

Topic Overview: Professional Entry Critical Care**Sub-Module: U3 – Hypotension**

[Last Updated January 2014]

This handout is designed to partner the topic overview simulation session U3: The Hypotensive Patient. This session involves a presentation, followed by a simulated scenario. Use this document to jog your memory or to aid in your reflection of the session, and the simulation.

We are targeting “higher level learning”. This is the application of skills and knowledge within a contextualised event to, hopefully, improve performance and practice. Learning is further encouraged through discussion and also working through simulated scenarios. This session is also designed to allow you to put into practice knowledge and skills attained from this session and other learning environments (other EdWISE sessions, any associated eLearning, clinical placements, etc.).

As clinicians we should be constantly reviewing our own practices and looking for current best practice standards. During the feedback sessions we will facilitate this reflection but we would also encourage you to reflect on your experience in this session and think about any improvements that could be made to your own practice, the practice of your team or department or to any systems that you work within. Reviewing this handout may help you to do this.

Introduction

A patient presenting on the ward, on the street or in the ED with Hypotension can be difficult to assess, manage and diagnose. This module will describe a structured approach to these patients including: initial assessment; early investigations; differential diagnoses and initial management. It is important to remember that prompt treatment of these patients is vital and will be greatly improved by a multidisciplinary team approach.

Objectives for this module

- Describe a structured approach to patient presenting with hypotension.
- Outline initial assessment of patient with hypotension
- Rationalise investigations to perform on patients with hypotension
- Provide a framework for thinking about potential differential diagnoses
- Discuss management options for some of the more common and/or serious pathologies presenting with hypotension
- Discuss the importance of communication, multidisciplinary teamwork, escalating concerns and handover when treating this patient population

Initial Assessment & Approach

The initial approach to the patient will be the same as for any critically unwell patient - DRS ABCDE (DEFG).

D - Danger

Is there any danger to you, your staff or the patient? If the patient has an altered LOC are they combative? Are they likely to put themselves, you or any of your team members at risk?

R - Response

Is the patient responsive? Do they respond to your arrival to their bedside? Ask them a question!

S - Shout for Help

Think about help at this stage. Although it may not be appropriate to shout for help with every critically ill patient that you see, it is worth thinking about your need for help with every patient that you see. This will make it less likely that you forget this vital step when you are in need! It is also important to think about the likely journey that this patient will take. Does your hospital have the appropriate skills and team available 24 hours? Is it likely that you are going to need to mobilise retrieval or specialist help? If so think of these early so that they are mobilised as early as possible.

A – Airway

Does the patient have an open and protected airway? If the patient is able to speak to you coherently and there are no added or abnormal sounds of breathing, then the likelihood is that they do. Ask the patient a question! If the patient is obtunded then airway opening manoeuvres may need to be attempted whilst help arrives. Oxygen can also be applied at this time via a non-rebreathing mask. If you are supporting the patient's airway you will require other members of the team to complete the initial assessment of the patient.

B - Breathing

- Look - Are they breathing or trying to breathe? Is the chest expanding well and symmetrically? Are there any lumps, bumps, rashes, defects on the chest wall (remember that there is a front, a back and two sides to the chest)? Is the patient exerting themselves to breathe? Is there intercostal recession or tracheal tug? Are they sat upright gasping for breath and unable to answer your questions? What colour is the patient? Do they look pink and healthy, or blue, or grey? What is their respiratory rate? How does this compare to their previously charted rates?
- Listen - Can you hear any abnormal sounds of breathing from the bedside - wheeze, stridor, grunting, coughing, other? Now its time for your stethoscope. Remember to listen to the front, back and sides and compare left with right.
- Feel - Palpate the chest for lumps, bumps, rashes, deformity and tenderness. You may also be able to feel rubs, thrills, heaves or surgical emphysema.
- Monitoring - A saturation probe can give you information about the patient's oxygenation and often the heart rate and rhythm. A good waveform may also indicate a decent perfusion pressure to that finger/ear. The saturation probe does not indicate the adequacy of ventilation so cannot tell us about the patient's carbon dioxide level. It is usually beneficial to administer supplemental oxygen to patients with a reduced level of consciousness. High flow oxygen via a non-rebreathing mask should be considered.

