York Teaching Hospital
NHS Foundation Trust

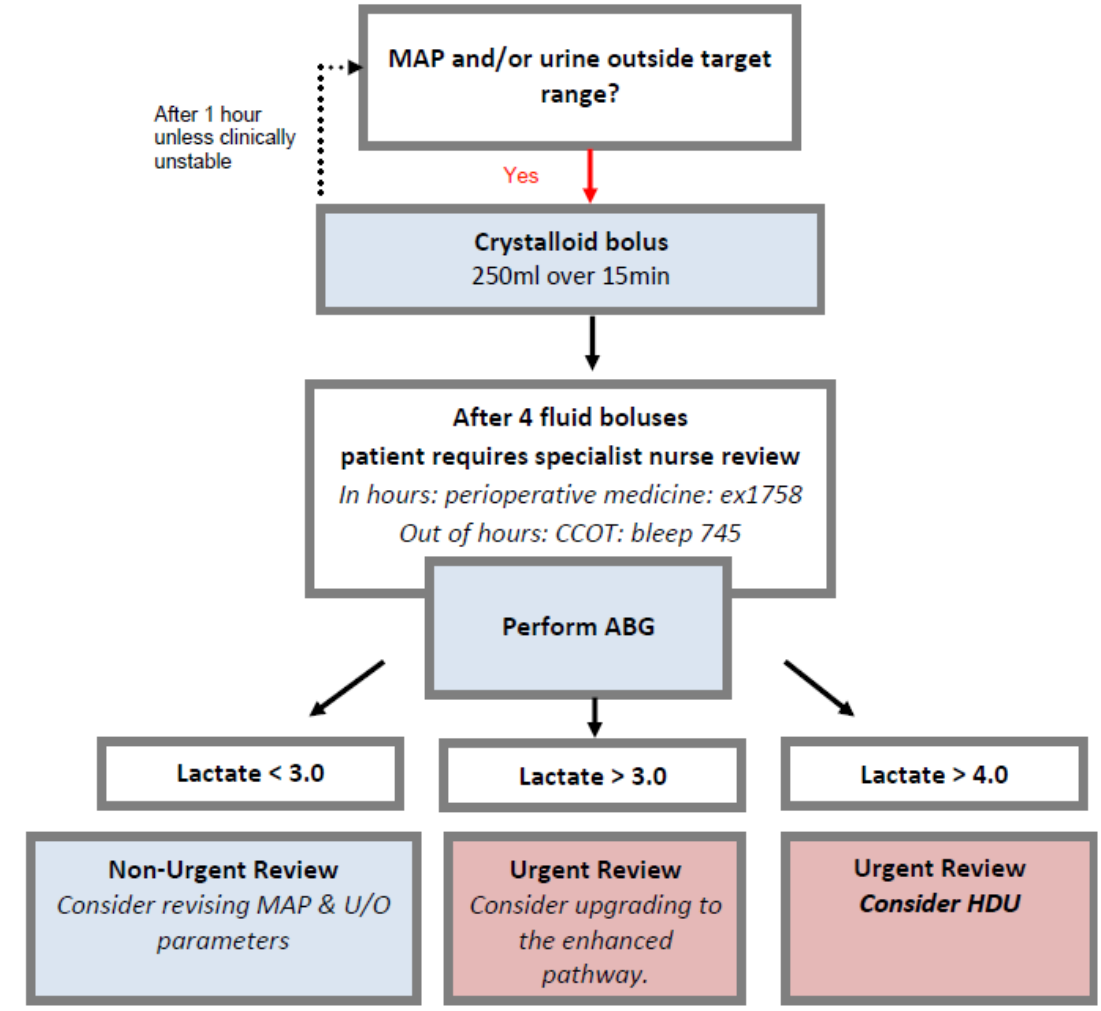
H.A.P.P.Y Manual

Haemodynamic optimisation And Perioperative Protocols at York hospital

Version 3.2 (29/12/17)
YORK TEACHING HOSPITALS NHS FOUNDATION TRUST

Contents

Colorectal Standard Perioperative Protocol



Use Deteriorating Patient Escalation Policy for timing of escalation:
NEWS score 3-4 review within 60min
NEWS score 5-6 review within 30min
NEWS score 7> within 15min
In the event that the patient is not triggering on their NEWS score we would advise a review within 60 minutes.

