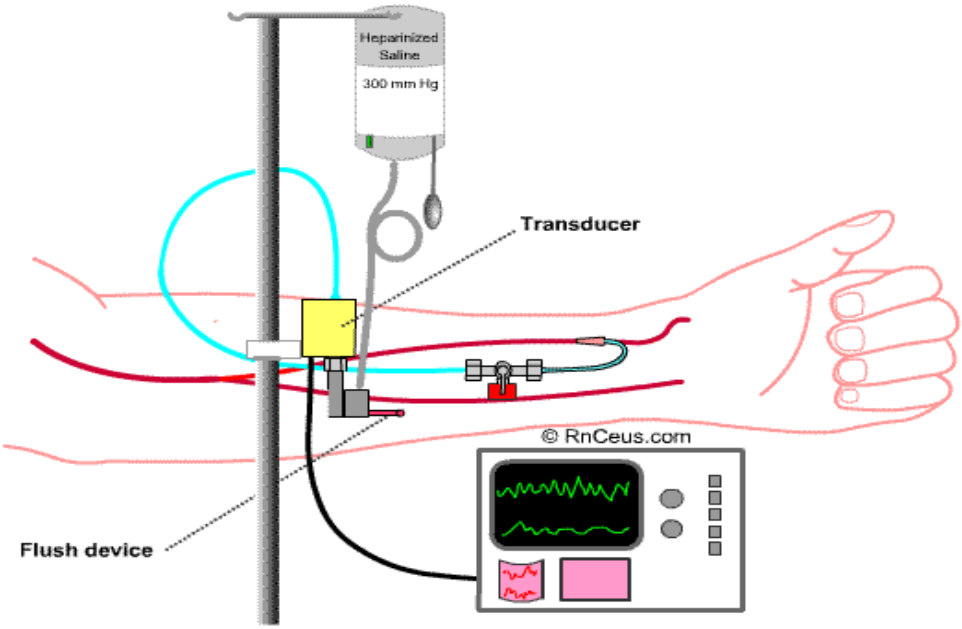
The Arterial Line

The art line is an often underutilized hemodynamic monitor that gives valuable circulatory information moment to moment. In addition to continuous monitoring of blood pressure it also allows frequent blood samples to be drawn without having to re-stick the patient. The Art line can be very handy in many situations, and it is important that we are proficient in our understanding and use of this valuable tool.

An arterial line monitors the pulse wave generated by the left ventricle. It will measure and display different wave amplitudes depending on placement location. This is influenced by systemic vascular resistance. Contraction of the left ventricle forces a pressure wave through the vascular system. This wave will change as you move from a proximal vessel (brachial line) to a more distal location (radial line). The further down the pipe, the more vascular resistance. Thus, the deflection from a radial line will be greater than the deflection of a brachial line.

The peak of the upward wave on the arterial monitor measures systolic pressure. As you follow the wave along the x-axis, you will notice a slight notch on the downward slope. This is known as the dicrotic notch and represents the closing of the aortic valve. This can give is some insight on the patient's volume status. For instance, a hypovolemic patient will have a dicrotic notch that is further down the downward stroke wave. The diastolic pressure is measured just before the beginning of the next systolic wave form.



A-Line Setup: It is important to remove air from the chambers for an accurate reading. Connect the transducer to a solution that is pressurized to 300 mmHg and ensuring that all air is out of the system.

- Ensure all stopcocks are off to the pressurized bag of solution
- Connect tubing to a pressure bag that is pressurized to 300 mm Hg
- Open system proximally one stopcock at a time and allow fluid to fill each system, at the proximal end allow fluid to briefly flow free
- Tighten all connections and avoid adding any extension lines

Radial Art Line Procedure (North Colorado Med Evac Procedures pg. 204)

- Perform Allen's test to determine adequate blood flow and appropriate site for insertion
- Position the wrist in dorsi-flexion at approximately a 30-45 degree angle
- Prepare the site with chlorhexadine and maintain sterile precautions
- Inject 1% Lidocaine into the sq tissue in a small "wheel" pattern
- Prepare equipment by checking assembly of catheter and guide wire, setting up the transducer and vamp while inflating pressure bag to 300 mmHg
- Palpate the artery with the non-dominant hand and insert the needle at a 30-45 degree angle
- Stabilized the needle and advance the guide wire as far as possible without forcing the wire through resistance
- Advance catheter over the wire until the hub is at the insertion site and remove the needle and wire as a single unit while holding proximal pressure
- Secure the catheter, connect to pressure line and perform square wave test.

Zeroing and positioning

Position the transducer at the phlebostatic axis (level of the heart, about the 4th intercostal space). Secure the transducer to the patient or to the bed next to the patient. Once secured, zero the monitor to atmospheric pressure.

- Open the line to free flow fluid at the distal stopcock (close to patient), connect transducer to the monitor.
- Select "zero" on the monitor and the monitor will zero itself to atmospheric pressure

Square Wave Test

This test is performed to evaluate the ability of the transducer to accurately reproduce the patient's hemodynamic waveforms. This shows you how dampened or sensitive the system is to the hemodynamic waveform caused by the patient's heartbeat. This is portrayed by visualizing how many oscillations (sharp waveforms) you will see on the monitor.

- Perform square test
    - You will see a level line (should be at 300 mmHg) until you pull the pig tail and allow fluid to flow. This will drop the pressure wave down to zero.
- When optimally dampened, you will have 1 to 2 oscillations within .12 seconds followed by a normal waveform.
- Overdampened system will have no oscillations after the square test and the normal waveform will be slightly rounded.
    - Check for air in the system, loose connections or kinks; check the pressure of the bag to ensure it's not greater than 300 mmHg.
- Underdampened system will cause many oscillations after the square test and the normal wave will be sharp or exaggerated. This causes a false high systolic pressure.
    - Check for air; ensure pressure bag is not less than 300 mmHg.

References

1. *Brenda Lynn Morgan, Critical Care Concepts ., et al. Hemodynamic Waveforms Interpretation, September 18, 2005*
2. *Critical Care Nurse April 2002 vol. 22 no. 2 60-79.*