



# Surgical Treatment after Augmentation Mammoplasty with Polyacrylamide Hydrogel

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## Abstract

Polyacrylamide hydrogel mammoplasty is a simple and relatively affordable surgery. However, this procedure is associated with a significant frequency of late complications, prompting its suspension in 2006. Despite this, patients continue facing long-term consequences. These include hydrogel migration, changes in breast shape and volume, granulomas, fistulas, and abscess formation. The clinical case described here presents the surgical treatment after augmentation mammoplasty with polyacrylamide hydrogel performed 35 years ago.

## Keywords

breast reconstruction, breast surgery, plastic surgery, polyacrylamide hydrogel mammoplasty, mastectomy

## INTRODUCTION

Polyacrylamide hydrogel (PAHG) gained popularity as an injectable filler for the face and body contouring surgery in the 1970s. PAHG is stable, highly biocompatible and also relatively inexpensive and affordable.<sup>[1]</sup> The technical simplicity of the procedure and the good aesthetic results it produces with absence of early complications have led to the widespread use of PAHG injections in breast contouring. However, at the turn of the 21st century, the number of reports of late complications began to grow. These complications included hydrogel migration, changes in the breast shape and volume, granulomas, fistulas and abscess formation.<sup>[1,2]</sup> There are even reports claiming that PAHG mammoplasty may be a cause of breast cancer. The aforementioned side effects can occur in individuals 1 to 20 years or more following a breast contouring treatment.<sup>[1]</sup> Although this type of mammoplasty was banned in the 2000s, some surgeons are still dealing with the procedure's long-term complications.

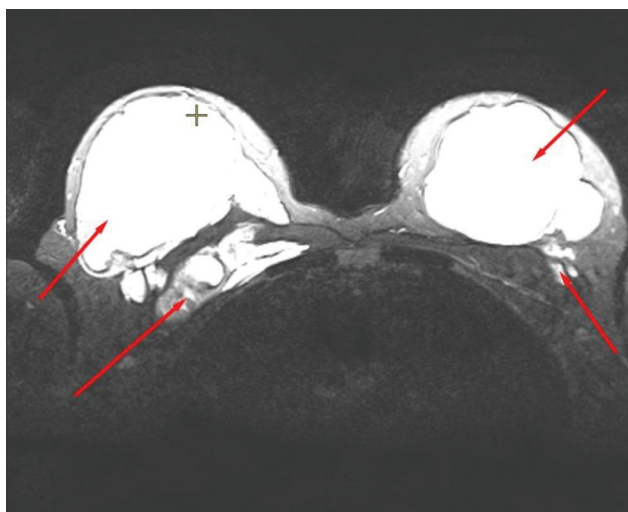
The presented clinical case describes the surgical treatment of a woman with a breast deformity 35 years after PAHG mammoplasty.

## CASE REPORT

*During a self-examination in 2018, a 58-year-old patient noticed a sudden increase in her breast volume and changes in breast shape. In 2022, because of a pronounced breast deformity, she sought surgical consultation. She reported that she had PAHG injection mammoplasty about 35 years ago. During a physical examination, her breasts were asymmetrical, enlarged in size, their contours were uneven and areas of thickened tissue were detected. Breast ultrasonography (US) revealed implants of irregular shape in both mammary glands. The patient underwent MRI of the mammary glands where diffuse impregnation of breast tissue with a gel with the formation of delimited clusters, foci of fibrous changes, as well as gel migration into the right intermuscular space were*

noted (Fig. 1). It was decided to perform a bilateral subcutaneous mastectomy using inverted-T technique and evacuate the gel from the intermuscular space. Anchor pattern was preliminarily drawn on the breasts (Fig. 2). Cefotaxime 1 g IV was administered as an antibiotic prophylaxis 30 minutes before mastectomy. The surgery was performed under combined endotracheal anesthesia. After applying antiseptic solution on the surgical site, skin and subcutaneous fat of the marked area were dissected and de-epithelization of the superomedial pedicle was performed to preserve nipple-areola complex. Subcutaneously dissected tissue of the right breast was abundantly impregnated with hydrogel (Fig. 3A). The right mammary gland was isolated to the fascia of the pectoralis major muscle. During the operation, about 300 ml of gel-like substance were evacuated. Given the migration of the PAHG into the retromammary and intermuscular space, the tissue impregnated with the gel was removed (Fig. 3B). The superomedial pedicle was repositioned and sutured to the pectoralis major muscle fascia with interrupted sutures, the peripheral skin flaps were brought together and sutured in layers to form the mammary gland. Similarly, according to

