HEALTH HOLDING
HAFER ALBATIN HEALTH CLUSTER
MATERNITY AND CHILDREN HOSPITAL

Department:	Maternal Intensive Care Unit		
Document:	Departmental Policy and Procedure		
Title:	Invasive Hemodynamic Monitoring in Maternal Intensive Care Unit		
Applies To:	All Maternity Intensive Care Unit Staff		
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1. PURPOSE:

1.1 To provide MICU Nurses a guideline.
1.2 To ensure high quality of nursing practice.
1.3 To enable the nurses to function in an effective and safe manner.

2. DEFINITIONS:

2.1 **Hemodynamic Monitoring** – is used to assess cardiac function and determine the effectiveness of therapy. Hemodynamic monitoring includes arterial blood pressure monitoring, central venous pressure and pulmonary artery pressure monitoring.
2.2 **Arterial Catheter** – are used to continuously monitor blood pressure, to titrated vasoactive agents and to obtain serial blood gases or other laboratory specimens in critically ill patients.
2.3 **Central Venous Pressure** – reflect the pressure of blood in the right atrium or vena cava.

3. POLICY:

3.1 All Nurses shall competent to do hemodynamic monitoring.
3.2 Calibrate system at beginning of each shift.

4. PROCEDURE:

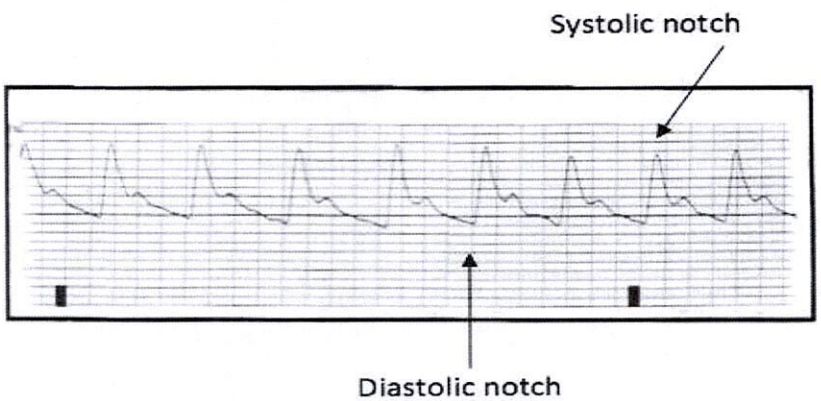
4.1 Arterial Blood Pressure
- 4.1.1 Insertion: Insert arterial line and connect to transducer. (if available / applicable)
- 4.1.2 Zero the system, to atmospheric pressure and monitoring.
  - 4.1.2.1 Wash your hands and follow standard precautions. Assemble the pressure monitoring system.
  - 4.1.2.2 Maintain asepsis by wearing personal protective equipment throughout preparation.
  - 4.1.2.3 Inflate the pressure bag 300 mm Hg, and check it for air leaks. Then release the pressure.
  - 4.1.2.4 Prepare the I.V. flush solution, and prime the pressure tubing and transducer system. At this time, add both medication (inject 500 units of Heparin into 500 cc Normal Saline bag) and tubing labels.
  - 4.1.2.5 Apply 300 mm hg of pressure to the system. The hang the I.V. bag on a pole.
  - 4.1.2.6 Insert pressure module to the monitor.
  - 4.1.2.7 Plug transducer cable into pressure module.
  - 4.1.2.8 Label the pressure module and set the appropriate scale for pressure being monitored.
  - 4.1.2.9 Ensure the system is entirely free of air bubbles, including the Stopcock and transducer.
  - 4.1.2.10 Tighten all connection and replace vented (white) caps on tubing with "deadened" (blue).

4.1.2.11 Connect flush system with the transducer to the transducer cable.
4.1.2.12 After the catheter is in place, connect pressure tubing to one of the Lumen ports with aseptic technique and flush the tubing and catheter.
4.1.2.13 Open transducer pressure tubing.
4.1.2.14 Position the head of bed (HOB) flat or up to 45 elevation.
4.2.1.15 Using carpenter's level, align stopcock above transducer level with client left atrium (phlebostatic axis) and mark client's chest for further readings.
4.2.1.16 To zero calibrate the system, turn stopcock near transducer off to client., remove cap from stopcock opening to air.
4.2.1.17 Depress "zero" button on monitor release button, and note monitor reading is zero.
4.2.1.18 Observe wave form at eye level.
4.2.1.19 Compare direct and indirect blood pressure measurements.
4.2.1.20 Activate monitor alarms, as appropriate.

