Appendix 2

Competency Title: Caring for a patient with an arterial line

Aims and objectives

Following completion of this competency document the practitioner will be able to:

- Discuss the indications for an arterial line
- Discuss the advantages and disadvantages of site selection
- Be able to interpret and troubleshoot an arterial waveform
- Be able safely care for the patient with an arterial line

Training methodology

- 3 hour theoretical training session
- 7.5 hour clinical shift caring for a patient with an arterial line

Additional training modules

This training module does not include the following competencies

- Assisting with the insertion of an arterial line
- Priming a transducer set
- Taking blood from an arterial line

Additional training can be accessed.

Trainee

Name: ----------

Title: ----------

Ward or department: ----------

Clinical assessor

Name: ----------

Title: ----------

Method of assessment: ----------

Supervision Record

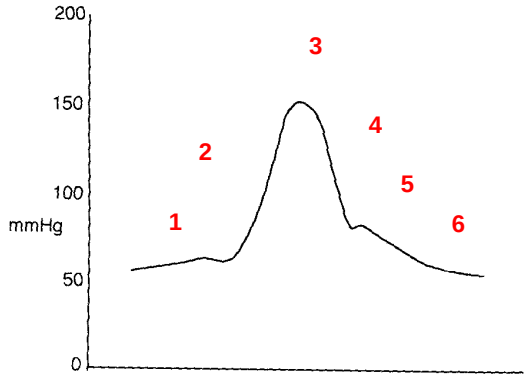
Please detail your clinical supervision activity.

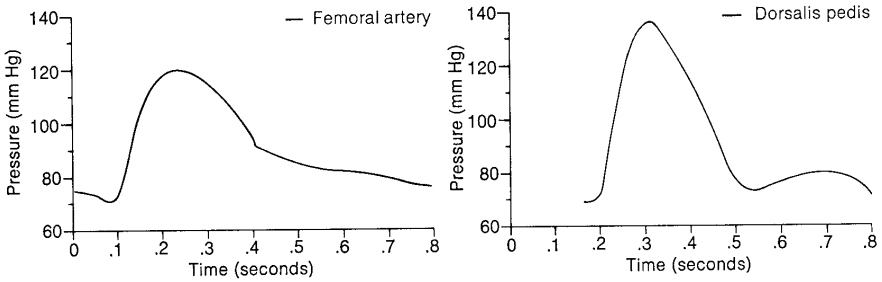
Date	Activity	Suggested learning activities	Clinical assessors signature

Skill criteria		**Knowledge criteria**	
No errors observed	5	Evaluation: *articulates response, what, when how and why*	5
Occasional errors, corrected by trainee	4	Synthesis: articulates the *connections between the parts*	4
Frequent errors, corrected by trainee	3	Analysis: *able to examine how parts relate to the whole*	3
Frequent errors, not corrected by trainee	2	Application: *can relate facts to another situation*	2
Trainee unable to proceed without instruction/prompting	1	Knowledge and understanding: *provides examples and distinguishes differences between examples*	1

S= skill (minimum level 4) K= knowledge (minimum level indicated in box *)

Observable criteria	**Minimum level**	**Tick level of achievement**					**Assessment Outcome**		**Assessors Signature and Date**
	*** State required level i.e. S4, K5**	**1**	**2**	**3**	**4**	**5**	**Pass ✓**	**Fail ✓**	
Arterial line insertion									
1. State four reasons for the insertion of an arterial line	K1								
2. Discuss the relative contraindications for an arterial line	K2								
3. Describe the correct procedure for ensuring adequate perfusion to the hand	K1								
4. Discuss why the radial approach is the preferred vessel for arterial cannulation	K2								
5. Discuss the disadvantages of the following sites: a. Radial b. brachial c. femoral d. dorsalis pedis	K2								
6. State six complications associated with arterial line placement and explore ways to minimize the occurrence	K3								
7. List the equipment required for the insertion of an arterial line	K1								

Observable criteria	Minimum level	Tick level of achievement					Assessment Outcome		Assessors Signature and Date
	* State required level i.e. S4, K5	1	2	3	4	5	Pass ✓	Fail ✓	
Interpreting the arterial waveform									
8. With reference to the cardiac cycle examine the component parts of an arterial wave form 	K4								
9. Evaluate the trace 	K4								