Enhanced Perioperative Protocol

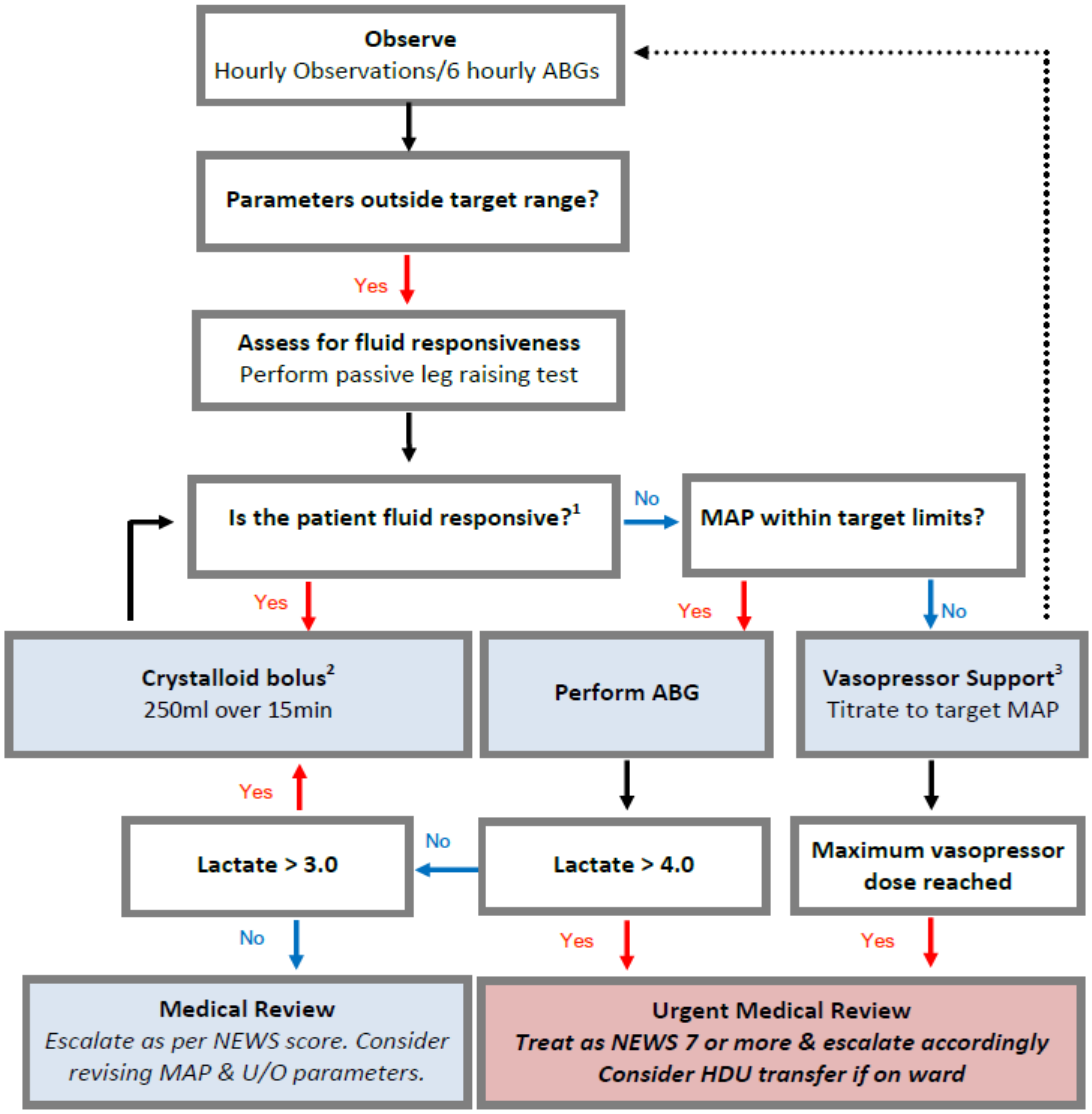
Post-Operative Destination

Nurse Enhanced Unit: Intermediate risk (3.1% mortality)

