

	Policies & Procedures  Title: <b>HEMODYNAMIC MONITORING – SETTING UP OF INVASIVE PRESSURE MONITORING LINES – ADULT</b>  I.D. Number: <b>1033</b>
Authorization  [ ] Tri-Site Critical Care Committee [x] SHR Nursing Practice Committee	Source: Critical Care Committee Cross Index: Date Effective: March 2005 Date revised: September 2013 Scope: <b>Saskatoon City Hospital  Royal University Hospital  St. Paul’s Hospital</b>

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## 1. PURPOSE

1.1 To minimize complications associated with invasive pressure lines.

1.2 To obtain accurate invasive pressure monitoring.

## 2. POLICY

<b>Staff who will perform this procedure</b>	<ul style="list-style-type: none"> <li>Health care Professional (RN, Anesthesia Assist, O.R. LPN) identified by their manager, will be certified in this Special Nursing Procedure/Added Skill to care for arterial lines in accordance with the SHR policy.</li> </ul>
<b>Physician’s order required</b>	<ul style="list-style-type: none"> <li>No</li> </ul>
<b>Special considerations</b>	<ul style="list-style-type: none"> <li>All patients requiring invasive pressure lines will be cared for in targeted areas.</li> <li>All invasive pressure lines and flush solution changed every 96 hours.</li> <li>Check amount of solution in bag and integrity of system every shift.</li> <li>Obtain readings with patient no higher than 45 degree backrest elevation or 30 degree lateral rotation.</li> <li>Zero Pressure line(s) at the beginning of each shift, if the system is disrupted or if the validity of the measurements is suspect.</li> <li>Ensure the transducer level is at the patient’s phlebostatic axis.</li> </ul>
<b>Flush solutions</b>	<ul style="list-style-type: none"> <li>ICU / OR / ER / PACU – Normal saline</li> <li>Cardiology – 2 units Heparin / 1ml of normal saline</li> <li>Intra-Aortic Balloon Pump – 2 units Heparin / 1ml of normal saline</li> </ul>
<b>Alarm limits</b>	<ul style="list-style-type: none"> <li>Monitor alarms will be enabled and set according to patient’s condition based on nursing assessment</li> <li>Monitor alarms limits should be set so that alarms will sound when a change in patient status occurs.</li> <li>Check alarm limits whenever zeroing pressure line, start of every shift, or change in patient condition.</li> </ul>

### 3. PROCEDURE

#### 3.1 Set-Up

##### 3.1.1 Supplies

- Appropriate Flush solution
- Pressure bag
- Transducer cable
- Pole & transducer mount
- Pressure monitoring kit
- Leveling device for leveling transducer
- Sterile male/female luer lock adapter (dead-ender)

3.1.2 Tighten all connections of monitoring kit.

3.1.3 Spike the flush solution with the IV administration end of the monitoring kit.

3.1.4 Flush the line in a systematic manner eliminating the air bubbles including those in all ports of each stopcock.

3.1.5 Aseptically replace open-ended caps with protective (closed) male/female luer lock adapter (dead-ender).

3.1.6 Attach the transducer to the monitor transducer cable. Plug the cable into the invasive pressure module in the bedside monitor.

3.1.7 Place the flush solution in the pressure bag and apply pressure to 300 mmHg.

##### 3.1.8 Zeroing

- Label pressure parameter appropriately. 'ABP' label must be used for the primary arterial waveform.
- Turn stopcock nearest to transducer OFF to patient.
- Remove the male/female luer lock adapter (dead-ender) aseptically from stopcock, which opens transducer to air.
- Touch ZERO on monitor and wait until zeroing is confirmed
- Aseptically replace male/female luer lock adapter (dead-ender). Turn stopcock ON to patient.

*Note: If a Zero Rejected message appears there is a transducer problem (see Appendix A).*

3.1.9 Level the transducer to the patient's phlebostatic axis (fourth intercostal space at mid-anterior posterior line).

3.1.10 Set monitor alarms appropriate for patient condition based on nursing assessment.

*Note: Do not permanently disable alarms due to risk of missing situation of disconnection of line and subsequent hemorrhage.*

3.1.11 Monitor the pressure system for:

- Appropriate scale
- Overdampened or underdampened waveform
- False high or low readings
- Inappropriate pressure waveform
- Blood back into tubing or transducer.

*Note: For trouble shooting of waveforms, see Appendix A.*

3.1.12 Documentation

- IV flush bags, line, dressing and date commenced on the appropriate record.

**4. REFERENCES**

BCCNP Cardiovascular Hemodynamics and Pharmacology (Nursing 229) July 2012.

Chatburn, J., Sandberg, W. S. (2010). Monitoring: In Clinical Anesthesia Procedures Of The Massachusetts General Hospital. 8th Ed. Philadelphia: Lippincott Williams & Wilkins. Pp 130 – 135.

Del Cotillo, M., Grané, N., Llaboré, M., and Quintana, S. (2007). Heparinized solution vs. saline solution in the maintenance of arterial catheters; a double blind randomized clinical trial. Intensive care medicine. 34:339-343.

