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Case Report

Silicone Granulomas in the Orbit following Breast Implant Rupture: Case Report

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Keywords
Silicone breast implant rupture · Silicone lymphadenopathy · Silicone granuloma · Orbital lesion · Case report

Abstract
Introduction: A known but uncommon complication following breast augmentation with silicone implants is the rupture of these implants and subsequent silicone migration through the lymphatic system. Exceptionally, there are sporadic instances of silicone granulomas forming in distant, non-lymphatic sites, posing diagnostic and management challenges in clinical practice. ***Case Presentation:*** A 56-year-old woman presented with slowly progressive diplopia and photosensitivity during the past 12 months. Ophthalmic examination revealed restriction of movement in all gazes in the right eye. Investigation with magnetic resonance imaging and positron emission tomography-computed tomography showed enlarged superior lateral and inferior rectus muscles in the right orbit, and a diffusely enlarged lacrimal gland in the left orbit, as well as a ruptured silicone breast implant on the right side. In addition, multiple enlarged lymph nodes were found throughout the body, as well as a mass in the internal oblique muscle of the abdominal wall. Fine-needle aspiration biopsy of the axillary lymph node and surgical biopsy of extraocular muscles confirmed a diagnosis of silicone granulomas. The patient received anti-inflammatory treatment with intravenous steroids but with no effect on symptoms. ***Conclusions:*** This case illustrates a rare instance of silicone dissemination from a ruptured breast implant leading to granuloma formation in multiple organs, including the orbit.

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Notably, the spread of silicone appeared to occur through both lymphatic and hematogenous routes. This finding underscores the importance of considering silicone granulomas in the differential diagnosis of orbital lesions for patients with a history of silicone implants.

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Introduction

Breast augmentation is a common cosmetic procedure, with 298,568 primary surgeries being performed during 2022 in the USA alone [1]. Since Cronin developed the silicone breast implant in the early 1960s, several advancements have been made to enhance their natural feel and reduce complications, including capsular contracture/calcification, migration, and rupture [2–4]. The basic design of a silicone breast implant is an outer, single- or multi-layer, silicone rubber shell filled with a combination of low- and high-molecular-weight silicone gel [3]. Due to US Food and Drug Administration requirements, breast implants are among the most studied human medical implants [4]. Rupture rates of breast implants vary by manufacturer and whether they are used for primary or revision augmentation, generally increasing with the age of the implant [3, 5]. The majority of ruptures are non-symptomatic and do not require treatment [3]. A rare but known complication is silicone spread via the lymphatic system causing silicone lymphadenopathy, usually developing 6–10 years after breast augmentation [5]. Silicone lymphadenopathy must be differentiated from breast implant-associated anaplastic large cell lymphoma (BIA-ALCL), a non-Hodgkin lymphoma linked to textured surface implants [6].

Silicone migration into tissues can provoke a foreign body reaction, leading to granuloma formation and subsequent scarring [5]. This phenomenon is well documented in the vicinity of ruptured breast implants, following cosmetic silicone injections, and in the orbit after silicone oil retinal tamponade [7–9]. Moreover, there have been rare reports of distant silicone granulomas occurring in non-lymphatic tissues such as the chest wall muscles, lower extremities, liver, lungs, pleura, and the inguinal region [10–15]. One report exists that describe distant silicone spread to the face, eyelids, and orbital fat [16]. Our findings extend this list by adding the extraocular muscles and the lacrimal gland as potential sites for silicone-induced granulomatous reactions.

Case Report

A 56-year-old woman presented with gradually worsening horizontal and vertical diplopia, pronounced photosensitivity, and intermittent headaches over the past year. Her past medical history was uneventful, apart from bilateral silicone breast implants 10 years previously for cosmetic reasons. She had not received any fillers in her face or body. Ophthalmic examination revealed restricted motility in all directions in the right eye, but normal movement in the left eye. Diplopia was experienced in all gaze directions except in the primary position. Vision was 20/20 in both eyes; slit-lamp and funduscopic examination showed no remarkable findings, but she had 2 mm right-sided proptosis. She exhibited no non-ophthalmological symptoms, and a general medical examination including routine blood analysis (complete blood cell count with differential, electrolytes, angiotensin-converting enzyme, rheumatoid factor, C-reactive protein, and thyroid hormone levels) showed normal results. Magnetic resonance imaging showed a general enlargement of the superior and lateral

