

ACCIDENTAL SUBCUTANEOUS INJECTION OF ELEMENTAL MERCURY A CASE REPORT

C. MAYNOU¹, M. MATHIEU-NOLF², H. MESTDAGH¹, G. GILLAS-BURON²

Subcutaneous injection of elemental mercury is a very rare situation. The authors report the case of a 31-year-old man who accidentally injected an unknown quantity of metallic mercury into his left forearm. Several surgical procedures were required to reduce the blood and urinary levels of mercury. However, the patient never developed clinical signs of chronic poisoning.

This observation confirms the lower risk of acute or chronic poisoning in subcutaneous injection of mercury and the need for early excision of contaminated tissue.

Key words : mercury ; intoxication.

Mots-clés : mercure ; intoxication.

INTRODUCTION

Metallic mercury is used principally in the chemical industry as a constituent of electrical devices or in the manufacture of accurate measuring devices (manometers, densitometers, barometers). It is also a component of dental amalgam, and its toxicity in this indication has recently been the subject of much debate.

In the professional setting, mercury is mainly absorbed by the ventilatory system, by inhalation of the vapor produced at room temperature. Subcutaneous injection of elemental mercury is very rare, although it may be injected voluntarily during attempted suicide, as part of drug addiction, or in patients with psychiatric disease. It is more often accidental, when a thermometer or other device containing mercury breaks and cuts the skin.

CASE REPORT

A 31-year-old man, whose job involves installing electric meters, accidentally injected an unknown quantity of metallic mercury into the anterior part of his left forearm. He came to the emergency room of the hospital 48 hours later because of inflammation and swelling of his forearm and a fever of 38.3°C. Initial surgical excision of the involved tissue removed a large quantity of mercury (figs. 1, 2, 3). Although no bacteria were isolated, he was started on a broad-spectrum antibiotic.

At this stage, only the liver function tests were altered, with a moderate increase in the transaminases and the gamma-glutamyl-transpeptidase, but the rest of the laboratory tests (full blood count, electrolytes, urea, creatinine and liver function tests) were completely normal.

The xray showed a tract of mercury, which followed the course of the deep humeral pedicle as far as the axilla.

Because of the persistently high levels of blood and urinary mercury, a second operation was performed on day 16. A large lymphatic network was removed, which adhered to the radial nerve as far

¹ Department of Orthopedic Surgery A, Hospital R. Salengro, 59037 Lille, France.

² Department of Toxicology, University Hospital, 59037 Lille, France.

Correspondence and reprints : C. Maynou , Department of Orthopedic Surgery A, University Hospital, 59037 Lille, France.



Fig. 1, 2, 3. — Mercury diffusion in the upper limb before surgical excision.

as the lower border of the tendon of the pectoralis major.

Histologic examination showed acute inflammatory changes, with an intense histiocytic reaction within the lymphatic canal. The extensive neurolysis of the radial nerve was complicated by sensory

and motor paralysis. Electromyography showed severe axonal degeneration.

Apart from involvement of the radial nerve, neurological examination did not disclose any other signs of mercury poisoning. In addition, otoscopic examination was normal, but an audiogram

showed preexisting mixed deafness, which was not related to the mercury injection. A neuro-ophthalmological examination, including testing of the visual acuity, eye movements and visual evoked potentials, was normal.

Since the blood and urinary mercury levels stabilized and there was no clinical symptomatology, it was decided that no further surgery was needed to remove the remaining mercury deposits in the axilla and forearm.

Ten months after the injection, the patient complained of tingling in his eyes together with morning headaches. His family noted that he had difficulty copying down numbers. A further electromyogram showed no signs of polyneuropathy, and confirmed that there had been an excellent recovery of the radial paralysis. Twenty months after the accident, a sudden rise in the blood and urinary mercury levels meant that further evacuation of the remaining mercury had to be performed. Because of the skin infiltration of the forearm, a large amount of skin had to be excised. Removal of the deposits at the axilla was extremely difficult because of adhesions to the nerves and blood vessels, and was once again complicated by a sensory-

motor deficit of the left radial, ulnar and median nerves.

Thanks to this final operation, practically all of the remaining mercury was removed and the blood levels of mercury dropped.

After 45 months of follow-up, there was a complete neurological recovery of the left arm, the blood and urinary levels of mercury had returned to normal, and the patient did not have any further signs of systemic poisoning. He had returned to his professional and sports (football) activities at the previous level.

DISCUSSION

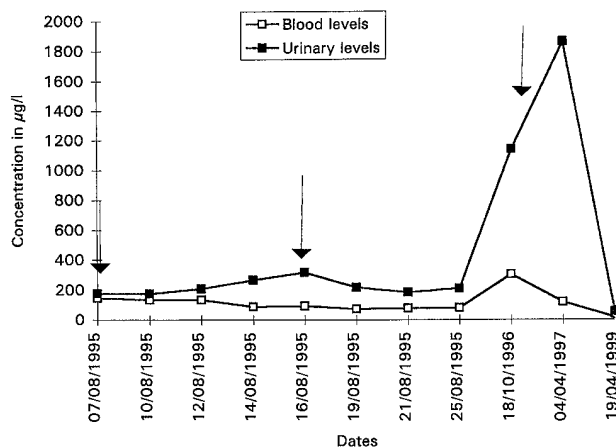
Mercury is a liquid at room temperature, and can thus be injected easily. After it enters the body, mercury is transported towards the liver, the kidneys and the brain, where it is rapidly oxidized into divalent mercury ions, which can bind to the thiol groups of the enzyme systems, causing tissue lesions.

