

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

journal homepage: [www.elsevier.com/locate/radcr](http://www.elsevier.com/locate/radcr)

## Case report

# Silicone exposure associated with breast papillary lesion: A case report <sup>☆,☆☆</sup>

Eduardo de Faria Castro Fleury, MD, PhD

Radiologist at Instituto Brasileiro de Controle do Câncer – IBCC, São Paulo, Brasil

## ARTICLE INFO

## Article history:

Received 10 December 2021

Revised 13 January 2022

Accepted 13 January 2022

## Keywords:

Breast implant

Silicones

Granuloma

Magnetic resonance imaging

Breast implant-associated

anaplastic large cell lymphoma

Metaplasia

## ABSTRACT

We described a breast papillary lesion related to silicone breast implant exposure. The case report is in accordance with our initial publication, where we proposed that silicone particles may trigger a process of reverse morphogenesis in pericapsular tissue resulting in metaplasia of the epithelial cells. The relationship between breast metaplasia and silicone implants is still little discussed in the literature. Our current study is based on evidence obtained from the files of a patient with a six-year-old history of silicone breast implant, which resulted in a diagnosis of a papillary lesion after a percutaneous breast biopsy. Currently, the main complications related to implants reported in the literature are intra- and extra-capsular ruptures, capsular contracture, and the most severe, breast implant-associated anaplastic large cell lymphoma. However, another complication not yet widely accepted in the literature is breast implant illness, resulting from silicone induced granuloma of breast implant capsule. Many medical specialists are skeptical about silicone disease potential and argue the lack of scientific evidence to support its existence. We believe that presenting these findings and the appropriate discussion of the results should contribute to a better understanding of the pathologies related to breast implants. It is worth mentioning that the safety of breast implants must be questioned.

© 2022 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

**Abbreviation:** BIAALCL, breast implant-associated anaplastic large cell lymphoma; BII, breast implant illness; SIGBIC, silicone-induced granuloma of breast implant capsule; BMRI, breast magnetic resonance imaging.

<sup>☆</sup> Acknowledgments: The authors gratefully acknowledge Sheila Cristina Lordelo Wludarski, from the Department of Pathology, Diagnostika, who generously provided assistance in the collection of data of the pathological slides. There is no grant funding/ financial support for this manuscript.

<sup>☆☆</sup> Competing interests: All authors have completed the ICMJE uniform disclosure form. The authors have no conflicts of interest to declare.

E-mail address: [edufleury@hotmail.com](mailto:edufleury@hotmail.com)

<https://doi.org/10.1016/j.radcr.2022.01.026>

1930-0433/© 2022 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

## Introduction

We recently published a theory describing the possibility of silicone leakage in the genesis of epithelial breast cancers. We described the neoplasia pathway from the macroscopic intact implant gel extravasation to the extracapsular space, the local aggressiveness and immunosuppressive agent exerted by the inflammatory response, followed by the direct toxicity of the silicone particle in the tumor microenvironment, to the metaplasia of the pericapsular epithelial cells exposed to the silicone [1].

Silicone implants are widely used in clinical practice for aesthetic and breast reconstruction purposes. Currently, the main complications related to implants reported in the literature are intra- and extracapsular ruptures, capsular contracture, and the most severe, breast implant-associated anaplastic large cell lymphoma. However, another complication not yet widely accepted in the literature is breast implant illness, resulting from silicone induced granuloma of breast implant capsule (SIGBIC) [2,3]. Many medical specialists are skeptical about breast implant illness and argue the lack of scientific evidence to support its existence [4]. The relationship between breast cancer and silicone implants is still little discussed in the literature [5,6].

Since 2017, we have been prospectively studying silicone implants in patients referred for breast magnetic resonance imaging. We observed the incidence of breast carcinoma in