Observable criteria	Minimum level	Tick level of achievement					Assessment Outcome		Assessors Signature and Date
	* State required level i.e. S4, K5	1	2	3	4	5	Pass ✓	Fail ✓	
10. Evaluate the trace 	K4								
11. Compare and contrast the following traces 	K3								
Transducer									
12. Discuss how a transducer works	K2								
13. Discuss why the transducer must be placed level with the right atrium	K2								

Observable criteria	Minimum level	Tick level of achievement					Assessment Outcome		Assessors Signature and Date
	* State required level i.e. S4, K5	1	2	3	4	5	Pass ✓	Fail ✓	
14. Discuss why the transducer must be calibrated to atmospheric pressure at the beginning of each shift	K2								
15. Discuss the effect of using excessively long or short tubing on the accuracy of the reading	K2								
16. Discuss why air bubbles in the tubing may cause inaccurate readings	K2								
Trouble shooting									
17. Discuss your actions if there is no arterial trace on the monitor	K2								
18. Discuss your actions if there is a sudden increase in blood pressure	K2								
19. Discuss your actions if there is a sudden decrease in blood pressure	K2								
20. Discuss your actions if there is bleeding from the site	K2								
21. Discuss your actions if the arterial catheter becomes dislodged	K2								
22. Summarise the nursing care of the patient with an arterial line in place	K3								
23. Summarise the key recommendations in the 2008 NPSA alert http://www.nrls.npsa.nhs.uk/resources/?entryid45=59891	K3								

Competency Statement

Practitioner's signature and date:

I am competent in this procedure at this time and understand the standard statement, action and outcome. Having received appropriate training, I accept full responsibility for the maintenance my own competence and have discussed this role as part of my job description with the person to whom I am managerially accountable.

Signature: Date:

Printed name: Date:

Clinical Assessor's signature and date:

I confirm that the above practitioner has achieved the required competency level and is now able to work autonomously in an unsupervised capacity.

Signature: Date:

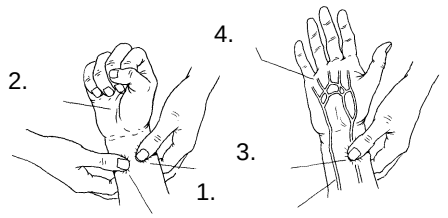
Printed name: Date:

Job role:

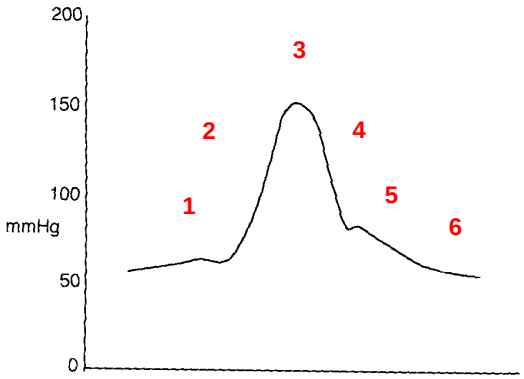
Please place one copy of this record in your professional portfolio and give a second copy to your line manager

