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**Outcome Goal:** To provide guidelines for accurate cardiac output measurement.

**Policy:** Lithium dilution cardiac output measurement is performed in critical care areas by licensed staff with demonstrated competency utilizing the following guidelines.

**General Information:**

1. The Lithium Dilution Cardiac Output (LiDCO) System measures Cardiac Output (CO) by indicator dilution. A small dose of lithium chloride is injected via a central venous catheter (CVC) or peripheral intravenous site provided it is not in the back of the hand; the resulting arterial lithium dilution curve is recorded by drawing blood through a Flow-through Cell Electrode Assembly containing a lithium sensor.
2. The LiDCOplus Cardiac Output system uses arterial pressure waveforms to display beat-to-beat blood flow changes and provide calculated cardiac output and hemodynamic trended data. It is calibrated using the LiDCO system to perform an indicator dilution CO.
3. In addition to arterial BP and CO the PulseCO calculates the following parameters: Body Surface Area, Systolic Pressure variation, Stroke Volume Variation, Cardiac Index, Stroke Volume, Stroke Volume Index, Systemic Vascular Resistance, and Systemic Vascular Resistance Index, Oxygen Delivery and Index.
4. The continuously calculated data can therefore provide a clear indication of significant changes in patient hemodynamics and when to perform invasive determinations of hemodynamic parameters.

**Contraindications for use of LiDCOplus Hemodynamic Monitor Include:**

1. Patients on IABP
2. Patients with aortic regurgitation
3. Patients with highly dampened peripheral arterial lines
4. Patients on Oral Lithium therapy
5. Patients under 40 kg (Pediatric patient)
6. Patients during first trimester of pregnancy

**Standard of Care/Policy Statement:**

The patient will have LiDCOplus cardiac output/hemodynamic parameters monitored by a Registered Nurse (RN) who has completed the competency program.

**Standard of Practice/Procedure:**

**Assemble equipment:**

- LiDCOplus Hemodynamic Monitor

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- LiDCO Setup pack
- Preexisting invasive arterial pressure monitoring

### **Initial Setup**

- Turn on LiDCOplus Monitor. Connect LiDCOplus to HP Pressure module.
- Input patient height and weight into LiDCOplus.
- Input patient height, weight, Lithium dose (0.3 mmol), Hgb, and Na in LiDCOplus.
- Gather the following equipment: LiDCO disposable kit, Lithium sensor, 20 cc syringe, 3 cc syringe and 250 cc NS (used to flush solution)

### **Pulse CO setup and Instructions**

1. Connect LiDCOplus to patient monitor: cable must be connected to the analog output on the pressure module.
2. At patient information screen, enter name, height, weight (required). Targets for MAP and CO may be entered and the operator may change from indexing and /or average. Press Patient Details ICON.
  - Note: Check that the pressure displayed on the bedside monitor is the same as the pressure displayed on the PulseCO monitor.
3. Press LiDCO screen icon for calibration, preferably during a stable hemodynamic period.
  - The accuracy of the calibration of the LiDCOplus monitor is extremely important-an incorrect calibration factor may result in significantly erroneous hemodynamic data being displayed.
4. Complete LiDCO calibration. If the patient is unstable average 2 LiDCO calibrations (see LiDCO setup and Instructions below)
5. Always check that calibration has occurred by checking that the Calibration Factor has changed.
6. LiDCOplus Hemodynamic Monitor data should always be checked and interpreted with respect to other clinical signs.
7. Note CVP data must be entered for SVR calculation. Press Patient Details ICON to adjust value.
8. Recalibrate the LiDCOplus every 12 hours.

### **LiDCOplus Calibration Setup and Instructions:**

1. Establish venous access.
2. Arterial line needs less than 1 ml priming volume, smaller than 12 inch extension tubing.

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3. Hang 250 or 500 ml 0.9% Normal Saline and spike with Smartsite as a flush supply. Attach change day sticker and Patient ID information sticker to flush bag.
4. Draw lithium into 10 ml syringe using filtered ‘straw’, label syringe with date, and your initials and hang on stand.
5. Flush sensor by attaching 3-way stopcock and flush until wick is saturated and tighten ‘O’ ring.
  - Make certain that the ‘O’ ring is tightened beyond the bleed hole to avoid blood loss during CO determination.
6. Connect blood collection bag to sensor and connect to arterial line stopcock no more than 12 inches from the patient. Properly flush the sensor to remove air bubbles.
7. Connect a 3-way stopcock to the ‘Park and Ride’ tubing and flush with saline.
8. Enter the patient data in the LiDCOplus as prompted: Lithium constant =10.5, Height, Weight, Lithium dose =0.3 mmol, most recent HGB, and Na.
9. Prepare the lithium injection, 2 ml=0.3 mmol and park it by injecting it into the ‘Park and Ride’ venous tubing. The lithium dose will remain in the ‘Park and Ride’ tubing which has a dead space of 3 ml.
  - The accuracy of the measurement of Cardiac Output depends on the accuracy of the metering of the Lithium dose.
10. Prepare a 20 ml syringe of 0.9% NaCl flush with 20 cc and attach to ‘Park and Ride’ venous tubing.
11. Turn art line stopcock off to patient and squeeze wings on pump and flush to clear any air in sensor
12. Turn stopcock OFF to monitor and ON to sensor and squeeze wings on pump to bring blood past sensor. Then start pump.
13. Check baseline reading, press INJECT then inject the 20 ml of 0.9% NaCl through the ‘Park and Ride’ venous tubing. Injection of flush should be at a fast rate and very steady. This will administer the Lithium dose. Immediately turn stopcock off to the ‘Park and Ride’. **DO NOT TURN THE PUMP OFF AT THIS POINT.**
  - During the LiDCO measurement the arterial pressure display is lost.
  - See last page of the LiDCOplus manual for trouble shooting waveform errors.
14. When the ‘OK TO STOP’ alert appears:
  - a. Turn off pump

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<p>b. Using the arterial line transducer flush system, flush blood out of the ‘Flow Through Sensor’ to the blood collection bag by turning stopcock off to patient and squeeze wings on pump and flush  **Do Not leave blood in the ‘Flow Through Sensor’ assembly since it may clog and impair sensor function.</p> <p>c. Flush the arterial cannula and re-establish arterial pressure display</p> <p>d. Complete input for hemodynamic profile and print or document.</p> <p>15. Complete the LiDCOplus procedure above. See pocket cards, posters and/or manual.</p> <p>16. The Lithium dose, LiDCO sensor, collection bag/tubing and the ‘Park and Ride’ tubing may be used for 48 hours.</p> <p>17. Place collection bag, sensor and ‘Park and Ride’, lithium syringe in a Bio hazard bag, label with patient information and change day sticker place in basket attached to the PulseCO monitor mount.</p>			