Evaluation of the Effects of Heparinized and Non-heparinized Flush Solutions on the Patency of Arterial Pressure Monitoring Lines: The AACN Thunder Project (1993). American Journal of Critical Care, Vol. 2, No. 1, 3-14.

Halm, M. A. (2008). Flushing hemodynamic catheters: what does the science tell us? American Journal of Critical Care. 17(1). Pp. 73-76.

intelliVue Patient Monitor Manual. (2005). Philips.

Kannan, A. (2008). Heparinized saline or normal saline? Journal of Perioperative Practitioners. 18(10) pg 440-1.

Lapum, J. L. (2006). Patency of Arterial Catheters With Heparinized Solutions Versus Non-Heparinized Solutions: A Review Of The Literature. Canadian Journal of Cardiovascular Nursing 16(2). Pg 64 – 69.

Leeper, B. (2008), practice resource network: what is the standard regarding isotonic sodium chloride solution versus heparin in pressure monitoring system? AACN News and Critical Care Nurse 2006. 26(2). 137 – 38.

Morton, P. G. et al. (2013). Hemodynamic Monitoring. In: Critical Care Nursing: a Holistic Approach. 8th ed. Philadelphia: Lippincott, Williams, Wilkins. Pg. 300 – 302.

Tuncali, B. E., Kuvaki, B., Tuncali, B., and Capar, E. (2005). A comparison of the efficacy of heparinized solution of the maintenance of perioperative radial arterial catheter patency and subsequent occlusion. International Anesthesia Research Society. 100:1117-21.

Weigand, D. L., (ed.) (2011) Arterial Catheter Insertion (Assist), Care, and Removal. In: AACN Procedure Manual for Critical Care. (6th ed). St. Louis: Elsevier Saunders. pp. 534 -547.

Whitta, R. K., Hall, K.F., Bennetts, T. M., Welman, L., and Rawlings, P. (2008). Comparison of normal or heparinized saline flushing on function of arterial lines. Critical Care Resuscitation. 8(3). Pg.205-8.

Woodrow, P (2009). Arterial Catheters: promoting safe clinical practice. Nursing Standard. 24 (4), pp 35 – 40.

Appendix A

Troubleshooting Pressure Monitoring System

- Displayed data may be significantly inaccurate unless the entire system is meticulously set up, zeroed, and leveled.
- When display data is suspect, always check patient status first, such doing a manual BP on each arm.

Problem	Possible Causes / Solutions
No waveform	<ul style="list-style-type: none"> <li>• Check the power supply, cable, and module.</li> <li>• Check for appropriate scale on the monitoring equipment and correctly labeled.</li> <li>• Rezero line</li> <li>• Check for loose connection in the pressure monitoring line</li> <li>• Check that stopcocks are in correct position</li> <li>• Check for kinked or compressed connecting tubing / catheter</li> <li>• Blood clot has occluded the vessel. Attempt to aspirate blood from the line.                             <ul style="list-style-type: none"> <li>◦ Use fast flush to clear the line once the clot is successfully aspirated.</li> </ul> </li> <li>• <b>Note:</b> Fast flushing the line before successfully aspirating a clot may cause dislodge the clot and cause distal embolization.</li> <li>• <b>Never</b> use a syringe to aggressively flush any hemodynamic monitoring line.</li> </ul>
Artifact	<ul style="list-style-type: none"> <li>• Check for electrical interference</li> <li>• Check for patient movement</li> <li>• Catheter whip may be the problem</li> <li>• Do square wave test to determine underdamping</li> </ul>
Unable to flush line with the continuous flushing system.	<ul style="list-style-type: none"> <li>• Ensure roller clamp on pressure tubing is open</li> <li>• Check the stopcock position and the tubing for kinks</li> <li>• Check to see that the pressure bag is inflated to 300 mmHg and adequate fluid in pressure bag</li> <li>• Reposition catheter to move it away from vessel wall or to remove catheter kinks.</li> <li>• Gently aspirate with a syringe (do not apply excessive force to aspirate).</li> </ul>
False high reading (underdamped waveform)	<ul style="list-style-type: none"> <li>• Do square wave test to determine underdamping.</li> <li>• Rezero line</li> <li>• Ensure the transducer is located at the phlebostatic axis</li> <li>• Check stopcocks and ensure they are open to the patient</li> <li>• Remove unnecessary tubing.</li> <li>• Check for air bubbles.</li> </ul>
False low reading (overdamped waveform)	<ul style="list-style-type: none"> <li>• Do square wave test to determine overdamping.</li> <li>• Ensure the transducer is located at the phlebostatic axis</li> <li>• Check flush bag to ensure fluid is present and pressure is at 300 mmHg</li> <li>• Rezero line</li> <li>• Check for loose connections and leaks</li> <li>• Check that the roller clamp is open</li> <li>• Check for air bubbles in the system</li> <li>• Check for kinks in the tubing</li> <li>• Check for blood in the system</li> <li>• Suspect possible occlusion at the catheter tip (i.e. thrombus), or the catheter tip may be resting against the vessel wall</li> <li>• Ensure appropriate scale for pressure being monitored</li> <li>• Attempt to aspirate blood to confirm proper placement</li> </ul>