Intraoperative Blood Pressure Measurement Modalities Are Separate and Not Equal

To the Editor:
We read with great interest the recent publication by Wax et al.1 The authors argue that because noninvasively detected blood pressure tends to be higher than that measured invasively in hypotensive patients and lower in hypertensive patients, some patients monitored with invasive arterial lines alone may undergo potentially harmful vasoactive and transfusion therapy if hemodynamic instability is not confirmed with noninvasive means. However, in the absence of outcome studies following these cohorts (patients whose treatment was guided by invasive arterial lines alone vs. those in whom such therapy was withheld based on noninvasive readings), one cannot make the authors’ claim: it remains entirely possible that the reliance on confirmatory noninvasive reading leads to potentially harmful undertreatment.

In reality, invasive and noninvasive modalities of blood pressure measurement use vastly different physical phenomena. Whereas an invasive line displays a direct, electronically processed, beat-to-beat intravascular pressure waveform, the noninvasive tool used in the study is an indirect oscillometric device. Oscillometric parameters are derived, not measured, from the superimposition of a pulse oscillogram envelope on a cuff pressure curve, with mean blood pressure determined at the point of maximal oscillations. Proprietary software algorithms, specific to individual manufacturers, are utilized in analyzing the slopes of scillograms to derive systolic and diastolic readings. These manufacturer-specific algorithms are generally not standardized for measurement accuracy,2,3 and, in addition to numerous other technical (i.e., the rate of cuff “bleed”) and clinical (i.e., size and location of the cuff not recorded in the authors’ database, and elastic properties of the vasculature) variables, affect the reliability of indirect oscillographic determinations. Therefore, in critically ill patients, noninvasive blood pressure measurements are generally considered unreliable.4,5

We applaud Wax et al. for their confirmation of a significant discrepancy between the direct and indirect modalities of blood pressure measurement, but would caution against withholding therapy based on nonuniformly standardized, and possibly inaccurate, confirmatory data.

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References

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In Reply:
We appreciate the concerns raised in Gologorsky et al.’s correspondence regarding our report of intraoperative radial invasive (ABP) versus brachial noninvasive (NIBP) blood pressure monitoring.1 We acknowledged in our discussion that there could be debate about which is the “real” pressure we should base clinical decisions upon and presented arguments for both, but offered no recommendation other than to consider both sources of data. As a global test of potential harm, we analyzed some short-term outcomes for those who did and did not have NIBP monitoring and did not find significantly worse outcomes for those who had NIBP monitoring (and its associated fewer transfusions or vasopressor uses). We agree that it would be valuable to do further study of the risks/benefits of withholding therapy, but there are already substantial data to suggest that transfusion, for whatever reason, may lead to worse outcomes and that avoidance of transfusion may be a safer alternative in the perioperative setting.2

We also recognize that NIBP and ABP are completely different technologies. Our data, however, not only compared invasive versus noninvasive modalities, but radial versus brachial sites as well. Brachial pressure may be closer to central pressure than radial pressure because radial pressure may sometimes reflect loss of vascular tone in the hand rather than indicating central hypotension. In order to test for this phenomenon in the setting of low ABP and higher NIBP, a wrist compression test has been suggested that will reportedly increase radial pressure closer to central pressure without overshoot.3 Had we used axillary ABP data, our results may have been very different, because our impression is that differences between brachial NIBP and axillary ABP are less than those found in our study. Finally, our patients were in a perioperative setting and not necessarily critically ill, intensive care unit patients in whom much of the data raising concerns about NIBP monitoring have been focused on.