High Dependency Unit: High risk (9.1% mortality)

Check list:

- ☐ Pathway obs chart
- ☐ Target parameters set
- ☐ Fluid boluses prescribed
- ☐ Vasopressor prescribed
- ☐ Cardiac Monitoring in place



1) Fluid responsiveness is shown with a >10% increase in stroke volume after a passive leg raise or fluid bolus.
2) After four fluid boluses please take an ABG and seek a medical review
3) Ensure baseline ABG is taken prior to starting vasopressors. On the ward use the metaraminol protocol described in the Perioperative Manual and on the pharmacy monograph.

Step by step guide to changing a transducer

This will not generally be required on the NEU but in case of a problem with the transducer set. The Perioperative Nurse specialist, Critical Care Outreach or an ODP can assist if required.

Equipment: 500ml bag of 0.9% N/Saline (prescribed), red arterial transducer set, Gloves, Apron, Transparent Dressing, pressure bag, non-injectable bung, procedure trolley.

Procedure	Rationale
Obtain patient consent.	To comply with the DOH, risk management & CQC standards and in accordance with all human rights.
Effective hand hygiene and apply gloves and apron.	To remove transient bacteria and reduce risk of infections. Gloves and apron should be worn and a dressing pack used to reduce opportunities for transmission of microorganisms.
Gather equipment.	See list above. The transducer line is red to prevent misidentification of arterial line and therefore avoid accidental injection of drugs into the artery.
Sign for the prescribed 0.9% N/Saline fluid.	Two nurses should check the infusion fluid. This is to comply with trust standards and prevent administration of the wrong infusion fluid.
Prepare transducer infusion set: **Step 1:** Using ANTT remove the transducer from the packaging ensuring all of the connections are secure **Step 2:** Insert the transducer into the holder **Step 3:** Spike the 500ml bag of 0.9% N/Saline. **Step 4:** Insert the fluid bag into a pressure bag **Step 5:** Open the roller clamp on the IV set and gravity prime the set using the snap back flush device. Ensure all ports are flushes through by manipulating the stop cock and no air bubbles are visible. **Step 6:** Attach non-injectable bungs to the ports. **Step 7:** Inflate the pressure bag to 300mmHg**.**	Connections can occasionally be loose straight from the packet. ANTT reduces the risk of infection. 0.9% normal saline must be used; any other fluid can cause serious harm or death. Do not inflate the pressure bag prior to priming the set as this may cause turbulence in the line and microbubbles. To prevent air emboli. The pressure bag is inflated to 300mmHg to ensure accurate measurement and allow delivery of saline at 3ml/hr to keep line patent.
Disconnect old transducer and connect new transducer to arterial line ensuring cable to monitor is also connected. Apply transparent dressing.	Remove the old transducer quickly. Connect the new transducer immediately to prevent the patient bleeding unnecessarily. A transparent dressing allows visualisation of the site for signs of infection and reduced the risk of site contamination.
Ensure transducer is in line with the 4th intercostal space in the mid axillary line.	This ensures an accurate reading.
Zero the transducer: **Step 1:** Open the stopcock on the transducer to air by turning it towards the patient and away from the transducer. **Step 2**: Remove the bung/cap. **Step 3**: Press the zero button on the monitor and confirm that the numeric value is '0.' **Step 4:** Close the stopcock. Flush the line using only the snap back flush. **Step 5**: Reapply the bung/cap	This removes the effect of atmospheric pressure.
Correctly label line with date and time (to be changed every 72 hours).	To ensure the line is changed at the correct time.
Document in nursing notes.	To keep an accurate record of actions as per the trusts record keeping policy.

