OPEN

PRS GLOBAL OPEN

IDEAS AND INNOVATIONS

Breast

Use of Hydrosurgical Debridement System for Silicone Gel Removal after Breast Implant Rupture

Alessandro Scalise, MD*
Alberto Pau, MD*
Caterina Licini, MSc, PhD†
Donatella Brancorsini, MD‡
Monica Mattioli Belmonte Cima, MSc, PhD†
Gaia Goteri, MD, PhD§
Giovanni Di Benedetto, MD, PhD*

Summary: Breast implant rupture is one of the most common complications in aesthetic and reconstructive surgery. Furthermore, this problem is closely linked to capsular contracture. It is therefore crucially important to effectively and promptly remove silicone leakage from breast pockets. Several techniques are described in the literature and have been typically used for this procedure. Hydrosurgical debridement (HD), which is usually applied in wound care to treat wounds, could be useful for the removal of the silicone leaked from prosthesis pockets after breast implant rupture. An entire periprosthetic capsule that contained a ruptured implant with silicone leakage was removed from a left breast. Half of the capsule was treated with HD, whereas the other half was left untreated as a control. Samples were processed by light microscopy and scanning electron microscopy for morphological analyses. light microscopy demonstrated that the nontreated tissues had a typical synovial-like structure with a middle layer of connective tissue in which there were numerous rounded empty spaces which contained silicone. In contrast, the superficial connective region of the treated tissues (T) had fewer and flattened spaces where the silicone was detected. Scanning electron microscopic analysis showed that in the T samples, the capsule thickness was compact compared with that of the nontreated tissues. Furthermore, the fibrous components appeared well organized with few and smaller silicone lacunae. HD is useful for the removal of silicone (ex vivo) from capsular surfaces after implant rupture. Because of its safety characteristics, this technique could be successfully used in vivo. *(Plast Reconstr Surg Glob Open 2024; 12:e5862; doi: 10.1097/GOX.0000000000005862; Published online 4 June 2024.)*

INTRODUCTION

Breast implant rupture is a common complication in aesthetic and reconstructive surgery. However, the removal of silicone leakage in intra- and extracapsular spaces could prove difficult and incomplete.

A current retrospective study on patients with high grades of capsular contracture showed an increased risk of recurrence when silicone gel implants rupture.[1] Several methods are used in surgical practice to remove silicone from breast pockets.[2–6] Hydrosurgical debridement (HD) is usually applied to treat wounds, particularly in the case of infected and necrotic tissues, or simple fibrinous tissues. This morphological study aimed to verify HD efficacy in silicone removal after implant rupture because this technique could be a good option as a procedure for breast pocket treatment in vivo.

MATERIAL AND METHODS

A 45-year-old woman was referred to our clinic after the rupture of the left intracaspular breast prosthesis (375 mL, containing cohesive gel). Consequently, an operation based on bilateral implant removal, breast pocket cleaning with a HD system, capsulotomy, and replacement of breast implants with new prostheses was planned.

An en bloc capsulectomy, which included the inner ruptured implant, was performed. A section on the major

*From the *Clinic of Plastic and Reconstructive Surgery, Department of Experimental and Clinical Medicine, Università Politecnica delle Marche, Ancona, Italy; †Histology, Department of Clinical and Molecular Sciences, Università Politecnica delle Marche, Ancona, Italy; ‡Anatomic Pathology, Department of Biomedical Sciences and Public Health, Azienda Ospedaliero Universitaria delle Marche, Ancona, Italy; and §Anatomic Pathology, Department of Biomedical Sciences and Public Health, Università Politecnica delle Marche, Ancona, Italy.*

Received for publication November 24, 2023; accepted April 3, 2024.

DOI: 10.1097/GOX.0000000000005862

Disclosure statements are at the end of this article, following the correspondence information.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

diameter (as capsulotomy) was made to divide the capsule into two equal parts and remove the inner implant. Half of the sample was treated with HD on the inner capsular surface to remove silicone. The other half was left untreated as a control.

In the study presented, the Versajet II system (Smith & Nephew) with an "exact" hand piece (45 degrees/14 mm) was used, set to maximum intensity (10/10). Both types of samples [ie, treated (T) and nontreated (NT)] were analyzed by the histology and anatomical pathology units. NT and T fibrotic capsule samples were processed by light microscopy and scanning electron microscopy (SEM).

RESULTS

The NT tissue showed a synovial-like morphology with three distinguishable layers. A pseudoepithelial structure was observed on the outer side, whereas the middle region was formed of connective tissue with numerous rounded empty spaces where silicone was contained. A thick fibrous tissue formed the inner layer. Inflammatory cells were evident in both the middle and inner layers (Fig. 1).

