

EDITORIAL



# Will the Real Blood Pressure Please Stand Up?

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Has this ever happened to you? You are caring for a WFNS and modified Fischer scale grade 3 subarachnoid hemorrhage patient whose screening studies make you very concerned for delayed cerebral ischemia. In evening rounds day 8 post-hemorrhage, the plan is if the patient's neurologic status worsens, after excluding "mimics," vasopressors will be initiated with an initial goal of raising the mean arterial blood pressure (MAP) by 15%.

At midnight you are called and told that the patient developed right arm weakness and speech difficulties. There is no fever, and head CT and laboratory values are unchanged. You agree with the team's decision to initiate vasopressors as planned.

The next morning you arrive early to assess the patient before rounds. As you enter the room, you see on the monitor that an arterial line has been placed and the MAP is 112 mm Hg, but you cannot find any vasopressors being administered. The patient is barely antigravity with the right arm and is only able to speak a few words.

You ask the patient's nurse what happened to the vasopressors, and she indicates that the order was to use norepinephrine to keep the MAP between 110 and 120 mm Hg and the patient was spontaneously reaching that goal without medication.

How did this happen? The patient seems worse than described overnight yet never received a trial of induced hypertension.

When we are presented with objective quantified data (i.e., a number), we tend to focus on the number and do not think about how it was obtained. This can be a serious problem when dealing with physiologic variables where differing conditions under which measurements are made and what method is used to measure them can alter the results. Were the transducers leveled

appropriately? Was the ICP recorded with the EVD open or closed? Was the patients upright when the X-ray was performed to look for free air under the diaphragm? Was the blood pressure measured with an automated cuff or arterial line?

It is the last example that is the subject of this issue's feature article "Correlation of Noninvasive Blood Pressure and Invasive Intra-arterial Blood Pressure in Patients Treated with Vasoactive Medications in a Neurocritical Care Unit" [1]. The authors compared noninvasive (oscillometric) blood pressure and intra-arterial blood pressure measurements in critically ill patients receiving vasoactive medications. In a prospective observational study, 2177 paired observations from 70 patients receiving vasopressors or antihypertensive agents were collected. An absolute difference of >20 mmHg in systolic blood pressure was seen in ~20% of observations of nicardipine, ~25% of observations of norepinephrine and ~35% of observations of phenylephrine.

So how is it that the patient never got started on vasopressors? Here is what happened. The team reviewed the MAP values for the previous 24 h, determined the average was 100 mm Hg; they chose a target MAP of 115 mm Hg, entered orders to titrate norepinephrine to keep MAP 110–120 mm Hg and proceeded to place a radial arterial line. The transducer was leveled and zeroed, and the infusion pump programmed. When the programming was complete, it was noted that the MAP was already within the goal range, so the medication was not started, and the patient never underwent a trial of induced hypertension.

Now the explanation is clear; the goal MAP was determined with values collected using an automated cuff and the therapy was guided by measurements taken from an arterial line. What should have been done was to directly compare simultaneous measurements from the automated cuff and arterial line and adjust the

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goals accordingly. When treating with vasoactive infusions targeted to a specific goal, it is critical to remember that values obtained using different methods are not interchangeable.

It is easy to see how this issue could impact other situations such as determining whether blood pressure is low enough to give t-PA or target for blood pressure reduction in acute intracerebral hemorrhage. All members of the care team need to be aware of and understand this issue. When changing the method of measuring blood pressure, paired simultaneous measurement should be taken and all goals adjusted accordingly.

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**Compliance with Ethical Standards****Conflict of interest**

The author declares there is no conflict of interest.

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**Reference**

1. Aiyagari et al. Correlation of noninvasive blood pressure and invasive intra-arterial blood pressure in patients treated with vasoactive medications in a neurocritical care unit. *Neurocrit Care* (2018). <https://doi.org/10.1007/s12028-018-0521-0>