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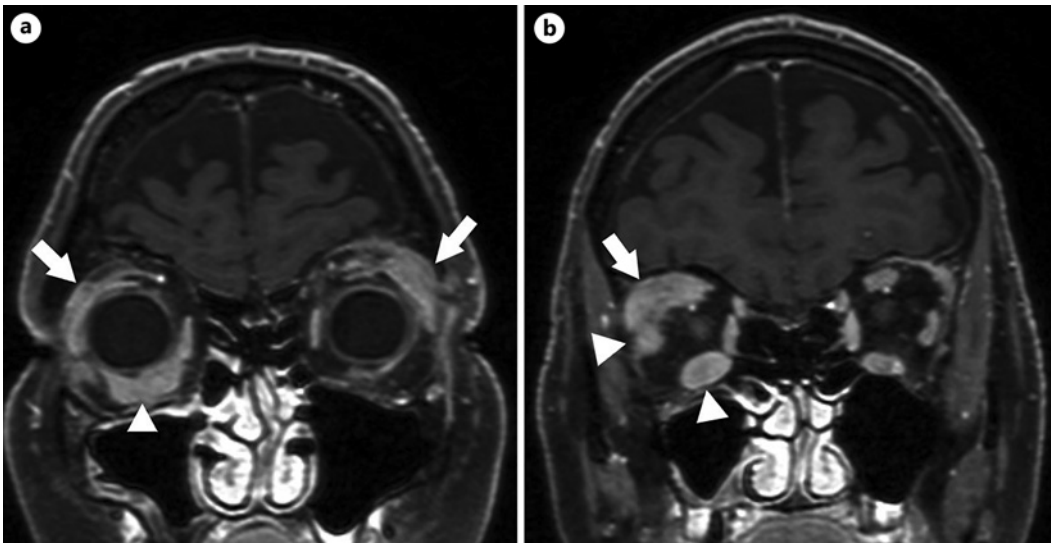

Fig. 1. a Contrast-enhanced T1 imaging of the anterior orbit showing enlarged contrast enhancing m obliquus inferior dx (arrowhead) and lacrimal gland bilateral (arrows). **b** Contrast-enhanced T1 imaging of the dorsal orbit with enlarged right lacrimal gland (arrow) and rectus muscles predominantly on the right side (arrowheads).

rectus muscles and the obliquus inferior muscle. It also revealed enlargement of the anterior portion of the inferior rectus muscle and a slightly enlarged lacrimal gland in the right orbit (shown in Fig. 1). Diffuse enlargement of the lacrimal gland and of the rectus muscles was seen in the left orbit. A lymphoproliferative process was initially suspected, and the patient was referred for hematological evaluation.

Positron emission tomography-computed tomography (PET-CT) with fluorodeoxyglucose F-18 (^{18}F-FDG) showed pathological metabolic activity in the previously mentioned extraocular muscles in the orbits and in the lacrimal glands. In addition, pathological metabolism was detected in one retromandibular lymph node on the left side, in multiple lymph nodes in the right axillae, along the right common and internal carotid artery, in the thoracic wall right of the sternum, in the hilum of the right lung and left side of the pelvis, as well as in the internal oblique muscle of the abdominal wall (shown in Fig. 2). A prominent pathological uptake was also detected around the right silicone breast implant, and subsequent mammography and ultrasound investigation confirmed that the implant had ruptured resulting in intracapsular silicone leakage and silicone uptake in axillar lymph nodes. The ^{18}F-FDG PET-CT did not show any pathological uptake indicating previous silicone filler injections.

A bone marrow biopsy was performed but showed no signs of BIA-ALCL. Fine-needle aspiration biopsy of the axillary lymph nodes demonstrated vacuolated colorless material and foreign body reactions, confirming lymphatic silicone uptake from the ruptured breast implant.

Since lymphatic silicone spread was not anticipated to cause the orbital involvement, an incisional biopsy of the right eye's extraocular muscles was performed. During the procedure, a pale, distinctly defined mass was observed in both the inferior rectus and inferior oblique muscles, exhibiting a rubbery texture. Additionally, the adjacent adipose tissue appeared unusually firm. Histopathological analysis corroborated earlier results, revealing foreign body granulomas and enlarged macrophages laden with material that had a multicystic appearance, strongly indicative of silicone presence. The material was birefringent on polarized light (shown in Fig. 3). There were no signs of BIA-ALCL or any other type of lymphoma. To rule out