If mercury is absorbed cutaneously, subcutaneously or intravenously, it mainly accumulates in the kidneys. When there is exposure to metallic mercury vapor, a large part of it passes the blood-brain barrier and remains in the nervous system before being oxidized. Divalent mercury ions can cross the blood-brain barrier, and so cannot be exchanged using chelation treatment.

Subcutaneous injection of mercury is accompanied by an intense local inflammatory reaction, which leads to the formation of a granuloma (13) or an abscess, which is frequently sterile. This inflammatory reaction may sometimes occur several weeks or months after the injection (2, 10). It may sometimes be responsible for systemic poisoning, since the mercury rarely stays exclusively subcutaneous.

When a subcutaneous injection occurs, there are generally no clinical signs of acute systemic poisoning (4, 13), although rare cases have been reported by Fichte *et al.* (3) and by Johnson and Koumides (6), in which acute renal failure or acute respiratory distress occurred. Pulmonary emboli of mercury are only seen when it is injected intravenously (4, 6, 11, 15).

Diagram showing variation of blood and urinary levels



Normal values for our laboratory
 Blood concentration < 10 µg/l
 Urinary concentration < 5 µg/l
 Arrows ; Times of surgery.

However, it is difficult to know in advance whether chronic poisoning will develop (1, 9), so prolonged clinical and biochemical monitoring is necessary. Schwarz *et al.* (12) described a case of a patient who developed amyotrophic lateral sclerosis 3 years after injuring his hand with a thermometer. This clinical monitoring screens for involvement of the central nervous system, which may produce trembling of the fingers, behavioral disorders or a reduction in psychomotor performance.

After subcutaneous injection of mercury, biochemical tests are usually only slightly altered. A moderate increase in the white blood cells (9, 14), or a slight increase in the liver enzymes may be seen. Renal failure is rare, but should always be suspected (3). In cases of chronic poisoning, there is no correlation between the urinary mercury levels and the severity of the symptoms. Some authors have observed very high levels of mercury in the blood and urine, without any sign of systemic poisoning (5, 7, 8). In fact, prolonged urinary excretion of mercury is always observed, because of a gradual build-up of mercury in the kidneys. The level of mercury in the blood is mainly of diagnostic value. However, urinary levels of mercury are useful to judge the efficacy of chelation treatment, and over the long term to screen for chronic poisoning. Subcutaneous injection requires early extensive excision of the contaminated tissue, preferably under xray guidance. This excision is often sufficient to make the blood and urinary levels of mercury drop (5, 8). Clinical and biochemical monitoring is however required for several years (2). The role of chelation in the treatment of mercury poisoning is controversial. It is only logical to use it if there are signs of systemic poisoning, and it is more often used in cases of intravenous injection, than after subcutaneous injection. Similarly, hemodialysis is only justified if renal failure with anuria occurs.

In our case, the delay in deciding on the treatment allowed the mercury to migrate to the lymphatic system, and several operations were required before the mercury levels returned to normal. Despite that, no signs of systemic poisoning were observed. However, the delay in performing these operations allowed chronic inflammatory changes

to occur, which made excision more difficult. This could have been avoided if the surgery had been performed earlier.

This observation confirms the need for early wide excision of contaminated tissue around the site of injection. This is usually enough to reduce the blood levels of mercury. Reduction in the urinary levels is seen much later. When there is no systemic spread, the risk of acute poisoning is low, but prolonged clinical and biochemical monitoring is essential to screen for chronic poisoning.

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SAMENVATTING

C. MAYNOU, M. MATHIEU-NOLF, H. MESTDAGH, G. GILLAS-BURON. Accidentale subcutane kwikinjectie.

Subcutane injectie van elementair kwik is zeldzaam. De auteurs beschrijven een man van 31 jaar, met zo'n injectie in de linker onderarm. Verschillende operaties waren noodzakelijk om zijn kwikgehalte in bloed en urine te doen verlagen. Echter was er op geen enkel ogenblik een klinisch teken van kwik intoxicatie. Deze casus bewijst het lage risico voor acute en chronische intoxicatie na subcutane injectie in de nood voor vroegtijdige excisie van gecontamineerd weefsel.

RÉSUMÉ

C. MAYNOU, M. MATHIEU-NOLF, H. MESTDAGH, G. GILLAS-BURON. Injection sous-cutanée accidentelle de mercure : présentation d'un cas.

L'injection sous-cutanée de mercure est un accident rarement rencontré. Les auteurs présentent le cas d'un homme de 31 ans qui s'est accidentellement injecté une quantité inconnue de mercure métallique au niveau de l'avant-bras gauche. Plusieurs opérations ont été nécessaires pour abaisser les taux sanguin et urinaire de mercure. Le patient n'a cependant jamais développé de signes cliniques d'empoisonnement chronique au mercure. Cette observation confirme le faible risque d'empoisonnement aigu ou chronique en cas d'injection sous-cutanée de mercure, ainsi que la nécessité d'une excision précoce des tissus contaminés.