

## 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.<sup>1</sup> 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,<sup>2</sup> and gastrointestinal symptoms have been reported among people living in highly seleniferous areas such as South Dakota and Nebraska in the United States.<sup>3</sup> Selenium deficiency may cause symptoms similar to those in toxicity and is responsible for Keshan disease, which is prevalent in China.<sup>4</sup>

The effects of chronic occupational exposure are well documented.<sup>4-7</sup> 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.<sup>8-15</sup> 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,<sup>8</sup> 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.

- 1 Stadtman TC. Biological function of selenium. *Nutr Rev* 1977;35:161-6.
- 2 Narr JR, Muth OH. Selenium poisoning in domestic animals and its relationship to man. *Clinical Toxicology* 1972;5:175.
- 3 Anonymous. Selenium poisoning. *Br Med J* 1973;iv:44.
- 4 Keshan Disease Research Group. Observations on effect of sodium selenite in prevention of Keshan disease. *Chin Med J [Engl]* 1979;92:471.

- 5 Lemby RE, Merryman MP. Selenium poisoning in the human. *Lancet* 1941;iii:435.
- 6 Bonard EC, Koranik O. Intoxication aigue par vapeurs d'hydrogene selenec. *Praxis* 1958;22:533.
- 7 Buchan RF. Industrial selenosis. *Occupational Medicine* 1947;3:439.
- 8 Köppel C, Baudisch H, Beyer K-H, Klöppel I, Schneider B. Fatal poisoning with selenium dioxide. *Clinical Toxicology* 1986;24:21-35.
- 9 Civil CDS, McDonald MJA. Acute selenium poisoning. *N Z Med J* 1978;87:354.
- 10 Carter RF. Acute selenium poisoning. *Med J Aust* 1966;1:525.
- 11 Wirth W, Hecht G, Gloxhuber C. *Toxicologie*. Stuttgart: Thieme, 1981:87.
- 12 Siokis LJ, Guthrie K, Pentel PR. Acute selenium poisoning. *Vet Hum Toxicol* 1980;22:364.
- 13 Schellmann B, Raithel HJ, Schaller KH. Acute fatal selenium poisoning. *Arch Toxicol* 1986;59:61-3.
- 14 Nantel AJ, Brown M, Deny P, Lefebvre M. Acute poisoning by selenious acid. *Vet Hum Toxicol* 1985;27:531-3.
- 15 Hunter D. *Diseases of occupation*. 4th ed. London: English University Press, 1969.

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## BOOKS RECEIVED

### Dermatology

*Clinical Dermatology*. "Cutaneous Investigation in Health and Disease: Noninvasive Methods and Instrumentation." Ed J-L Leveque. Series editor A R Shalita. (Pp xxi + 439; figs; \$150.) New York: Dekker, 1989. ISBN 0-8247-7967-3.

*Problems in Dermatologic Diagnosis & Management*. Ed W Clark Lambert. (Pp xxv + 311; colour plates; price not stated.) Illinois: American Academy of Dermatology, 1988.

### Environmental and public health

*Problems and Solutions in Radiation Protection*. J E Turner, J S Bogard, J B Hunt, T A Rhea. (Pp xi + 301; figs; £13.50 paperback.) New York: Pergamon Press, 1988. ISBN 0-08-035552-8.

### Family planning

*The Pill Protection Plan*. G Martlew, S Silver. (Pp 160; figs; £2.99 paperback.) Wellingborough: Grapevine, 1989. ISBN 0-7225-1738-6.

### General practice

*The Royal College of General Practitioners*. Occasional Paper 42. "The Contribution of Academic General Practice to Undergraduate Medical Education." R C Fraser, E Preston-Whyte. (Pp viii + 40; £6.50 paperback, including postage.) London: Royal College of General Practitioners, 1988. Available from Central Sales Office, RCGP, 14 Princes Gate, London SW7 1PU. ISBN 850-841-39-9.

### Immunology

*Macmillan Dictionary of Immunology*. F S Rosen, L Steiner, E Unanue. (Pp xii + 223; figs; £9.95 paperback.) London: Macmillan, 1989. ISBN 0-333-39248-5.