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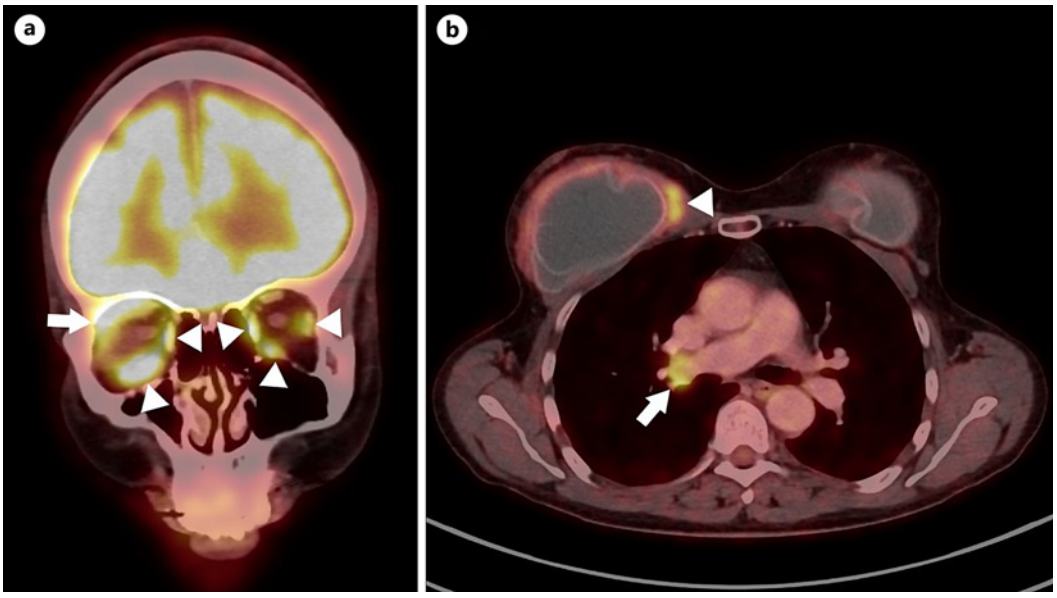

Fig. 2. a 18F-FDG PET-CT of the face with pathological uptake in orbital muscles bilaterally (arrowheads) and left lacrimal gland (arrow). **b** 18F-FDG PET-CT of the thorax with pathological uptake surrounding ruptured silicone breast implant (arrowhead) and in lymph nodes in the right pulmonary hilus (arrow).

extrapulmonary communication between the pulmonary and the systemic circulation, transesophageal echocardiography was carried out, showing no signs of communication between the atria.

Follow-up ^{18}F-FDG PET-CT 7 months after the first investigation showed an increase in the size of the retromandibular and pelvic lymph nodes and slight progression of the soft tissue changes in the abdominal wall, while the remaining findings were unchanged. The patient had not experienced any new symptoms or progression of previous symptoms.

Due to the multiorgan involvement, the patient was evaluated by specialists in rheumatology, hematology, plastic surgery, and cardiovascular surgery, in addition to ophthalmology. The ruptured implant was removed to prevent further silicone dissemination. In an attempt to reduce the granulomatous inflammation, intravenous methylprednisolone 500 mg per week for 4 weeks followed by 250 mg per week for an additional 4 weeks was administered. Unfortunately, this had no effect on her orbital symptoms. Strabismus surgery was not indicated as multiple extraocular muscles were involved and there was no diplopia in the primary position. The patient is currently being treated conservatively and monitored for any progression of symptoms. Her orbital symptoms are completely unchanged 2 years after onset. Fortunately, her headache was found to be tension type and not related to the silicone granulomas, and it resolved following physiotherapy. The CARE Checklist has been completed by the authors for this case report, attached as online supplementary material (for all online suppl. material, see https://doi.org/10.1159/000539184).

Discussion

In the presented case, silicone from a ruptured breast implant disseminated in the body, not only via the lymphatic system but also via hematogenous spread. There were no signs of pulmonary tissue involvement or pathological connections between the pulmonary and