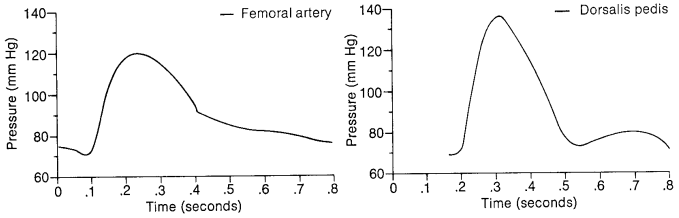
Assessors Guidelines

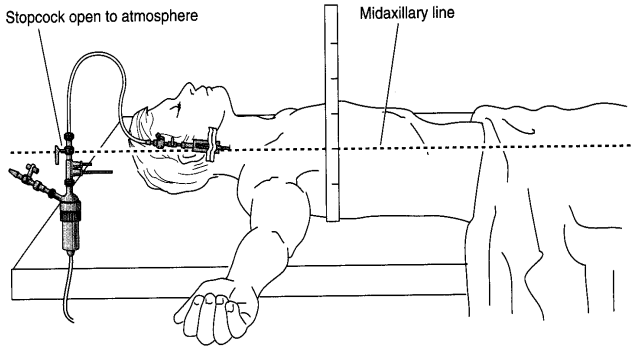
Assessment Criteria	Required knowledge and/or skill
1. State four reasons for the insertion of an arterial line	• To allow continuous monitoring in shocked patients with hemodynamic instability • Patients undergoing any major or prolonged surgery • Patient receiving vasoactive infusions where drug titration is required • Monitoring and control of blood pressure in a hypertensive crisis, dissecting aortic aneurysm or CVA • Patient receiving intra-aortic balloon counterpulsation • Patients with severe respiratory or acid-base imbalance requiring frequent monitoring of arterial blood gases • Patients requiring frequent diagnostic blood testing
2. Discuss the relative contraindications for an arterial line	• Peripheral vascular disease due to increased risk of limb ischemia i.e. radial approach in a patient with Raynaud's disease • Dorsalis pedis approach in a diabetic patient • Coagulopathies or bleeding disorders due to increased risk of haemorrhage at the insertion site • Current or recent use of fibrinolytics agents or anticoagulants causing an increased risk of bleeding at the insertion site • Insertion sites that are infected or burned • Insertion sites where previous vascular surgery has been performed, or that would involve catheter placement through vascular grafts

Assessment Criteria	Required knowledge and/or skill
3. Describe the correct procedure for ensuring adequate perfusion to the hand	 1. Ulnar and radial artery occluded 2. Pallor produced by clenching fist 3. Ulnar artery released 4. Unclenched hand turns pink because of ulnar artery connecting branches
4. Discuss why the radial approach is the preferred vessel for arterial cannulation	• Good collateral circulation • The artery is near the skin and easier to access • The site is easily observable
5. Discuss the disadvantages of the following sites: a. Brachial b. Femoral c. Dorsalis pedis	***Femoral approach*** Potential risk of ischemia to the leg; patient dignity is compromised; High risk of infection ***Brachial approach*** This is an end artery; vessel damage or thrombosis at this point may lead to loss of blood supply to the forearm; haematoma at this site may lead to medial nerve compression; difficulty in obtaining a good trace if patient moving ***Dorsalis pedis*** This is a small artery which is difficult to cannulate; patient mobilisation difficult; difficult to obtain an accurate trace (BP reads higher); vessel thrombosis can occur leading to necrosis of the toes

Assessment Criteria	Required knowledge and/or skill
6. State six complications associated with arterial line placement and explore ways to minimize the occurrence	**Haemorrhage** • Keep arterial site exposed at all times • When priming the line always tighten all of the connections **Air embolism** • Check connections before priming • Prime the line thoroughly • Use a closed system • Do not let the flush back empty **Infection** • Aseptic techniques should be used for insertion, taking blood samples and redressing • Change the catheter as described in the policy • Inspect site on a shift basis and always use a transparent dressing to aid this visual inspection • Dress line according to unit policy **Accidental administration of drugs** • Label line clearly • Do not use three way taps in the system **Thrombosis/emboli** • Use small bore cannula • Ensure transducer pressure bag inflated • Never leave blood in the line and always flush after line manipulation **Limb ischaemia** • Use small bore cannula • Do not inject drugs • Check pulses proximal and distal to the site of insertion • Observe limb colour, sensation and temperature

Assessment Criteria	Required knowledge and/or skill
7. List the equipment required for the insertion of an arterial line	• Arterial cannula of choice • Sterile gloves • Sterile dressing pack • Cleaning solution i.e. chloraprep • A fully primed transducer set • Local anaesthetic • Steristrips • Occlusive dressing • Transducer leads
8. With reference to the cardiac cycle examine the component parts of an arterial wave form 	1. The anacrotic notch occurs just before the opening of the aortic valve. It is usually only seen in central aortic pressure and some pathological conditions 2. The **anacrotic limb**, or anacrotic rise, is a rapid upstroke that begins at the opening of the aortic valve in early systole. The steepness, rate of ascent, and height of this initial upswing is related to the contractility and stroke volume of the left ventricle. 3. The **systolic peak** represents the highest pressure generated by the left ventricle during myocardial contraction. This point marks the patient's actual systolic blood pressure. 4. The **dicrotic limb** begins during late systole as the flow of blood out of the left ventricle starts to decrease. 5. The **dicrotic notch** marks the closure of the aortic valve and the beginning of diastole. 6. The end diastole landmark is the location at which the patient's actual diastolic blood pressure is measured.