C - Circulation

- Look - What does the patient's skin look like? Are they flushed, pale, mottled, peripherally cyanosed? Are there any obvious sites of fluid loss - urine in catheter bag, vomit bowls, suction, input/output charts or blood? Are there any indications of fluid replacement or circulatory support - IV fluids, blood, syringe drivers containing drugs acting upon the circulatory system?
- Listen - Auscultating the precordium can give you some vital clues - rhythm, rate, murmurs, clicks, pericardial rubs. You may also be able to hear crackles at the bases of the lungs that may indicate left ventricular failure.
- Feel - Feeling the temperature of the patient's hands and feet can give an indication of distal perfusion. You can compare central capillary refill times to peripheral. Feel for pitting oedema and for calf tenderness. Palpating peripheral pulses is also important. This can give an indication of rhythm, rate, pulse pressure and

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character. You should also compare the pulse pressures in the peripheral pulses, you may be able to diagnose an aortic dissection! Absent pulses may be due to poor or obstructed vasculature or a low perfusion pressure. Palpating the liver may also give an indication of right sided heart failure if it is enlarged and/or pulsatile.

- Monitoring can also give valuable information. The monitoring available will vary as to where the patient is and the appropriate monitors will be determined by the patient's illness. Saturation monitoring can give valuable information on heart rate and rhythm. This can be supplemented by 3 or 5 lead ECG and non-invasive blood pressure monitoring. Invasive monitoring may be available in some critical care areas. Information from these devices can be invaluable but should always be reviewed in the context of that particular patient and also the vital sign trends. IV access should be gained and bloods taken for analysis. IV fluids should be considered. If blood pressure is found to be low and refractory to fluid bolus then consideration should be given to inotropic support.

D - Disability

By the time you assess disability you may have a good idea of the patient's conscious level. If they are able to answer a question appropriately then they are likely to have an open airway with some amount of ventilation and perfusion to allow the delivery of oxygen and blood and glucose to the brain. It also means that the brain is functioning at a relatively good level. If the patient seems confused or obtunded then a more thorough investigation of the nervous system is required.

The use of the AVPU scale (Alert, Voice, Pain, Unresponsive) can give an indication to the patient's conscious level. A score of P or U should be a cause for concern. The Glasgow Coma Scale is a more in-depth assessment. It is made up of 3 categories - Eye response, Verbal response, Motor response it is scored from 3-15 with a score of 15 being normal and 3 meaning that the patient is completely unresponsive.

If the patient is able to obey commands it is often worth asking them to move each of their limbs in turn. This may indicate a weakness or paralysis of a muscle group or limb. Look for asymmetry in the face, body and limbs. If an abnormality is found then assessment of tone/reflexes/power and sensation are important additions to the examination. Patients with focal neurology should be assessed quickly and thoroughly so that a likely site of the pathology can be found and treated. If the patient has signs and symptoms suggestive of a stroke, early imaging and then treatment as required is vital to decrease loss of brain cells. This can make a huge difference to the patient's end quality of life.

Check the pupils for symmetry, size and response to light. Fundoscopy may give an indication of raised intracranial pressure or

Glasgow Coma Scale

Eye Scores

- 4 - Eyes open
- 3 - Eyes open to voice
- 2 - Eyes open to pain
- 1 - Eyes do not open to any stimulus

Verbal Scores

- 5 - Normal verbal response, orientated
- 4 - Confused speech
- 3 - Random words
- 2 - Incoherent words
- 1 - No verbal response

