SHOCK in Paediatric Trauma

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(Fellow, Hong Kong College of Paediatric Nursing,
MSc, MN, BN)

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Time: 18:30 - 19:30
Venue: Paediatrics & Adolescent Ambulatory Centre, G/F,
Block C, Yan Chai Hospital
Content

- Definition of shock
- Classification and phase of shock
- Recognition of Shock
- Shock management
Definition of Shock

- Shock is a syndrome resulting in inadequate perfusion of tissues, leading to a decrease in the supply of oxygen and nutrients required to maintain the metabolic needs of cells.

- Shock is often, but not always, characterized by inadequate peripheral and end-organ perfusion.

- It does not depend on the blood pressure measurement.
Definition of Shock

- All types of shock can result in impaired function of vital organ, such as brain and kidneys.
- If prolonged, it leads to multiple organ failure and death.
- It can be caused by any serious disease and injury.
Phase of Shock

Normal Cardiac Output
Normal blood pressure

↑ Cardiac output
↑ Blood pressure

↓ Cardiac output
↓ Blood pressure
Phases of Shock

- Compensated Shock
- Decompensated Shock
- Irreversible Shock

Compensated Shock

Decompensated Shock / Hypotensive Shock

Irreversible Shock / Cardiac Arrest
Compensated Shock

- A clinical state of tissue perfusion that is inadequate to meet metabolic demand in the presence of blood pressure within the normal range.

- When oxygen delivery is limited, compensatory mechanism by to maintain normal blood flow to the brain and heart.
# Common Signs of Compensated Shock

<table>
<thead>
<tr>
<th>Compensatory Mechanism</th>
<th>Area</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased heart rate</td>
<td>Heart</td>
<td>Tachycardia</td>
</tr>
<tr>
<td>Increased SVR</td>
<td>Skin</td>
<td>Cold, pale, mottled, diaphoretic</td>
</tr>
<tr>
<td></td>
<td>Peripheral circulation</td>
<td>Delayed capillary refill</td>
</tr>
<tr>
<td></td>
<td>Pulse</td>
<td>Weak peripheral pulse; narrow pulse pressure (increase diastolic pressure)</td>
</tr>
<tr>
<td>Increase renal and splanchnic vascular resistance (redistribution of blood flow away from these areas)</td>
<td>Kidney</td>
<td>Oliguria (decrease urine output)</td>
</tr>
<tr>
<td></td>
<td>Intestine</td>
<td>Vomiting, ileus</td>
</tr>
</tbody>
</table>
Decompensated Shock

- Hypotension (I.e. systolic blood pressure (SBP) > 5\textsuperscript{th} percentile for age.

- According to the AHA (2010), hypotension is characterized by the following limits of systolic blood pressure (SBP):

<table>
<thead>
<tr>
<th>Age</th>
<th>Lower limit of Blood pressure (systolic) mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonate (0- 28 days)</td>
<td>&lt; 60</td>
</tr>
<tr>
<td>Infant (1 to 12 months)</td>
<td>&lt; 70</td>
</tr>
<tr>
<td>Children (1 to 10 years)</td>
<td>70 + (2 x age in years)</td>
</tr>
<tr>
<td>Children (&gt; 10 years)</td>
<td>&lt; 90</td>
</tr>
</tbody>
</table>
Classification of Shock

Shock can result from:

- Inadequate blood volume or oxygen-carrying capacity (hypovolemic shock including hemorrhagic shock).
- Inappropriate distribution of blood volume and flow (distributive shock).
- Impaired cardiac contractility (cardiogenic shock).
- Obstructed blood flow (obstructive shock).
Classification of Shock

Shock can be categorized into 4 types:

- Hypovolemic shock
- Distributive shock
- Cardiogenic shock
- Obstructive shock

Shock in Trauma Patient:

- Haemorrhagic shock
- non-haemorrhagic shock
## Classification of Shock

<table>
<thead>
<tr>
<th>Classification</th>
<th>Etiology</th>
<th>Underlying Pathology</th>
</tr>
</thead>
</table>
| Hypovolemic    | -Haemorrhage  
                -Burns         | -Whole blood loss  
                - Plasma Loss    |
| Cardiogenic    | -Myocardial infarction  
                -Dysrhythmias  
                -Blunt cardiac injury | -Loss of cardiac contractility  
                -Reduced cardiac output  
                -Loss of cardiac contractility |
| Obstructive    | -Cardiac temponade  
                -Tension pneumothroax  
                -Tension haemothroax | -Compression of heart with obstruction to atrial filling  
                -Mediatstinal shift with obstruction to atrial filling  
                -Combination of above |
| Distributive   | -Neurogenic shock  
                -Anaphylactic shock  
                -Septic shock | -Venous pooling- maldistribution of blood volume  
                -Shunting in microcirculation and in later stages- decrease in venous resistance  
                -Poor distribution of blood flow |
### Classification of Shock

<table>
<thead>
<tr>
<th>Shock type</th>
<th>Heart rate</th>
<th>Stroke volume</th>
<th>Cardiac output</th>
<th>Systemic vascular resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiogenic</td>
<td>Increased</td>
<td>Decreased</td>
<td>Decreased</td>
<td>Increased</td>
</tr>
<tr>
<td>Hypovolemic</td>
<td>Increased</td>
<td>No change or decreased</td>
<td>No change or decreased</td>
<td>Increased</td>
</tr>
<tr>
<td>Distributive (spinal&lt;sup&gt;a&lt;/sup&gt;)</td>
<td>Increased (normal or decreased&lt;sup&gt;a&lt;/sup&gt;)</td>
<td>Increased (no change&lt;sup&gt;a&lt;/sup&gt;)</td>
<td>Increased</td>
<td>Decreased</td>
</tr>
</tbody>
</table>

<sup>a</sup> Denotes physiologic variation in spinal shock caused by a predominant decrease in sympathetic input.
Haemorrhagic Shock

- Most common cause of shock after injury
- Haemorrhage is defined as acute loss of circulating blood volume.
- Causes of significant blood loss contributing to haemorrhagic shock are:
  - Major vessel disruption
  - Massive haemothoraces
  - Liver or spleen injuries
  - Pelvic fractures
  - Extremity fractures
  - Amputation
## Classification of haemorrhagic shock in children

<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><strong>Blood Loss</strong></td>
<td>&lt;15%</td>
<td>15-25%</td>
<td>26-39%</td>
<td>&gt;40%</td>
</tr>
<tr>
<td><strong>CVS</strong></td>
<td>Normal to ↑ HR Normal BP/P ↓ Peripheral pulse</td>
<td>↓ HR ↓ Normal BP Periperal pulse</td>
<td>↑↑ HR Hypotension Thready periperal pulses</td>
<td>↑↑ ↑HR Profound hypotension, Absent peripheral pulse, Thready central pulses</td>
</tr>
<tr>
<td><strong>Resp</strong></td>
<td>Normal Rate</td>
<td>Tachypnea</td>
<td>Moderate tachypnea</td>
<td>Severe tachypnea</td>
</tr>
<tr>
<td><strong>CNS</strong></td>
<td>Slightly anxious</td>
<td>Irritable, confused, combative</td>
<td>Diminished response to pain</td>
<td>Coma</td>
</tr>
</tbody>
</table>
## Classification of haemorrhagic shock in children