4.2.2 Document date and time of procedure, insertion site, application of dressing, insertion site condition, patient tolerance of procedure, observe for any potential complications.

4.2.2.1 The normal arterial waveform should have

4.2.2.1.1 Anacrotic limb – Initial up stoke, which occurs as blood is rapidly ejected from the ventricle through the open aortic valve in the aorta.
4.2.2.1.2 Systolic peak – Resulting in the systolic peak, the waveform highest point.
4.2.2.1.3 Dicrotic limb – As blood continues in to the peripheral vessels, arterial pressure falls and the waveform begins a downward trend, called the dicrotic limb. Arterial pressure usually keeps falling until pressure in the ventrical is less then pressure in the aortic root.
4.2.2.1.4 Dicrotic Notch – When ventricular pressure is lower that aortic root pressure, the aortic valve close, this event appears as a small notch on the waveform's downside called the dicrotic notch.
4.2.2.1.5 End Diastolic – When the aortic valve close, diastolic begins, progressing until aortic root pressure gradually falls to its lower point. On the waveform, this is known as endidiastolic
4.2.2.1.6 Tracing from arterial blood Pressure Monitoring



4.2.2.1.7 Recognizing abnormal arterial waveform.

Abnormality	Possible Cause	Nursing Intervention
Alternating high and low waves in a regular pattern	Ventricular bigeminy	Check the patient ECG to confirm. The tracing should reflect premature ventricular contraction every second beat.

Abnormality	Possible Cause	Nursing Intervention
Flattened Waveform	Over damper, waveform, hypertensive patient	Check the patient blood pressure with sphygmomanometer. If you obtain a higher reading, suspect over damping. Correct the problem by trying to aspirate the arterial line. If you succeed flush the line. If the reading is very low and absent suspect hypotension.
Slightly rounded waveform with consistent variation in systolic height	Patient on ventilator with positive end-expiratory pressure.	Check the patient systolic blood pressure regularly. The difference between the highest and lowest systolic pressure reading should be less than 10 mmHg if the difference exceeds that amount, suspect pulses paradoxus possibly from the cardiac tamponade.
Slow upstroke	Aortic Stenosis	Check the patient heart sound for the sign of aortic stenosis. Notify the physician.
Diminished amplitude on aspiration	Pulses paradoxus due to cardiac tamponad constrictive pericarditis or lung disease	Check the patient blood pressure during inspiration and expiration. If inspiratory pressure is at least 10 mmHg less than expiratory pressure call the physician.
Alteration in beat to beat amplitude	Pulses alterans which may indicate left ventricular failure.	Observe the patient ECG and inform the physician. Notify the physician if this is a new and sudden abnormality.

4.3 Central Venous Line Insertion:

4.3.1 Insertion – Insert central line and connect and transducer.

4.3.2 Zero the system to atmospheric pressure and monitoring: Follow the step no 4.1.2.

4.3.3 Waveforms in CVP – The normal CVP waveform consists of three upwards deflections (a, c, & v waves) and two downward defections (x and y descent).

These waves are produced as follows:

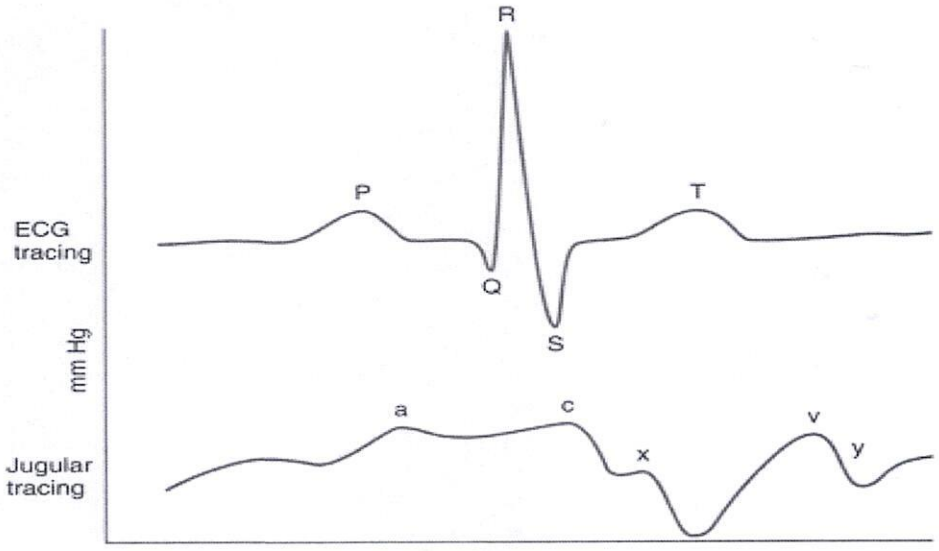
4.3.3.1 The "a" wave is produced by right atrial contractions and occurs just after the P wave on the ECG.