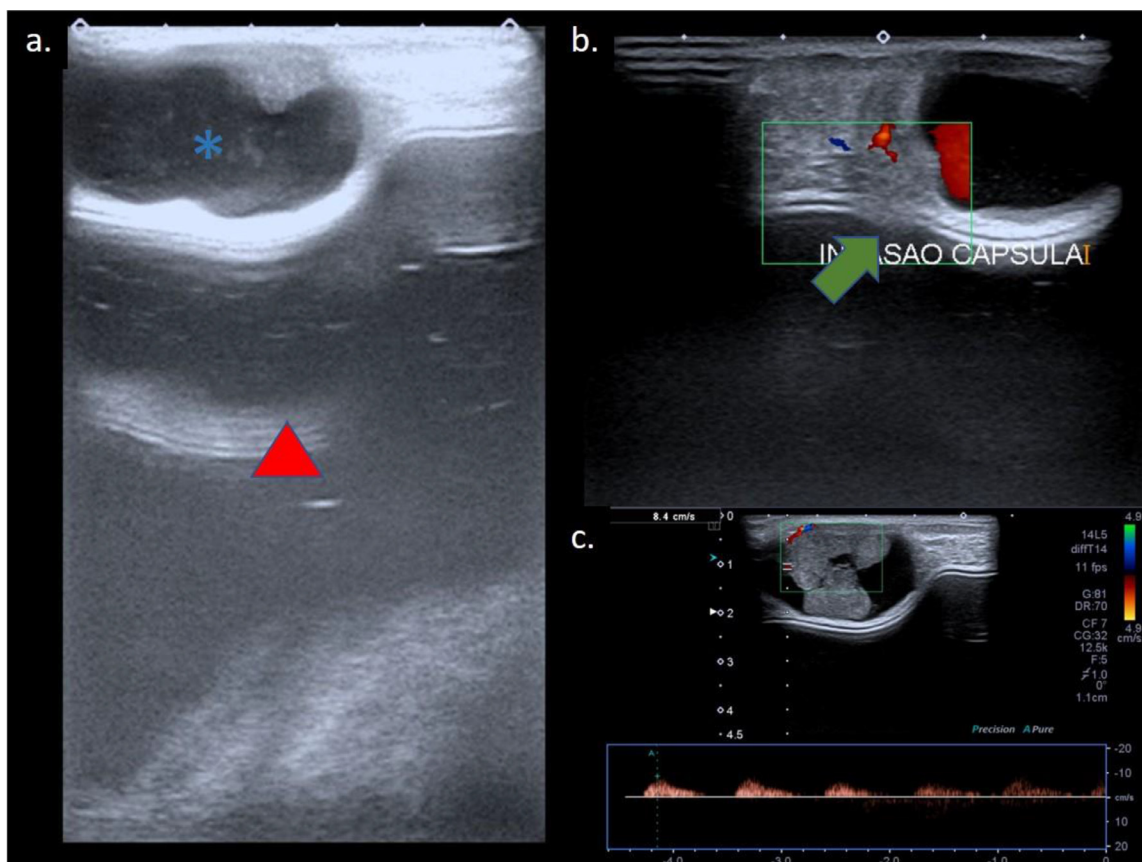
about 5% of these patients and described some common findings in the evolution control in these patients. We elaborated a theory supported by our findings, where we tried to describe the role of silicone in breast cancer development in patients with implants. We used an index case where the findings were well documented [1,7].

In this case report, we followed up a patient with a silicone breast implant, that resulted in a papillary lesion from preoperative histological diagnosis after a percutaneous biopsy.

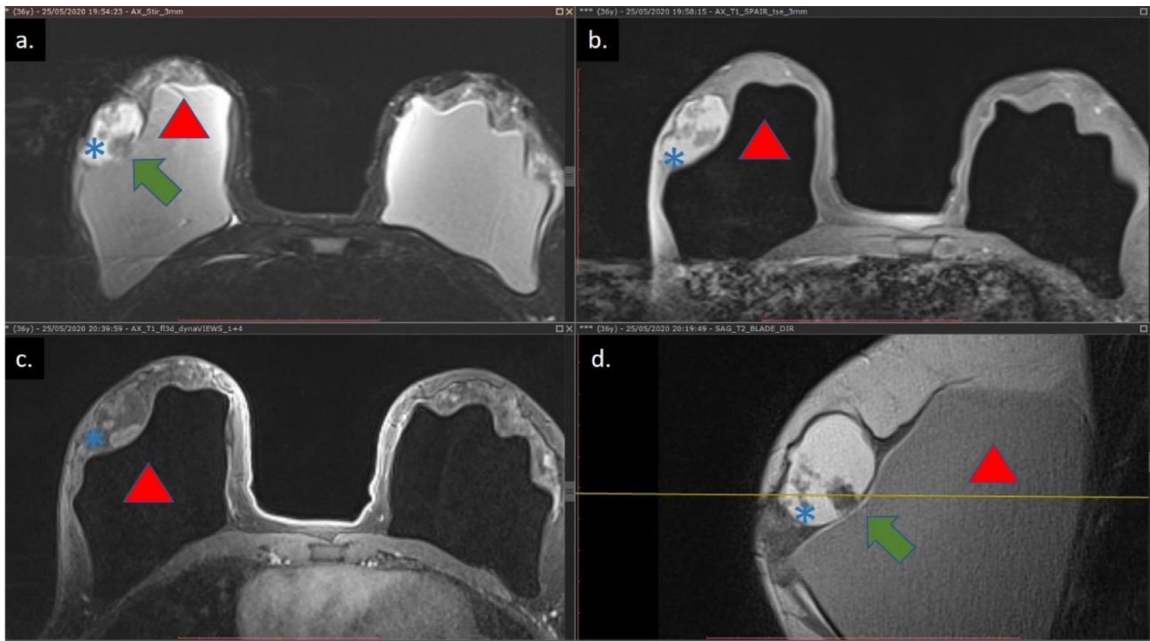
We correlated the findings with the anatomopathological study and imaging results to validate the previous study's theory, where we tried to link the breast implant with cell metaplasia.

