Attempted murder by selenium poisoning

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Criminal poisoning should be kept in mind when patients present with unexplained but typical symptoms of toxicity

Murder by poison is not confined to history and detective fiction. The case reported here highlights the need at least to consider foul play in a patient who has symptoms compatible with toxicity and in whom no firm diagnosis has been made.

Case report

A previously healthy 46 year old man was admitted to hospital with a four week history of illness. He complained of a sudden onset of profuse watery diarrhoea and vomiting. This had subsided after one week but returned a week later. The second episode was more severe and accompanied by abdominal cramps and loss of weight. He gave no relevant medical history and had never been abroad. He was a divorcee now living with his girlfriend.

On admission physical examination yielded normal results, though a strong odour of garlic was noticed on his breath. Haematological and biochemical investigations yielded normal results. No pathogenic organisms were isolated on repeated examination of stool samples. Shortly after admission his scalp hair began to fall out. Four days later, however, his bowel motions were normal, his vomiting had stopped, and he was putting on weight. He was discharged from hospital feeling quite well but was readmitted two weeks later with a recurrence of his symptoms. His alopecia was quite distinct, and he was found to have a purple-red discolouration at the base of his fingernails and toenails. He was also dehydrated and mildly jaundiced. The table shows the results of investigations. He was rehydrated with intravenous fluids, and once again his symptoms resolved and he was eating normally within two days. Sigmoid biopsy specimens showed a mild non-specific inflammation of the colonic mucosa. A barium enema and a barium meal and follow through examination both yielded normal results.

A dermatological opinion was sought on the changes in his nails and hair. These were considered to be a response to severe illness. His gut hormones were screened to exclude a tumour that was secreting hormones, but concentrations were normal. Two weeks later he felt quite well again and was discharged. He was readmitted after three days with an acute recurrence of identical symptoms.

At this time the question of criminal poisoning was raised with the patient. Although he dismissed this possibility and could think of no one with sufficient motive, samples of blood and urine were sent to Guy's Hospital for measurement of arsenic and thallium concentrations (thallium causes alopecia and nail dys-

trophy and is a constituent of certain rat poisons). Both concentrations were within normal limits. His symptoms again remitted in hospital. Exasperated at our inability to establish a diagnosis, he discharged himself and did not attend the next outpatient clinic.

Almost three months later he returned. He had gained 5 kg in weight, his hair had completely regrown, and the discolouration of his nails had all but disappeared. He said that his girlfriend had left him prostrate at home several weeks earlier, too weak to move from his bed. After 48 hours he had recovered sufficiently to eat and drink. He alleged that his girlfriend had been trying to poison him and had defrauded him of several thousand pounds. He thought that she had gone abroad. We told the police of these allegations and of the patient's recent medical history. Subsequent investigations by the criminal investigation department disclosed that the girlfriend had bought large quantities of gun blue at a local gun shop. Gun blue is a lubricant solution containing selenious acid, nitric acid, and copper nitrate. Unfortunately, no blood or urine samples had been saved during the acute toxic episodes. Police investigations are still in progress. The patient made a complete recovery.

Discussion

Selenium is an essential element for animals and humans, being incorporated in several enzymes including glutathione peroxidase. It is readily absorbed from the gastrointestinal tract, and a normal diet provides 60-150 µg/day.¹ Selenium is widely used in industry—for example, in semiconductor technology, electronic engineering, the glass industry, the rubber industry, and medicine and as a lubricant in gun blue. Toxicity is common in cattle grazing on seleniferous soil,² and gastrointestinal symptoms have been reported among people living in highly seleniferous areas such as South Dakota and Nebraska in the United States.³ Selenium deficiency may cause symptoms similar to those in toxicity and is responsible for Keshan disease, which is prevalent in China.⁴

The effects of chronic occupational exposure are well documented.⁴⁻⁷ They include a metallic taste in the mouth, an odour of garlic on the breath due to methylation of selenium, mucosal irritation, gastroenteritis, paronychia, and red pigmentation of nails, hair, and teeth. We could find only eight reported cases of acute selenium poisoning, four of which were fatal.⁸⁻¹⁵ All were caused by accidental or suicidal ingestion or inhalation of selenium compounds. Clinical and necropsy findings included haemolysis, necrosis of the liver, cardiomyopathy occurring within hours, convulsions, pulmonary oedema and oedematous swelling of the kidney, infection with legionella, and red pigmentation of all viscera. Two of the fatal cases were due to ingestion of about 10-15 ml of gun blue by children under the age of 3. Toxic concentrations of selenium may be detected in the blood and urine, but treatment is symptomatic. In vitro tests of haemoperfusion for removing selenium from the blood have been disappointing,⁸ as might be expected, as selenium is found mainly in erythrocytes or bound to plasma protein.

Results of general investigations in man later thought to have been poisoned with selenium

	Concentration
Serum sodium	134 mmol/l
Serum potassium	3.3 mmol/l
Serum bicarbonate	24.1 mmol/l
Serum urea	8.6 mmol/l
Total bilirubin	25 µmol/l
Conjugated bilirubin	Normal
Transaminase	Normal
Alkaline phosphatase	Normal

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That our patient survived his ordeal was no thanks to us. We think that there are lessons to be learnt from this case. Firstly, doctors should consider the possibility of criminal poisoning in similar cases. Secondly, a serum sample should be saved for legal purposes. Thirdly, an awareness of the characteristic garlic odour and red pigmentation in selenium poisoning, whether accidental, suicidal, or criminal, may lead to an early diagnosis.

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