4.3.3.2 The "c" wave occurs due to isovolumic ventricular contractions forcing the tricuspid vale to bulg upward into the right atrium. (RA).

4.3.3.3 The pressure within the RA then decreases as the tricuspid valve is pulled away from the atrium during right ventricular ejection, forming the X descent.

4.3.3.4 The RA continues to fill during ventricular systole, forming the V wave.

The Y descent occurs when the tricuspid valve opens and blood from the RA empties rapidly into the RV during early diastole.



4.3.4 Guide to Interpretation of the CVP

CVP Reading	Other features that may be present	Diagnosis to consider	Treatment
Low	Rapid pulse Blood pressure normal or low urine output Poor Capillary refill.	Hypovolemia	Give fluid challenges until CVP rises and does not fall back again. If CVP rises and stays up but urine output or blood pressure does not improve consider inotropes.
Low or normal or high	Rapid pulse Signs of infection pyrexia Vasodilation/ Constriction	Sepsis	Ensure adequate circulating volume (as above) and consider inotropes or vasoconstrictors.
Normal	Rapid pulse low urine output. Poor capillary refill.	Hypovolaemia	Treat as above Venoconstriction may cause CVP to be normal. Give fluid challenges* and observe effect as above.
High	Unilateral breath sounds. Asymmetrical chest movement.	Tension pneumothorax	Thoracocentesis then intercostal drain.
CVP Reading	**Other features that may be present**	**Diagnosis to consider**	**Treatment**
Continuation	Resonant chest with		

	tracheal deviation. Rapid Pulse.		
High	Breathlessness Third heart sound Pink frothy sputum Oedema Tender Liver	Heart Failure	Oxygen, diuretics, sit up consider inotropes.
Very High	Rapid pulse Muffled Heart sounds	Pericardial Tamponade	Pericardiocentesis and drainage.

4.3.5 **Factor Effecting:**

Factors that increase CVP include	Factors that decrease CVP include
Hypervolemia	Hypovolemia
Forced Exhalation	Deep Inhalation
Tension Pneumothorax	Distributive shick
Heart Failure	
Pleural Effusion	
Decreased Cardiac Output	
Cardiac Tamponade	

4.3.6 Pathologic CVP Waveforms: Variations on the normal central venous waveform can provide information about cardiac pathology. For Examples:

4.3.6.1 In atrial fibrillation, waves will be absent, and in atrioventricular disassociation, a waves will be dramatically increased ("cannon waves") as the atrium contracts against a closed tricuspid valve.

4.3.6.2 In tricuspid regurgitation the c wave and x descent will be replaced by a large positive wave of regurgitation as the blood flows back into the right atrium during ventricular contraction. This can elevate the mean central venous pressure, but it is not an accurate measurement. A better way of estimating CVP in this case would be to look at the pressured between the regurgitation waves for more accurate mean.

4.3.6.3 In cardiac tamponade, all pressure will be elevated, and they descent will be nearly absent.

5. MATERIAL AND EQUIPMENT:

5.1 Pressure Transducer monitoring system (Flush solution according to standard, pressure bag or device, pressure tubing, transducer monitor cable, cardiac monitor)

6. RESPONSIBILITIES:

6.1 Physician
6.2 Nurse

7. APPENDICES:

N/A

6. RESPONSIBILITIES:

6.1 Physician
6.2 Nurse

7. APPENDICES:

N/A

8. REFERENCES:

8.1 Guidelines for Adult ICU Care/ Ministry of Health, General Directorate of Health Centers- Riyadh, 2013

9. APPROVALS:

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