

Title: Nicotine poisoning due to intravenous injection of cigarette soakage

Short running head: Poisoning by cigarette soakage injection

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Abstract

A 27-year-old female nurse intravenously injected 5 mL of cigarette soakage solution which contained approximately 5.7 mg nicotine in a suicidal attempt. Clinical manifestations consisted of nausea, palpitation, abdominal pain, repeated vomiting, and diarrhea. She remained fully conscious during this episode. About 7 h later, she visited emergency department on foot and received fluid infusion for dehydration. She fully recovered at night of the day. This is the first documented report of acute nicotine poisoning due to intravenous injection of cigarette soakage in humans. Signs and symptoms appeared immediately after the injection, but this case seemed to be relatively mild in terms of clinical manifestation. The elimination half life of nicotine seems to be short, *i.e.*, less than one hr. Therefore, if initial treatment is appropriate and the patient can survive acute phase of nicotine poisoning, prognosis is good.

Text

Introduction:

Most reports of acute nicotine poisoning are caused by ingestion of cigarettes or its soakage, or absorption through skin from tobacco leaves (green tobacco sickness) or dermal patch (1, 2). We report a case of acute nicotine poisoning due to intravenous injection of cigarette soakage.

Case report:

A 27-year-old female nurse (160-cm, 50 kg) bought a package of cigarettes for suicide at 1 a.m. on a day of November. She soaked 20 cigarettes in 100 mL of tap water using a small glass for one hr. The local atmospheric temperature at that time was recorded to be 4 °C. Then, she aspirated 10 mL of the soakage into a 10 mL syringe and applied a 23 gauge needle. About 2:30 a.m., she injected about 5 mL of the liquid via her left antecubital vein, and made a hypodermic injection of 5 mL because the needle slipped out from the vein. Immediately after the injection, she felt nausea, palpitation, abdominal pain, and had repeated vomiting about 20 times and diarrhea. After perspiration for 30 min, she experienced a chill but remained fully conscious during this episode.

In the morning, she called her hospital asking for a sick leave, which revealed the injection event to several colleagues of hers. At 9:10 a.m. on the same day, she visited the emergency department on foot accompanied by one of her colleagues. Vital signs at the emergency room were as follows: heart rate 64 beats per min, blood pressure 112/60 mmHg, body temperature 36.7 °C. Nothing was particular on physical examination except swelling and induration in her left antecubital region. The swelling was about 5 cm in diameter and associated with mild spontaneous pain and tenderness. A needle wound was recognizable in the center of the swelling. There were no abnormalities on blood test of liver and kidney functions. She was admitted to our hospital for psychiatric care and received fluid infusion for dehydration, and almost all the symptoms subsided at night of the day. About 35 h later from the injection, although the swelling and induration became slightly larger, tenderness got less severe.

Blood nicotine levels were measured at 14 h and 27 h after injection, and both results were under 0.005 µg/mL. Blood nicotine level just after visiting the emergency room was not measured due to a communication error.

Discussion

Acute nicotine poisoning caused by injection of nicotine solution is extremely rare. To our best knowledge, this is the first documented report of acute nicotine poisoning due to intravenous injection of cigarette soakage in humans. Although intravenous injection of the liquid per se was not witnessed, considering the patient's occupation, local findings, and symptoms, her statement appeared highly reliable. Therefore, we believe intravenous injection of cigarette soakage was indubitably carried out in this patient.

In mild nicotine poisoning, patients feel nausea, headache and dizziness, and might have vomiting and diarrhea. In severe cases, abdominal pain, diaphoresis, distraction, weakness, disturbance of consciousness, convulsion and death by respiratory muscle paralysis might ensue. Cardiovascular signs of acute nicotine poisoning are tachycardia and hypertension at low concentration, whereas bradycardia and hypotension occur at high concentration. Fortunately, our case seemed to be relatively mild in terms of clinical manifestation despite intravenous injection of nicotine solution, because consciousness was well preserved although gastrointestinal symptoms and tachycardia were observed. Typically, symptom of acute nicotine poisoning appears within 30 min(3). However, signs and symptoms appeared

immediately after the injection due to the intravenous route in this case.

Previous studies reported that 1 to 4 mg nicotine ingestion caused toxic symptoms and 30 to 60 mg of nicotine was lethal(4). To estimate the amount of injected nicotine, we reproduced the nicotine soakage. Twenty cigarettes of the same brand were soaked in 100 mL of water for 1 h at 10 °C, because outside temperature was 4 °C at the time of the event. The nicotine concentration of the soakage was measured to be 1.14 mg/mL (Gas Chromatograph Mass Spectrometer). Therefore, total amount of acutely administered nicotine was estimated to be 5.7 mg, since 5 mL of cigarette soakage was injected intravenously. Fukumoto et al.(5) reported that average amounts of nicotine of 32 popular brands were 11.72 +/- 2.27 (SD) mg per one cigarette. Accordingly, it appears that about a half of nicotine content was soaked into water under the above-mentioned condition, supposing that the cigarette the patient used contains average nicotine content. It is noteworthy that cigarette soakage is able to have relatively high concentration of nicotine in a short period of time.

Nicotine is metabolized primarily in the liver and is excreted as a nonactive metabolite through the kidney. Although the speed of excretion is dependent on the urinary pH, being rapid when the pH is acidic, elimination half life of nicotine seems to be less than one hr (6). Therefore, if initial treatment is appropriate and the patient can

survive acute phase of nicotine poisoning, prognosis is good. Regarding the low nicotine levels measured in our patient, this does not preclude the conduct of the nicotine injection because it was measured late as 14 h after the injection in comparison with its short half life.

In summary, we experienced a rare case of acute nicotine poisoning caused by intravenous injection of nicotine solution. Despite intravenous route of injection, which can be lethal or seriously toxic, the patient survived without serious sequelae. Clinicians should be aware that nicotine poisoning can be caused by intravenous injection.

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