<table>
<thead>
<tr>
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<th>Class I</th>
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<tbody>
<tr>
<td><strong>Blood Loss</strong></td>
<td>&lt;15%</td>
<td>15-25%</td>
<td>26-39%</td>
<td>&gt;40%</td>
</tr>
<tr>
<td><strong>Skin</strong></td>
<td>Warm, pink</td>
<td>Cool extremities, Mottling, Delayed cap refill</td>
<td>Cool extremities, Mottling, Delayed cap refill</td>
<td>Cool extremities Pallor Cyanosis</td>
</tr>
<tr>
<td></td>
<td>Normal cap refill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Renal</strong></td>
<td>Normal urine output</td>
<td>Oliguria ↑ Urine SG</td>
<td>Oliguria ↑ BUN</td>
<td>Anuria</td>
</tr>
<tr>
<td><strong>Acid-base</strong></td>
<td>Normal pH</td>
<td>Normal pH</td>
<td>Metabolic acidosis</td>
<td>Metabolic acidosis</td>
</tr>
</tbody>
</table>
Non-haemorrhage Shock

- Cardiogenic shock - blunt cardiac injury, cardiac tamponade, air embolus, myocardial infarction associated with the patient’s injury
- Tension pneumothorax
- Neurogenic shock
- Septic shock
Recognition of Shock
Primary Assessment & Resuscitation

A – Airway maintenance + C – spine control
B – Breathing
C – Circulation + Haemorrhage control
D – Disability (neurological exam)
Airway Assessment + C-spine immobilization

- Clear/ patent
- Maintainable with head positioning
- Not maintainable without intubation
Breathing Assessment

- Respiratory rate
- Respiratory effort/ mechanics
- Breath sounds/ air entry/ tidal volume
- Skin color and pulse oximetry
Primary Assessment & Resuscitation

A – Airway maintenance + C – spine control
B – Breathing
C – Circulation + Haemorrhage control
D – Disability (neurological exam)
Recognition of Shock

Assessment

- Level of consciousness
- Pulse: quality, rate and regularity
- Skin colour
- Capillary refill (? > 2 sec)
- Skin temperature
- External haemorrhage
- Measure blood pressure
- Urine output
Pulses

- Thready pulses are felt, as cardiac output falls and systemic vascular resistance increases.
- Loss of central pulse is considered as cardiac arrest
Skin Perfusion

- Evaluation of temperature, capillary refill and color
- Cold extremities when cardiac output decreases
- Mottling, pallor and peripheral cyanosis when skin perfusion is poor
- Prolonged capillary refill when cardiac output decreases
Evaluation of skin perfusion

- Temperature of extremities → forearms and legs
- Capillary refill time
- Colour

Pink → Pale → Blue

Weak Perfusion

Mottled

Worsening Perfusion
Perfusion - Kidneys

- Evaluation of urine output
- Urine output less than 1ml/kg/hr in the absence of renal disease is a sign of poor renal perfusion or hypovolaemia

<table>
<thead>
<tr>
<th>Age</th>
<th>Urine output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>At least 1ml/kg/hr</td>
</tr>
<tr>
<td>Preschool</td>
<td>At least 1ml/kg/hr</td>
</tr>
<tr>
<td>Adolescent</td>
<td>At least 1ml/kg/hr</td>
</tr>
</tbody>
</table>
Evaluation of Disability - Brain

- Evaluation of responsiveness
- Use of AVPU scale
  - A - alert
  - V - response to voice
  - P - response to pain
  - U - unresponsiveness
- Glasgow Coma Scale
- Muscle tone
- Papillary response
## Modified Glasgow Coma Scale for Infants and Children

<table>
<thead>
<tr>
<th></th>
<th>Child (&gt; 2 yr)</th>
<th>Infant (0-2 yr)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eye Opening</strong></td>
<td><strong>Spontaneous</strong></td>
<td><strong>Spontaneous</strong></td>
<td><strong>4</strong></td>
</tr>
<tr>
<td></td>
<td>To verbal stimuli</td>
<td>To verbal stimuli</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>To pain only</td>
<td>To pain only</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>No response</td>
<td>1</td>
</tr>
<tr>
<td><strong>Verbal Response</strong></td>
<td>Oriented, appropriate</td>
<td>Coos and babbles</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Confused</td>
<td>Irritable Cries</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Inappropriate words</td>
<td>Cries to pain</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Incomprehensible words or non-specific sounds</td>
<td>Moans to pain</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>No response</td>
<td>1</td>
</tr>
</tbody>
</table>
## Modified Glasgow Coma Scale for Infants and Children