## Case report

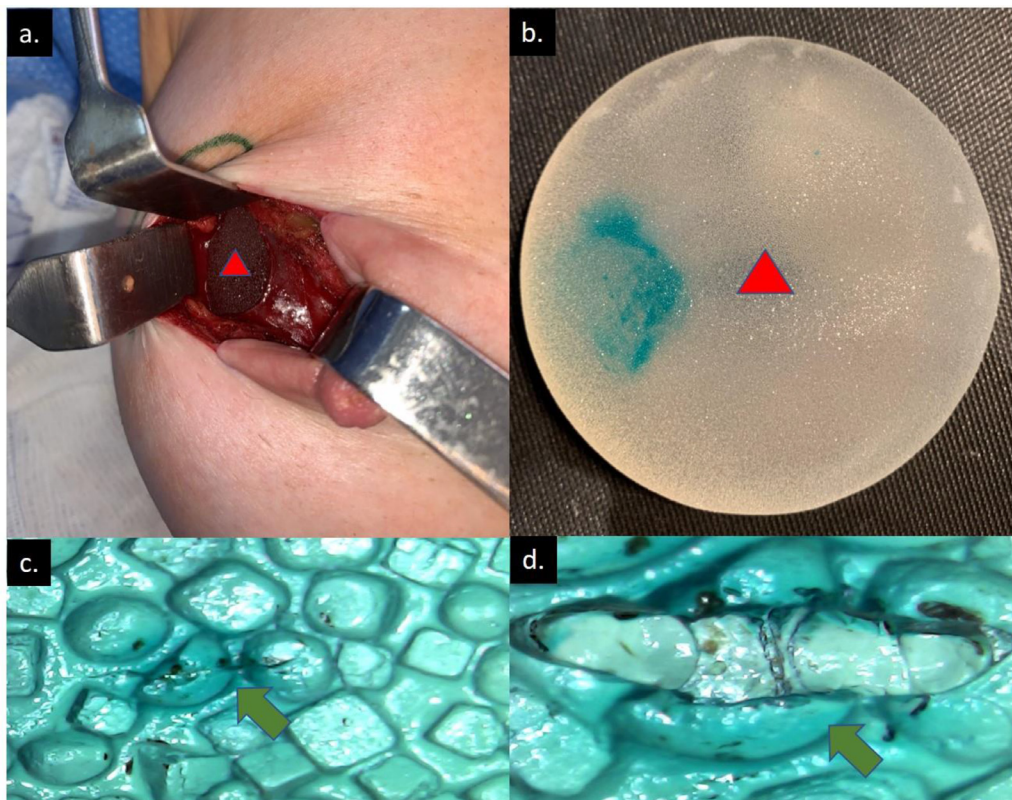
A 32-year-old patient with a story of aesthetic breast-augmentation surgery using silicone breast implants for six years. She reported a fast-growing lump of two months duration in her right breast. She underwent breast ultrasound (US) scan and magnetic resonance imaging for diagnosis. The US images showed a tumor with irregular fibrous surface (Fig. 1) similar to the MRI findings (Fig. 2). In the implant fibrous capsule, we described a vascularized complex solid-cystic mass in color Doppler images.