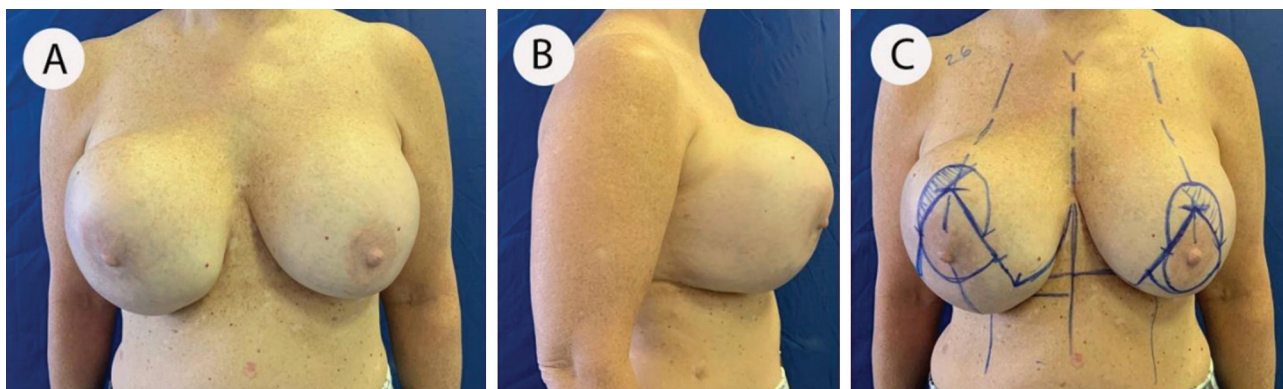
the preliminary marking, the skin and subcutaneous fat of the left breast were dissected. The left mammary gland was isolated to the major pectoral muscle fascia, about 300 ml of gel-like contents were evacuated during isolation, no intraoperative intermuscular leakages were detected. The de-epithelized pedicle was sutured to the fascia of the major pectoral muscle, and peripheral flaps were sewn together in layers. Suction drains were installed in the area of the removed mammary glands through the counterincision. In the postoperative period, symptomatic therapy with NSAIDs (ketorolac 30 mg IM) was carried out. On postoperative day 3, the drains were removed, and 4 days after mastectomy, a follow-up US detected soft tissue edema in the area of intervention without fluid accumulations. Five days after surgery, the patient was discharged from hospital (Fig. 4). Routine pathological examination revealed numerous areas of basophilic homogeneous substance (gel) in both mammary glands, surrounded by fibrous tissue with foci of chronic productive inflammation, consisting of histiocytes and multinucleated cells (Fig. 5). On postoperative day 14, follow-up breast US was performed and it detected no fluid accumulations.



