Case Reports

Tellurium-Intoxication *

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Summary. Tellurium is one of the rarest elements on earth. Intoxications are rare and almost exclusively occupationally exposed workers are affected. Only a few cases of non-occupational poisoning have been reported so far.

Severe poisoning results in respiratory depression and circulatory collapse. After occupational exposure main symptoms and signs include loss of appetite, dryness of the mouth, suppression of sweating, a metallic taste in the mouth, and most notable, a sharp garlic odor of the breath, sweat and urine.

We report our findings in a 37 year old, non-occupationally exposed woman with tellurium intoxication.

Key words: Intoxication – Poisoning – Tellurium – Tellurium-Intoxication

Tellurium is one of the rarest elements, participating only with 10−7% in the composition of the earth’s crust and occurring mainly as metal tellurides [5, 6, 11]. It is a by-product of copper, silver, lead and gold refining. Accumulation in the anodic sludge during electrolytic refining of copper is the main source of tellurium production. The last estimate of the world production of tellurium in 1975 was about 150–200 tons (U.S. Bureau of Mines, cited in [6]).

Tellurium finds limited but widespread industrial uses:

- in glass industry as a coloring agent
- in chemical industry as a catalyst
- in microelectronic industry as a semiconducting compound for thermoelectric applications [3, 5, 6, 7, 8, 12].

Reports of acute occupational tellurium intoxications are rare. In workers who had been smelting platinum ore with high contents of Tellurium and complained about acute headache, nausea, dizziness, accelerated pulse and breathing frequency as well as strong odor of garlic in the exhaled air and sweat were noticed [10]. Other authors report on irritation of the respiratory tract (Popowa et al.; Izrael'son; cited in [6]).

After occupational long-term exposure in steel workers who had been handling tellurium pellets at blast furnaces for steel alloys, garlic odor of breath, sweat and urine, metallic taste, dryness of the mouth, disorder of sweat function, dry itchy skin, anorexia, nausea, vomiting, depression and somnolence have been described (Schie and Deeds; Steinberg et al.; cited in [6] and [7]).

Fatal cases due to occupational tellurium exposure have not been described so far [7].

The only lethal tellurium intoxications reported so far occurred after accidental injection of sodium tellurite in place of sodium iodide in retrograde pyelography [8].

We report a tellurium intoxication in a 37 year old woman with no industrial exposure to tellurium. The most notable sign of intoxication was a peculiar garlic odor of breath.

Case Report

In March 1988 a 37 year old woman was referred to our hospital because of weight loss, fatigue and a garlic odor of breath. She was well until four weeks before admission, when she acutely experienced nausea and vomiting together with a metallic
taste in the mouth and a sharp garlic odor of breath, sweat and excrements. She realized that the first symptoms occurred only hours after she had tasted from a piece of meat that had developed a greenish colour and a partly metallic-like surface. She only tried a small piece and disposed the rest into the freezer. She did not offer the meat to other members of her family, who did not show any health effects.

Fever developed at the second day and resolved spontaneously together with nausea and vomiting after approximately five days. Two weeks after the onset of symptoms she observed hair loss.

The patient was working as an office employee. She denied all contact with chemicals, insecticides, pesticides and heavy metals. A consumption of garlic and drugs was denied.

**Clinical Findings**

On examination the patient appeared well. The temperature was 36.8°C, the heart rate 72 min⁻¹ and the blood pressure 125/80 mm Hg. Clinical examination revealed a strong garlic odor. The lungs were clear, the heart and abdomen normal, liver and spleen were not felt. There was no peripheral edema or cyanosis, neurologic examination was negative.

Further investigations showed that full blood indices, liver and renal function tests, serum electrolytes, urine analyses, chest radiograph and ultrasonic examination of the abdomen were normal. Gastroscopic examination showed petechial gastric bleeding in the fundus. Microscopic examination of the gastric mucous membranes revealed a minimal and focal inflammation.

**Toxicological Analyses and Results**

To establish the diagnosis we performed toxicological analyses in biological material (blood, urine, hair) and in the suspected piece of meat, which had been stored in the freezer.

We quantified all substances, which are known to cause garlic odor in breath, loss of hair and vomiting, i.e. tellurium (Te), selenium, arsenic and thallium [4, 5, 6, 7, 10, 14]. Analyses of arsenic and thallium were carried out at the Institut für Rechtsmedizin (Director: Prof. Dr. med. M. Staak), Cologne.

The determination of selenium in urine was performed by hydrid atomic absorption spectrometry according to [11]. Selenium analyses were carried out after wet oxidative digestion of the biological material.

Also for the estimation of tellurium, hydrid atomic absorption, spectrometry was used. The concentration in urine was directly measured, serum and hair was first digested with nitric acid and sulfuric acid under a well defined time-temperature programme. The digestion residue was dissolved in hydrochloric acid; sodium boron hydrid was used as reducing agent. For calibration the standard addition method was carried out. The analytical detection limit for the Te determination was 0.5 µg/l in urine and serum.

The analytical reliability criteria for the Te determination were: Precision: ±5% (in the range of 10–15 µg/l in biological material). Specimens of serum, urine and hair of the patient were taken four weeks after the assumed intoxication. Selenium, thallium and arsenic were not detected, concentrations of tellurium are listed in Table 1.

**Table 1. Concentrations of tellurium in biological materials.**

<table>
<thead>
<tr>
<th>Material</th>
<th>Concentration (µg/l)</th>
</tr>
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<tbody>
<tr>
<td>Serum</td>
<td>27.6 (1.0)</td>
</tr>
<tr>
<td>Urine (1st)</td>
<td>3.2 (1.0)</td>
</tr>
<tr>
<td>Urine (2nd)</td>
<td>3.1 (1.0)</td>
</tr>
<tr>
<td>Urine (24h)</td>
<td>6.7</td>
</tr>
<tr>
<td>Hair</td>
<td>n.d.</td>
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</tbody>
</table>

n.d. = not detected, --- no value known

Additionally a specimen of the suspected meat was investigated. After wet oxidative digestion 800–1000 µg Te/kg meat was determined.

**Treatment and Course of the Intoxication**

The patient was given ascorbic acid, 200 mg per day, and was discharged. Eight weeks after Te intake a bright colour of her new grown hair was observed while the hair loss disappeared. The garlic odor became less apparent but persisted until November 1988. The patient noticed that the odor was intensified after the intake of alcoholics. No persistent health impairments developed.

**Discussion**

Our patient demonstrated the typical signs of tellurium intoxication, the most notable being the