Step by step guide to taking a blood gas

Equipment: Apron, Gloves, Sanicloth, Pre-heparinised arterial blood gas syringe, 5ml syringe

Procedure	Rationale
Obtain patient consent.	To comply with the DOH, risk management & CQC standards and in accordance with all human rights.
Positive patient identification.	To prevent potential harm from misidentification.
Effective hand hygiene.	To remove transient bacteria.
Clean blue tray using a green clinell wipe and allow to dry.	Create an clean field.
Apply non-sterile apron and gloves.	To reduce transmission of microorganisms and contamination of hands with bloods.
Clean the arterial non-injectable bung for 30 seconds with 2% chlorhexidine or 70% alcohol sanicloth and allow to dry for 30 seconds	To remove transient microorganisms from the port, see ANTT policy.
Open the three way tap on the arterial line closest to the patient so it is open to the patient. This allows bloods to flow from the patient to the three way port. Attach a 5 ml syringe to the non-injectable bung and gently withdraw 3mls of blood. Return the syringe to the sterile packaging.	This removes saline and old blood from the line. Withdrawing the blood slowly helps to avoid arterial spasm and damage to red cells. This ensures the key parts are not contaminated.
Attach a pre-heparinised arterial blood gas syringe to the port and gently fill with 2-3mls of blood.	To prevent clotting.
Expel any air from the syringe and gently rotate.	Prevents blood coagulation.
Turn the three way tap to close it to the port to allow you to flush the arterial line to the patient. **Flush only with the snap back flush.** Observe the patients fingers for signs of discolouration and any change in sensation.	To clear blood from the line and maintain patency. To ensure early recognition of complications such as poor perfusion to the extremities.
Reconnect the 5 mls syringe and flush the bionector port **using the snap back flus**h and arterial line by turning the three way tap off to the patient.	To prevent blood clotting in the line.
Label the sample with patients ID.	To ensure correct details are entered into the gas analyser.
Ensure sample is processed within 15 minutes and in accordance with annual mandatory blood gas analyser training.	The sample deteriorates after 15 minutes, if analysed after this time the results may not be accurate.
Dispose of all blood filled syringes in clinical waste.	To comply with waste management policy.
Review results/document on observation chart and take appropriate action if required.	To ensure patient is treated in accordance with protocol and any issues escalated to appropriate members of staff.

Step by step guide to removing an arterial line

Equipment: Apron, Gloves, procedure trolley, sterile wound care pack, stitch cutter, sanicloth, sterile scissors, sterile universal container, small sterile dressing

Procedure	Rationale
Obtain patient consent.	To comply with the DOH, risk management & CQC standards and in accordance with all human rights.
Positive patient identification.	To prevent potential harm from misidentification.
Check patient's coagulation, haemoglobin and platelets.	To prevent unnecessary bleeding.
Effective hand hygiene.	To remove transient bacteria.
Clean procedure trolley with a green clinell wipe.	Cleaning the trolley and allowing it to dry with provide a clean field to work on.
Apply apron and gel hands.	To remove transient bacteria and reduce opportunities for transmission of microorganisms and prevent contamination of hands with blood.
Open wound care pack, scissors, stitch cutter (if sutured in), dressing and swabs.	To facilitate ANTT and protect key parts.
Apply clean non-sterile gloves.	To reduce opportunities for transmission of microorganisms and prevent contamination of hands with blood.
Place paper towel from wound care pack under arterial line site.	To reduce the risk of micro-organism transmission.
Loosen dressing.	To make it easier to remove dressing.
Remove non-sterile gloves, gel hangs and apply sterile gloves.	To protect patient from introduction of micro-organisms and bacteria.
Cut and remove all sutures if present.	To free line ready for removal.
Remove arterial line, immediately placing sterile gauze on exit site and apply pressure for at least 5 minutes.	To prevent blood loss and maintain asepsis.
Once bleeding has stopped apply dressing.	To protect exit wound and maintain asepsis.
If signs of infection or requested by medical team cut tip of arterial line (without contaminating) and place in sterile universal container. Send sample to microbiology.	To facilitate surveillance of invasive lines.
Safely dispose of any sharps/contaminated equipment.	To comply with waste management policy.
Clean procedure trolley surface and wash hands.	To prevent spread of microrganisms and remove transient. bacteria
Document line removal in the nursing notes.	To ensure an accurate record of removal of line in accordance with trust record keeping policy.
Observe site for bleeding and haematoma following removal.	To prevent undetected bleeding/ haemorrhage.

