

## THE CLINICAL PICTURE

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# Methemoglobinemia in an HIV patient



**Figure 1.** The patient's hands on presentation (top) and after treatment with intravenous methylene blue (bottom).

**A** 45-YEAR-OLD MAN with known human immunodeficiency virus infection presented with a 5-day history of dyspnea. When his dyspnea had become symptomatic, he had restarted his home dapsone prophylaxis, but his dyspnea had progressively worsened, and his urine became dark.

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On presentation to our institution, he was tachycardic, tachypneic, hypoxic, and cyanotic (**Figure 1**). Chest radiography revealed multifocal bilateral airspace opacities. He was started on vancomycin and piperacillin-tazobactam for treatment of presumed pneumonia, and his dapsone was continued for prophylaxis against *Pneumocystis jirovecii* pneumonia.

During the next several hours, his hypoxia worsened, and his peripheral capillary oxygen saturation was 87% despite use of a Venturi mask at a 35% fraction of inspired oxygen. Arterial blood gas testing revealed an elevated partial pressure of oxygen (143 mm Hg) and chocolate-brown colored arterial blood. Due to the low peripheral capillary oxygen saturation, high partial pressure of oxygen, and abnormal color of his blood (**Figure 2**), serum methemoglobin testing was ordered and revealed a concentration of 22.9% (normal value < 1.5%).

Based on these test results, the patient's dapsone was stopped and replaced with atovaquone. Intravenous infusion of methylene blue was started, with subsequent improvement of the hypoxia and cyanosis (**Figure 1**). His urine became green, but it returned to a normal color in a matter of hours. He was ultimately diagnosed with *P jirovecii* pneumonia and completed a course of atovaquone with total resolution of his symptoms.

## ■ THE MECHANISMS BEHIND METHEMOGLOBINEMIA

Heme iron is normally in the ferrous state ( $\text{Fe}^{2+}$ ), which allows for hemoglobin to carry oxygen and release it to tissues.<sup>1</sup> Exposure to an oxidative stress can lead to methemoglobinemia from an increase in abnormal hemoglobin that contains iron in a ferric state ( $\text{Fe}^{3+}$ ).<sup>1,2</sup>

Methemoglobin reduces oxygen-carrying capacity in two ways: it is unable to carry oxygen, and its presence shifts the oxygen dissociation curve to the left, causing any remaining normal hemoglobin to be unable to release oxygen to the tissues.<sup>1,2</sup>

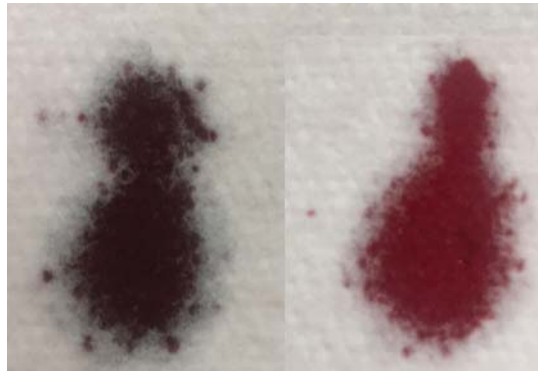
Causes of acquired methemoglobinemia include topical anesthetics (eg, benzocaine, lidocaine) and antibiotics (eg, dapsone).<sup>2,3</sup> Signs and symptoms include cyanosis, headache, fatigue, dyspnea, lethargy, respiratory distress, and dark-colored urine.<sup>1,2</sup>

### MANAGEMENT

Treatment consists of intravenous methylene blue, which reduces the hemoglobin from a ferric state to a ferrous state.<sup>1-4</sup> Methylene blue is a water-soluble dye excreted primarily in the urine, and common side effects include dizziness, nausea, and green urine.<sup>5-7</sup> The blue pigments from methylene blue combine with urobilin (a yellow pigment in the urine), producing a green color.<sup>7</sup> This is not pathological

### REFERENCES

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**Figure 2.** The patient's arterial blood on presentation (left) compared with a sample of normal arterial blood (right).

and requires no treatment, as the urine returns to normal color after the body fully excretes the dye.<sup>5-7</sup>

If intravenous methylene blue fails to produce a response, other treatments to consider include hemodialysis, blood transfusion, exchange transfusion, and hyperbaric oxygen therapy.<sup>2</sup>

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**Causes of acquired methemoglobinemia include antibiotics and topical anesthetics**