Indoxacarb poisoning: A rare presentation as methemoglobinaemia

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INTRODUCTION
Indoxacarb is an oxidiazine compound and a sodium channel blocker. It is a broad-spectrum insecticide widely used in commercial and farm planting for the control of certain insects, i.e. moth, leaf hopper and fruit worm.

CASE REPORT
A 52-year-old farmer came to our intensive care unit with an alleged history of consumption of an unknown pesticide (suicidal attempt) while working in the field during the day hours. As per records he was given gastric lavage and inj. atropine in a local hospital and then referred to our hospital. On admission he was cyanosed and unresponsive with a Glasgow coma scale (GCS) of 8/15. He was immediately intubated and put on controlled mechanical ventilatory support with a FiO₂ of 1.0. The noninvasive blood pressure (NIBP) was 80/60 mmHg, pulse rate (PR) was 130 per min and SpO₂ was 83%. The pupils were bilaterally dilated and were sluggishly reacting to light. The right internal jugular vein was cannulated and central venous pressure (CVP) was 3 cm of water. Intravenous fluids were given to keep a CVP of 10 cm of water or a urine output of 50 ml/h. Considering the possibility of organophosphorus poisoning, inj. atropine i.v. and inj. pralidoxime i.v. (dose 25–50 mg/kg) were given over a period of 15 min. The investigations like complete blood count, kidney function test, liver function test, serum electrolytes and serum cholinesterase were sent. While sampling, the arterial blood was found to be chocolate brown coloured, which did not change its colour even on deliberate exposure to room air. Another arterial sample was analysed and revealed pH 7.25, PaCO₂ 38, PaO₂ 245, HCO₃⁻ 16.7 and SaO₂ 88%. It was observed that despite continuing mechanical ventilation with 100% O₂, the SpO₂ value did not rise and remained stationary at 83–84% for another hour.

The patient’s relatives were thoroughly questioned again about the poison and later on they could bring the bottle of poison consumed. It was indoxacarb (14.5% SC Avaunt), which is a non-organophosphorus oxidiazine insecticide. Therefore inj. pralidoxime and inj. atropine were not repeated. Considering the cyanosis, stationary SpO₂, chocolate brown colour of arterial blood and disproportionately high PaO₂ on arterial blood gas (ABG) analysis, the possibility of methemoglobinaemia was suspected. As the facility for determining methemoglobin levels was unavailable, we started the treatment on the basis of clinical presentation which was successfully managed with inj. methylene blue and other symptomatic and supportive treatment.

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Injection methylene blue\textsuperscript{[3,5]} (dose 10 mg/kg) and ascorbic acid\textsuperscript{[8,6]} (vitamin C) were administered intravenously. Inj. ascorbic acid\textsuperscript{[8,6]} was given in 5% dextrose at a rate of 100 ml/h. Within an hour of giving inj. methylene blue, the patient started improving in terms of better sensorium and an increased SpO\textsubscript{2} value (90%). Repeat ABG analysis showed pH 7.47, PaCO\textsubscript{2} 30, PaO\textsubscript{2} 315, HCO\textsubscript{3} 21.8 and SaO\textsubscript{2} 98% at a FiO\textsubscript{2} of 1.0. Thereafter, FiO\textsubscript{2} was reduced to 0.6 and inj. methylene blue 70 mg (dose 1 mg/kg) and ascorbic acid 500 mg in 5% dextrose were continued at 12-h intervals. The next day SpO\textsubscript{2} value rose to 92%; ABG analysis revealed pH 7.48, PaCO\textsubscript{2} 32, PaO\textsubscript{2} 340, HCO\textsubscript{3} 22.3 and SaO\textsubscript{2} 100% at a FiO\textsubscript{2} of 0.6 and he became responsive to verbal commands. He was put on the synchronized intermittent mandatory ventilation (SIMV) mode with a FiO\textsubscript{2} of 0.5 and a pressure support of 12 cm of H\textsubscript{2}O. On day 3, the SpO\textsubscript{2} value rose to 95% and he became fully conscious. He was given a T-piece trial with O\textsubscript{2} at a rate of 5 l/min. ABG showed a pH 7.46, PaCO\textsubscript{2} 36, PaO\textsubscript{2} 410, HCO\textsubscript{3} 21.6 and SaO\textsubscript{2} 100%. The next day he was extubated and was kept on face mask with O\textsubscript{2} at a rate of 5 l/min. On day 5 with stable haemodynamics and GCS 15/15 he was shifted to ward.

**DISCUSSION**

Indoxacarb insecticide is formulated as 30% active water-soluble granule. The oral LD\textsubscript{50}\textsuperscript{[1]} is 1800 mg/kg and dermal LD\textsubscript{50}\textsuperscript{[1]} is >5000 mg/kg. It affects insects by either direct exposure of spray droplets or through ingestion of treated foliage and fruit. Once absorbed, it kills the organism by blocking the flow of sodium ions.\textsuperscript{[1,4]} This results in impaired nerve function, cessation of feeding, paralysis and death in insects.

Methemoglobinaemia\textsuperscript{[3,5-7]} (MetHb) is generated by the oxidation of haem iron moieties to the ferric state causing characteristic bluish brown colour resembling cyanosis. MethHb has such a high affinity to O\textsubscript{2} that virtually no O\textsubscript{2} is delivered to tissues and the O\textsubscript{2} dissociation curve is shifted towards left. Methemoglobinaemia\textsuperscript{[3,5-7]} should be suspected in patients with hypoxic symptoms who appear cyanotic, though PaO\textsubscript{2} levels on ABG analysis are sufficiently high to fully saturate the haemoglobin. The characteristic chocolate brown appearance of freshly drawn blood can be a critical clue.\textsuperscript{[3]} The SpO\textsubscript{2} value around 85% is because of the typical light absorbance spectra\textsuperscript{[8]} of MetHb. Normally MetHb levels\textsuperscript{[3,5-7]} are less than 1%. The cyanosis\textsuperscript{[3,5-7]} usually manifests at a level of 15% and treatment is warranted\textsuperscript{[3,5-7]} at levels above 30% while levels >60% are considered to be lethal.\textsuperscript{[3,5-7]}

Methemoglobinaemia is treated with methylene blue, 1–2 mg/kg, administered slowly. If cyanosis persists, the dose may be repeated at an hourly interval to a maximum\textsuperscript{[5]} of 7 mg/kg/day. The maintenance dose\textsuperscript{[5]} of methylene blue is 1 mg/kg twice or three times a day. Other supportive measures include the administration of vitamin C and correction of the metabolic abnormalities.

In our patient, methemoglobinaemia had occurred following the ingestion of indoxacarb insecticide which was identified and treated on the basis of clinical suspicion and ABG analysis. Further literature research revealed a similar case report\textsuperscript{[8]} published in year 2008 in IJCCM.

Therefore, it can be substantiated that indoxacarb, an oxidiazine insecticide, also manifests its toxicity in humans in the form of methemoglobinaemia. As in our patient, it could be successfully managed with intravenous methylene blue and other supportive and symptomatic treatment. As indoxacarb is a commonly used insecticide, the clinicians working in ICUs should be able to recognise and manage it.

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