age group – Must use Holliday-Segard Formula
- Adult – can use wt + 40 formula
- Maximum fluid maintenance for normal daily loss: 120ml/hr
### Hypovolemic Shock

- **Nursing Management**
  - Ensure a patent airway (*always #1*)
  - Make sure client has patent IV access
    - If they need something in an emergency you want them to have a patent line.
  - Administer oxygen
  - Place client in Modified Trendelenburg
  - If overt bleeding, apply pressure to the site
  - Monitor vital signs every 5 minutes
    - Those vitals can change very quickly.
  - Administer meds as ordered
  - Increase the rate of fluid delivered

### Rule of 4 -2-1 (Holliday-Segard Formula)
- 4 ml per kg for the first 10 kg of body weight;
- 2 ml per kg for the next 10 kg (11-20kg);
- 1 ml per kg for any weight >20 kg

### Example: Calculating maintenance fluid requirements for 70 kg male.
- 0-10 kg: 10 * 4 ml = 40 mL
- 11-20 kg: 10 * 2 mL = 20 mL
- 21-70 kg: 50 * 1 mL = 50 mL
- Total = 110 mL/hr

### Weight + 40

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**Example:**

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**DEFINITION**

- Cardiogenic shock is a state of systemic hypotension persisting >30 minutes, with reduced end-organ perfusion due to low cardiac output despite adequate filling pressures.

**Causes of cardiogenic shock**

- Acute MI
- LV Systolic failure
- RV infraction
- Papillary muscle rupture (1%)
- Acute VSD (1-3%)
- Free wall rapture (1-6%)
Management

- Rapid correction of haemodynamic compromise is essential, to avoid organ damage from hypoperfusion: ATN, MI extension, shock liver

GENERAL MEASURES

- Management of reversible cause: 5H’s, 5T’s
  - Hypoxia, hypovolemia, hypokalemia, hypothermia, hydrogen ion, tamponade, t. pneuemothorax, toxins, thrombosis
- Maintain SBP >90mm Hg and PCWP <20mm Hg
- Correct hypoxia, acidosis - ventilatory support if required.
- Control arrhythmias - brady or tachyarrhythmias
- Control hyperglycemia by insulin.
Improvement of CO

- If condition persists despite optimal LV filling, inotropic support is usually needed.
- High PCWP, in the presence of shock, necessitates inotropic or mechanical support.

Tandem Heart LVAD-Extracorporeal devices

- **Left atria-to-femoral arterial LVAD**
  - Low speed centrifugal continuous flow pump
  - Maximum flow 4L/minute

MECHANICAL SUPPORT

- INTRA-AORTIC BALLOON PUMP (IABP)
- PERCUTANEOUS VENTRICULAR ASSIST DEVICES (pVAD)
- EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO)
ACCAHA Guidelines

Cardiogenic Shock

Early Shock
Diagnosed on Hospital presentation

- Fibrinolytic therapy if all of the following are present:
  1. Greater than 90 minutes to PCI
  2. Less than 3 hours post STEMI onset
  3. No contraindications

- Arrange prompt transfer to invasive procedure capable center

Delayed Onset Shock
Echocardiogram to rule out mechanical defects

- Arrage rapid transfer to invasive capable center

IABP

Cardiac Catheterization and Coronary Angiography

1-2 vessel CAD
Moderate 3-vessel CAD
Severe 3-vessel CAD
Left main CAD

- PCI IRA
- PCI IRA
- Cannot be performed
- Immediate CABG

Staged Multivessel PCI
Staged CABG

Circulation. 2004;110:588-63
Definition

- Septic Shock:
  - sepsis-induced hypotension (systolic blood pressure <90 mm Hg [or a drop of >40 mm Hg]) with
  - signs of tissue hypoperfusion
  - despite adequate fluid resuscitation for at least 1 hour
- Refractory septic shock
  - Septic shock that lasts for >1 h and does not respond to fluid or pressor administration

- Principle of mechanism
  1. Peripheral vasodilation and pooling of blood
Signs and Symptoms

