

## K6 A Suicidal Sodium Nitrite/Nitrate Ingestion Outbreak in Houston, Texas

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**Learning Overview:** After attending this presentation, attendees will understand the concern for easily available chemicals that can be used as toxins and the importance of Methemoglobin (MetHb) saturation in postmortem cases involving sodium nitrite and sodium nitrate ingestion. Six suicidal cases in eight months from late 2019 to early 2020 will be presented with relevant case findings and toxicology results, including MetHb saturation. The postmortem MetHb saturation found in these cases will be compared to published antemortem and postmortem MetHb saturation in fatal cases involving methemoglobinemia.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by drawing attention to commonly used chemicals that can be used as toxins in postmortem cases. Sodium nitrite and sodium nitrate are readily accessible chemicals that are used in different manufacturing and industrial purposes, such as food preservation and fertilizers. While relatively harmless at low concentrations present in food, at higher concentrations, nitrite leads to oxidation of the iron in hemoglobin, converting it to inactive MetHb.<sup>1</sup> Nitrate can cause the same oxidation after being reduced to nitrite by bacteria in the body.<sup>1</sup> Low (<5%) saturation of MetHb is considered normal. When saturation reaches or exceeds ~20%, cyanosis, headaches, vomiting, loss of consciousness, and other toxic effects can occur, and >70% saturation is considered to be lethal.<sup>2</sup>

As nitrite and nitrate are not commonly investigated in routine toxicology testing, exposure, and toxicity to these agents are often limited to autopsy findings and indirect toxicology testing such as MetHb saturation. Being able to use MetHb saturation as a tool to aid in determining cause of death is important in the absence of other significant toxicological results. As most published nitrite/nitrate exposure cases typically provide antemortem MetHb levels, providing postmortem MetHb saturation levels in suicidal nitrite/nitrate exposure cases can assist in interpretation.

**Methods:** Postmortem blood specimens for the six cases were sent to NMS Labs for MetHb saturation testing by spectrophotometry. Blood sources for these cases included heart ( $n=1$ ), iliac ( $n=1$ ), and femoral ( $n=4$ ) that were collected in lavender-top tubes. Additional in-house testing varied for each case based on the case circumstances and pathologist requests, but all cases did include testing for ethanol, methanol, isopropanol, and acetone along with a 10-panel enzyme-linked immunosorbent assay screen.

**Results:** The six cases included four males and two females that ranged in age from 17 to 29 years old. MetHb saturation ranged from 16–47% with no other significant toxicological findings other than one case where etizolam was identified. Autopsy findings included blue-gray cutaneous discoloration and dark brown discoloration of the blood and various tissues. In six other published fatal methemoglobinemia cases, MetHb saturation was reported in postmortem blood for five cases and repeated antemortem blood in one case.<sup>3-6</sup> The postmortem saturation in the published cases ranged from 23–95%. For the case with repeated antemortem levels, the initial MetHb saturation was reported as 70%, followed by 30% post-treatment with methylene blue, and finally dropped to 18% after a transfusion before death occurred. In non-fatal cases, the MetHb saturation has been reported as low as 19% and as high as 94% after nitrite exposure.<sup>7,8</sup>

**Discussion/Conclusion:** Due to the ease of access of nitrite and nitrate containing compounds, concerns for their exposure cannot be ignored in toxicology cases. It is clear from fatal and non-fatal nitrite exposure cases that the MetHb saturation varies greatly and there is significant overlap in the MetHb saturation and outcome. The antemortem MetHb saturation levels that are used to establish risk also do not appear to be relevant in postmortem cases, and more information regarding MetHb in postmortem cases involving methemoglobinemia and nitrite/nitrate exposure would be useful to better understand an expected range to assist in interpretation.

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### Methemoglobin, Sodium Nitrite/Sodium Nitrate, Suicide