Arterial Line complications

	Cause	Signs and Symptoms	Intervention
Air Embolism	Air in circuit prior to connection. 3way tap left open. Air in giving set.	Over dampened arterial waveform, tachycardia tachypnoea, cyanosis, loss of consciousness	Call for urgent medical help, administer oxygen. Check and secure all bungs an connections
Thrombosis forming in arterial catheter	Pressure bag deflated below 300mmHg. No fluid left in flush bag. Tubing not flushed properly after sampling.	Change or loss in pulse pressure upon palpation, loss of warmth, sensation and mobility to limb, loss of arterial waveform.	Call for urgent medical help.
Haematoma	Leakage of blood at site following cannula insertion. Failure to apply enough pressure when arterial catheter removed.	Swelling of limb or insertion site	Secure cannula. Apply pressure if this occurs post removal. Get a medical review.
Accidental injection of drugs/wrong infusion fluid used for flush	Confusion of CVC and arterial lines. Not using a red transducer set. Lines not being clearly labelled. Wrong fluid selection. Fluid not double checked. Pressure bag obscuring fluid label. Flush fluid not checked every shift.	Immediate discomfort sensory problems, tingling/burning flushing, mottling muscle contractures, weakness, paralysis bbscure blood sugar levels	Call for urgent medical help. Withdraw blood from the line to try and remove drug from circulation. Complete an incident form. May require referral to plastics team.
Infection	Inadequate asepsis on line insertion. Inadequate care and maintenance of site. Prolonged time in situ.	Redness, warmth, pain, inflammation, swelling or pus at the site. Evidence of tracking and/or increased septic markers.	Inform medical team. Remove line. Swab insertion site and send tip for MC&S.
Haemorrhage	Loose connection. Bungs left off. 3-way taps left open. Unnoticed accidental removal.	Visible blood loss. Hypotension. Cardiac arrest.	Call for help. Assess the patient. Remove cannula if dislodged. Apply direct pressure until the bleeding stops. Check that all bungs are tight and secure.
Arterial Injury	Trauma to artery on insertion. Prolonged time in situ.	Over/under dampening of the arterial line. Variable pulse pressure on palpation. Blotching of distal limb when line is flushed.	Inform medical team. Assess perfusion and observe the limb.

General Guidance/ Prevention of arterial line complications

Sampling:

- Withdraw slowly.
- Blood should not be left in line for longer than necessary (never longer than 3 minutes).
- The line must be flushed clear following blood sampling (using only the snap back flush).

Transducer & flush:

- The flush fluid should be checked every shift by the nurse looking after the patient.
- The transducer should never be taken down with an arterial cannula left in situ.
- Ensure all connections and bungs are tight and secure.
- Ensure pressure bag is kept inflated to 300mmHg.
- Ensure the line is fully primed prior to connection.
- The transducer and flush bag should be changed every 72 hours.

Care of line:

- Ensure the line is clearly visible.
- Prior to securing the line it should be curled in a 'U' to prevent any direct pull on the line.
- The site should be secured with sterile, moisture permeable, clear dressing.