Motor Scores

- 6 - Obeys commands (e.g. touches nose if asked)
- 5 - Localises to painful stimulus (Classically this should be a painful stimulus above the clavicles. If the patient is able to move the hands above the level of the clavicles in response to the stimulus then they are localising to pain. A good jaw thrust is a good stimulus and will also help to open the patient's airway!)
- 4 - Flexes or withdraws to pain. Patient tries to move hand/finger when nail bed is compressed
- 3 - Abnormal flexion in response to pain. Flexor posturing; adduction of arm, internal rotation of shoulder, pronation of forearm, flexion of wrist. This is a decorticate response
- 2 - Extension in response to pain. Extensor posturing; external rotation of shoulder, supination of forearm, extension of wrist. This is a decerebrate response
- 1 - No motor response to pain.

stigmas of disease (e.g. poorly controlled diabetes).

In every critically unwell patient check a blood sugar level **Don't Ever Forget Glucose (DEFG)**. This is especially important in those with an altered LOC. Both hypo and hyperglycaemia can cause altered mental states and even coma.

E - Exposure

With explanation to the patient and consideration for their dignity, expose the patient so that you can inspect all areas of their body. Looking for rashes, bumps, bruises, trauma, bleeding, drains, vascular access, etc. It is then important to cover the patient to maintain body heat and also dignity.

Look for clues as to a cause of their hypotension. Are they wet with water/sweat/blood? Are there any wounds or obvious bleeding points? Are there any drains? Are there any infusions connected which could be contributing to the hypotensive state.

The DRS ABCDE (DEFG), with practice and good teamwork, should only take a few minutes. Any life threatening conditions should be identified and treated during this time. If anything potentially life threatening is seen, remember to call for help. A structured, thorough, team approach is what is needed for all critically ill patients!

History

During the initial assessment it is often possible to take a concise history from the patient this should include an **AMPLE** history.

- Allergies
- Medications:
 - This should include prescribed medications (along with compliance), over the counter and herbal/alternative medications along with street/illicit drugs. If the patient is diabetic - have they been taking their insulin/hypoglycaemics as normal?
- Previous Medical History:
- Last time the patient ate or drank
- Event (back ground to presentation).

Aetiology of Hypotension

- In medicine and physiology hypotension is the term used for low blood pressure.
- 'Normal' blood pressure is: systolic range of 90-140mmHg, diastolic range of 60-90mmHg.
- Blood pressure (BP) is equal to cardiac output (CO) multiplied by the systemic vascular resistance (SVR)
- Cardiac output is determined by the heart rate and stroke volume.
 - Blood is an incompressible fluid that flows through a closed circuit. The volume of blood pumped out by the left side of the heart should be the same volume that reaches the right side of the heart (over time). This is known as the principle of continuity, and it indicates that the stroke output/volume of the heart is the key determinant of circulatory blood flow.
 - There are three elements that determine stroke volume. These include preload, contractility, and afterload.
 - Preload is the load imposed on resting muscle that stretches the muscle to a new length.
 - Contractility is the velocity of muscle contraction when muscle load is fixed
 - Afterload is the total load that must be moved by a muscle when it contracts.
 - Treatment varies depending on which element is causing a reduction in blood flow.

- Systemic vascular resistance = the resistance to flow that must be overcome to push blood through the circulatory system.
 - The resistance offered by the peripheral circulation is known as the systemic vascular resistance.
 - The resistance offered by the vascular of the lungs is known as the pulmonary vascular resistance.
 - Decrease in blood vessel diameter increases SVR, vasodilation on the other hand will decrease SVR.
- Hypotension is a physiological state, it is not a disease in itself.
- Severely low blood pressure can deprive the brain and other vital organs of oxygen and nutrients, leading to shock.
- Successful management of hypotension depends on:
 - Rapid diagnostic assessment
 - Diagnosis-specific intervention
- Hypotension is classified into three categories:
 - Fluid loss: bleeding, severe dehydration
 - Distributive: sepsis, spinal
 - Pump failure: cardiogenic
- You need to decide the category of hypotension because the management for each will be different

Hypovolaemia (Fluid Loss)

- Uncontrolled bleeding is the leading cause of preventable death in trauma
- Early intervention improves outcomes
- Coagulopathy common after severe trauma and occurs very early
- Massive Transfusion Protocols replace blood and coagulation factors in a coordinated manner
- Haemorrhage is responsible for about 40% of trauma deaths globally. Injuries are sustained from both blunt and penetrating trauma, which demonstrate different injury patterns and sites of bleeding.

