J Cutan Pathol 2000: 27: 301–305
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Journal of
Cutaneous Pathology
ISSN 0303-6987

Silicone granuloma on the entry points of acupuncture, venepuncture and surgical needles

We describe a case of epithelioid granuloma on the entry points of needles used for acupuncture, venepuncture and for taking skin biopsy. The acupuncture needles used at each session were silicone coated. Silicon was detected in the vacuoles of macrophages and multiple nucleated giant cells by X-ray microanalysis. To our knowledge, this is the first case of silicone granuloma arising on the entry points of acupuncture, venepuncture and surgical needles.

Yanagihara M, Fujii T, Wakamatu N, Ishizaki H, Takehara T, Nawate K. Silicone granuloma on the entry points of acupuncture, venepuncture and surgical needles.
J Cutan Pathol 2000; 27: 301–305. © Munksgaard 2000.

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Accepted January 30, 2000

There are three forms of silicone (dimethylpolysiloxane) in medical use:[1] silicone oil is used as a coating for needles (hypodermic, surgical, acupuncture, etc.) and syringes. The needles are coated with the silicone oil to decrease the pains when the needles enter the skin by reducing the entry friction. Silicone gels are also used as an implant material in the breast, face, penis, etc. Silicone elastomers are used as heart valves, shunts (ventriculoperitoneal, dialysis, ureteral, etc.), coatings on pacemakers and the shells of breast implantsa.[1,2] Granulomatous reactions following injections of large amount of silicone are well known not only in the breast,[3] but also in the face,[3,4] and penis.[5] However, to our knowledge the reaction following a small amount of injected silicone is unknown. We report silicone granuloma due to silicone coated acupuncture, venepuncture and surgical needles.

Case report

A 55-year-old Japanese woman visited our dermatology office with papules at acupunctured points. About 4 years previously she had acupuncture on her back, hips, neck, legs and arms for her shoulder pain and lumbago for a total of 30 days. She did not notice any skin changes on the acupunctured points at that time. Two months later, she had acupuncture again for the shoulder pain and lumbago over 3 days. About three weeks after the treatment, she noticed papules at the acupunctured points. There was no history of itchness or pain.

Laboratory tests were all within normal limits, including blood cell counts, liver function test, angiotensin converting enzyme, lysozyme, chest X-ray, ^{67}Ga scintigraphy. The Mantoux reaction was negative.

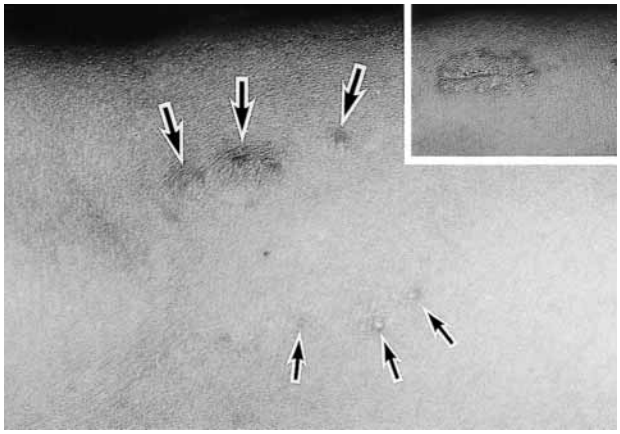

Fig. 1. Many papules were present at the acupuncture (big arrows) and venepuncture (small arrows) points on the right elbow. Inset: after the biopsy of the lesion of the acupuncture points on the elbow, papules appeared at the entry points of the surgical needles.

