The incidental injection of metallic mercury into soft tissue is a rare event in the general population. Mercury can produce local inflammation, abscesses, granuloma, and membranous fat necrosis. Herein, we report a rare case of soft tissue mercury deposits with imaging findings, including magnetic resonance (MR) imaging findings, located at the mercury droplet deposits which appear as signal voids on all sequences, with surrounding intermediate to high signal intensity on the T2-weighted image.

**Index words**: Mercury
Foreign bodies
Magnetic resonance (MR)
Soft tissue

Mercury is unique in that it is the only metal that is liquid at room temperature. It tends to form perfectly shaped minute spheres when in contact with air or water because of its high surface tension. Due to such a physical property, the injection of mercury into soft tissue produces a characteristic radiographic appearance.

We report a case of mercury foreign bodies within the soft tissue of the arm with imaging findings, including MRI findings.

**Case Report**

A 25-year-old male was referred to the department of orthopedic surgery from an outside hospital due to the presence of foreign bodies in his right upper arm. The foreign bodies were first identified 2 years prior, while serving in the military. The subject claimed to have had no subjective symptoms, except for mild pain in the right upper arm during his tenure in the military. After discharge from military service, the patient visited our hospital to remove the foreign bodies. The radiographs revealed metallic foreign bodies scattered in his right upper arm (Fig. 1A). A physical examination revealed a palpable mass in the lateral aspect of the right upper arm without tenderness or swelling. Upon admission, the patient’s serum mercury level was 14.82 μg/dL (normal level < 0.5 μg/dL). Otherwise, his laboratory exam results were within the normal range, except for a slightly elevated CRP value, as follows: WBC count = 6470, ESR = 9, CRP = 1.09. Despite this finding, the patient denied any history of exposure or self-administration of mercury.

Computed tomography (CT) and MRI were performed to assess the degree of mercury presence. The CT demonstrated two clusters of interspersed, high density foreign bodies in the muscle and periosteal areas of the humerus, with a beam hardening artifact (Fig. 1B).
Fig. 1. A 24-year-old male with soft tissue and periosteal mercury deposits in his right upper arm.

A. Oblique view of the right humerus demonstrates radiodense particles in the soft tissue and periosteal areas.

B. Axial scan on computed tomography shows multiple small radiodense particles scattered in the subcutaneous and periosteal areas.

C-F. Axial T1-weighted (C), T2-weighted (D), contrast enhanced T1-weighted fat suppressed axial (E) sagittal (F) images, mercury deposits are demonstrated as multifocal signal void lesions. For the T2-weighted image, the surrounding intermediate high signal intensity areas are visible. This is probably due to the foreign body reaction and edematous change around the mercury deposits.

G. The gross specimen shows multiple gray and silvery droplets of mercury.

H. A follow-up AP view of the right humerus after surgery shows a decreased bulk of radiodense materials in both the soft tissue and periosteal areas of the right upper arm.
MRI results revealed several dot-like signal voids in the periosteum of the humerus on an axial T1-weighted image (Fig. 1C). The axial T2-weighted image showed intermediate signal intensity lesions surrounding the dot-like signal voids (Fig. 1D). The contrast-enhanced fat saturated T1-weighted image showed fairly intense enhancement (Fig. 1E, F).

Four weeks after the patient’s initial visit, surgical exploration revealed the mercury as small dark silver spheres (Fig. 1G). The histologic specimen revealed the formation of a microabscess and fibrosis with several silvery globules (< 1 mm). Subsequent to the surgical procedure, a follow-up radiograph revealed a decrease in the amount of radiodense particles in both the soft tissue and periosteal areas of the right upper arm (Fig. 1H). The postoperative evaluation found that the patient did not complain of any specific symptoms, except for intermittent pain in his right upper arm.

Discussion

Mercury can be found in household items such as thermometers, barometers, commercial batteries, and fluorescent light bulbs. The subcutaneous or intravenous injection of metallic mercury has been reported as accidental or deliberate. The latter has been described in psychiatric patients, suicide attempts, and in athletes hoping to increase their physical performance (1).

The injection of mercury in soft tissue produces local and systemic effects, which includes local inflammation, abscesses, granulomas, and membranous fat necrosis at local injection sites (2). The systemic absorption of mercury from soft tissue deposits, probably due to vascular or lymphatic spread, has been reported, and has been found to result in elevated blood mercury levels (3). Consistently, our patient also showed elevated blood mercury levels. Once injected, the mercury is converted into mercuric ions, which are then for the most part excreted in the urine, with a half-life of about 60 days (4). However, the continuous release of mercury from the soft tissue deposits causes chronic exposure, as in our case.

In previous reports, the early excision of subcutaneous mercury deposits has been reported to effectively lower blood mercury concentrations (3). Krohn and co-workers suggest that the proper management of subcutaneously injected metallic mercury includes four steps: a) excision of all readily accessible subcutaneous mercury, b) monitoring of the CNS and renal function for evidence of mercurial toxicity, c) chelation therapy when there is such systemic toxicity, and d) psychiatric consultation and treatment when indicated (5).

Histologically, the mercury on hematoxylin and eosin preparations classically appears as spaces with adjacent or intraluminal dark grey to black opaque globules with surrounding microabscesses and granuloma formations (6). For the radiographs and CT, the small mercury globules appeared as numerous small globular metallic opacities (7), which is consistent with our study. A sonographic examination found that the mercury globules appear as multiple small echogenic dots (8).

Monu et al. (9) described the MR imaging findings of soft-tissue granuloma, which are associated with the presence of foreign bodies. The granuloma appeared as a signal voids in an area of high signal intensity on T2-weighted images. These signal voids represent nonmetallic foreign bodies such as wood and plastics. On the contrary, Lee et al. (10) described high signal intensity foreign bodies, surrounded by mild high signal intensity granulomas on T1-weighted images. In this case, the foreign bodies represented oil droplets. In our case, the mercury droplets appeared as small globular signal void lesions for all sequences, similar to the nonmetallic foreign bodies described in the previous report (9). The signal voids are surrounded by an intermediate to high signal intensity area on T2-weighted images with diffuse enhancement on enhanced images. This enhancement indicated the presence of the reaction to foreign bodies in the form of edema, which was proven by histologic specimen, since the mercury is a diamagnetic metal. However, unlike the previously reported cases, no definite soft tissue mass-like lesion, representing the granulomas, were observed in our case (9, 10).

Herein, we report a case of mercury injection in the soft tissue of the upper arm of our patient, which was diagnosed by preoperative imaging [plain radiograph, CT, and MRI], and was attributed to the peculiar appearance of mercury, despite the patient’s denial of mercury exposure.

References


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