Safety:

- Ensure alarm limits are set.
- The arterial line must be clearly labelled with 'Arterial' stickers.
- A non-injectable bung should be used.
- The nurse must carry out neurovascular observations on the limb distal to the cannula at least 4 hourly and document on the care plan at least once per shift.
- If there are any signs of inflammation/infection a doctor should review.
- After removing the line pressure should be applied for at least five minutes.

Troubleshooting

Problem	Solution
Difficulty with zeroing, does not reach '0' waveform does not reach baseline	Check all equipment and connections Ensure line is correctly labelled on the monitor Ensure pressure bag is pumped up to 300mmHg Ensure all roller clamps are open Check system for clots and air bubbles Consider changing transducer cable to monitor
Unable to aspirate	Check patient side of line for any kinks Ensure 3-way tap is open in the right direction Manipulate cannula gently while trying to aspirate Flush gently with snap back flush (not a syringe) Consider changing cannula
Falsely high readings	Check position of catheter and transducer Check over/underdamped? Remove any kinks/air bubbles/clots Perform manual blood pressure to confirm reading

Arterial Waveforms

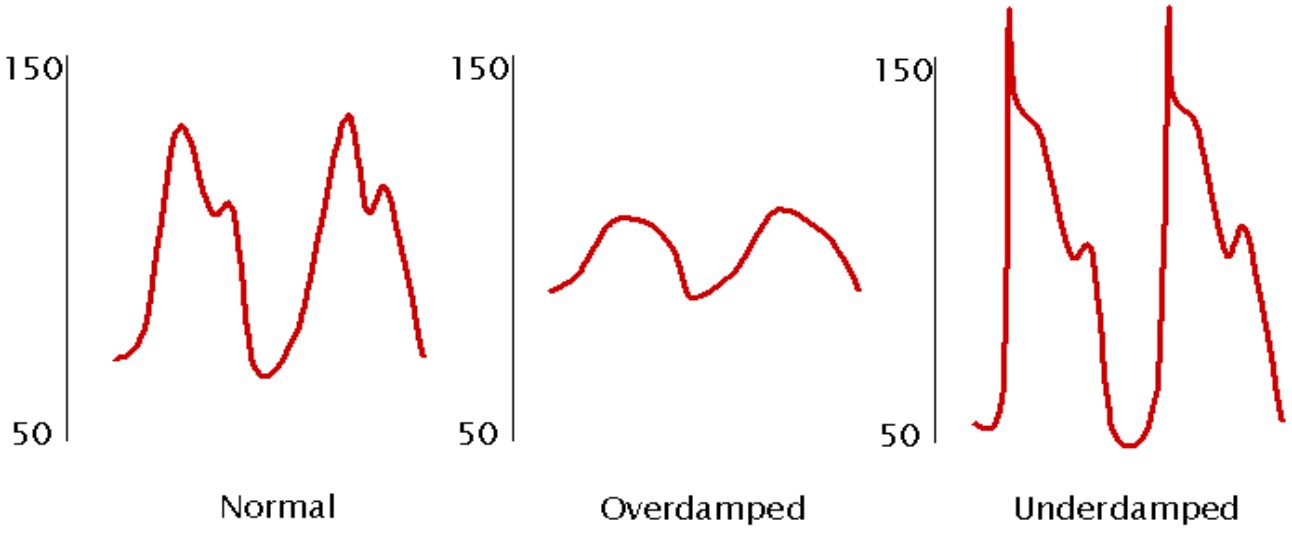
MAP: The MAP is the average arterial pressure during the cardiac cycle, and it provides an overall indication of peripheral tissue perfusion. For this reason, the map is used clinically to help guide management of the patient's haemodynamic status.

Overdamped waveforms: (see diagram below) Overdamped waveforms can lead to an underestimation of the systolic and a falsely high reading of the diastolic as well as poorly defined components of the pressure trace (no dichotic notch)

- Check for clots or air bubbles in the transducer line
- Ensure that the catheter is not resting against the vessel wall
- Check for any kinking in the tubing.
- Check bag inflated to 300mmHg and there is adequate fluid in the bag.

