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Non-Job Related Increased Urinary Excretion of Mercury

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Summary. Increase in urinary excretion of mercury and increase in blood concentration following the use of mercury based drugs has been checked by a limited volunteer study.

Key words: Phenylmercury – Hg-drug – Mucosal absorption.

In the course of an epidemiological survey of workers exposed to mercury vapour we found that one non-exposed (control) subject had a slightly elevated mercury concentration in urine (Hg-U : 15.6 μg/g creatinine) and in blood (Hg-B : 2.18 μg/100 ml) by comparison with usual values found in non-exposed (control workers) (range Hg-U : 0.9 – 3.3 μg/g creatinine : range Hg-B = 1.0 – 2.7 μg/100 ml).

A repetition of the urine analysis the following day confirmed our original finding. Survey of the work place and enquiry about extra-professional activities and dietary habits of this worker did not reveal any source of environmental exposure to mercury. Other potential sources of exposure were thus searched for. Some cosmetics and drugs contain mercury. It has been demonstrated that cutaneous absorption of mercury occurs following skin application of mercury containing ointments or solutions (Barr et al., 1973; Marzulli and Brown, 1972; Silverberg, 1968; Silverberg et al., 1967) and during the routine use of soap containing phenylmercury derivatives (Valloton and Lob, 1973; Peters-Haefeli et al., 1976). However the subject denies skin application of any pharmaceutical preparation containing mercury presently available in Belgium. Furthermore analysis of the soap he usely utilized did not reveal the presence of mercury. A follow-up of the concentration of mercury in urine collected from this worker demonstrated a progressive decline of the amount of mercury excreted (Fig. 1). This suggested that an acute exposure was probably responsible for our initial finding. Mercury is also used as an antiinfectious agent in gargle and mouth-wash. The subject was thus questioned about the occurrence of a recent throat or mouth infection. He recalled having had a pharyngitis about three weeks before the first urine analysis,

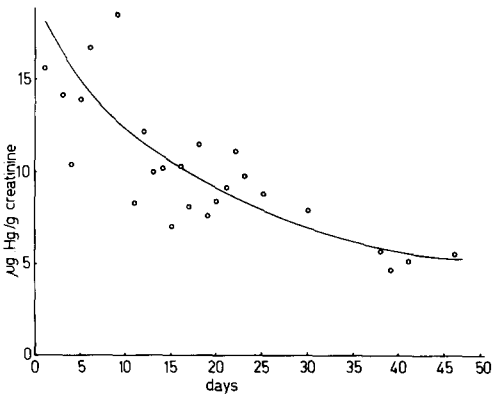

Fig. 1. Follow-up of urinary concentrations of mercury in the non-occupationally exposed subject with increased urinary mercury concentration

which he treated by gargling with Hydro-Merfen (a mercury based desinfectant solution containing 2 mg phenylmercury-borate per ml water which is diluted 20 times with water before the local treatment). He applied this treatment 3 or 4 times a day for 3 days. The use of this pharmaceutical preparation was thus suspected of being responsible of the slight elevated urinary mercury concentration found in this subject during the survey. Indeed it is known that arylmercury derivatives are readily absorbed by all routes. On the contrary to alkyl derivatives they release easily inorganic mercury *in vivo* which is stored in the kidney and is partially excreted in urine.

A limited volunteer study (8 adult male subjects) was thus undertaken to evaluate the extend of urinary excretion of mercury following its use for throat desinfection: Phenylmercuryborate (under the trade name Merfen-Zyma-Galen) is commercialized in two forms for the treatment of mouth or throat infection : a concentrated aqueous solution at 2 mg/ml to be diluted 20 times before use and lozenges to suck at 0.3 mg per tablet. These preparations can be purchased in pharmacies without medical prescription. The design of our volunteer study was the following : 3 subjects gargled once with 200 ml of the diluted Hydro Merfen solution (0.2 mg phenylmercuryborate per ml), 3 subjects gargled twice with 24 h – interval between each treatment and 2 subjects sucked 5 tablets (Merfen lozenges) (0.3 mg phenylmercuryborate per lozenge) one every hour. Urine and blood were regularly collected up to 65 days after the start of the experiment and their mercury content was determined. For practical reasons it was only possible to collect spot samples. In order to evaluate whether this acute exposure to mercury could already influence renal functions, the following biological determinations were also performed before and 24 and 48 h after treatment : total proteins and aminoacids in urine, albumin, β_2-microglobulin and creatinine concentration in plasma and urine. The methods of analysis have been described previously (Bernard et al., 1976).

The evolution of the concentration of mercury in blood and in urine in each volunteer is shown in Fig. 2. It demonstrates that the use of these mercury based drugs is associated with a marked increase in urinary excretion of mercury (up to 50 times) and a slight increase in blood concentration (up to 6 times). The absorption of mercury is

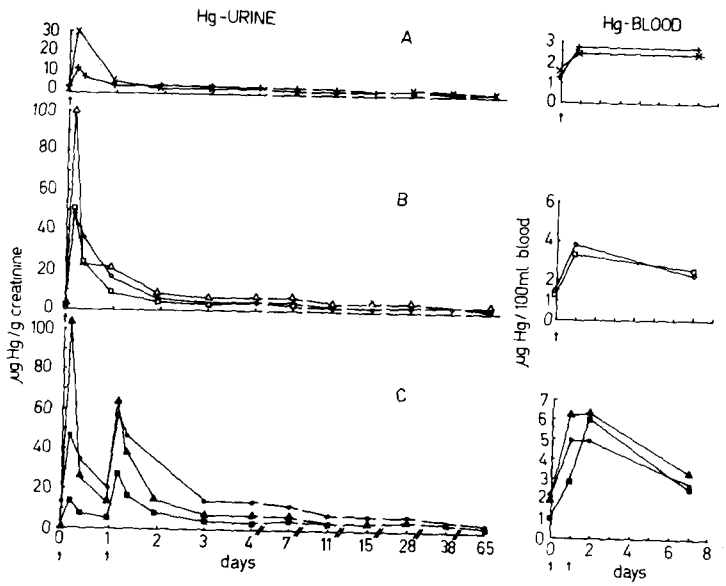

Fig. 2. Blood and urine concentrations of mercury in 8 adult male volunteers following the use of phenylmercury borate containing gargle or tablets. **A** Use of 5 tablets (0.3 mg phenylmercuryborate per tablet; one every hour). **B** Use of a 200 ml gargle solution (0.2 mg phenylmercuryborate per ml). **C** Use of two 200 ml gargle solutions at 24 h-interval. – The arrows indicate the start of the treatment

rapid since the highest urine concentration was found in the first sample collected 4 h after gargling. We did not find any significant change in the other biological parameters determined in blood (β_2 microglobulin, albumin, creatinine) and in urine (total protein, amino acids, albumin, β_2 microglobulin) which suggests that this acute absorption of mercury did not cause any kidney impairment. The highest urinary concentration of mercury found in two volunteers was about 100 μg/g creatinine. According to Bell et al. (1973) this concentration corresponds approximately to the concentration found in workers exposed for 7–8 h to 100 $\mu g/m^3$ mercury vapor (twice the current ACGIH Threshold limit value).

Higher values would certainly have been found if more than one gargle had been applied during the same day which is probably the case in practice.

Since self treatment of sore throat with mercury based preparation is probably not exceptional, the occupational physician may sometimes be confronted with similar cases and thus draw false conclusions about the intensity of occupational exposure if he does not inquire about the possible use of mercury containing drugs.

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