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Mercury Injection by an Adult Female

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Abstract: A case of subcutaneous injection of elemental mercury (Hg) by an adult white female in Gauteng, South Africa is described. The patient had been injecting Hg directly into her breast tissue. The exact quantity of injected Hg and the time period of exposure was unknown. First line of therapy was the surgical removal of the Hg droplets from the breast tissue followed by chelation therapy with 400mg of D-penicillamine given six-hourly over a period of five days. Whole blood samples of the patient were received at the Analytical Services Laboratory of the National Institute for Occupational Health (NIOH) to monitor blood mercury (Bl-Hg) levels. Initial results showed an exponential decrease in Bl-Hg levels after commencement of treatment. By week 18, Hg levels had decreased to 24 µg/L. Further testing needed to be done, however the patient did not present for any future appointments.
Keywords: Elemental mercury poisoning, subcutaneous injection, chelation therapy.

1 Introduction

Several reports in the literature concerning mercury intoxication via subcutaneous injection of elemental Hg have been reported, with only a total of 78 cases that have been reported over a period 1923-2000.[1] Other cases have been reported in the literature.[2,3,4]Due to the apparent rarity of the occurrence, the immediate and long term health effects are uncertain and inconclusive.[1,5] Typical symptoms of mercury poisoning are headaches, numbness and tingling of the peripheries, visual difficulties, loss of hearing, tremor, unsteady gait, skin rash, emotional and cognitive difficulties.[1,6,7,8] The most common local presentation in patients with self-injection of mercury is abscess formation.[9] Symptoms of Hg poisoning are multiple and they can be acute, subacute or chronic.[10] Self-subcutaneous injection of Hg is unusual and normally does not lead to systemic effects.[11]

Blood and breast tissue samples taken from a 30-year-old white adult female, with existing neurological symptomatology, who had been injecting Hg into her breast tissue, were received by the Analytical Services laboratory. Bl-Hg is a useful biomarker after short term and high level exposure. [12] The patient was admitted to a Gauteng Hospital with typical symptoms of Hg poisoning. The exact quantity of injected Hg was unknown. At the time of admission in August 2015, the patient presented with skin lesions.

It was further confirmed that not only did the patient inject the mercury; she also drank it, boiled it in water, and then inhaled the vapour. The mercury was removed surgically from the breast, thereafter, the patient was placed on chelation therapy and her blood mercury levels monitored over a nine-week period. Figure 1. Below, shows the breast tissue sample as received by the Analytical Services Laboratories. Radiology images, (Figures 2 and 3), taken post-surgical evacuation of the mercury, revealed multiple mercury deposits scattered in the breast and chest wall.

Fig. 1: Breast tissue with mercury droplets as received at the Analytical Services Laboratories.

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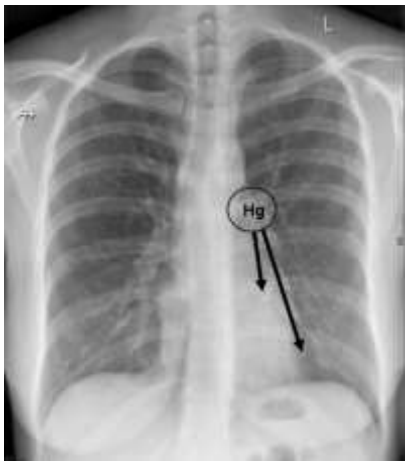

Fig. 2: Radiological image of residual mercury noted in the chest-wall post-surgery.

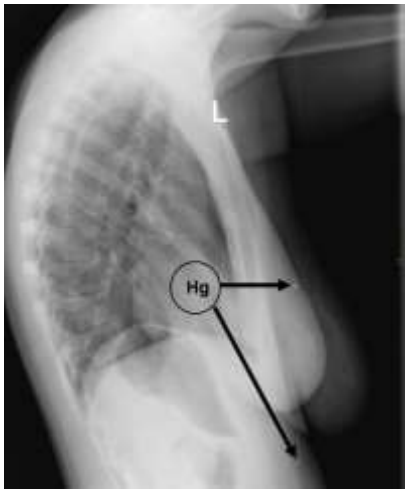

Fig. 3: Radiological image of residual mercury noted in the breast post-surgery.

