Augmentation Mammoplasty Using Polyacrylamide Hydrogel Injection Can Mimic Breast Cancer After 20 Years: A Case Report

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Polyacrylamide hydrogel (PAAG), an injectable, jelly-like, medical hydrogel, has been popular in some countries as a non-surgical method of mammoplasty since approximately 2000. Particularly in China, many patients underwent mammoplasty using PAAG during a 16-year period until 2006, and studies on its course and complications were also conducted. However, evidence regarding the relationship between PAAG mammoplasty and malignancy is lacking, and only a few cases have reported the possibility of this association. Herein, we present a case in which malignancy was suspected because of complications 20 years after PAAG injection mammoplasty.

Key Words: Breast, Mammoplasty, Foreign bodies, Polyacrylamide gel

INTRODUCTION

Polyacrylamide hydrogel (PAAG), an injectable, jelly-like, medical hydrogel, has been popular in Europe, China, and Russia as a non-surgical method of mammoplasty since approximately 2000 [1,2]. PAAG was injected under simple local anesthesia, and the results were similar to those of implant surgery; therefore, this technique gained popularity at local clinics in these countries [1,3]. Particularly in China, from the end of 1990 to 2006, until the national ban on PAAG, many patients underwent mammoplasty using PAAG for approximately 16 years, and studies on its course and complications were conducted [1,2,4]. Like other injectable implants, PAAG is known to cause complications, such as induration, pain, swelling, infection, fever, aseptic inflammation, hematoma, gel migration, and leakage [1,5,6]. However, evidence of its relationship with malignancy is lacking, and only a few cases have reported the possibility of this association [2,7,8].

Herein, we present a case in which malignancy was suspected because of complications 20 years after PAAG injection mammoplasty.

A 58-year-old woman visited a local clinic with left breast pain that started 3 months ago. She underwent an ultrasound examination of the breast and was referred to our hospital for suspected malignancy. Although the patient had no significant history, she underwent bilateral mammoplasty using injectable PAAG approximately 20 years ago for cosmetic purposes in China. She first complained of a recent increase in size and pain associated with the left breast when she visited the hospital in March 2022. On examination, the left breast was larger than the right breast, and grade IV Baker’s capsular contracture was observed. In addition, there were no specific findings on the nipple, the areola, or the skin. On palpation, both breasts were firm; however, the left breast was harder than the right. There were no additional palpable masses in either breast. There were no significant findings on basic blood investigations and chest radiographs. Magnetic resonance imaging (MRI) revealed multifocal and multicentric cystic masses with enhancing nodular portions in both breasts. About 3.0-cm enhancing mass in the left 2 o’clock position and a 3.9-cm mass abutting the chest wall 8 cm away from the nipple in the left 6 o’clock position were observed. For the mass in the left 2 o’clock position, a biopsy was recommended, as it was suspected as a category 4b lesion (Figure 1).

Ultrasonography (USG) also revealed findings similar to those observed on MRI, and a USG-guided core needle biopsy was performed

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for the most prominent 3.0-cm mass in the left 2 o’clock position, which was suspected as a category 4b lesion (Figure 2).

The pathology results of the core needle biopsy revealed infarction and degeneration. The patient wanted to undergo bilateral PAAG removal, as the possibility of malignancy could not be ruled out. Therefore, total bilateral PAAG removal and, if necessary, bilateral total mastectomy was planned. Intraoperative findings revealed huge masses from the previous PAAG mammoplasty, which were completely encapsulated and separated from the surrounding tissue and were well dissected from the normal breast tissue and muscle. Invasion of the surrounding tissues due to cancer growth, which we were concerned about, was not observed. Therefore, we did not perform total mastectomy or surrounding tissue resection but only performed bilateral foreign body removal (Figure 3). The gross specimen was surrounded by a very thick capsule with jelly-like fluid material inside.

The cross sectional findings revealing a thick capsule full of debris are shown in Figure 4. In the left breast, we could observe the part where core needle biopsy was performed because it was suspected as a mass. The final pathology results for both foreign bodies revealed only the chemical material with fibrosclerosis and degeneration. This case report was approved by the public Institutional Review Board (IRB No. P01-202210-01-004).