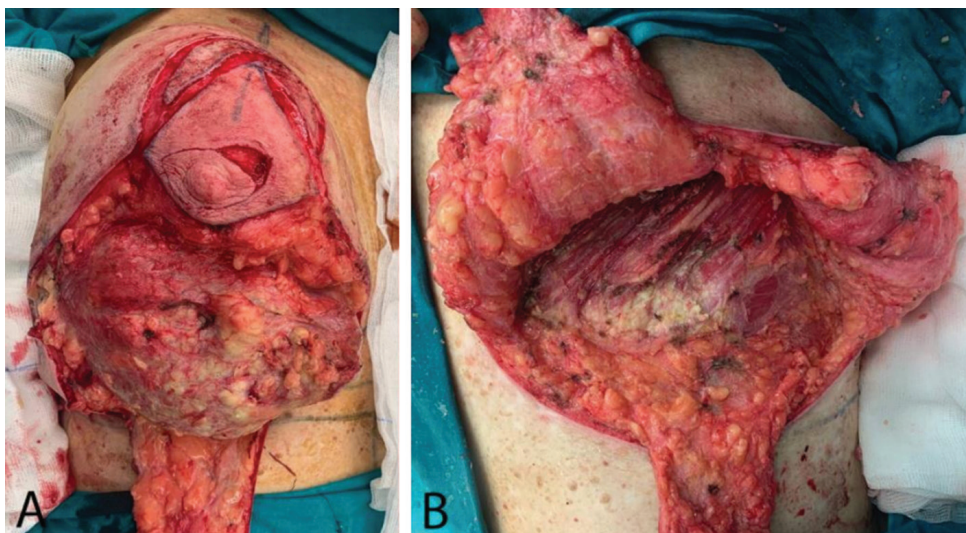
**Figure 1.** Both mammary glands are infiltrated with PAHG. The right retromammary space is filled with polyacrylamide gel particles. Small clusters of PAHG are seen behind right and left mammary glands (marked by red arrows).

## DISCUSSION

Over the past century, the history of tissue fillers repeated itself many times. The first mention of heated paraffin as a filling agent dates back to 1890-1900.<sup>[1]</sup> Due to numerous complications, including not only chronic inflammatory and purulent processes, but also deaths associated with fat embolism, surgeons and cosmetologists categorically refused this method. Paraffin was replaced in the 1940s and 1950s by liquid silicone.<sup>[1]</sup> Many of the complications associated with paraffin injections recurred, but this time with silicone injections. Several cases of silicone migration to other parts of the body after augmentation mammoplasty, fistulas and ulcers formation were reported. Pulmonary complications such as pneumonitis and silicone embolism that resulted in death also were described. In the 1970s, silicone injections were substituted with PAHG injections.<sup>[1]</sup> Early postoperative results seemed satisfactory, but over time, the number of late complications associated with PAHG injections increased to 18.3%–81%.<sup>[3,4]</sup>



**Figure 2.** A. Frontal view before surgery; B. Lateral view before surgery; C. Preoperative sites marking.



**Figure 3.** Intraoperative picture. **A.** Inflamed mammary gland impregnated with PAHG; **B.** Retromammary space infiltrated with polyacrylamide.