*Reviews on Immunoassay Technology*. Vol 1. Ed S B Pal. (Pp ix + 238; figs; £40.) London: Macmillan, 1988. ISBN 0-333-45285-2.

*Reviews on Immunoassay Technology*. Vol 2. Ed S B Pal. (Pp xix + 204; figs; £40.) London: Macmillan, 1988. ISBN 0-333-46849-X.

### Infection

*Hydrocephalus Shunt Infections*. R Bayston. (Pp ix + 160; figs; £22.50.) London: Chapman and Hall, 1989. ISBN 0-412-31240-9.

### Intensive care

*Intensive Care: Facing the Critical Choices*. T A Raffin, J N Shurkin, W Sinkler III. (Pp viii + 210; figs; £11.95.) New York: Freeman, 1988. ISBN 0-7167-1970-3.

### Medicolegal

*Law and Medicine*. Ed T W Bennett,

D J Devine, D B Hutchison, et al. (Pp x + 233; R85 paperback, R97.70 by post.) Cape Town: Juta, 1988. ISBN 0-7021-2202-5.

### Nephrology

*Developments in Nephrology*. Vol 21. "Renal Transplantation: Sense and Sensitization." Ed S M Gore, B A Bradley. (Pp xxii + 311; figs; £63.) Strasbourg: Council of Europe/Dordrecht: Kluwer, 1988. Distributed by MTP Press. ISBN 0-89838-370-6.

*Developments in Nephrology*. Vol 22. "The Kidney in Plasma Cell Dyscrasias." Ed L Minetti, G D'Amico, C Ponticelli. (Pp x + 303; figs; £60.95.) Dordrecht: Kluwer, 1988. Distributed by MTP Press. ISBN 0-89838-385-4.

### Neurology

*Current Problems in Epilepsy*. 6. "Anatomy of Epileptogenesis." Ed B S Meldrum, J A Ferrendelli, H G Wieser. (Pp vii + 187; figs; £24.) London: Libbey, 1988. ISBN 0-86196-155-2.

*Current Research in Alzheimer Therapy: Cholinesterase Inhibitors*. Ed E Giacobini, R Becker. (Pp vi + 366; figs; £28.) New York: Taylor and Francis, 1988. ISBN 0-8448-1555-1.

### Nutrition

*What to Eat When You're Expecting*. A Eisenberg, H Murkoff, S Hathaway. (Pp 331; £5.99 paperback.) Wellingborough: Thorsons, 1989. ISBN 0-7225-1634-7.

### Oncology

*Atlas of Cancer Incidence in the Nordic Countries. A Collaborative Study of the Five Nordic Cancer Registries*. O M Jensen, B Carstensen, E Glatte, et al. (Pp 206; figs; £47.) Helsinki: The Cancer Societies of Denmark, Finland, Iceland, Norway and Sweden, 1988. ISBN 952-90010-8-8.

*Cancer Growth and Progression*. Vol 1. "Fundamental Aspects of Cancer." Ed R H Goldfarb. Series editor H E Kaiser. (Pp x + 211; figs; £59.95.) Dordrecht: Kluwer, 1988. Distributed by MTP Press. ISBN 0-89838-990-9.

*Cancer Growth and Progression*. Vol 2. "Mechanisms of Carcinogenesis." Ed E K Weisburger. Series editor H E Kaiser. (Pp x + 199; figs; £59.95.) Dordrecht: Kluwer, 1988. Distributed by MTP Press. ISBN 0-89838-991-7.

*Cancer Growth and Progression*. Vol 3. "Influence of Tumor Development on the Host." Ed L A Liotta. Series editor H E Kaiser. (Pp x + 240; figs; £59.95.) Dordrecht: Kluwer, 1988. Distributed by MTP Press. ISBN 0-89838-992-5.

*Cancer Growth and Progression*. Vol 4. "Influence of the Host on Tumor Development." Ed R B Herberman. Series editor H E Kaiser. (Pp x + 191;

figs; £59.95.) Dordrecht: Kluwer, 1988. Distributed by MTP Press. ISBN 0-89838-993-3.