Figure 1. Magnetic resonance imaging for evaluation. (A) The axial T1-weighted pre-contrast image shows an iso signal intensity mass with an internal hyperintense portion in the left breast. Polyacrylamide hydrogel (PAAG) appears as a large prepectoral fluid collection that appears isointense. (B) The axial T2-weighted image shows relatively symmetrically located multiseptated masses at the peripheral aspect of the PAAG collection that is T2 hyperintense. (C) The axial dynamic-enhanced T1-weighted image of the first post-contrast acquisition shows an approximately 3.0-cm sized heterogeneous enhancing mass (arrow) in the left breast at the 2 o’clock position (type 1, persistent kinetic curve). (D) The diffusion-weighted (DW) images obtained with diffusion gradients (b-value of 800 sec/mm²) (F-1) and the parametric apparent diffusion coefficient (ADC) map (F-2). An enhancing area of a multiseptated mass (arrow) appears bright on a DW image and dark on an ADC map (ADC value: 0.999 x 10⁻³ mm²/s).

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Herein, we observed that PAAG could create necrotic lesions that mimic cancer. PAAG has been used for facial contours, lips, and atypical soft tissue lesion shaping prior to its use in mammoplasty, and its stability has been verified [1,9-12]. Since 1997, China imported PAAG from Ukraine and began performing augmentation mammoplasty [1-3]. As this procedure gained popularity, complications were also reported. However, there are only three reports of malignancy, and it is challenging to determine whether these are directly related to PAAG [2,5,7]. A previous study demonstrated that PAAG increased c-myc proto-oncogene messenger ribonucleic acid expression and caused apoptosis in human fibroblasts, thereby changing the physical param-

**Figure 2.** Ultrasound findings. (A) Ultrasound reveals multiple, variable-sized, heterogeneous echoic masses that are avascular at the peripheral aspect of a large, unilocular collection of injected polyacrylamide hydrogel material with thick, internal debris. (B) Ultrasound-guided core needle biopsy of the left 2 o’clock mass, category 4b.

**Figure 3.** Gross specimen findings. Right, 13.0 × 10.2 cm, Left, 13.5 × 13.0 cm, with a thick degenerated necrotic capsule and inner gel-like fluid material.

**Figure 4.** Cross sectional findings. (A) Left breast and (B) right breast.
eters of cells [2,13]. This finding may serve as the basis for predicting an increased risk of cancer; however, solid evidence is missing [7,14]. Conversely, there may be many cases in which early or hidden breast cancers caused by mammoplasty may be missed or detected late [2,7,14].

The patient did not report any symptoms or complications for 20 years after undergoing bilateral PAAG mammoplasty. Therefore, regular breast examinations were not performed. With the occurrence of breast pain that started 3 months prior to presentation, she realized that there may be a problem related to the mammoplasty. Although recent imaging techniques can adequately screen for breast cancer under implant conditions, in the case of injectable mammoplasty, such as PAAG, accurate screening is challenging; therefore, USG or MRI is preferred [3,15]. USG and MRI have proven to be effective for cancer detection, even in cases of injectable mammoplasties [2,3,15]. In the case of MRI, the current state and complications are reflected by the state of the PAAG water content [3]. Fortunately, the final pathological finding in the patient in this report was not breast cancer. However, based on this case, it can be highlighted that a long-term injectable augmentation mammoplasty requires periodic breast cancer screening.

In Korea, although not PAAG, AQUAfilling gel (Biomedica, Prague, Czech Republic), a hydrophilic gel comprising 98% sodium chloride solution (0.9%) and 2% cation copolyamide, has recently been used for augmentation mammoplasty. Its complications have been reported in several case reports. It has a cosmetic outcome similar to that of PAAG; therefore, similar complications are expected [6].

As in this case report, it should be explained to patients that augmentation mammoplasty using PAAG or other injectable materials may not be permanent and may require surgical removal in the case of complications. In addition, since it has a different characteristic from a normal breast, it is necessary to educate patients on the need to monitor breast cancer through regular breast examinations using USG or MRI.

**CONFLICT OF INTEREST**

The authors declare that they have no competing interests.

**REFERENCES**