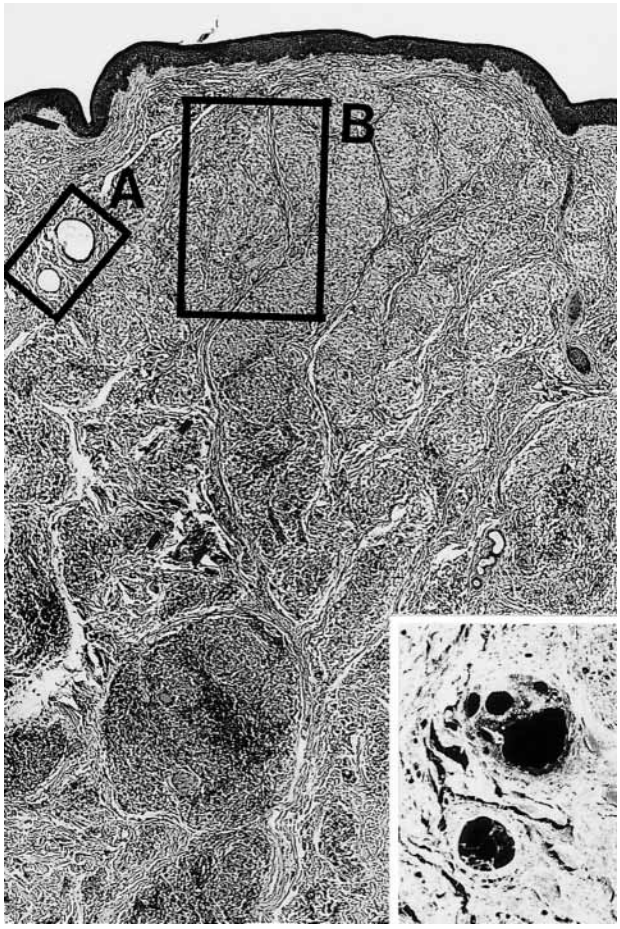

Fig. 2. In the lesion of the acupunctured points the granulomatous nodules are through the dermis and surrounded by strands of fibrotic connective tissue. Two oval cavities lined by histiocytes contain amorphous refractive material (boxed area A). Inset: higher magnification of boxed area (A). Glittering material is seen in the oval cavities under the dark field microscope.

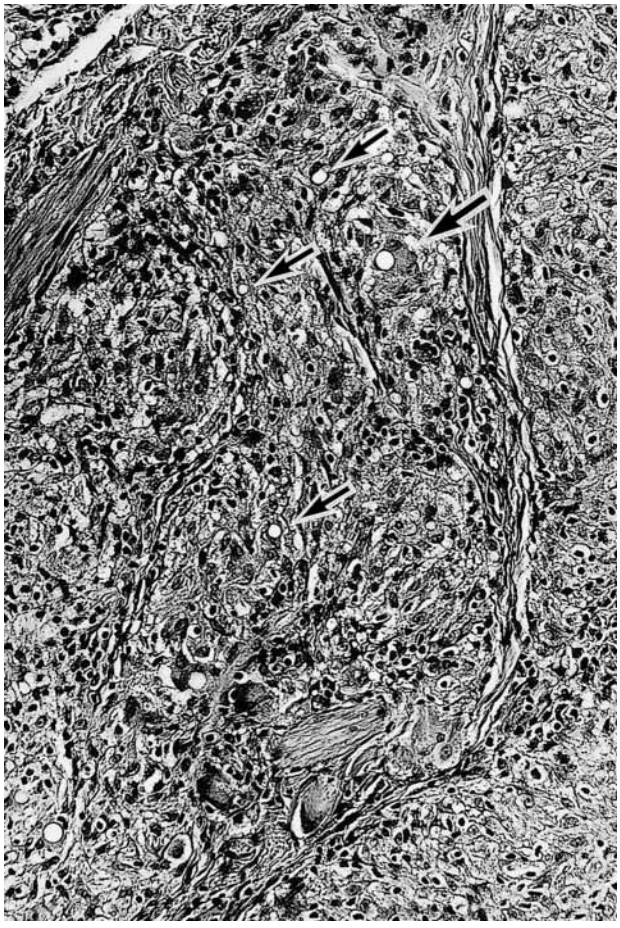

Fig. 3. Higher magnification of boxed area (B) of Fig. 2. Vacuoles are present in the cytoplasm of epithelioid histiocytes (small arrows) and multi-nucleated giant cells (big arrow).

Clinical findings

The miliary to match-head sized, skin-colored to red papules were distributed on her shoulders, back, hips, flexural surface of elbows (Fig. 1) and knees. All the papules erupted at the acupunctured points except on the elbows, where the papules were also present at the venepunctured points from blood tests ordered in a private clinical office before the patients came to our office. The papules on the elbow coalesced, but were separate on the other parts of the body. Not counting the coalesced papules, there were 69. About three weeks after the biopsy from the acupunctured area, red papules appeared on the entry sites of the surgical needle and nylon suture (Fig. 1, inset).

Material and methods

Specimens were taken from the lesion of the acupunctured area, and from the lesion of the venepunctured area. The specimens were examined by light and electron microscopy.