<table>
<thead>
<tr>
<th>Motor Response</th>
<th>Child (&gt; 2 yr)</th>
<th>Infant (0-2 yr)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Response</td>
<td>Obeys commands</td>
<td>Moves spontaneously and purposefully</td>
<td>6</td>
</tr>
<tr>
<td>Localized painful stimulus</td>
<td>Withdraws to touch</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Withdraws in response to pain</td>
<td>Withdraws in response to pain</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Flexion in response to pain</td>
<td>Decorticate posturing (abnormal flexion)</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Extension in response to pain</td>
<td>Decerebrate posturing (abnormal extension)</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td>No response</td>
<td></td>
<td>1</td>
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</table>
Normal BP in Paediatrics

<table>
<thead>
<tr>
<th>Age</th>
<th>Systolic BP (mmHg)</th>
<th>Diastolic BP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Neonate (1 day)</td>
<td>60 - 76</td>
<td>60 - 74</td>
</tr>
<tr>
<td>Neonate (4 day)</td>
<td>67 - 83</td>
<td>68 - 84</td>
</tr>
<tr>
<td>Infant (1 month)</td>
<td>73 - 91</td>
<td>74 - 94</td>
</tr>
<tr>
<td>Infant (3 month)</td>
<td>78 - 100</td>
<td>81 - 103</td>
</tr>
<tr>
<td>Infant (6 month)</td>
<td>82 - 102</td>
<td>87 - 105</td>
</tr>
<tr>
<td>Infant (1 year)</td>
<td>68 - 104</td>
<td>67 - 103</td>
</tr>
<tr>
<td>Child (2 years)</td>
<td>71 - 105</td>
<td>70 - 106</td>
</tr>
<tr>
<td>Child (7 years)</td>
<td>79 - 113</td>
<td>79 - 115</td>
</tr>
<tr>
<td>Adolescent (15 years)</td>
<td>93 - 127</td>
<td>95 - 131</td>
</tr>
</tbody>
</table>

Range from 33rd - 67th percentile in the first year of life and from 5th – 95th percentile for systolic and diastolic BP according to age and gender.
According to the AHA (2010), hypotension is characterized by the following limits of systolic blood pressure (SBP):

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<td>&lt; 90</td>
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Recognition of Shock

Assessment

- **Diagnostic Procedure**
  - Chest radiograph - to determine the presence of hemothorax/pneumothorax
  - Pelvic radiograph - to locate fracture
  - Femur radiograph if fracture is suspected

- **Laboratory Studies**
  - Venous blood sample for typing
  - Urinalysis including specific gravity
  - Arterial pH, PaO2, PaCO2 and base deficit
Fundamentals of Shock Management

• The acute treatment of shock focuses on restoring oxygen delivery to the tissues and improving the balance between tissue perfusion and metabolic demand.

• The acute treatment of shock includes:
  – Optimizing oxygen content of the blood
  – Improving volume and distribution of cardiac output
  – Reducing oxygen demand
  – Correcting metabolic derangements
Management Approach

Treat underlying causes of shock

- Optimization of fluid status
- Optimization of cardiac output
- Optimization of perfusion pressure
Shock Management

A – Airway maintenance + C – spine control
   - Assist with endotracheal intubation

B – Breathing
   - Administer oxygen via non-re-breathing mask
   - Monitor oxygen saturation with continuous pulse oximetry
Circulation

Intervention

- Haemorrhage control - any uncontrolled external bleeding

- Fluid resuscitation: 2 large-bore IV with Ringer’s Lactate solution/ Normal Saline (20ml/kg)

