

# Ask the Clinical Instructor

A Q&A column for those new to the cath lab

Questions are answered by:  
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**When I look at the aortic pressure on the monitor during a case, I notice the little line running across the middle. They tell me that is a mean arterial pressure. Why do I need to know that?**

— Virginia CVT student

The mean arterial pressure (MAP) is an important tool to have available for monitoring of a patient over time. It is usually already calculated on your hemodynamic monitoring screen, but maybe you didn't have an idea of what it was.

The MAP is simply the average blood pressure of an individual. It's defined as the average arterial pressure during a cardiac cycle. Our monitoring systems continuously monitor this number.

To figure out a MAP, it is a simple calculation:

$$\text{MAP} = \frac{\text{Systolic pressure} \times 2 (\text{diastolic pressure})}{3}$$

For example, if your patient's blood pressure is 120/80, the MAP would be:  
 $120 + 80 + 80 = 280$   
 $280 / 3 = 93^*$

\*I rounded down from 93.333333

People have asked me why the 'average' isn't based upon 2 systolic and 1 diastolic. If we think about the cardiac cycle, which part is shorter, systole or diastole? If you look at an arterial waveform of someone with a normal heart rate, the systole portion is really only the upstroke of the arterial waveform. Everything else is

diastole, and often diastole is twice as long as systole. Therefore, we take 2 diastoles and 1 systole to get the average pressure. If you read some detailed textbooks, they explain the mathematical concept behind the formula. Once the heart rate gets to 180 or higher, you may want to consider altering the formula because the length of systole and diastole is becoming more equal, but that is beyond the scope of our application of MAP.

What does MAP mean clinically? It reflects the "driving" or perfusion force within the vessels at all times. After systole, our blood flow just doesn't stop in our arteries. If it did, we would certainly have some side effects. To prevent this, there is actually some forward flow in the arteries at all times. This underlying pressure maintains the perfusion in the major organs of our body.

It is generally accepted that a MAP of 60 is what is needed to maintain adequate organ perfusion. Depending on what textbook you read, or what nurse or doctor you talk to, the average seems to be anywhere from 70-110. Of course, common sense would indicate the need to adjust it a little based upon the acuity of the patient. If the MAP pressure drops below that point, the receiving organ may not receive enough blood flow and can become ischemic. If this problem is not reversed, the organ can begin to die.

I would be remiss if I didn't mention that this doesn't apply in cases of damped pressure in the coronary arteries, or when the catheter tip is against the wall of the aorta or in diseased periphery that you may be working on. These measurements generally

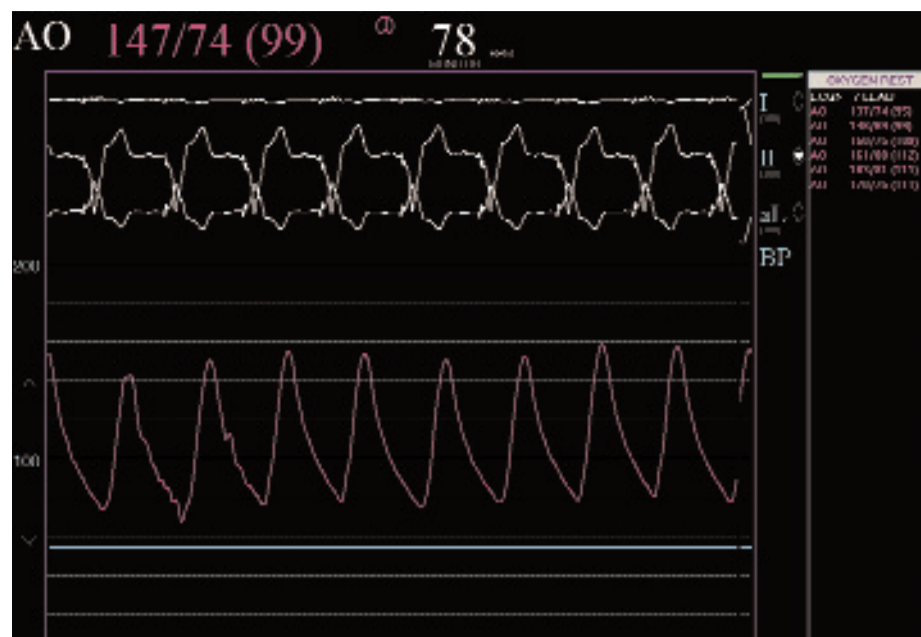


Figure 1. Here we can see the MAP being recorded with the systolic and diastolic readings. This is also commonly displayed in the brackets after the pressure numbers.

must come from the aorta or large artery being monitored. Blood pressure cuffs can give you an accurate reading of MAP, but it isn't as accurate as a direct invasive measurement.

Some specific types of patients in which a MAP is monitored closely:

- Dissected abdominal aneurysms where specific blood pressure control is paramount until surgery is performed;
- Neurologic patients, particularly those with trauma;
- Any patient, particularly cardiovascular patients, who are on vasopressors.

While more difficult to calculate, MAP can also be a product of:

$$\text{MAP} = \text{cardiac output (CO)} \times \text{peripheral vascular resistance (PVR)}$$

In labs that routinely calculate PVR, as well as cardiac output via the Fick method or angiographically, a number can also be obtained. This data is somewhat more difficult to obtain, and has a higher incidence of error because of the complexity of obtaining it.

*A small side note:* we can also see MAP defined as "mean atrial pressure." We will see this when we are performing a right heart catheterization (RHC) on a patient and measure pressures in the right atrium (RA), left atrium (LA) or pulmonary capillary wedge (PCW). In reality, there isn't a clinical reason to measure specific A, C and V waves in a NORMAL patient without any pathology. Instead, we can just report the mean

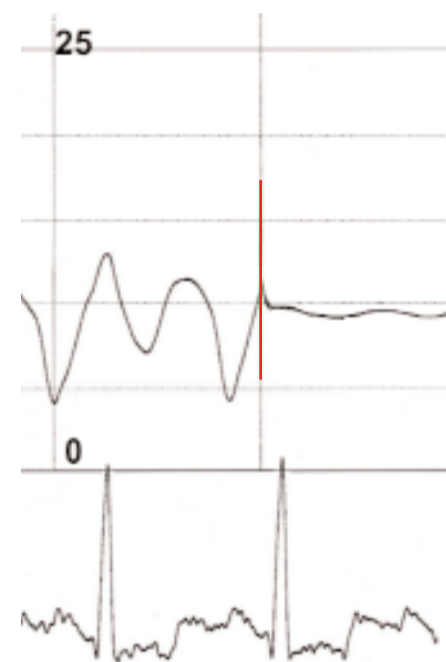


Figure 2. Here we see the monitoring system switched to only show the "mean" atrial pressure.

atrial pressure that our monitor supplies us. Of course, appropriate leveling, zeroing and technique is important in obtaining these values.

MAP monitoring may have more importance in the long-term care of the sick patient in the ICU, but that care can often start in the cath lab. Understanding what MAP is, and in what settings it is important, is a vital step in the continuum of care for the patient. [n](#)

Next month, we'll answer a question about monorail versus over-the-wire devices.

Email your question to [tginapp@rcisreview.com](mailto:tginapp@rcisreview.com)