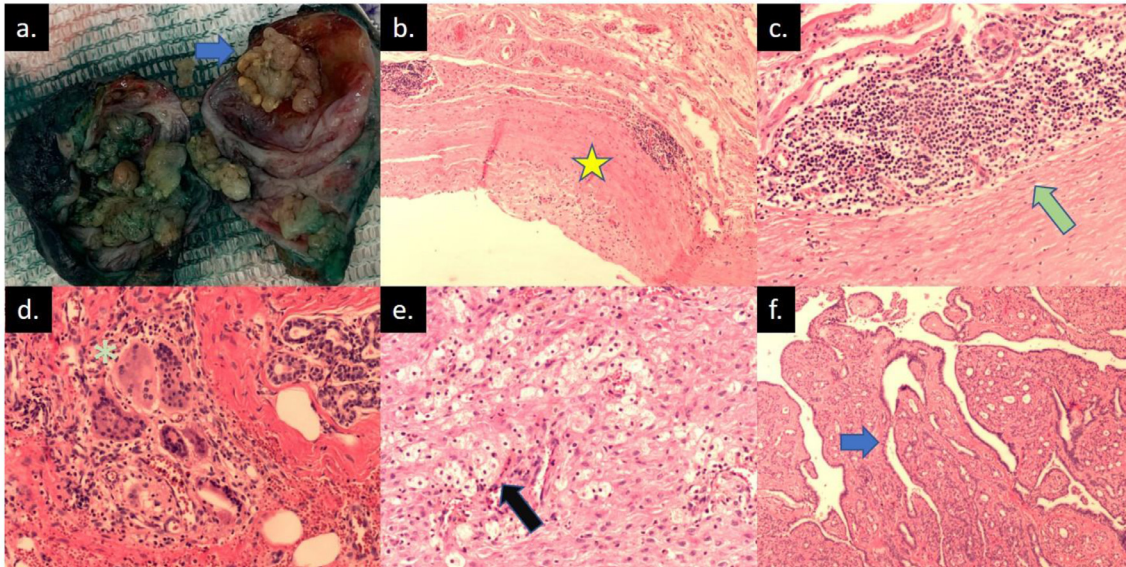
**Fig. 1** – Ultrasonography of the right breast (A–C). Blue asterisk presents a solid-cystic mass in the pericapsular region (A). The green arrow shows a vascularized infiltrative lesion invading the fibrous capsule of the implant (B). Arterial enhancement pattern in the mass vegetation at Doppler scan (C).



**Fig. 2** – Magnetic resonance imaging of the same lesion (A–D). T2-weighted sequence (A), T1-weighted sequence (B), post-contrast sequence (C) and sagittal DP-weighted sequence (D). The blue asterisk represents the solid-cystic mass, while the red triangle represents the breast implant. The green arrow shows the area of tumor infiltration into the prosthesis.



**Fig. 3** – Macroscopy and microscopy of breast implants (A–D). The red triangle shows the textured breast implant, with no evident signs of rupture, and the tumor area is marked with patent blue (A and B). Microscopy of the implant shell showing irregularity of the surface with heterogeneous content inside (C). When pressing the implant, discontinuity of the implant area is observed with exposure to the internal content. There is still vascularization inside and foci of fat in between (D).



**Fig. 4 – Macroscopy and microscopy of the surgical specimen (A-F).** Surgical specimen showing solid-cystic mass, with vegetations inside the lesion represented by the blue arrow (A). The yellow star represents the fibrous capsule (B). In the green arrow, a matrix of typical lymphocytes is observed between the area of fibrosis (C). The blue asterisk represents giant cell (D), while the black arrow points to foamy histiocytes (E). The blue arrow shows the microscopy of the papillary lesion (F).

During surgery, the silicone implant was painted with patent blue to delimitate the tumor site. Macroscopically, the prosthesis showed no rupture signs. It was observed in the patent blue projection area through microscopy, a discontinuity of the implant surface with exposure of its contents to the extracapsular surface (Fig. 3).

The surgical specimen showed a solid-cystic lesion with vegetations inside, while the microscopic examination showed a complex papillary lesion with an intense inflammatory process. The dominant inflammatory process cells were T-cell lymphocytes and foamy histiocytes (Fig. 4).

The final pathological diagnosis was a papillary lesion. The lesion site was evidenced by a shell discontinuity of the implant, where silicone content extravasation was observed.

The patient opted to replace the old implant with a new breast implant from another brand and underwent routine imaging screening for follow-up.

## Discussion

The relationship between breast implants and tumor genesis is controversial in the literature. Some studies reported the association between breast carcinoma and silicone implants but do not describe the pathology pathway for neoplasm development [8]. Some articles still report breast sarcoma cases in patients with implants but do not describe the pathophysiology and the trigger point of the development of these tumors [9].

In a recent article, we described the possible pathway of breast carcinoma in patients with silicone implants. The theory is based on metaplasia concepts, T-cell dysfunction in cancer immunity, inhibitory cells in the tumor microenvironment, morphogenesis, and bauplan. We described the association of

breast carcinoma in patients with breast implant who presented with the same MRI and US imaging findings [1].

However, there seem to be no studies in the medical literature associating silicone breast implants to benign neoplasms. According to our theory, chronic and constant exposure to silicone in the tumor microenvironment could determine aggression and metaplasia in target cells, findings similar to those reported in Barrett's mucosa in the distal esophagus. As described in the esophagus, only a few cases will progress to carcinoma.

