Granuloma of Silicone Breast Implants

A case report and literature review

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Silicone, a synthetic polymer containing the element silicon, has been used for breast implants. Complications resulting from the placement of silicone breast implants are becoming more frequent in clinical practice. Breast implant rupture is common and poses challenges for radiologists and physicians. Radiologists must be familiar with the normal and abnormal findings of common implants. Clinically apparent silicone granulomas are a relatively rare complication of breast implant placement and surgical resection is indicated when they are symptomatic or of diagnostic concern. The objective of this study is to examine the latest generations of silicone breast implants and the clinical literature related to silicone granulomas together with a case of silicon granuloma diagnosed in our service. The findings are based on diagnostic breast Ultrasound and MRI scans performed at our service.

Keywords: silicone, breast implant, granuloma, Ultrasound and MRI scans

Silicone, a synthetic polymer containing the element silicon, has been used for many years to produce breast implants. Complications resulting from the placement of silicone breast implants are becoming more frequent in clinical practice. Breast implant rupture is common and poses challenges for radiologists and physicians. Clinically apparent silicone granulomas are a relatively rare complication of breast implant placement and surgical resection is indicated when they are symptomatic or of diagnostic concern [1].

Nowadays, many breast augmentation surgeries are performed in Romania. The economic boom associated with socio-cultural factors led to breast implants on over 4,000 women in 2014, according to the first statistics, made by the Association of Plastic Surgeons in Romania. Most of the women got silicone implants [2].

The first implant surgery was done in 1895 at the University of Heidelberg in Germany, by using the fat from a female patient's hip and implanted it into her breast. Over the decades, physicians used different compounds as breast implant fillers: ivory, glass balls, ox cartilage, rubber, gutta-percha, polyethylene terephthalate, polyethylene chips, polyvinyl alcohol-formaldehyde polymer sponge (Ivalon), polyether foam sponge (Etheron), polyester (polyurethane foam sponge), and teflon-silicone prostheses [2].

Breast implants as we know them these days, silicon as a gel inside a kind of *sac* had their debut in the 1960s. The silicone gel implants should not be confused with the chemical element, silicon, which is part of the composition of silicones. They were first synthesized around 1900 and are synthetic polymers with a silicon-oxygen backbone similar to that in silicon dioxide (silica), but with organic groups attached to the silicon atoms by C-Si bondswith the chemical formula $(R_2SiO)_n$, where: R is an organic side group (e.g., methyl, $-CH_3$) attached to a siloxane ...-Si-O-Si-O-Si-O-... *back bone* or chain (fig. 1).

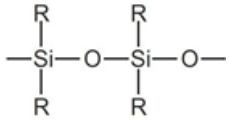

Fig. 1. Chemical structure of the silicone

Silicone gels are based on thepolydimethylsiloxane (PDMS), which contains a repeating -SiO backbone with organic $-CH_3$ groups attached to the silicon atom. The complete PDMS formula is $CH_3[Si(CH_3)_2O]_nSi(CH_3)_3$. PDMSis aliquid with a viscosity that increases as theaverage chain length is increased (fig. 2).

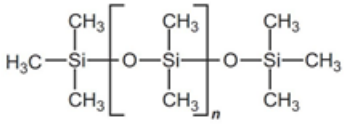

Fig. 2. Chemical structure of the polydimethylsiloxane (PDMS)

The medical literature describes many complications related to the presence of silicone implants, the main ones being seromas, infections, hematomas and intra- and extra capsular ruptures. Implant rupture can have various causes, but most ruptures have no obvious traumatic origin and sometimes occur in asymptomatic patients. Most implant ruptures occur 10 to 15 years after implantation [2].

Experimental part

A 68-year-old woman with pain and hardness in her right breast for several months was referred to breast radiology

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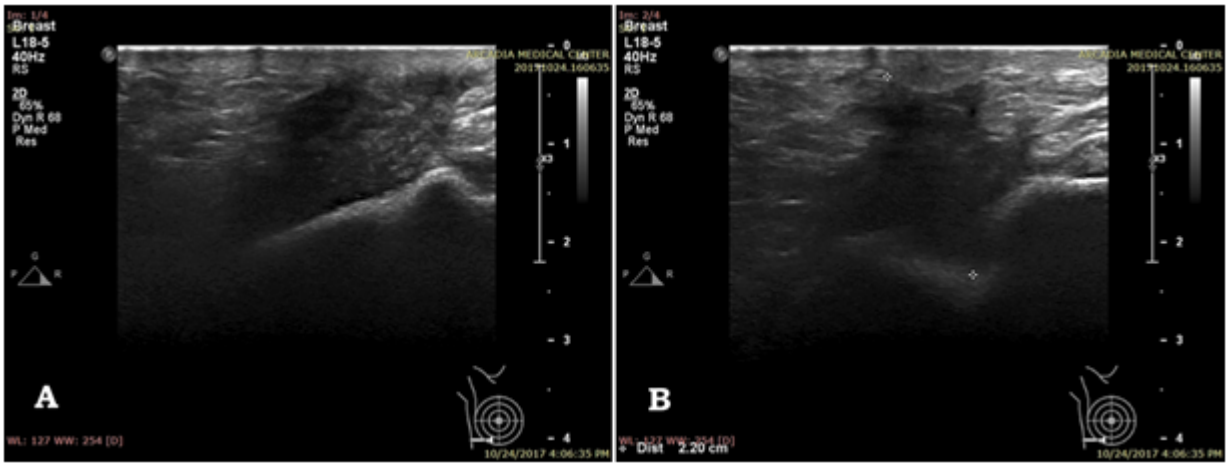