2 Methods and Materials

Whole blood samples from the patient were received and stored in a fridge (2-8^{o}C). Samples were prepared by wet digestion with a combination of Nitric acid (60%) ultrapur, Hydrogen peroxide (30%) EMSURE® ISO grade, both from Merck according to SANAS accredited method. [13] Digested samples were analysed for mercury using a Perkin Elmer®FIMS 100 (Flow Injection Mercury System).

The following quality controls were used (a) certified reference material, Nycomed Seronorm® Trace Element control in whole blood a lot number 1406264 Level 2 with concentration value of 19.50 µg/L and (b)in-house quality control bloods (QC1 and QC2) spiked with 10µg/mL Perkin Elmer® Mercury Standard to give concentrations of 5 and 18 µg/L respectively. Samples were analysed twice each with 2 replicates. Results were reported in µg/L of blood. A calibration curve (Fig 4) was prepared as given in Table 1.

Table 1: Calibration standards concentration.

Standards	Concentration(µg/L)
Calibration Blank	0
1	2.5
S2	5.0
S3	10.0
S4	15.0
S5	20.0

The analytical range of the method is 2.5 – 20.0 µg/L. Acceptance criteria applied are according to SOP NIOH0338. [14].

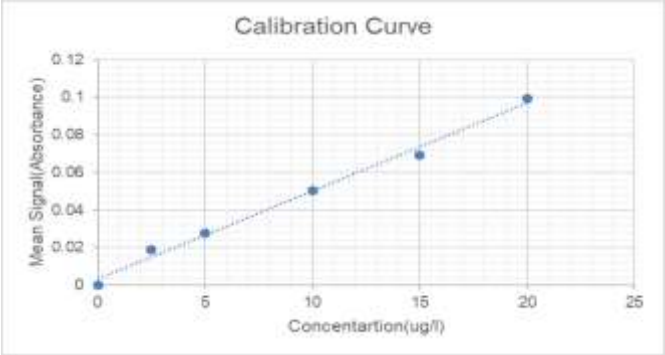

Fig.4: Calibration curve.

The technique used was Cold Vapour Atomic Absorption Spectrometry (CV-AAS). The method had a limit of quantification (LOQ) of 2.5µg/L. An acceptable percentage Relative Standard Deviation (RSD) of 20% at 10 – 100µg/L and 15% at >100µg/L according to SOP NIOH 0338.[14] Analytical Services laboratory participates in the Wadsworth New York Proficiency Testing scheme administered by the New York State Department of Health.

3 Results and Discussion

The levels of Hg (µg/L) in the patient samples are given in Table 2 below.

Table 2: Mercury in patient blood.

Samples	Sampling schedule	Results µg/L
Sample 1	Initial	646.20
Sample 2	1 week	121.20
Sample 3	3 weeks	139.78
Sample 4	9 weeks	51.36
Sample 5	18 weeks	24.61

*Reference levels of Hg for unexposed persons: 2.8µg/L.[15]

The concentration of Hg in all samples was very high relative to the levels of unexposed persons (2.8 µg/L) which is in agreement with exposure to high levels of Hg. The exponential drop in Hg levels (Figure 35) from the initial sample to sample 2 is evidence of the effectiveness of the six-hourly chelation therapy using 400mg of D-penicillamine.

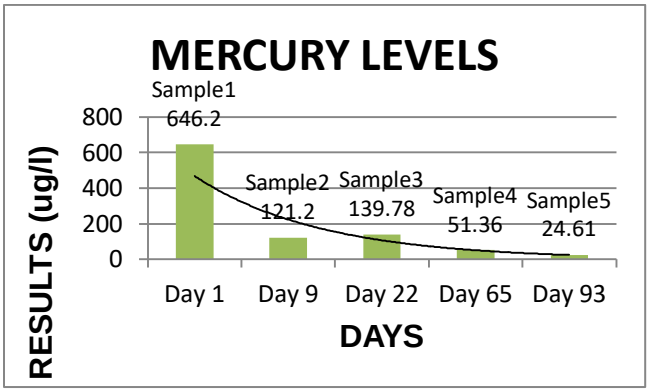

Fig. 5: Mercury levels from baseline initial (baseline) to 18 weeks.

