HEMODYNAMIC MONITORING, Part 2

Critically ill patients require continuous assessment of their cardiovascular system to diagnose and manage their complex medical conditions. This is most commonly achieved by using direct pressure monitoring systems, often referred to as hemodynamic monitoring. Pulmonary artery pressure (explained here), central venous pressure (CVP), and intra-arterial blood pressure (BP) monitoring (covered in Part 1) are common forms of hemodynamic monitoring; noninvasive hemodynamic monitoring is used in some facilities. For invasive monitoring, specialized equipment is necessary, including:

- a CVP, pulmonary artery, or arterial catheter, which is introduced into the appropriate blood vessel or heart chamber
- a flush system composed of intravenous (I.V.) solution (which may include heparin), tubing, stopcocks, and a flush device, which provides for continuous and manual flushing of the system
- a pressure bag placed around the flush solution that’s maintained at 300 mm Hg of pressure; the pressurized flush system delivers 3 to 5 mL of solution per hour through the catheter to prevent clotting and backflow of blood into the pressure monitoring system
- a transducer to convert the pressure coming from the artery or heart chamber into an electrical signal
- an amplifier or monitor, which increases the size of the electrical signal for display on an oscilloscope.

Catheter site care is essentially the same as for a CVP catheter. As in measuring CVP, position the transducer at the phlebostatic axis to ensure accurate readings. Watch for complications of pulmonary artery pressure monitoring, which include infection, pulmonary artery rupture, pulmonary thromboembolism, pulmonary infarction, catheter kinking, dysrhythmias, and air embolism.

**Pulmonary artery pressure monitoring**

Pulmonary artery pressure monitoring is an important tool used in critical care for assessing left ventricular function, diagnosing the etiology of shock, and evaluating the patient’s response to medical interventions, such as fluid administration or vasoactive medications.

You’ll monitor pulmonary artery pressure using a pulmonary artery catheter and pressure monitoring system. Catheters vary in their number of lumens and their types of measurement (such as cardiac output or oxygen saturation) or pacing capabilities. All types require that a balloon-tipped, flow-directed catheter be inserted into a large vein (usually the subclavian, jugular, or femoral vein); the catheter is then passed into the vena cava and right atrium. In the right atrium, the balloon tip is inflated, and the catheter is carried rapidly by the flow of blood through the tricuspid valve, into the right ventricle, through the pulmonic valve, and into a branch of the pulmonary artery. When the catheter reaches a small pulmonary artery, the balloon is deflated and the catheter is secured with sutures. Fluoroscopy may be used during insertion to visualize the catheter’s progression through the heart chambers to the pulmonary artery.

This procedure can be performed in the operating room or cardiac catheterization laboratory or at the bedside in the critical care unit. During insertion of the pulmonary artery catheter, observe the bedside monitor for waveform and electrocardiogram changes as the catheter is moved through the heart chambers on the right side and into the pulmonary artery.

After the catheter is correctly positioned, you can measure CVP or right atrial pressure, pulmonary artery systolic and diastolic pressures, mean pulmonary artery pressure, and pulmonary artery wedge pressure. If a thermodilution catheter is used, you’ll measure cardiac output and calculate systemic and pulmonary vascular resistance.

Normal pulmonary artery pressure is 25/9 mm Hg, with a mean pressure of 15 mm Hg. When the balloon tip is inflated (usually with 1 mL of air), the catheter floats farther out into the pulmonary artery until it becomes wedged. This is an occlusive maneuver that impedes blood flow through that segment of the pulmonary artery. A pressure measurement—called pulmonary artery wedge pressure—is taken within seconds after wedging of the pulmonary artery catheter; then the balloon is immediately deflated and blood flow is restored. After ob-