Fig. 3. Breast ultrasound B mode. A, B: hypoechoic, irregular, poorly defined lesion in the periphery of the inferior outer quadrant of the right breast

department because of suspected breast cancer. The patient had undergone breast augmentation with silicone implants when she was 57-year-old.After 11 years, she complained of pain and a palpable mass in the lower outer quadrant of the right breast. B mode breast ultrasound using a linear probe (6-18 MHz) (Philips Affinity 70 ultrasound unit, The Netherlands)showed a hypo echoic, irregular, poorly defined lesion in the periphery of the lower outer quadrant of the right breast, which raised the suspicion of a malignant breast tumor or an extra capsular rupture of the silicone implant on the right side (fig. 3).

Dynamic contrast-enhanced magnetic resonance imaging (DCE - MRI) of the breast was then performed on a 1.5T MR system, Philips Achieva, The Netherlands.T1 and T2 -weighted images showed low signal intensity, spiculated, poorly defined mass, with an inhomogeneous contrast uptake and a benign type of Kuhl curve; the silicon suppression sequence shows quite well the extra capsular rupture of the right implant (fig. 4).

We didn't find lymph adenppathies on clinical examination, US and MRI.

The US and MRI images reviewed together weren't specific for a malignant lesion; considering the history and symptoms of the patient, the only possible diagnosis was a silicone granuloma.

Due to suspicion of the malignancy, a biopsy was performed to inferior outer quadrant of the right breast under sonographic guidance. Histological analysis identified giant cells along with an apparent foreign body response. No evidence of malignancy was found. The final diagnosis for our patient was extra capsular rupture of the right breast implant with silicone granuloma and the patient was referred to the surgery department for resection. Informed consent was obtained from the patient for the publication of this case.

Results and discussion

A silicon granuloma is a tissue reaction produced by silicon which was first described in 1964 by Winer et al. According to different theories silicone leakage combined with chronic low-grade infection may play a role or that granuloma formation is the result of the foreign body response.This chronic inflammatory response may occur many years after breast augmentation with silicone implants, or even after the implants are removed [1].

Rupture is a late complication and the silicone gel can beintracapsular (when the gel remains within the scar tissue capsule surrounding the implant), extracapsular (when the gel moves outside the capsule but remains within the breast tissue) or migrated (when the gel moves beyond the breast).The frequency of asymptomatic rupture of silicone rubber envelopes is between 0.2 and 4% and increases with age of the implant. Rupture-free survival is estimated to be 98% at 5 years and 83%–85% at 10 years for newer implants [5]. The silicone gel that migrates beyond the breast tissue incites inflammation and silicone

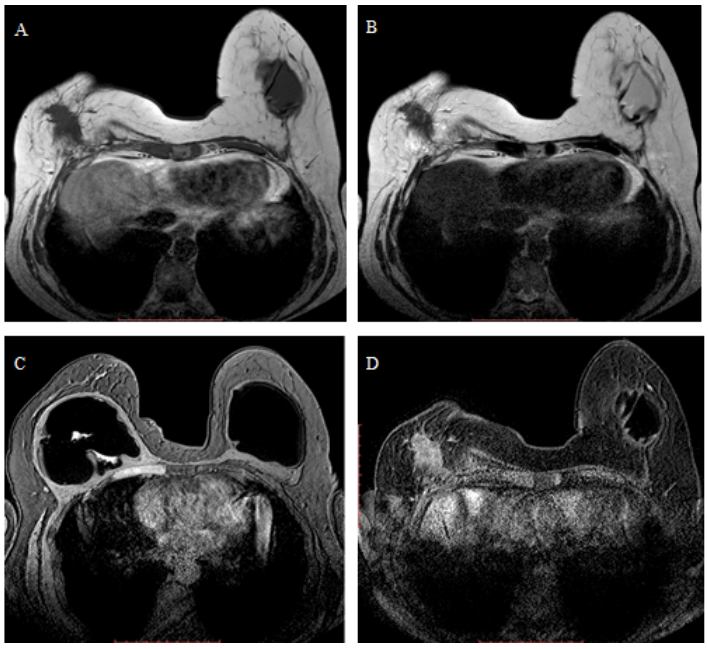

Fig. 4. DCE - MRIof the breast: A, B - T1 and T2 -weighted images - low signal intensity, spiculated, poorly defined mass in the lower outer quadrant of the right breast; C - silicon suppression sequence – extra capsular rupture of the right implant; D - dynamic contrast enhanced sequence - inhomogeneous contrast uptake of the right breast mass

granuloma formation [7] with cell-mediated immune reactivity and T cell stimulation. The presence of lymphadenopathy is often more a worry for malignancy and in presence of granulomatous inflammation, the relationship between a possible implant rupture and a foreign body reaction is not always established, unless breast implant rupture is suspected and/or spectrometry microanalysis is specifically performed [8].

Conclusions

We used only ultrasonography and magnetic resonance imaging to diagnose this patient with silicon granuloma and we excluded mammography because of the initial suspicion of silicone breast implant rupture on the ultrasound. Each technique has specific strengths and weaknesses that may make a particular technique the study of choice for an individual patient.

Finally, it is important to inform the patient about the potential risk and health effects of silicone breast implants.

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