A 92-year-old African-American woman suffered from smoke inhalation during a house fire. The patient was transferred from a cross-town hospital to receive hyperbaric oxygen (HBO) therapy for carbon monoxide intoxication. Before arrival she was sedated, intubated, and administered hydroxocobalamin (CyanoKit®; King Pharmaceuticals, Bristol, TN) 5 g intravenously for presumed cyanide poisoning. In the Emergency Department (ED) a Foley catheter was placed and, upon inspection, her urine was tinted a deep red color (Figure 1). The patient received prompt HBO treatment and was transferred to the Intensive Care Unit. The extended duration of hydroxocobalamin-induced chromaturia can be measured by viewing the urine collection bag on day 8 (Figure 2). Despite mechanical ventilation, HBO therapy, and treatment for cyanide toxicity, the patient suffered cardiopulmonary arrest while in the Intensive Care Unit and passed away days later.

DISCUSSION

Cyanide poisoning secondary to smoke inhalation is due to the combustion of products that contain carbon and nitrogen, such as foam rubber, wool, plastics, and other common synthetic materials. It has been postulated that the inhalation of cyanide gases during residential fires may be more hazardous than carbon monoxide poisoning (1,2). Bertol and colleagues estimated that the burning of 2 kg (4.4 lb) of polyacrylonitrile, a commonly found synthetic material, would fill an averaged-sized living room with a lethal concentration of hydrogen-cyanide gas (3).

The traditional cyanide antidote kit, used for cyanide ingestions and exposures, is not recommended for use in cyanide poisoning secondary to smoke inhalation. This is due to the induction of 20–25% methemoglobin from the stepwise administration of amyl and sodium nitrites. This induced methemoglobinemia, combined with a potential high level of carboxyhemoglobin due to carbon monoxide overexposure, may reduce oxygen-carrying capacity to dangerously low levels. Hydroxocobalamin is approved for cyanide poisoning due to smoke inhalation, is simple to administer, and removes cyanide through a unique mechanism of action. HYDROXOCobalamin binds cyanide directly on a one-to-one molar basis and transforms the antidote into the water-soluble molecule CYANOcobalamin, vitamin B₁₂ (4). Excess cyanocobalamin is then excreted by the kidneys. There is no reduced oxygen-carrying capacity due to this antidote. It is estimated that a dose of approximately 4 g of hydroxocobalamin is required to remove a lethal dose of cyanide (5). However, doses from 2.5–20 g have been studied and used in humans.
Adverse effects of hydroxocobalamin include rare allergic reactions and transient hypertension. The most notable side effect of this medication is marked reddening of the skin, urine, and other bodily fluids. According to the package insert, due to the "dark red color of hydroxocobalamin, the two most frequently occurring adverse reactions were chromaturia (red-colored urine) which was reported in all subjects receiving a 5 g dose or greater; and erythema (skin redness), which occurred in most subjects receiving a 5 g dose or greater" (4). The patient in this case showed no apparent skin reddening; however, her urine appeared deep red in color. Condensate along the interior contour of her endotracheal tube was also tinted a pinkish-red color. This pigmentation is generally regarded as harmless and resolves within days to weeks.

Hydroxocobalamin-imparted color to bodily fluids can interfere with colorimetric sensors and tests. The degree of interference depends on assays and equipment used, as well as the amount of medication infused. Notably, hydroxocobalamin may falsely increase carboxyhemoglobin and methemoglobin values, while decreasing oxyhemoglobin (6). As treatment for carbon monoxide poisoning will most likely be concomitant for smoke inhalation victims, initial assessment of blood gases is recommended before hydroxocobalamin administration. False variations in serum liver enzymes, creatinine, magnesium, iron, and coagulation measurements have been seen, as well as variances in urine laboratory values, both in vivo and in vitro (4,7,8). The clinical relevance of these variations has yet to be determined.

Recently, a report described an unsuccessful hemodialysis effort after hydroxocobalamin administration. A colorimetric alarm within the dialysis machine indicated a "blood leak," which prevented dialysis despite repeated restart attempts (9). Presumably, the pigment distributes across the dialysate membrane, triggering the safety alarm, which shuts down the machine. Blood leak sensitivity likely varies between dialysis units; however, the extreme color imparted to bodily fluids may lead to treatment complications or failures. Clinicians should be aware of this concern should hemodialysis be warranted after hydroxocobalamin administration for any type of cyanide exposure or poisoning.

CONCLUSION

Hydroxocobalamin is a unique tool available to the practitioner for the treatment of cyanide poisoning. Healthcare professionals should be aware of this medication's mechanism of action, as well as this stunning visual side effect that has the potential to interfere with therapy.

REFERENCES