*Cancer Growth and Progression*. Vol 5. "Comparative Aspects of Tumor Development." Volume and series editor H E Kaiser. (Pp x + 259; figs; £59.95.) Dordrecht: Kluwer, 1988. Distributed by MTP Press. ISBN 0-89838-994-1.

*Cancer Treatment and Research*. "Cancer Chemotherapy: Concepts, Clinical Investigations and Therapeutic Advances." Ed F M Muggia. Series editor W L McGuire. (Pp xii + 238; figs; £50.95.) Boston: Kluwer, 1989. Distributed by MTP Press. ISBN 0-89838-381-1.

*IARC Scientific Publications*. No 92. "Cell Differentiation, Genes and Cancer." Ed T Kakunaga, T Sugimura, L Tomatis, H Yamasaki. (Pp x + 203; figs; £25 paperback.) Lyon: International Agency for Research on Cancer, 1988. Distributed by Oxford University Press. ISBN 92-832-1192-8.

*Nutrition and Cancer Prevention. Investigating the Role of Micronutrients*. Ed T E Moon, M S Micozzi. (Pp xiv + 588; figs; £179.50.) New York: Dekker, 1989. ISBN 0-8247-7993-2.

### Ophthalmology

*Ophthalmic Surgical Procedures*. P S Hersh. (Pp xii + 416; figs; £45.) Boston: Little Brown, 1989. Distributed by Churchill Livingstone. ISBN 0-316-35865-7.

### Orthopaedics

*Rofacial Orthopedics with the Function Regulator*. R Fränkel, C Fränkel. (Pp 219; figs; £27.30.) Basel: Karger, 1989. Distributed by John Wiley and Sons. ISBN 3-8055-4697-1.

*Pocket Reference Series*. "Orthopaedics." P G Stableforth. (Pp viii + 223; figs; £14.95 paperback.) Tunbridge Wells: Castle House, 1988. ISBN 0-7194-0131-3.

*Prosthetic Ligament Reconstruction of the Knee*. Ed M J Friedman, R D Ferkel. (Pp xvi + 218; figs; £40.) Philadelphia: Saunders, 1988. Distributed by Harcourt Brace Jovanovich. ISBN 0-7216-2559-2.

### Orthopaedics

*Total Hip Arthroplasty*. R E Booth, Jr, R A Balderston, R H Rothman. (Pp vi + 310; figs; £48.50.) Philadelphia: Saunders, 1988. Distributed by Harcourt Brace Jovanovich. ISBN 0-03-013328-9.

### Paediatrics

*A Colour Atlas of Muscle Disorders in Childhood*. V Dubowitz. (Pp 182; figs and colour plates; £40.) London: Wolfe Medical, 1989. ISBN 0-7234-0811-4.

### Pathology

*A Colour Atlas of Multiple Sclerosis & Other Myelin Disorders*. C W M Adams. (Pp 231; figs; colour plates; £55.) London: Wolfe Medical, 1989. ISBN 0-7234-0952-8.

### Pharmacology

*Radiopharmacy and Radiopharmacology Yearbook 3*. Ed P H Cox, Managing editor C M King. (Pp xi + 347; figs; £145 paperback.) New York: Gordon and Breach, 1988. ISBN 2-88124-670-2.

### Pharmacology—clinical

*Therapeutic Risk: Perception, Measurement, Management*. Ed D Burley, W H W Inman. (Pp xii + 103; figs; £10.50 paperback.) Chichester: Wiley, 1988. ISBN 0-471-91752-4.

### Psychiatry

*Family Games: General Models of Psychotic Processes in the Family*. M S Palazzoli, S Cirillo, M Selvini, A M Sorrento. (Pp xvii + 285; figs; £14.95 paperback.) London: Karnac, 1989. ISBN 0-946439-53-2.

### Psychology

*Macmillan Dictionary of Psychology*. S Sutherland. (Pp ix + 491; figs; £29.95.) London: Macmillan, 1989. ISBN 0-333-38829-1.