Identifying the site of blood loss requires both physical assessment and imaging. The primary examination aims to identify any life-threatening problems. The secondary survey should include a systematic assessment of areas of potential large blood loss. This is inclusive of:

- Abdominal area
- Thoracic area
- Pelvic area
- Long bones

Imaging should include the main areas of blood loss and xray trauma series includes images of the chest, abdomen, pelvis and c-spine. Whole body CT, particularly for multi-trauma may be recommended.

Fluid replacement is essential. Current evidence recommends permissive hypotension for penetrating thorax and abdominal injuries. This means infusing fluids to maintain a mean arterial pressure of 60mmHg and a systolic between 70-90mmHg, or until adequate mentation and peripheral pulses is maintained.

Early colloid therapy is recommended where necessary. Massive transfusion policies are in place to aid in blood replacement therapy in trauma.

Currently a ratio of 1:1:1 is recommended (Packed red blood cells: fresh frozen plasma: platelets).

Once an identified source of bleeding is identified it should be controlled. These may involve application of pelvic binders, or emergency surgery depending on the site.

In trauma the lethal triad refers to a medical condition combining hypothermia, acidosis and coagulopathy. These conditions share a complex relationship, where each compounds the other if not rectified. Hence the importance to ensure warmth, warmed fluids and/or colloids and the application of rapid transfusion policies.

Sepsis

- Systemic inflammatory response syndrome
- Calculated incidence of adult severe sepsis in Australia and New Zealand is 0.77 per 1000 population
- 11.8% of ICU admissions were diagnosed with severe sepsis
- 26.5% mortality

Of deteriorating patients with hypotension as the cause for escalation, sepsis is the leading cause. Preliminary NSW data suggests that 30% of clinically deteriorating patients who require a Rapid Response call are septic.

Statistically these patients have a high mortality rate and sepsis is a common occurrence in the critical care setting.

It is therefore essential to identify patients early who either have, or at risk for developing sepsis. The Surviving Sepsis Campaign is nation wide, and focuses on early identification and aggressive management.

Health care providers should be aware of patients with high risk for developing sepsis. These include:

- Immunocompromised patients (HIV, chemotherapy, organ transplants, neonates)
- Patients with a known source of infection (inclusive of patients currently on antibiotic therapy)
- Non-specifically unwell patients (particularly in the elderly population)
- Recent surgery
- Indwelling device

Managing Sepsis

*Surviving Sepsis Campaign <http://www.survivingsepsis.org/Guidelines/Pages/default.aspx> This website contains the international evidence based guidelines. The NSW Health sepsis pathway is based upon these guidelines.

Adult Sepsis Pathway for NSW Health <http://www.cec.health.nsw.gov.au/programs/sepsis-sepsistoolkit>

- Recognise
 - risk factors, signs and symptoms of sepsis
 - Inform senior clinician
- Resuscitate
 - Rapid IV crystalloid and antibiotics within one hour
 - Aim for MAP > 65, Systolic BP > 100
 - Have they improved after one hour?
- Refer
 - Specialist care +/- retrieval

Copies of pathway are available on

http://www.cec.health.nsw.gov.au/documents/programs/sepsis/sepsis_pathway_final_3_may_2011_adult.pdf



ADULT SEPSIS PATHWAY



RECOGNISE

Does your patient have risk factors, signs or symptoms of infection?

- | | |
|-----------------------------------|---|
| Immunocompromised | Skin: cellulitis, wound |
| Indwelling medical device | Urine: dysuria, frequency, odour |
| Recent surgery/invasive procedure | Abdomen: pain, peritonism |
| History of fever or rigors | Chest: cough, shortness of breath |
| Red Flags in ambulance handover | Neuro: decreased mental alertness, neck stiffness, headache |

AND

Does your patient have 2 or more yellow criteria?

