Methemoglobinemia and Seizure Following Indoxacarb Poisoning

Department of Emergency Medicine, College of Medicine, The Catholic University of Korea, Seoul, Korea, Department of Psychiatry, College of Medicine, The Catholic University of Korea, Seoul, Korea

Young Min Oh, M.D., Kyoung Ho Choi, M.D., Kyoung Uk Lee, M.D.

Indoxacarb is an oxadiazine insecticide with selective lethality through blockade of neuronal voltage-dependent sodium channels. It has a low mammalian toxicity, and few cases of human toxicity after indoxacarb ingestion can be found in the literature. A 36 year-old male patient visited our ED after a generalized tonic clonic seizure, which was witnessed by his mother. His past medical history was nonspecific. On initial presentation, he showed a decreased level of consciousness with a Glasgow coma score of 5/15 (E1V1M3), unprotected airway, hypoxia, and cyanosis. The saturation gap and cyanosis after intubation and mechanical ventilation was strongly suggestive of methemoglobinemia due to poisoning. Finally, the methemoglobin (metHb) level was 27.4%. Therefore, the patient received 100 mg of methylene blue (2 mg/kg, 1% solution) and 50 g of charcoal. The insecticide was found to be ingested xenobiotic (Steward Gold; 5% indoxacarb; 95% inert ingredients and other components). On the second hospital day, the patient became alert. The patient’s metHb level was 0.1%. The endotracheal tube was removed. On the fifth hospital day, he was discharged in good condition. Herein we present a case of indoxacarb poisoning with methemoglobinemia and seizure, which are unusual presentations.

Key Words: Indoxacarb, Poisoning, Methemoglobinemia, Seizure

Case Report

A 36-year-old man came to our emergency department (ED) by 119 ambulance 30 minutes after a generalized tonic-clonic seizure. He had no histories for use of recreational drugs, epilepsy, and head trauma. On arrival, the patient’s initial vital signs were blood pressure, 140/60 mmHg; pulse rate, 118 beats/minutes; respiratory rate, 24 breaths/minutes; and body temperature, 36.4°C. His Glasgow coma scale score was 5/15 (E1V1M3). The bedside blood glucose level was 139 mg/dl. Physical examinations revealed the cyanotic lips, profuse oral secretions, and grunting sound, but no signs of trauma. Pulse oximetry was 83%. He received the rapid sequence intubation to protect the airway, and the ventilator was applied. After initial airway management, cyanosis on his lips and low SaO2 were still noticed. Arterial blood gas analysis with the 100% oxygen supply showed the following: pH, 7.355; Pco2, 40.6 mmHg; Po2, 440 mmHg; HCO3-, 22.3 mmol/L; and SaO2, 99%. The presents of saturation gap and cyanosis refractory to oxygen therapy were suggested the methemoglobinemia due to poisoning. The initial methemoglobin (metHb) level showed 27.4%. Laboratory data showed white blood cell count of 13,500/mL, hemoglobin of 18.1 g/dL, platelets counts of 315,000/mL, blood urea nitrogen of 12.7 mg/dL, creatinine of 0.33 mg/dL, sodium of 143 mEq/L, potassium of 3.2 mEq/L, chloride of 102 mEq/L, and serum
osmolality of 321 Osm/L. Intravenous 100 mg of methylene blue (2 mg/kg, 1% solution) was administered immediately. The patient received 50 g of charcoal with sorbitol to prevent the further absorption of xenobiotics. To exclude the organic brain regions, we performed the brain computerized tomography scan, which showed normal. 1 hour after administration of methylene blue, the metHb level decreased to 4% (Fig. 1). Bedside electroencephalography (EEG) showed no epileptiform discharges. The patient was still drowsy and lethargic, but became responsive to verbal command. At that time, the patient’s mother brought the bottle of the insecticide (Steward Gold®; 5% indoxacarb; 95% inert ingredients and other components), which was found at his room. He was admitted to ICU. At the 2nd hospital day, the patient became alert. The following metHb level was 0.1%. After extubation, he stated that he had ingested intentionally about 10~20 ml of the insecticide with a suicide attempt, and lost his consciousness. At the 5th hospital day, he was discharged without neurological sequelae with psychiatric support.

**Discussion**

Human toxicity after indoxacarb exposure includes irritations of eyes and skin, blurred vision and hemato-logic abnormalities\(^5\). Methemoglobinemia is a rare and unusual toxicity following indoxacarb poisoning. To our knowledge, indoxacarb poisoning related seizure has never been reported.

Methemoglobin (metHb) occurs in physiologic or pathologic conditions when the iron atom in hemoglobin is oxidized from the ferrous state to the ferric state\(^6,7\). Normally, metHb levels are less than 1% of total hemoglobin\(^6\). According to their own chemical features, xenobiotics may produce methemoglobinemia by direct acting, in the presence of oxygen, or only after biotransformation\(^6\). Active intermediate after biotransformation of aromatic metabolite was suggested to be able to produce methemoglobinemia following indoxacarb poisoning, but the exact mechanism is still unknown\(^2\).

The symptoms of methemoglobinemia are often vague and nonspecific, but higher metHb levels are related to the more severe symptoms\(^6\). Alteration in the level of consciousness, circulatory collapse, seizures, and death could be seen with the levels greater than 50~70%\(^6,7\). In contrast to the previous results, our patient showed only 27.4% of the metHb level, which was measured about 30 minutes after seizure. Therefore, it might be questionable that the only lower level of methemoglobinemia could induce the seizure, as shown in our patient. However, it has been known that some compounds producing oxidant stress such as benzocaine and lidocaine may cause a
seizure unrelated to the development of significant methemoglobinemia. Victim’s own or xenobiotic-induced oxidant stress might be the one of possible reasons to explain the seizure unrelated to the significant methemoglobinemia.

Basic approach to diagnose methemoglobinemia is known to identify the presence of saturation gap and cyanosis refractory to oxygen therapy. Without strong suspicion and careful monitoring, the diagnosis may be delayed or missed in unusual presentations. The simple quantitative bedside test may be useful to detect the methemoglobinemia if co-oximeter is not available. However, if available, co-oximetry is a definite diagnostic method.

Literatures provide few cases of indoxacarb poisoning with methemoglobinemia. Rebound phenomenon was observed in the half of them. Treatments included in airway managements and ventilator care, stabilizing blood pressure, and administrations of methylene blue with or without ascorbic acid as a supplemental antioxidant. Methylene blue is a key antidote for methemoglobinemia. Therapy with methylene blue 1~2 mg/kg intravenously, is indicated over 5~10 minutes as a 1% solutions in the patients with severe symptoms, more than 20% of metHb levels, and underlying disease susceptible to hypoxia such as anemia, chronic obstructive pulmonary disease, and congestive heart failure. Administration of antioxidants may be beneficial to recover the depleted endogenous redox cycle. However, the efficacy of ascorbic acid is still questionable because of its delayed onset of action. Our patient was successfully treated by methylene blue without supplemental antioxidants.

In summary, methemoglobinemia is an unusual and rare toxicity after indoxacarb poisoning. Herein we presented a case of indoxacarb poisoning with unusual presentations such as methemoglobinemia and seizure.

REFERENCES