The Hazards of Invasive Arterial Pressure Monitoring

By Lisa Kirkland, FACP

In the intensive care unit or operating room, continuous readout of blood pressure is often required, usually to monitor for changes in stability or the effects of vasoactive drugs.

In most cases, a small-bore (no greater than 20-gauge), single-lumen, specially designed catheter is placed; intravenous catheters are not appropriate. The catheter is connected to special tubing that is stiff and relatively short, and this tubing attaches to a transducer via three-way stopcock. The entire tubing and catheter are filled with saline under pressure from a flush bag, creating a hydraulic system. It is critical that the saline pressure be kept at about 300 mm Hg to maintain fidelity of transmission of pressure waves from the artery to the transducer. The transducer sits on a pole or the bedrail at the estimated level of the center of the patient’s right atrium. Inside the transducer are a flexible diaphragm and a silicon chip. The diaphragm moves with the pulsations of the fluid column originating at the arterial catheter tip. The chip detects movements, amplifies them and converts them to electrical signals, which are then displayed on a monitor as waveforms.

Can you see any points at which serious data errors can be introduced into this system? I can find at least 10. (See sidebar.) Most are human errors. No wonder we frequently confirm the invasive pressure measurement with a noninvasive one, and struggle to decide which reflects the patient’s true systemic blood pressure. The two methods use different principles, too. Noninvasive cuff measurement is based on flow-generated oscillation, and invasive intra-arterial readings come from pressure-generated waveforms.

Remember that flow equals pressure only if resistance is constant. Critically ill or anesthetized patients rarely have stable vascular resistance.

Fortunately, there is a measurement that is reasonably consistent between the two: mean arterial pressure (MAP). The