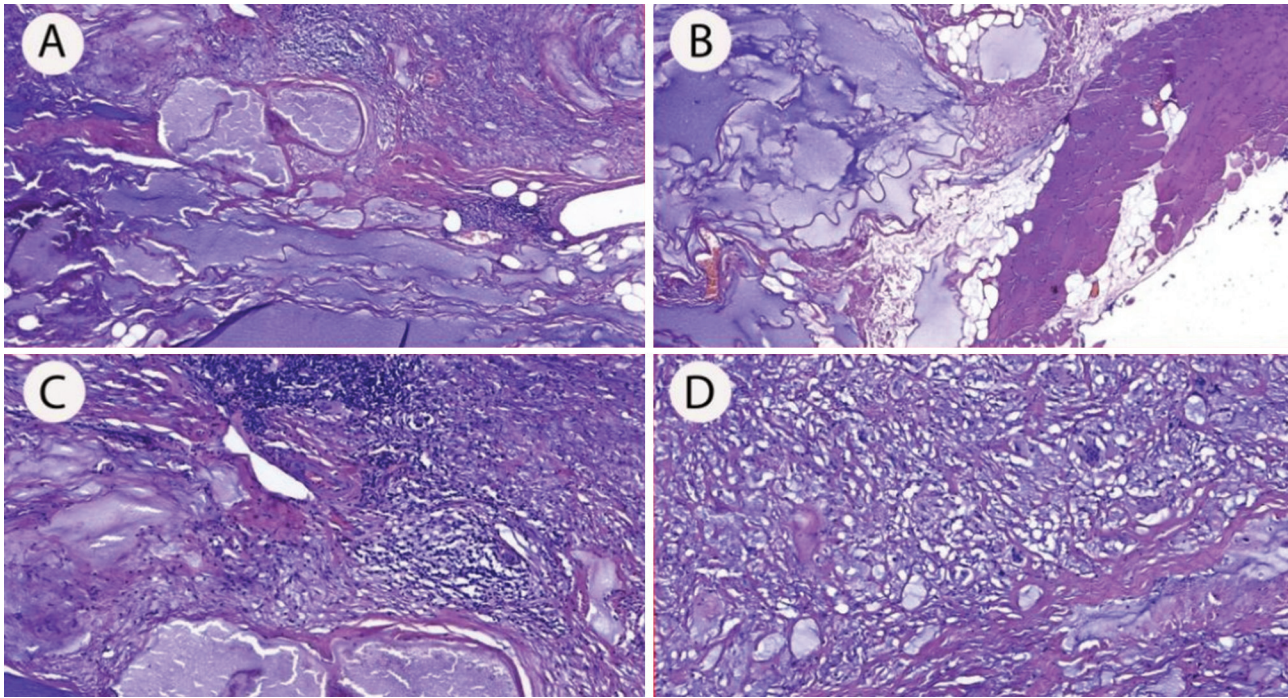


**Figure 4.** **A.** Frontal view after surgery; **B.** Lateral view after surgery.

More detailed studies in mice showed that in the early hours after PAHG injection into the subcutaneous fat, neutrophil migration, the release of a large number of pro-inflammatory mediators, such as prostaglandins, leukotriene B4, and lysozyme were observed.<sup>[5]</sup>

Clinical manifestations resulting from PAHG injections<sup>[6]</sup> can be divided into two categories<sup>[1]</sup>. The first type includes the chronic inflammatory changes in the mammary tissue – a change in skin color, induration, hydrogel replacement into the intermuscular spaces and other parts of the body.<sup>[1,7]</sup> The second type comprises purulent-necrotic processes (abscesses, skin ulcers, fistulas), which are associated with the unpredictable hydrogel migration. PAHG microparticles may reach different layers of a mammary gland, such as dermis and epidermis, resulting in blood supply disruption, pain, and subcutaneous nodules formation.<sup>[1]</sup>

Post-injection complications may develop from several months to several decades after injection was made. Cases of PAHG granulomas formation in the supraclavicular region, shoulder and anterior abdominal wall were described.<sup>[2,7]</sup> According to current data, PAHG migrates down to the inframammary fold towards the anterior abdominal wall or the pelvis (in 34% of cases), laterally beyond the posterior axillary line towards the back (in 25% of cases), up to the axillary tail or upper limb (in 22% of cases), medially towards contralateral side (in 10% of cases), and may occupy several zones simultaneously (in 9% of cases).<sup>[7]</sup> In the presented clinical case, US and MRI revealed lateral migration of PAHG. Hydrogel migration direction is of great significance for surgical treatment planning.<sup>[7,8]</sup> In the absence of inflammation and massive PAHG migration, it is possible to perform one-step hydrogel evacuation and breast augmentation using an implant. In the remaining



**Figure 5.** A, B, C, and D. - multiple foci of PAHG particles seen as basophilic homogeneous substance are scattered along the mammary gland tissue. Polyacrylamide inclusions are surrounded by histiocytes and multinucleated cells.

cases, two-stage surgery is indicated, since it is associated with a lower risk of capsular contracture. Complications after such procedures remain high, up to 39%–51.5% of cases.<sup>[8]</sup> Given the pronounced cosmetic defect, diffuse impregnation of the mammary gland and PAHG migration into the axillary region, the patient underwent mastectomy without breast reconstruction.