The SEM analysis revealed a disorganized collagenous fibrous component with several large lacunae caused by silicone (Fig. 2). The T tissue showed two main layers of connective tissue. The outer layer contained a few flattened and rounded small spaces that probably contained silicone. The inner layer formed of dense fibrous tissue was thick, with numerous blood vessels and some inflammatory cells (Fig. 3).

With regard to the SEM analysis, the capsule thickness was more compact, compared with that of the NT tissue. Furthermore, the fibrous component seemed well organized with few and smaller silicone lacunae (Fig. 4).

DISCUSSION

Silicone leakage is a serious problem related to implant rupture and represents a common complication in breast aesthetic and reconstructive surgery. The severity of fibrous capsule reaction and its related contracture are linked to silicone leakage into the implant pocket, which causes an inflammatory tissue response.[7]

For these reasons, it is clear that it is crucial to promptly and effectively remove the leaked silicone after implant rupture from a periprosthetic capsule without calcification or excessive thickness[1,2]

Typically, the suction technique is applied using specific equipement such as syringes or bottles connected to a vacuum system.[3–5] Chemical agents like Shur-Clens can be useful to remove silicone gel from breast pockets.[6] A recent article showed that a pulse lavage system (InterPulse Irrigation System), which is usually applied in the treatment of infected or contaminated open wounds as well as in implant surgery delivering a high-intensity jet of water that impacts perpendicularly and not selectively the surface to be treated, is also effective for the treatment of complications from breast implant rupture like silicone leakage.[2]

HD could represent a good and quick alternative technology for breast pocket cleaning after implant rupture for different reasons. First, the main feature of HD is its ultraselectivity: as has been noticed in wound treatment applications, its innovative water jet, which is parallel to the tissue being treated, is useful for performing selective and controlled debridement with low risk of damaging good tissues. Thus, the instrument does not cause deep diffusion of the substance or material to be removed. Microscopic examination shows that after the treatment, the residual silicone has not undergone migration or substantial depth changes compared with untreated tissues.

Takeaways

Question: We aimed to effectively and promptly remove silicone leakage from breast pockets after breast implant rupture, to prevent any issues like capsular contracture.

Findings: The authors propose the use of hydrosurgical debridement for the removal of the silicone leaked from prosthesis pockets after breast implant rupture.

Meaning: Hydrosurgical debridement system has proved to be useful for the removal of silicone (ex vivo) from capsular surfaces after implant rupture.

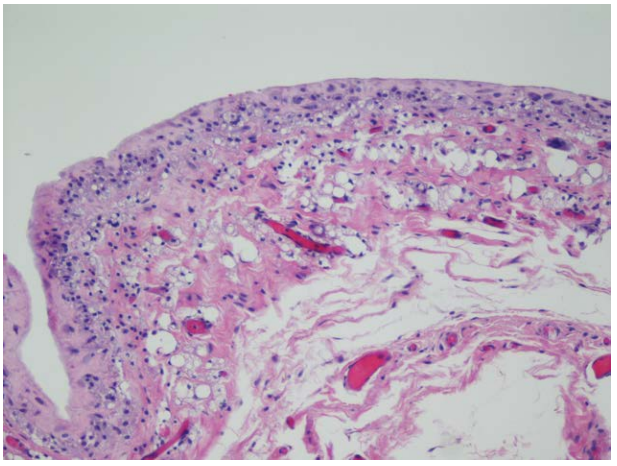

Fig. 1. Histological images of NT tissues (hematoxylin & eosin staining, 20× magnification).

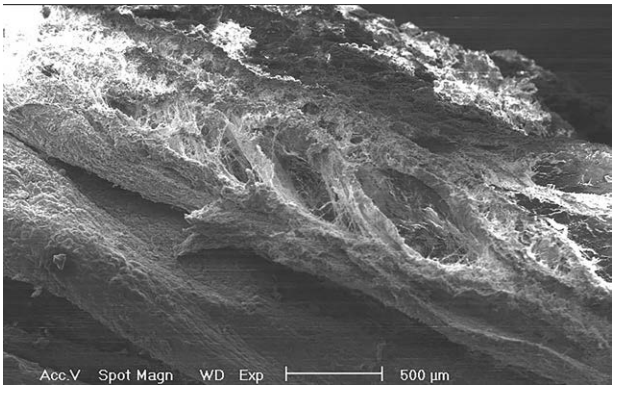

Fig. 2. NT tissues observed by SEM (scale bars 500 µm).