In this case report, the patient had a complex solid-cystic lesion in the right breast. The imaging pattern is very similar to that described in patients with undifferentiated carcinoma in our published article. In both US and MRI, an area of discontinuity of the fibrous capsule is observed, serving as a communication channel between the tumor and the intracapsular region.

Upon the examination of the implant microscopically, there was discontinuity of the surface of the implant, exposing its internal content. According to the theory, a silicone particle considered cytotoxic migrates out of the implant. This toxic particle will also trigger an inflammatory process at the fibrous capsule mediated by macrophage activation and lymphocyte recruitment. When extracapsular, it can act directly on the breast glandular tissue and determine local metaplasia [1,10].

As explained in the previous study, the direct toxicity of silicone with the products of the inflammatory process can be toxic to epithelial cells, triggering cellular aggression and metaplasia. Associated with this, the dysfunction of T cells determining changes in immunity to cancer and reverse morphogenesis contribute to the explanation of tumor genesis, which can vary from benign lesions, as in the case presented, to malignant lesions, as in the cases described in the original article of our hypothesis.

This article aims to discuss breast implant toxicity and metaplasia in the extracapsular environment. In our experience, we believe that the development of neoplasia related to silicone implants are underreported due to a lack of knowledge and appropriate investigation for these complications. We believe that disseminating these findings and the appropriate discussion of the results should contribute to a better understanding of the pathologies related to breast implants. It is worth mentioning that the safety of breast implants must be questioned.

This case report is presented with robust original evidence that postulates the potential of chronic silicone exposure to the pericapsular space as the trigger point to promote cell metaplasia, in accordance to our previous publication.

### Reporting checklist

The authors have completed the CARE reporting checklist.

### Ethical statement

The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013).

### Patient consent statement

Written informed consent for the publication of this Case Report has been obtained.

### REFERENCES

- [1] Fleury E, Nimir C, D'Álessandro GS. The breast tumor microenvironment: could silicone breast implant elicit breast carcinoma? *Breast Cancer (Dove Medical Press)* 2021;13:1–14.
- [2] Adrada BE, Miranda RN, Rauch GM, Arribas E, Kanagal-Shamanna R, Clemens MW, et al. Breast implant-associated anaplastic large cell lymphoma: sensitivity, specificity, and findings of imaging studies in 44 patients. *Breast Cancer Res Treat* 2014;147(1):1–14. doi:10.1007/s10549-014-3034-3.
- [3] Fleury EF, Rêgo MM, Ramalho LC, Ayres VJ, Seleti RO, Ferreira CA, et al. Silicone-induced granuloma of breast implant capsule (SIGBIC): similarities and differences with anaplastic large cell lymphoma (ALCL) and their differential diagnosis. *Breast Cancer (Dove Medical Press)* 2017;9:133–40. doi:10.2147/BCTT.S126003.
- [4] Rohrich RJ, Kaplan J, Dayan E. Silicone implant illness: science versus myth? *Plastic Reconstr Surg* 2019;144(1):98–109. doi:10.1097/PRS.00000000000005710.
- [5] Nakahori R, Takahashi R, Akashi M, Tsutsui K, Harada S, Matsubayashi RN, et al. Breast carcinoma originating from a silicone granuloma: a case report. *World J Surg Oncol* 2015;13:72. doi:10.1186/s12957-015-0509-6.
- [6] Zhou YM, Chaudhry HE, Shah A, Andrews J. Breast squamous cell carcinoma following breast augmentation. *Cureus* 2018;10(10):e3405. doi:10.7759/cureus.3405.
- [7] Fleury E. Silicone induced granuloma of breast implant capsule (SIGBIC) diagnosis: breast magnetic resonance (BMR) sensitivity to detect silicone bleeding. *PloS One* 2020;15(6):e0235050. doi:10.1371/journal.pone.0235050.
- [8] Lee KT, Kim S, Jeon BJ, Pyon JK, Mun GH, Ryu JM, et al. Association of the implant surface texture used in reconstruction with breast cancer recurrence. *JAMA Surg* 2020:e204124 Advance online publication. doi:10.1001/jamasurg.2020.4124.
- [9] Morgenstern L, Gleischman SH, Michel SL, Rosenberg JE, Knight I, Goodman D. Relation of free silicone to human breast carcinoma. *Arch Surg (Chicago, Ill.: 1960)* 1985;120(5):573–7. doi:10.1001/archsurg.1985.01390290051008.
- [10] Onnekink C, Kappel RM, Boelens WC, Pruijn G. Low molecular weight silicones induce cell death in cultured cells. *Sci Rep* 2020;10(1):9558.