- Respirations ≤ 10 or ≥ 25 per minute
- $SpO_2 < 95\%$
- Systolic blood pressure ≤ 100 mmHg
- Pulse ≤ 50 OR ≥ 120 per minute
- Altered LOC or change in cognitive status
- Temp ≤ 35.5 or $\geq 38.5^\circ C$

NO

Re-assess

Treat and re-assess simultaneously:
Sepsis may still be a concern

YES

Perform venous blood gas if available

Does your patient have any red criteria?

- | | | |
|---|--|---|
| <input type="checkbox"/> SBP ≤ 90 mmHg | <input type="checkbox"/> Lactate ≥ 4 mmol/L | <input type="checkbox"/> Base Excess < -5.0 |
| <input type="checkbox"/> Age > 65 years | <input type="checkbox"/> Immunocompromised | |

NO

YES

This patient may have SEPSIS:

- Inform the doctor-in-charge
- Monitor vital signs & fluid balance
- Obtain blood cultures x 2 sets
- Investigate source of infection: e.g. urinalysis, urine M/C/S, chest x-ray
- Obtain IV access and start IV fluids
- Administer empiric antibiotics within one hour unless another diagnosis is more likely Refer to Therapeutic Guidelines: Antibiotic, version 14 <http://www.tg.org.au>
- Refer / communicate with admitting team

This patient has SEVERE SEPSIS or SEPTIC SHOCK until proven otherwise:

- Inform the doctor-in-charge
- Expedite transfer to a resuscitation area or equivalent
- Turn over page for Resuscitation Guideline

CONSIDER ELIGIBILITY for ARISE

Respond and Escalate

ADULT SEPSIS PATHWAY: Resuscitation Guideline

RESUSCITATE

Does the patient have an Advance Care Directive? Are there treatment limitations?

- Patient assessment and treatment proceeds simultaneously
- Maintain SpO₂ ≥ 95%
- Monitor respiratory rate, SpO₂, heart rate and rhythm, blood pressure, temp, fluid balance
- Obtain intravenous access
Take two sets of blood cultures, FBC including lactate OR venous blood gas for lactate, EUC, LFT, coagulation & glucose (glucometer or formal)
- Fluid resuscitate
 - Give 20mL/kg of 0.9% sodium chloride STAT fluid challenge
 - If no response, repeat 20mL/kg once (unless there are signs of pulmonary oedema)
 - If no response, insert IDC and commence vasopressors (as per local protocol) to achieve a MAP of ≥ 65mmHg in consultation with Doctor-in-Charge

Start IV antibiotics within 60 minutes

**** Do not wait for results of investigations ****

- Investigate source of infection e.g. urine M/C/S, chest x-ray, sputum, wound
- Refer /communicate with admitting team and ICU

RE-ASSESS

IS YOUR PATIENT RESPONDING TO RESUSCITATION?

Signs of improvement	If Improving take the following action:
MAP ≥ 65mmHg	<ul style="list-style-type: none"> • Continue monitoring vital signs closely • Strict monitoring of fluid balance • Investigate and treat the source of infection
Urine Output > 0.5mL/kg/hr	
SpO ₂ ≥ 95%	
Decreasing serum lactate level	
Improving LOC	



REFER

IF NO IMPROVEMENT INTENSIVE CARE MANAGEMENT IS REQUIRED

1. Reassess suitability to continue resuscitation
2. Request review by ICU doctor to occur within 30 minutes
3. If you do not have an ICU at your facility, seek advice immediately from the

**ADULT MEDICAL RETRIEVAL SERVICE 1800 650 004 or
the local Critical Care Advisory Service**

Minimum requirements for patient monitoring:

- Continuous blood pressure, continuous urine output via IDC
- Repeat serum lactate every 4 hours



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