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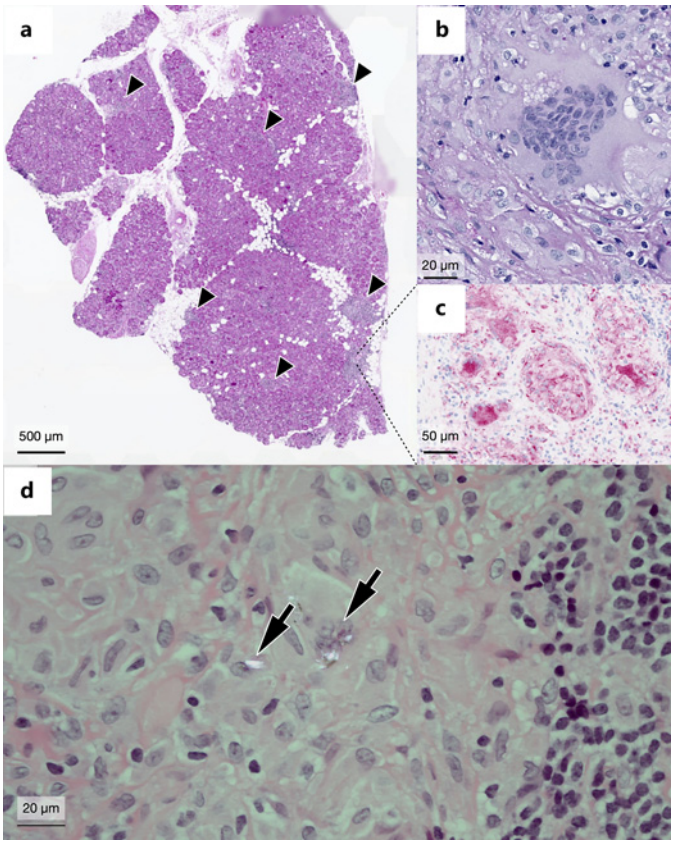

Fig. 3. Histological and immunohistochemical characterization of the lacrimal gland. **a** Low magnification reveals the lobular structure of the lacrimal gland interspersed with areas of granulomatous inflammation (arrowheads), stained with hematoxylin and eosin. **b** Higher magnification of these granulomatous regions shows the presence of multinucleated foreign body giant cells. **c** Immunohistochemical analysis (CD68) highlights an elevated concentration of macrophages within the granulomas. **d** Examination under polarized light reveals birefringent material within the granulomas (arrows).

systemic circulation. Consequently, the mechanism responsible for silicone aggregation and subsequent granuloma formation at distant sites remains unclear. However, we believe that the orbital involvement in this case was incidental, reflecting the high vascularization of the area, rather than any affinity for orbital tissues.

In 2018, Chen et al. [16] published a similar case of another 56-year-old female where a ruptured silicone breast implant had led to a disseminated silicone granulomatosis including the torso, arms, legs, periocular area, eyelids, and orbital fat. However, this case exhibited overt inflammatory reaction with painful erythematous lesions, joint stiffness, and fatigue. In contrast, our case had no systemic symptoms and no local inflammatory signs. This difference may explain why treatment with systemic immunosuppression and breast implant removal had a dramatic effect on symptoms in this case but not in ours.

The management of silicone implant ruptures has been discussed extensively in the plastic surgery literature, and the consensus is that non-symptomatic cases should be managed conservatively, as they are not considered to pose significant health risks [3]. Patients experiencing local symptoms such as a change in breast shape or size, palpable lumps, capsular contracture, or pain are often given the choice of explantation and capsulectomy or observation [3]. Detecting lymphadenopathy necessitates a thorough diagnosis,

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particularly in breast cancer patients with breast reconstructions, to exclude breast cancer metastases and BIA-ALCL. When malignancy has been ruled out, silicone lymphadenopathy needs only to be treated if symptomatic [5]. When there are signs of distant spread, early removal of the implant may be advisable as the consequences of further dissemination of material may be serious. Anti-inflammatory treatment with intravenous steroids did not have any positive effect on ocular symptoms in our case. However, if inflammatory signs are present, as in the case described by Chen et al. [16], systemic immunosuppression may have a positive effect.

For ophthalmologists, silicone deposition in the extraocular muscles presents a clinical challenge by causing restrictive strabismus. Depending on the muscle involvement, this may be challenging or impossible to correct surgically or with prisms. In our case, the patient is experiencing trouble negotiating stairs but otherwise largely unperturbed by her double vision. Her main concern is a 2 mm proptosis on her left eye resulting in an asymmetric appearance.

While this case illustrates a rare complication of silicone breast implants, the increasing popularity of this cosmetic procedure suggests that adverse effects may also rise. It also emphasizes the need to monitor known silicone breast implant ruptures and consider early removal if distant silicone granulomas are detected. Silicone granulomas should be included in the list of known differential diagnoses for orbital lesions.

Acknowledgments

This case was presented at the Orbital Society Symposium in Seoul, South Korea, 2022.

Statement of Ethics

The patient has provided written informed consent for publication of this case report and accompanying images. Ethical approval is not required for this study in accordance with national guidelines.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

E.B. (corresponding author): conceptualization, writing – original draft, and project administration. R.L.: investigation and writing – review and editing. S.J.J. and G.S.: formal analysis, visualization, and writing – review and editing. E.D.K.: investigation, supervision, and writing – review and editing.

Data Availability Statement

All data generated or analyzed during this study are included in this article and its online supplementary material. Further inquiries can be directed to the corresponding author.

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