Underdamped waveforms: (see diagram below). Underdamped waveforms can lead to an overestimation of the systolic and the diastolic may be underestimated

- Remove excess lengths of tubing or extra 3-ways taps
- Patient factors such as tachycardia and high cardiac output may lead to an underdamped trace
- It is also more common to see underdamped traces in young people as they produce strong contractions that can overshoot or increase resonance in the system



Arterial Blood Gases

Normal Values for Arterial Blood Gas

Blood pH	7.35 – 7.45	A high reading indicates alkalosis. A low reading indicates acidosis. A normal reading may indicated either normal, mixed defect or a compensated defect.
PaC02	4.5-6.0kPa	High $PaCO_2$ with an acidosis indicates a respiratory problem. If the $PaCO_2$ is normal or low with acidosis it indicates compensation.
Bicarbonate	22-28mEq/L	If the bicarbonate fits with the pH it suggests a primary metabolic problem. If not, it indicates compensatory changes.
P02 Level	>10kPa	Reflects the amount of oxygen gas dissolved in the blood. Be warned a 'normal' p02 may not be if a patient is on supplemental oxygen.
Lactate	0 to 2 mmol/l	Tissue hypoperfusion increases the production of acids, including lactic acid. Restoring tissue perfusion by fluid resuscitation, inotropic support, or other interventions often normalizes lactate levels. Persistent lactate elevations are associated with poor outcomes
Base Excess	-2 to +2mmol/L	A negative base excess and low bicarbonate is an indicator of metabolic acidosis and poor perfusion. Therefore a fluid bolus can improve this.

Primary Acid-Base Disturbances

- **Respiratory acidosis**: low pH, high $PaCO_2$, normal or high if compensating bicarbonate.
  Causes: neuromuscular weakness, intrinsic lung disease - eg, COPD.
- **Respiratory alkalosis**: high pH, low $PaCO_2$, normal or low if compensating bicarbonate.
  Causes: any cause of hyperventilation - eg, anxiety, pain.
- **Metabolic acidosis**: low pH, normal or low normal $PaCO_2$, low bicarbonate.
  Causes: Sepsis, DKA, Renal Failure
- **Metabolic alkalosis**: high pH, normal $PaCO_2$, high bicarbonate.
  Causes: vomiting, burns, ingestion of base

Metaraminol administration

What is metaraminol?

Metaraminol stimulates alpha receptors in the sympathetic nervous system. This causes vasoconstriction and leads to an increase in blood pressure due to increased systemic vascular resistance.

Metaraminol is similar to noradrenaline but is longer acting and can be given peripherally. Normal IV infusion rates are 0.5-5mg/hr (using the below reconstitution that's 1ml-10mls/hr). If you require an infusion above **6**ml/hr please refer straight to HDU.

Potential side effects include hypertension, bradycardia, arrhythmias.

Preparation

Metaraminol (10mg/ml)
38 ml NaCL 0.9%
50 ml Luer lock syringe
2ml syringe

1. Draw up 2 ml or 20mg of metaraminol (concentration 10mg/ml)
2. Reconstitute this NaCl 0.9 % to make 40mls producing a metaraminol solution that is of a concentration of 0.5mg/ml.

Administration

1. Connect the syringe via an infusion line to either a peripheral or central venous cannula.
2. Start the infusion using a dedicated Alaris syringe driver at a rate of 1ml/hr.
3. Titrate the infusion in 0.5-1ml/hr increments to achieve a MAP in the target range. Half-life ranges from 1-2minutes so titrate approximately every 10 minutes to ensure safe titration.
4. If the MAP exceeds the target range then decrease the infusion in 1ml/hr increments until the target range is achieved.
5. Remain with the patient and monitor the blood pressure continuously until this target is achieved.