- Symptoms: FEVER/hypothermia, depends on site of infection.
- Signs:
  - Warm peripheral extremities (due to vasodilation)
  - Febrile
  - hypotension
  - Tachypnea, tachycardia
  - Oliguria
  - Rash
- History taking: comorbidities
  - DM,
  - Chronic lung disease
  - alcoholism,
  - liver cirrhosis,
  - Recent invasive procedure (especially in CKF)
  - HIV
  - Immunosuppressive agent (Steroid)
  - Malignancy
Management of Septic Shock

Management of hemodynamic instability

- ABC
- Continuous ECG, BP, HR, Pulse oximetry monitoring
- Bladder catheterization
- Pulmonary arterial catheterization

Management of Infection

- C&S before empirical antibiotic
- Intravenous broad-spectrum antimicrobials should be initiated immediately (preferably <30 minutes) following the clinical diagnosis
- At dosing at the high end of the therapeutic range
- Duration of therapy: 7-10 days
- Empirc antimicrobial therapy should be adjusted to a narrower regimen within 48 to 72 hours if a plausible pathogen is identified or patient stabilizes clinically

Fluid Challenge

Rate of administration should be reduced if cardiac filling pressure increase without concurrent hemodynamic improvement

- Mainstay of hemodynamic supports
- Fast and rapid wide bore fluid resuscitation
- urine output rate should be kept at >0.5 mL/kg per hour by continuing fluid administration
- central venous pressure should be maintained at 8–12 mmHg
Septic Shock

Nursing Management
- Asepsis and hygiene
- Culture & Sensitivity
- Parenteral therapy and medication

Anaphylactic Shock

- An allergic, IgE mediated, hypersensitivity response to a foreign substance to which a patient has been previously sensitized
- Type I hypersensitivity
- Causes:
  - Drugs: penicillin, aspirin, streptomycin
  - Vaccines: measles
  - Blood products
  - Insect bites: bees
  - Food: seafood
Clinical Features

Onset:
- Commonly: 5-60min of exposure
- Delayed onset: after few hours
- Biphasic response: recurrence of symptoms 1-8 hrs later due to late phase reaction
- Protracted anaphylaxis: persistence of symptoms up to 48hrs despite therapy

Skin:
- Urticaria (200 cases): Area of focal dermal edema
- Angioedema (20 cases): Localized non-pitting deeper edematous process
- Pruritus
- Tingling of face (usually at mouth)
Angioedema

View

Urticaria
ABC
Bladder catheterization
ECG, RR, BP, SaO2
recumbent position

Remove the inciting agent

- High flow Oxygen with facemask → fail → ETT → difficult intubation due to severe laryngeal edema → tracheostomy / cricothyroidotomy proximally
- Prompt application of cricothyroidotomy
- Insect: flick out insect stinger with a tongue blade
- Ingestion of allergen: gastric lavage and activated charcoal
Administer histamine antagonists in patients who remain hypotensive despite epinephrine.

- block vasodilation, capillary leak, and shock
- $H_1$ blockade, 25–50 mg of diphenhydramine IV 6hrly
- $H_2$ blockade, 50 mg of ranitidine IV 6hrly
  crystalloid or colloid

aggressive fluid resuscitation

Still Hypotension
IM aqueous epinephrine 0.3-0.5 ml of 1:1000

Repeat every 20 minutes

Severe airway compromise / hypotension

IV Epinephrine 3 - 5ml 1:1000

If require multiple doses

Repeat every 5-10min

Epinephrine Infusion

• Epinephrine is the mainstay of initial management
• controlling symptoms and maintaining blood pressure.
Still Hypotension

Pulmonary artery catheterization

Inotropes

- Maintain MAP > 60-65mmHg
- dopamine, isoprenaline infusion
Neurogenic Shock

- Causes:
  - Post-spinal surgery
  - Spinal injury
- Clinical features:
  - Bradycardia, hypotension, warm peripheral extremities

Obstructive Shock

- Causes:
  - Tension pneumothorax
  - Cardiac tamponade
  - Pulmonary embolism
Anaphylactic Shock