Assessment Criteria	Required knowledge and/or skill
9. Evaluate the trace 	**Underdamped** • exaggerated response causing spiking • Overestimate systolic blood pressure • under estimate diastolic blood pressure • Mean arterial pressure remains unchanged • Incorrect tubing • Increased vascular resistance
10. Evaluate the trace 	**Overdamped** • blunted response with an indistinct waveform • Under estimate systolic blood pressure • overestimate diastolic blood pressure • Loss of pressure in the bag • No fluid in the bag • Air bubbles • Blood clots • Position/kinking • Tubing too long or wrong type
11. Compare and contrast the following traces 	

Assessment Criteria	Required knowledge and/or skill
12. Discuss how a transducer works	
13. Discuss why the transducer must be placed level with the right atrium	• If the transducer is lower than the right atrium (phlebostatic axis) the blood pressure reading will read higher than the patients will. • If the transducer is higher than the right atrium the blood pressure reading will read lower than the patients will. 
14. Discuss why the transducer must be calibrated to atmospheric pressure at the beginning of each shift	• The transducer must be calibrated at least once a shift to a known pressure i.e. atmosphere.
15. Discuss the effect of using excessively long tubing on the accuracy of the reading	• Standard IV connecting tubing is too compliant (soft), and absorbs waveform energy, causing overdamping. Movement of the tubing produces fluid movement in the system and produces external artefact. • Shorter tubing length (less than 3-4 feet) increases the natural frequency of the monitoring system and lessens the chance of underdamping.

Assessment Criteria	Required knowledge and/or skill
16. Discuss why air bubbles in the tubing may cause inaccurate readings	• Carefully inspect all fluid-filled components after setup as air may come out of solution during monitoring. Pinpoint air bubbles affect the accuracy of the system and cause over dampening.
17. Discuss your actions if there is no arterial trace on the monitor	**Possible causes** • Tap turned off to patient • Catheter disconnected • Poor catheter position • Transducer, cable or modules fault • Asystole **Action** • Check taps • Check all connections • Manipulate catheter position • Systematically change cable, module & transducer • Commence CPR
18. Discuss your actions if there is a sudden increase in blood pressure	• Could be accurate – assess patient for pain and check for side effects of recently administered drugs • Sudden bolus of vasoactive drug – check infusion pumps • Transducer drips below the phlebostatic axis – check level of transducer • Consult medical team if not resolved
19. Discuss your actions if there is a sudden decrease in blood pressure	• Could be accurate – assess patient for pain and check for side effects of recently administered drugs • Vasoactive drug not being infused – check infusion

Assessment Criteria	Required knowledge and/or skill
	pumps and lines for disconnection. Check pump is infusing • Transducer drips above the phlebostatic axis – check level of transducer • Consult medical team if not resolved
20. Discuss your actions if there is bleeding from the site	• Transducer set disconnected – check and tighten all connections • Patient has developed a coagulopathy – check clotting studies and Consult medical team if not resolved
21. Discuss your actions if the arterial catheter becomes dislodged	• Immediately apply pressure to site for a minimum of 5 minutes. This will be longer in a patient with a coagulopathy • Reassure the patient • Ask a colleague to check the patients cardiovascular status • Consultant medical team • Prepare a trolley for a new line • Run through a new transducer set
22. Summarise the nursing care of the patient with an arterial line in place	• Ensure that the arterial catheter site is visible – special measures around dignity and privacy will have to be put in place if a femoral line is in place • On taking over the care of the patient check for loose connections, backflow of blood, type of fluid in infusion bag, level of fluid in infusion bag and zero the transducer. • Use an aseptic technique for line manipulation

Assessment Criteria	Required knowledge and/or skill
	and change giving sets and dressing in line with Trust policy • Ensure that the line is clearly labeled in line with Trust policy • Check and document pulses distal and proximal to the insertion site together with limb colour, sensation and temperature
23. Summarise the key recommendations in the 2008 NPSA alert http://www.nrls.npsa.nhs.uk/resources/?entryid45=59891	• Patient with arterial lines should be inserted and managed in critical care, theatres and the Emergency Department. Patients should not be nursed outside these areas to avoid complications • Sampling from arterial lines should only be done by competent, trained staff. • Arterial infusion lines must be clearly identified. • Any infusion attached to an arterial line transducer must be prescribed and checked before administration. • Infusion fluids must be checked at regular intervals and on handover • Only sodium chloride 0.9% should be used to keep lines open • Labels should clearly identify contents of infusion bags, even when pressure bags are used.