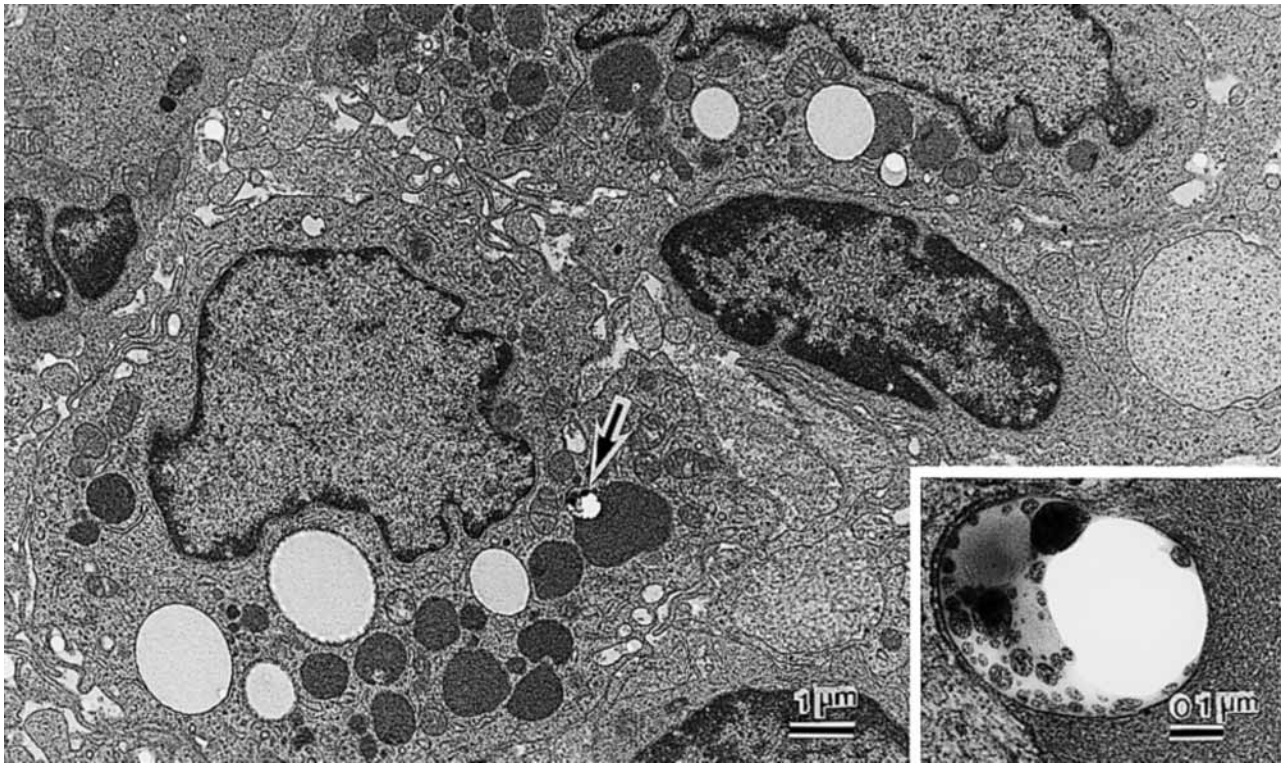

Fig. 4. A macrophage containing many vacuoles with pale homogeneous material (PHM). ×8,500. Inset: higher magnification of the indicated area. PHM in the lysosome contain high density ovoid bodies. The PHM shrinks and the edges detach from the membrane. ×60,000.

Light microscopy

The specimens were fixed in 10% formaldehyde solution and embedded in paraffin. The tissue sections were stained with hematoxylin-eosin (H&E) and examined under a conventional, dark field and polarized light microscope.

Electron microscopy

The specimens were fixed with 2.5% glutaraldehyde buffered with 0.1 M phosphate buffer (pH 7.4) and 1% osmium tetroxide buffered with 0.1 M phosphate buffer (pH 7.4), and embedded in epoxy resin. Ultrathin sections were stained with uranyl acetate and lead citrate and examined under a conventional transmission electron microscope (Jeol 1200EX II). To confirm that the vacuoles in the cytoplasm of macrophages contained silicon, an analytical electron microscope with an energy-dispersive X-ray detector (Tracor Northern TN 200) was used. Thin sections were mounted on 200-mesh copper grids. The microscope settings were as follows: 100 kV accelerating voltage, 2×109A specimen current, a spot size L, and 100 s. counting time. In the spot size L, areas of 40–60 nm^2 were examined under a magnification power of 10,000.

Results

The histopathological findings of the lesions at both the acupunctured and venepunctured areas were similar.

Light microscopy

Granulomatous nodules in the dermis and subcutis were surrounded by strands of fibrous connective tissue (Fig. 2). The nodules were composed of histiocytes, epithelioid histiocytes and multinucleated giant cells surrounded by lymphocytes (Fig. 3). Some of the vacuoles present in the cytoplasm of the epithelioid histiocytes and giant cells were weakly stained by eosin (Fig. 3). Refractive material in the cytoplasm of giant cells appeared pale yellow. Small cystic spaces surrounded by fibrous tissue, histiocytes and giant cells contained the amorphous, refractive and non-staining material. The material glitted under the dark field microscope (Fig. 2, inset) and were not birefringent under the polarized light microscope.