- Lab-test – type and screen, CBP, chemical, toxicology

- Blood replacement as needed
ALGORITHM 2
Resuscitation Flow Diagram for the Pediatric Patient with Normal and Abnormal Hemodynamics

Surgical Consultation
20 mL/kg Ringer’s Lactate Solution as Bolus
(May Repeat 1 or 2 Times)*

Hemodynamics
Normal

Further Evaluation

Transfer as Necessary

Observe

Operation

Hemodynamics
Abnormal

10 mL/kg PRBCs

Normal

Further Evaluation

Operation

Abnormal

Operation

Transfer as Necessary

Observe

Operation

*See text page 251 and 252.
## Response to initial fluid resuscitation

<table>
<thead>
<tr>
<th></th>
<th>Rapid response</th>
<th>Transient response</th>
<th>No response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vital signs</strong></td>
<td>Return to normal</td>
<td>Transient improvement, recurrence of ↑HR and ↓BP</td>
<td>Remain abnormal</td>
</tr>
<tr>
<td><strong>Estimated blood loss</strong></td>
<td>Minimal (10-20%)</td>
<td>Moderate &amp; ongoing (20-40%)</td>
<td>Severe (&gt;40%)</td>
</tr>
<tr>
<td><strong>Needs for more crystalloid</strong></td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td><strong>Blood preparation</strong></td>
<td>Type &amp; cross-match</td>
<td>Type- specific</td>
<td>Emergency blood release</td>
</tr>
<tr>
<td><strong>Need for operative intervention</strong></td>
<td>Possibly</td>
<td>Likely</td>
<td>Highly likely</td>
</tr>
<tr>
<td><strong>Early presence of surgeon</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Not responding to fluid challenge ??

- Identify cardiogenic event
- Using inotropes/ vasopressors/ or both
- Perform echocardiogram
Inotropes/ Vasopressors

- Dopamine
- Dobutamine
- Adrenaline
- Noradrenaline
INOTROPES

 Acts on HR & cardiac contractility
Vasopressors

- Acts on peripheral vascular tones
- Either vasoconstriction/ vasodilatation
<table>
<thead>
<tr>
<th>DRUGS</th>
<th>Receptors</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dobutamine</td>
<td>Beta 1/2</td>
<td>^ HR/ SV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peripheral vasodilatation</td>
</tr>
<tr>
<td>Dopamine</td>
<td>Alpha 1/ beta 1</td>
<td>^ SV/ vasoconstriction</td>
</tr>
<tr>
<td>Adrenaline</td>
<td>Alpha 1</td>
<td>^ HR/ SV</td>
</tr>
<tr>
<td></td>
<td>Beta 1/2</td>
<td>vasoconstriction</td>
</tr>
</tbody>
</table>
## Vasoactive Agents

<table>
<thead>
<tr>
<th>DRUGS</th>
<th>Receptors</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noradrenaline</td>
<td>Alpha 1</td>
<td>Peripheral vasoconstriction</td>
</tr>
<tr>
<td>Phenylephrine</td>
<td>Alpha 1</td>
<td>Peripheral vasoconstriction</td>
</tr>
</tbody>
</table>
Epinephrine (Adrenaline)

- Both $\alpha$- and $\beta$- adrenergic effects
  - $\alpha$- adrenergic action (vasoconstriction) increase systemic vascular resistance and elevates the systolic and diastolic blood pressure
  - $\beta$- adrenergic action increases myocardial contractility and heart rate and relaxes smooth muscles in the skeletal muscle vascular bed and in bronchi
Epinephrine (Adrenaline)

Indications:
- Cardiac arrest
- Symptomatic bradycardia unresponsive to ventilation and oxygen administration
- Hypotension not related to volume depletion