Safety precautions

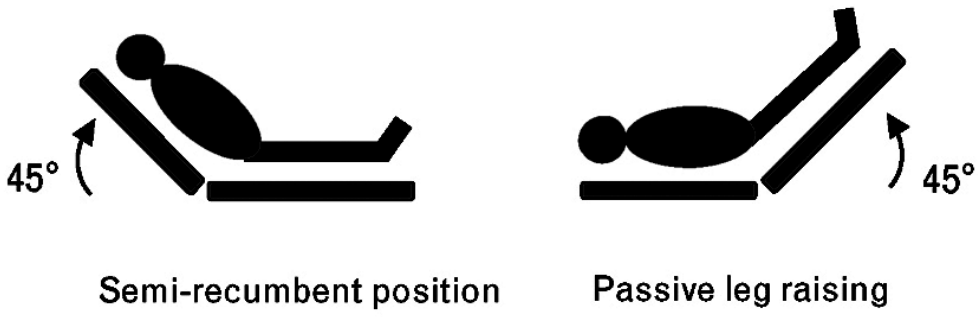
1. Syringes should be changed every 24hours.
2. A cannula and line should be dedicated to metaraminol. If metaraminol is running a patient should have cannulas in situ.
3. Lines should be clearly labeled.
4. Ensure staff are alerted to patient being on metaraminol (complete space on bed space board).
5. Prepare next syringe in plenty of time (we suggest 2-4hours).
6. Ensure alarm limits set on BP monitoring devices
7. **NEU must not be left unattended while metaraminol is running**

Passive leg raise (PLR) test

The passive leg raise transiently increases venous return (by about 200ml) in patients who have reduced blood volume. The PLR is a diagnostic test for hypovolaemia and not a treatment.

Technique.

1. Place and secure the arterial transducer on the patient's upper arm at the level of the of the 4th or 5th intercostal space (approximately at the level of the nipple) and in the mid axillary line.
2. Sit the patient at 45 degrees in the semi recumbent position with their legs completely flat.
3. Wait 2 minutes for stabilisation of the signal and then record stroke volume from the EV 1000 (pre procedure stroke volume).
4. Using the bed controls lower the patient's body to horizontal so that the legs are raised to 45 degrees.
5. Wait for 90 seconds and record stroke volume (post procedure stroke volume).
6. Return the patient to the semi recumbent position.



Nurse Competencies

Final Competency Sign off
……. has completed the Peri-Operative Protocolised Pathway training objectives for post-operative care and is competent to care for patients on this pathway. ……Signature …… Date [Trainee] ……Signature …… Date [Trainer]

Competency	Achieved *Signature & Date*	Action Plan if required
Arterial Access The nurse; • Is able to identify sites for arterial cannulation. • Can list the risks and complications of arterial access and lines. • Is able to safely secure an arterial line • Is able to prime, attach and zero an arterial line • Knows the prescribing and checking procedure for transducer fluid • Is able to recognise normal and abnormal waveforms • Is able to complete the arterial line care plan • Understands when an ABG is required • Is able to safely sample from the arterial line • Has been trained to use the blood gases machine • Understands where to document an ABG and the process of escalating abnormal results. • Is able to safely remove a line		
Advanced cardiac monitoring The nurse must demonstrate knowledge of: • MAP • Cardiac Output and Stroke Volume • The haemodynamic optimisation protocol The nurse should be able to; • Use the Edwards monitoring equipment. • Assess for fluid responsiveness using a passive leg raise • Able to interpret chanced in stroke volume and treat accordingly		
Metaraminol The nurse must demonstrate knowledge of: • Understand of how metaraminol acts upon the heart and body. • Is familiar with the protocol for running metaraminol infusions. • Understands and implements safety precautions when setting up and titrating a metaraminol infusion, including correct labelling of the line and pump. • Understands the indications, contraindications and correct dosing and reconstitution of metaraminol.		