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Anesth Analg 2007;105:549-550

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doi: 10.1213/01.ane.0000265695.72785.9d

LETTER TO THE EDITOR

Section Editor:

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Methylene Blue Administration Is Associated with Decreased Cerebral Oximetry Values

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To the Editor:

Methylene blue is administered to patients undergoing open heart surgery for treatment of a vasoplegic syndrome, which is characterized by high cardiac output, low systemic vascular resistance (SVR), and low systemic perfusion pressures, and is resistant to large doses of vasoconstrictors. As described in a recent publication, we administered methylene blue as an IV loading dose (2 mg/kg over 20 min), followed by continuous infusion ($0.5 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$) when the attending cardiac anesthesiologist determined that a refractory case of vasoplegia is present (1). Concomitant with the initiation of the methylene blue loading dose, we noted that cerebral oximetry values (INVOS®, Somanetics, Troy, MI) declined markedly in all patients despite significant improvement in systemic perfusion pressure. The image below illustrates this phenomenon in two patients by replicating the INVOS monitor display.

In both patients, methylene blue was administered due to a vasoplegic syndrome that was unresponsive to high doses of vasoconstrictors (norepinephrine $>0.4 \text{ mcg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, vasopressin $>8 \text{ U/h}$). In Patient 1, methylene blue was administered during cardiopulmonary bypass. Following the loading dose, the cerebral oximetry value declined by almost 70% to values in the low teens where it remained for the rest of the case, while the vasoconstrictor dosages were reduced significantly and mean arterial pressure (MAP) was adequate (50–60 mm Hg on cardiopulmonary bypass). In Patient 2, a vasoplegic syndrome was diagnosed upon separation from cardiopulmonary bypass. Coincident with the methylene blue bolus administration, the cerebral oximeter reading declined to values in the low 20 s. Transfusion of

packed red blood cells to increase hemoglobin oxygen carrying capacity was associated with partial recovery of cerebral oximetry values; however, the values remained 30%–40% lower than the baseline before methylene blue administration. Both patients were discharged with no apparent neurological sequelae.

The absorption of light as it traverses tissues is affected by dye administration, so it is reasonable to expect that methylene blue administration should interfere with cerebral oximetry. Nevertheless, this phenomenon has not been described when methylene blue is administered to patients whose cerebral oxygenation is being monitored with near infrared spectroscopy (NIRS). Methylene blue has a dose- and time-dependent effect on plasma light absorbance, with a spectral absorption peak at 668 nm, resulting in falsely low pulse oximetry readings (2). The INVOS device uses two near-infrared wavelengths (730 and 805 nm) and measures the spectral absorbance of blood in brain tissue. Regional oxygen saturation is calculated as the ratio of oxyhemoglobin to total hemoglobin; however, the values must be interpreted according to the relative amounts of arterial and venous blood in brain tissue (typically 75% venous and 25% arterial). The manufacturer notes in the device manual that the administration of any dye can affect the measurement. There is no mention of the specific effects of methylene blue, however.

In contrast to the present report, we are aware of one other report where methylene blue was not noted to affect cerebral oximetry measurement (3). The exact NIRS device used is not mentioned in that brief communication. On the basis of our observations with the INVOS device, we caution clinicians to be aware of the potential for methylene blue to affect cerebral oximetry measurements.

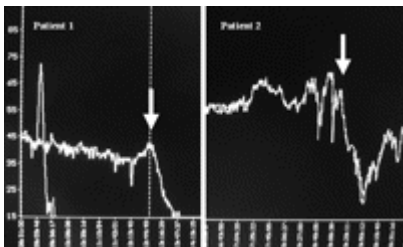


Figure 1. Cerebral oximetry monitor displays for two patients. The arrows indicate the point in time when methylene blue was administered as an IV bolus.

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