Dose:
- IV / IO
  - Initial 1:10,000 at 0.1ml/kg
  - Subsequent same dose
- ET
  - 1:1,000 at 0.1ml/kg
  - For neonate, 1:10,000 at 0.1-0.3ml/kg
- Q3-5min
Epinephrine (Adrenaline)

Side effect:

- High dose → atrial tachycardia or VT
- Arrhythmia, chest pain, nervousness, restlessness
- Extravasation → local ischaemia
Dopamine Hydrochloride

- An endogenous catecholamine with complex cardiovascular effects
- **Indications**
  - Inadequate cardiac output
  - ↓BP
  - ↑splanchnic blood flow & urine output

<table>
<thead>
<tr>
<th>Dosage (2 – 5ug/kg/min)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• vasodilatory effects, little direct cardiac action</td>
</tr>
<tr>
<td></td>
<td>• ↑renal, splanchnic, coronary and cerebral blood flow</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dosage (5-10ug/kg/min)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• ↑cardiac contractility</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dosage (10-20ug/kg/min)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Vasoconstriction, ↑BP, ↑AR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dosage (&gt; 20ug/kg/min)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Vasoconstriction, no further inotropic effect</td>
</tr>
</tbody>
</table>
Dopamine Hydrochloride

Side effect:

- ↑BP, ↑HR
- Arrhythmia (ventricular ectopic, SVT, VT)
- Ectopic heart beats, conduction abnormalities
- Extravasation → tissue necrosis & gangrene of extremities
Dobutamine Hydrochloride

- Synthetic catecholamine possessing relatively selective action at β-adrenergic receptors which effects including ↑ cardiac contractility and heart rate, often with mild dilation of the peripheral vascular bed.

Indications

- Myocardial dysfunction (e.g. severe congestive heart failure)
- Inadequate cardiac output, particularly in patients with elevated systemic or pulmonary vascular resistance
- Poor perfusion despite adequate intravascular volume
- Post resuscitation myocardial dysfunction
Dobutamine Hydrochloride

Dose
- 2-20 μg/kg/min.
- often started at 5-10 μg/kg/min
- IV infusion into large vein

**Side effect:**
- ↑HR, ↑BP, nausea, vomiting
- Tachyarrhythmias or ectopic beats
- Extravasation → tissue ischemia & necrosis
Noradrenaline

Both $\alpha$- and $\beta$- adrenergic effects

- $\alpha$- adrenergic action (vasoconstriction) increase systemic vascular resistance and elevates the systolic and diastolic blood pressure

- Most often used after volume repletion and administration of other inotropes have been ineffective in raising the BP
Noradrenaline

- Dose: 0.15-0.1 microgram/kg/minutes
- The rate of infusion is titrated up to 1 microgram/kg/min

Side effect:
- High dose → ischemic injury of the extremities
Circulation

Intervention

● Insert an indwelling urinary catheter
● ECG
● Pericardial tamponade- pericardiocentesis
● ED thoracotomy / surgery
Evaluation and ongoing assessment

- Reassessing patient response and avoiding complications
- Control haemorrhage → surgical intervention
- Monitoring end-organ perfusion
  - Monitor urine output
  - Collaborating with other trauma team members as diagnostic studies and physical assessment identify the cause and source of haemorrhage
- Monitor temperature to determine hypothermia
Therapeutic End Points

Clinical Improvement:
- Normal heart rate and blood pressure for age
- Normal pulse
- Capillary refill time < 2 seconds
- Warm extremities
- Normal mental status
- Urine output > 1ml/kg/hr
- Decrease serum lactate
- Decrease base deficit
Early Recognition of shock and intervention is critical in halting progression from compensated to hypotensive shock to cardiopulmonary failure.

Treatment goal for shock is to prevent end-organ injury and halt the progression of cardiopulmonary failure and cardiac arrest.
The End

Question & suggestion are welcome
Reference and Bibliography

- American College of Surgeon (2007) Advanced Trauma Life Support
- Emergency Nurses Association (2000). Trauma Nursing Core Course