- **Nursing Implications**
  - Assess for allergies
  - Communication
  - Knowledgeable about s/s (and how to deal with them should they arise)
  - Teach about future exposures (and inform the families also so they can help)

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**Neurogenic Shock**

- **Clinical features:**
  - Bradycardia, hypotension, warm peripheral extremities
- **Mx:**
  - ABC + Supine position with leg elevated
  - Fluid resuscitation
  - NE
  - Anal wink or bulbocarvenosus reflex

**Nursing management**

- Elevate and maintain HOB 30 degrees
  - Most everyone on a neuro floor has the HOB up 30
- Support cardiovascular and neurologic function
- Prevent blood pooling in lower extremities
  - Apply TED hose
  - Prevent DVTs
Nursing Assessment (Cont’d)

- CABs: circulation, Airway, breathing, and Focused assessment of tissue perfusion
- Vital signs
- Peripheral pulses
- Level of consciousness
- Capillary refill
- Skin (e.g., temperature, color, moisture)
- Urine output

Nursing Implementation

- Health Promotion
  - Identify patients at risk (e.g., elderly patients, those with debilitating illnesses or who are immunocompromised, surgical or accidental trauma patients)
  - Planning to prevent shock (e.g., monitoring fluid balance to prevent hypovolemic shock, maintenance of handwashing to prevent spread of infection)

Nursing Assessment (Cont’d)

- Brief history
  - Events leading to shock
  - Onset and duration of symptoms
  - Details of care received before hospitalization
  - Allergies

Nursing Implementation (Cont’d)

- Acute Interventions
  - Monitor the patient’s ongoing physical and emotional status to detect subtle changes in the patient’s condition
  - Plan and implement nursing interventions and therapy
Nursing Implementation (Cont’d)

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  - Monitor the patient’s ongoing physical and emotional status to detect subtle changes in the patient’s condition
  - Plan and implement nursing interventions and therapy

Nursing Implementation (Cont’d)

- Respiratory status
  - Respiratory rate and rhythm
  - Breath sounds
  - Continuous pulse oximetry
  - Arterial blood gases
  - Many patients will be intubated and mechanically ventilated

Nursing Implementation (Cont’d)

- Neurologic status: Orientation and level of consciousness
- Cardiac status
  - Continuous ECG
  - VS, capillary refill
  - Hemodynamic parameters: central venous pressure, PA pressures, CO, PAWP
  - Ongoing assessment of CO

Nursing Implementation (Cont’d)

- Urine output
- Tympanic or pulmonary arterial temperature
- Skin: Temperature, pallor, flushing, cyanosis, diaphoresis, piloerection
- Bowel sounds
Nursing Implementation (Cont’d)

- Nasogastric drainage/stools for occult blood
- I&O, fluid and electrolyte balance
- Oral care/hygiene based on O2 requirements
- Passive/active range of motion

- Assess level of anxiety and fear
  - Medication PRN
  - Talk to patient
  - Visit from clergy
  - Family involvement
  - Comfort measures
  - Privacy

Others

- Prevention of stress ulcer
  - Ranitidine or PPI
- Prevention of deep vein thrombosis
  - UF heparin or LMW heparin if no C/I
- Prevention of ARF
  - Induce diuresis by furosemide (make sure adequate fluid therapy) → look for hyperkalemia
  - IV 2-5micro g/kg/minute of dopamine (low dose)
- Glucose control
  - Insulin to prevent DKA in DM patient
- Metabolic Acidosis
  - Treat in severe cases only.

Complications of Shock

- CNS
  - Encephalopathy
- CVS
  - Reduced myocardial contractility
- Renal
  - Acute Renal Failure
- Pulmonary
  - ARDS
  - Atelectasis
- GIT
  - Stress Ulcer
  - Mesenteric Ischemia
  - “Shock” liver
- Hematology
  - DIVC
- Metabolic
  - Hyperglycemia
  - Lactic Acidosis
- Skeletal
  - Gangrene