The Hg level at three weeks is slightly higher; this could be due to residual Hg in the tissue of the patient from other compartments leaching into the blood after surgical removal. This effect could be explained by the fact that Hg is lipophilic and therefore will dissolve in fatty tissue and slowly finds its way back into the bloodstream. [12]

The radiological images (Figs 2 and 3) showed radio-dense dots indicative of residual mercury noted in the breast and chest wall. Closer histopathology scrutiny shows minute lung parenchyma suggestive of Hg emboli into the lung fields (Fig 6).

Self-subcutaneous injection of Hg is very rare but well documented. [3, 10, 16, 17, 18] It tends to be attempted by those who are in a suicidal and depressive state or seek to improve sexual or athletic performance. [11] It has also been reportedly used by drug addicts seeking new ways to becoming intoxicated. [1] Self-injection of Hg can also occur in mentally sound people. [10] Surgical intervention followed by chelation therapy has been considered the most effective form of treatment.

This case report has showed that; (1) Surgical removal in conjunction with chelation therapy is very effective in quickly reducing mercury, (2) Forms of exposure can be occupational and non-occupational which includes intentional exposure by self-injection and inhalation of vapours and (3) It has been stated by Caravati *et al*.,[19] that Hg vapour is absorbed more (70-80%) through inhalation. This patient boiled and inhaled Hg as well as intravenous injection, which explains the very high levels of Hg in the blood.

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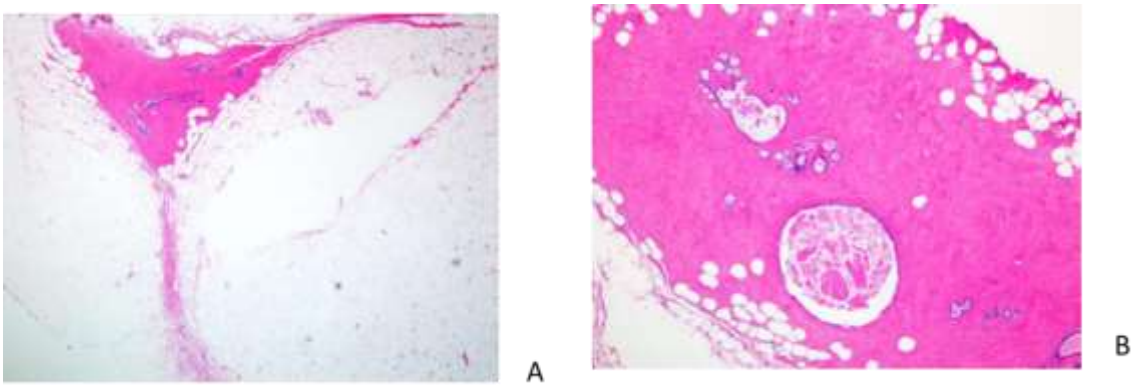

Fig. 6 (A) Microscopy of the left breast biopsy and **(B)** Microscopy of the left breast biopsy, magnified fibrous septae.

4 Conclusions

In this case, surgical removal of elemental Hg from breast tissue, followed by chelation therapy with D-penicillamine was very effective in rapidly decreasing the levels of Hg in the patient's blood. Ideally, prolonged monitoring and patient chemical status is required to prevent early and late reactions of acute and/or chronic Hg intoxication, [1] unfortunately the patient did not present for follow-up appointments.

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Authors Contributions

Boitumelo Kgarebe conceptualised the study and wrote the manuscript; Lerato Mochaki performed data collection, data analysis and wrote the manuscript, Robin Ballantine assisted with results interpretation and writing of the

manuscript, Poobalan Poongavanum assisted with analysis and writing the manuscript and Angela Mawela assisted with analysis and data interpretation. All authors contributed the finalisation of the manuscript.

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Conflict of Interest

None

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