### Radiology

*Magnetic Resonance Imaging of the Spine*. M T Modic, T J Masaryk, J S Ross. (Pp xiii + 280; figs; colour plates; £64.) Chicago: Year Book Medical Publishers, 1989. Distributed by Wolfe Medical Publications. ISBN 0-8151-5956-0.

*MRI Atlas of the Abdomen*. R Weissleder, D D Stark. (Pp viii + 200; figs; £65.) London: Dunitz, 1989. ISBN 0-948269-45-6.

*MRI Atlas of the Musculoskeletal System*. L W Bassett, R H Gold, L L Seeger. (Pp viii + 415; figs; £79.95.) London: Dunitz, 1989. ISBN 0-948269-43-X.

### Respiratory medicine

*Lung Biology in Health and Disease*. Vol 39. "Comparative Pulmonary Physiology: Current Concepts." Ed S C Wood. Executive editor C Lenfant. (Pp xxvi + 854; figs; £180.) New York: Dekker, 1989. ISBN 0-8247-7961-4.

### Sports medicine

*Medicine and Sport Science*. Vol 28. "China's Sport Medicine." Ed Qu Mianyu, Yu Changlong. Series editors M Hebbelinck, R J Shephard. (Pp viii + 120; figs; £45.) Basel: Karger, 1988. Distributed by John Wiley and Sons. ISBN 3-8055-4806-0.

*Medicine and Sport Science*. Vol 29. "Normalities and Abnormalities in Human Movement." Ed B Kirkcaldy. Series editors M Hebbelinck, R J Shephard. (Pp xiv + 212; figs; £77.80.) Basel: Karger, 1989. ISBN 3-8055-4823-0.

### Surgery

*Amputation Surgery and Lower Limb Prosthetics*. Ed G Murdoch, R G Donovan. (Pp xxi + 470; figs; £49.50.) Oxford: Blackwell Scientific, 1988. ISBN 0-632-01711-2.

*Surgery for General Practitioners*. B A Maurice. (Pp viii + 257; figs; £15 paperback.) Tunbridge Wells: Castle House, 1989. ISBN 0-7194-0136-4.

### Terminal care

*The Lisa Sainsbury Foundation Series*. "Loss and Bereavement." B Cook, S G Phillips. Series editors V Darling, P Clench. (Pp viii + 90; £6.50 paperback.) London: Austen Cornish, 1988. Available from The Lisa Sainsbury Foundation, 8-10 Crown Hill, Croydon, Surrey CR0 1RY. ISBN 1-870065-06-9.

### Tropical medicine

*Malaria: Principles and Practice of Malariology*. In two volumes. Ed W H Wernsdorfer, Sir I McGregor. (Pp xxx + 1818; index; figs; £195 set.) Edinburgh: Churchill Livingstone, 1988. ISBN 0-443-02417-0.

### Miscellaneous

*Care of the Wounded in Vietnam*. R M Hardaway. (Pp xii + 232; figs; paperback, price not stated.) Kansas: Sunflower University Press, 1988. ISBN 0-89745-106-6.

*Computer Presentation of Data in Science*. D Simmonds, L Reynolds. (Pp xiv + 178; figs; £29.50.) Dordrecht: Kluwer, 1988. ISBN 0-89838-415-X.

*Disabling Diseases: Physical, Environmental and Psychosocial Management*. Ed A Frank, P Maguire. (Pp x + 277; figs; £14.95 paperback.) Oxford: Heinemann Medical, 1988. ISBN 0-433-00057-0.

*Ellis Horwood Books in Information Technology*. "Smart Cards: Principles, Practice, Applications." R Bright. General Editor J M M Pinkerton. (Pp 173; figs; £24.95.) Chichester: Ellis Horwood, 1988. Distributed by John Wiley and Sons. ISBN 0-7458-0374-1.

*Handbook of Medical English Usage*. S Merne. (Pp xiv + 241; £12.95 paperback.) London: Heinemann, 1988. ISBN 0-433-21250-0.

*Imprisonment Today: Current Issues in the Prison Debate*. Ed S Backett, J McNeill, A Yellowless. (Pp ix + 204; £29.50.) London: Macmillan, 1989. ISBN 0-333-42195-7.