Electron microscopy

Macrophages and multinucleated giant cells had various sized vacuoles in their cytoplasma (Fig. 4). The

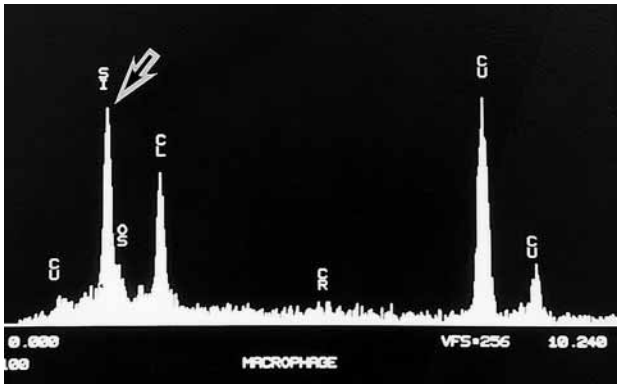

Fig. 5. Analytical electron microscopy of PHM gives a distinct peak indicating silicon (arrow).

vacuoles contained pale homogeneous material (PHM). PHM was encased by a membrane. Variable sized ovoid dense bodies were seen in many PHMs (Fig. 4, inset). Under the electron beam, the PHMs containing the ovoid bodies shrank more readily, and their edges detached more readily from the membrane than PHMs with no bodies (Fig. 4). The mitochondria often contained dense, round granules with a low density core and myelin figures.

X-ray microanalysis of PHM is shown in Fig. 5. Analytical electron microscopy gave a distinct peak that indicated the presence of elemental silicon in the PHM.

According to the manufacturer of the needles, the needles were coated with silicone. The acupuncture and surgical needles were coated with MDX4–419 aminofuctional dimethylsiloxane copolymer (Dow Coring) and venepuncture needles were coated with dimethylpolysiloxane (Terumo). We diagnosed this case as silicone granuloma.

Discussion

In this case, granulomas occurred at entry points of acupuncture, venepuncture and surgical needles. The granulomas were composed of epithelioid cells and multinucleated giant cells resembling sarcoid. The element of silicon was detected in the vacuoles of macrophages by analytical electron microscopy. In most reported cases of silicone granuloma, the granuloma arise after an injection of a large amount of silicone gel. To our knowledge, ours is the first case of silicone granuloma arising on the entry points of acupuncture, venepuncture and surgical needles coated with silicone.

The silicone granuloma histopathologically was a foreign body granuloma, and occasionally contained pale yellow refractable material.[6] The multiple clear spaces of various sizes containing the pale yellow refractable material were surrounded by epithelioid histiocytes and multinucleated giant cells and the clear vesicles were present in their cytoplasma.[6] This material was clearly seen under the dark field microscope[7] and was not birefringent under the polarized light microscope.[6] Asteroid bodies are infrequently seen in the giant cells.[6,8]

Macrophages and multinucleated giant cells had various sized vacuoles in their cytoplasm. The vacuoles contained PHM. Variable sized ovoid dense bodies were seen in many PHMs. Leog ASY[9] reported that PHMs examined by electron microscope showed a characteristic tendency to "burn" in the electron beam. In our case, PHMs with the ovoid dense bodies showed a marked tendency to shrink compared with PHMs without the dense bodies.

Unlike silica, since silicone in silicone granuloma was not birefringent under the polarized light microscope, it is difficult to differentiate it from sarcoid. Therefore in order to make a diagnosis, it may be necessary to know whether the patient has been exposee to silicone for a long time and to histopathologically determine the pale yellow refractable material and the ovoid vacuoles in the cytoplasm of epithelioid histiocytes and giant cells. When elemental silicon is detected in the specimen by X-ray microanalysis, the diagnosis may become easier.

The pathogenesis of silicone granuloma is not clear. It is known that repeated exposure to silicone gel can induce delayed hypersensitivity.[10,11] In our case, the patient did not notice the skin change at the acupunctured points during the first acupuncture therapy series. The granuloma initially occurred about 3 weeks after the second acupuncture therapy series. The first acupuncutre therapy series may have sensitized the patient to silicone.

Nowadays, silicone has wide applications in medicine, pharmacy and cosmetics.[9] Spallation and migration of silicone from blood pump tubings can also occur.[9] Silicone particles has been found in the macrophage cells especially in the liver and spleen, but also in lymph nodes, bone marrow, lung and artery wall of patients treated by repeated haemodialysis.[9,12] In some cases, macrophage response formed sarcoid-like granulomas.[12] Patients exposed to silicone for a long time may suffer from silicone granuloma of their skin.

The silicone granuloma in this case resembled sarcoid. However, we could not confirm that this patient had sarcoidosis, because the laboratory tests, including the angiotensin converting enzyme test, lysozyme test, chest X-ray, ^{67}Ga scintigraphy and the Mantoux reaction, were all within normal limits. In old scar (silica granuloma), it is known that there may be sarcoidal infiltration in systemic sarcoidosis.[13] Therefore, it is reasonable that the silicone granuloma in this patient might be the early stage of sarcoidosis. We

intend to carefully follow-up the patient in this study for several years.

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