



PET-CT findings of inflammatory changes related to PAAG breast injections

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Abstract

Breast augmentation was first introduced in 1964 by utilizing silicone based implants with many variety of breast augmentation techniques invented since. Polyacrylamide hydrogel (PAAG) based breast injections have been available since 1980s as a low cost means of breast augmentation. In this case report, a 41-year-old female with history of lymphoma was noted to have FDG avid breast lesions on PET-CT, which was later found to be related to breast augmentation technique utilizing PAAG injections. This case report briefly discusses the PAAG injections, their imaging characteristics on various modalities, complications, and management.

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Case report

A 41-year-old female of Asian descent presented to the nuclear medicine department for PET-CT imaging after being diagnosed with lymphoma. On initial imaging, contrast enhanced CT scan through the thorax demonstrated ill-defined retro-glandular mixed density collections with thick enhancing capsule and enhancing strands coursing through the collections (Figure 1). A fused PET-CT (Figure 2A) with corresponding attenuation corrected image (Figure 2B) demonstrated FDG avid retro-glandular ill-defined collections and avid FDG activity within the native breast tissue.

Upon further questioning patient's history revealed cosmetic breast augmentation utilizing polyacrylamide hydrogel (PAAG) injections performed at a New York City salon many years earlier. She elicited history of intermittent breast tender-

ness for some time, but did not seek medical attention as she related these symptoms to cyclical physiologic breast tenderness. No further imaging was performed at our facility as she continued her treatment at a local facility, and the patient was unfortunately lost to follow-up. Although rarely encountered in daily practice, here is a case of PET-CT findings of inflammatory changes within breast tissue related to PAAG injections.

Discussion

Breast augmentation is the most common cosmetic procedure in the United States and across the world according to recent statistics, with an increasing trend [1]. Breast augmentation utilizing silicone implants was first introduced in 1964. In addition to silicone and saline implants, there have been many



new methods of breast augmentation invented over the years [2]. One such technique is the use of PAAG injections as a tissue filler utilized during illegal procedures across the country, which include facial fillers and buttock implants as well as breast augmentation. This method was first introduced in the Soviet Union in 1980s, and slowly spread into China and Iran. Although banned in the United States due to its side effect profile, patients with PAAG breast injections are commonly encountered in the United States due to immigration and tourism [3-6].

Polyacrylamide is considered a non-toxic water-soluble compound, which becomes polyacrylamide hydrogel (PAAG) upon hydration. PAAG is a suspension of 2.5-5% polyacrylamide and 95-97.5% water. PAAG injections appear as water density on CT, as in the case of this patient, due to water solubility [8]. A total volume of 150-200mL of PAAG suspension is injected into the retroglandular space of each breast, usually at the inframammary crease or upper region of the breast. Gel implants have also been visualized within the pectoralis musculature, which may be a result of migration vs. erroneous site of injection [3-6].

The acrylamide monomer is present in polyacrylamide preparation at a level ranging from <0.1 – 0.1% [5,7]. Occasionally this polyacrylamide can degrade into the monoacrylamide, which is both a neurotoxin and a carcinogen. Based on literature review there is no evidence to suggest breast augmentation obscures or delays diagnosis of breast cancer, nor is there a direct causality established between PAAG implants and development of malignancy [8]. However, Cheng et al presented two cases of breast cancer in patients with PAAG implants with two possible theories. PAAG can [1] inhibit growth and induce apoptosis of human fibroblasts, and [2] alter the size and granularity of human fibroblasts, while inducing an increase in mRNA expression of *c-myc*, both of which can eventually lead to fibrosis, foreign body reaction and inflammation [8].

Generally, patients who have undergone PAAG injections present at the time of routine breast imaging for cancer screening. However, there is a subset of females who may present within 6 months to 10 years post injection with a complaint of induration or masses (most common), followed by pain, and other non-specific symptoms [5,6]. The most concerning complication after receiving PAAG injections is breast cancer. The key to diagnosis of such complications is to identify breast augmentation material on routine imaging, as history is generally not forthcoming. Thus, using this case as an example, recognition of such lesions on unrelated imaging such as a CT thorax is vital. It is essential to identify pathologies related to these injections on imaging to guide appropriate disposition of these patients.

Breast imaging typically consists of ultrasound, mammography, and MRI. On ultrasound, PAAG injections appear as retro-glandular globular hypoechoic collections with variable internal echogenicity and a thick surrounding echogenic focus, corresponding with the capsule. The internal echogenicity may depend on whether there is active inflammation within and surrounding these collections [9]. On mammography, the injection material may appear as an amorphous fluid collection similar to or denser than adjacent normal breast. On MRI, PAAG injections appear as non-enhancing T2 hyperintense fluid collections with internal foci of T2 hypointensity, which likely correspond

with fibrous strands or debris such as calcifications [9].

Treatment involves multi-step surgical debridement with a goal to remove the gel completely. Management can vary depending on presence of active inflammation or infection. An initial debridement followed by reconstruction at a later time is utilized in patients with active inflammation [10]. Similarly, management of local infection is suggested prior to debridement and reconstruction to allow the breast to maintain normal shape [10]. Unfortunately, in many cases the debridement results in resection of large volume of native breast tissue and subsequent reconstruction with resultant unsatisfactory appearance of the breasts with extensive postsurgical scarring [3,6].

Conclusion

In conclusion, although such a case is uncommon in general practice, physicians should be aware of various breast reconstruction approaches and recognize signs of abnormality at the earliest presentation. This will reduce the chance of delayed diagnosis of malignant breast cancer. Additionally, physicians must educate the patients of the devastating complications of utilizing such illegal means of cosmetic procedures.

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