Since hydrogel is highly adhesive, surgical intervention is associated with a number of technical difficulties, especially when it migrates to the intermuscular spaces. Early PAHG removal is associated with a better prognosis and a better cosmetic effect.<sup>[4]</sup> Examination of such patients should include mammography, US, and MRI. Based on the accumulated scientific knowledge, MRI mammography is the most optimal diagnostic method in order to identify the exact hydrogel location and assess risk of long-term complications.<sup>[9]</sup> In this regard, at the stage of preoperative planning, all patients are required to undergo MRI examination. Comprehensive imaging, clinical picture and hydrogel localization assessment allow us to determine the optimal volume of surgical intervention and the possibility of further breast reconstruction.<sup>[10]</sup>

## CONCLUSIONS

Unsatisfactory and aggravating results of injection mammoplasty led to a significant decrease in performing this procedure. However, surgeons continue to deal with the long-term complications of this procedure. The chronic inflammatory process, PAHG migration, and trophic changes

in the chest wall soft tissue lead to considerable technical difficulties during surgical intervention and unsatisfactory aesthetic results.

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## Competing Interests

The authors have declared that no competing interests exist.

## REFERENCES

1. Peters W, Fornasier V. Complications from injectable materials used for breast augmentation. *Can J Plast Surg* 2009; 17(3):89–96.
2. Hilton JD, Steinke K. Extensive migration of injected free liquid silicone for breast augmentation with related major complications. *BJR Case Reports* 2015; 1(2):20150098.
3. Luo S-K, Chen G-P, Sun Z-S, et al. Our strategy in complication management of augmentation mammoplasty with polyacrylamide hydrogel injection in 235 patients. *J Plast Reconstr Aesthet Surg* 2011; 64(6):731–7.

- Zou H, Mo R, Wang S, et al. Analysis of breast follow-up results in patients after polyacrylamide hydrogel (PAAG) or silicone prosthesis removal. *J Plast Reconstr Aesthet Surg* 2023; 77:219–27.
- Errasfa M, Russo-Marie F. Characterization of a polyacrylamide gel-induced granuloma in mice: involvement of arachidonate metabolites. *Agents and Actions* 1988; 24(1-2):123–9.
- Osmanov EG, Shulutko AM, Krylov AY, et al. Polyacrylamide mammary syndrome - specificity of the histological pattern of the focus before and after air-plasma treatment. *Med J Russian Feder* 2021; 27(3):247–55. doi: 10.17816/0869-2106-2021-27-3-247-255
- He J, Wang T, Dong J. Classification and management of polyacrylamide gel migration after injection augmentation mammoplasty: a preliminary report. *Aesthetic Plast Surg* 2020; 44(5):1516–21.
- Patlazhan G, Unukovych D, Pshenishov K. Breast reconstruction and treatment algorithm for patients with complications after polyacrylamide gel injections: a 10-year experience. *Aesthetic Plast Surg* 2013; 37(2):312–20.
- Teo SY, Wang SC. Radiologic features of polyacrylamide gel mammoplasty. *Am J Roentgenol* 2008; 191(3):W89–95.
- Sukhotko AS, Covantsev S, Kovaleva MV. Tissue engineering in breast cancer reconstruction: a look into the future. *Iberoam J Med* 2023; 5(4):141-142. doi: 10.53986/ibjm.2023.0016

## Хирургическое лечение после увеличивающей маммопластики с использованием полиакриламидного гидрогеля

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### Резюме

Маммопластика с использованием полиакриламидного гидрогеля – простая и относительно доступная операция. Однако эта процедура связана со значительной частотой поздних осложнений, что побудило её приостановить в 2006 году. Несмотря на это, пациенты продолжают сталкиваться с долгосрочными последствиями. К ним относятся миграция гидрогеля, изменение формы и объёма груди, гранулемы, свищи и образование абсцессов. Описанный здесь клинический случай представляет собой хирургическое лечение после увеличивающей маммопластики с использованием полиакриламидного гидрогеля, проведённой 35 лет назад.

### Ключевые слова

реконструкция груди, хирургия груди, пластическая хирургия, маммопластика с использованием полиакриламидного гидрогеля, мастэктомия