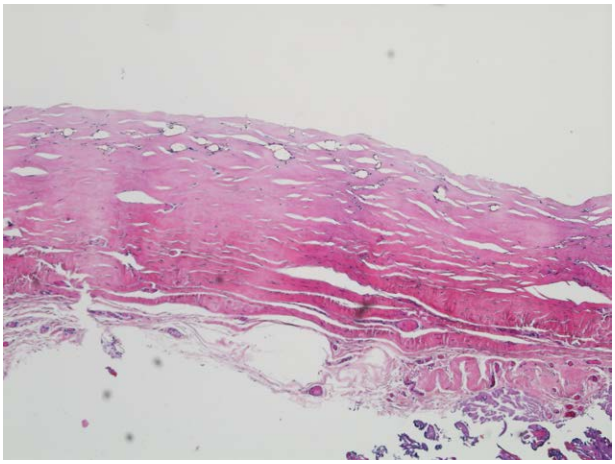

Fig. 3. Histological images of treated tissues (hematoxylin & eosin staining, 20× magnification).

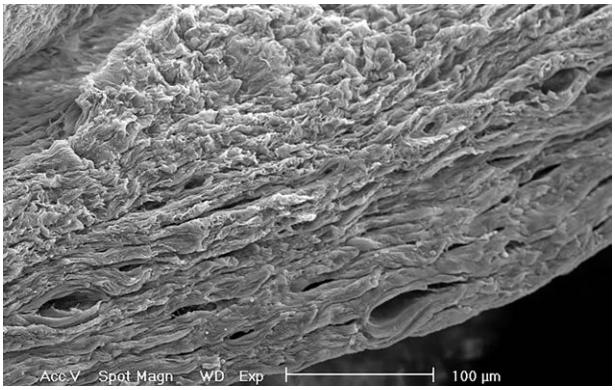

Fig. 4. Treated tissues observed by SEM (scale bars 100 µm).

Moreover, in a possible in vivo implant rupture routine treatment, this method can guarantee quick and effective removal of silicone leakage thanks to the modulated high-intensity water jet and vacuum system integrated into the handpiece. [**See Video 1** (**online),** which displays a demonstration of the HD system's capability to remove silicone gel (×2 speed).]

On the other hand, as highlighted by the analysis of light microscopy and SEM, selective shaping of capsular surfaces can be achieved, particularly in the peripheral layers, where a high amount of inflammatory cells interface with silicone. Indeed, in the case-study presented, the treated tissue did not present the pseudoepithelial structure on the outer side, just like the nontreated tissue. In the peripheric layer, there were fewer flattened and rounded small spaces, which probably contained silicone, and the inflammatory cells in the inner layer had decreased.

In vivo experimentation is needed to understand how to optimally treat the tissues without causing damage or complications. The goal is to find a proper balance that considers the intensity of the water jet and the duration of the treatment, but above all, to allow the surgeon to develop the ability to treat tissues as appropriately as possible, depending on the specific case. However, until further in vivo studies are performed, the use of HD for silicone gel removal from the breast pocket is not recommended.

CONCLUSIONS

HD allows for quick and ultraselective removal of silicone leakage from a breast capsule after implant rupture. This technique is also effective in modifying the histological features of the capsule as demonstrated by the light microscopy and SEM analyses. This method could be used in vivo, and in a future experimental study, the effectiveness of HD in preventing the recurrence of capsular contracture could be demonstrated.

Alberto Pau, MD
Clinic of Plastic and Reconstructive Surgery
Department of Experimental and Clinical Medicine
Università Politecnica delle Marche
Via Conca 71, Ancona 60126
Italy
E-mail: s1102238@pm.univpm.it

DISCLOSURE

Alessandro Scalise, MD (Smith & Nephew): participation in conferences, organization of courses. The other authors have no financial interest to declare in relation to the content of this article.

REFERENCES

1. Swanson E. Open capsulotomy: an effective but overlooked treatment for capsular contracture after breast augmentation. *Plast Reconstr Surg Glob Open.* 2016;4:e1096.
2. Lam MC, Walgenbach-Brünagel G, Pryalukhin A, et al. Management of capsular contracture in cases of silicone gel breast implant rupture with use of pulse lavage and open capsulotomy. *Aesthetic Plast Surg.* 2019;43:1173–1185.
3. O'Neill JK, Taylor GI. A novel method to remove silicone gel after breast implant rupture. *J Plast Reconstr Aesthet Surg.* 2006;59:889–891.
4. Bell MS, Doumit GD, Buinewicz BR. Removal of silicone breast implants and review of literature. *Can J Plast Surg.* 2009;17:e48–e49.
5. Pizzonia G, Sasso A, Musumarra G. An adapted suction technique to aid removal of ruptured silicone implants. *JPRAS Open.* 2019;20:92–93.
6. Bitar GJ, Nguyen DB, Knox LK, et al. Shur-clens: an agent to remove silicone gel after breast implant rupture. *Ann Plast Surg.* 2002;48:148–153.
7. Caffee HH. The influence of silicone bleed on capsule contracture. *Ann Plast Surg.* 1986;17:284–287.