

The Augmented Breast



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Augmented breasts present special challenges for medical imaging. This article reviews mammographic techniques and other imaging modalities used to screen for and diagnose breast disease in patients with augmented breasts. Other topics include different types of breast implants and surgical techniques used for implantation, as well as overviews of breast disease and mammographic reporting.

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After completing this article, readers should be able to:

- Summarize the history of breast augmentation surgery.
- Describe the characteristics of silicone and saline breast implants.
- Identify the different implantation sites for breast implants.
- Discuss implant complications.
- List the most common risk factors for breast cancer.
- Summarize breast cancer screening recommendations.
- Discuss special issues concerning mammography of augmented breasts and describe the Eklund technique.
- Compare and contrast other imaging techniques used to evaluate augmented breasts.
- Explain the classification system for breast findings on a mammographic report.

Medical imaging is used to screen for breast cancer and guide biopsy and treatment of breast cancer. For women with breast implants, imaging also can be useful for examining the integrity of the implant for rupture or other abnormalities; however, imaging women with breast implants can be challenging because the implants obscure anatomy.¹ With breast cancer diagnosed in 254 000 American women each year,² it is important to obtain clear and effective imaging to potentially save thousands of lives.

Statistics

Breast augmentation is the most common cosmetic surgery in the United States, according to the American Society of Plastic Surgeons. In 2010, approximately 296 000 cosmetic breast augmentation procedures were performed, followed by nose reshaping (252 000) and eyelid surgery (209 000). There was a 2% increase in cosmetic plastic surgery from 2009 to 2010 and a

39% total increase in breast augmentation from 2000 to 2010.³ Because this trend is expected to continue, it is important that health care professionals have a clear understanding of the differences and challenges associated with treating patients with augmented breasts. For radiologic technologists, the focus is on obtaining quality imaging in a way that enhances patient care.

Breast cancer is equally common in women with and without breast implants⁴ and is the second most common cancer among all women (with skin cancer being the most common).⁵ Global mortality is higher among women with augmented breasts compared with those without, although this is thought to be the result of lifestyle differences and not necessarily related to implants.⁶ According to the Centers for Disease Control and Prevention, almost 41 000 women died from breast cancer in 2007.⁷ Fortunately, the death rate from breast cancer has declined in the United States every year since 1990⁸; however, early detection is critical to maintaining this success.

History of Breast Augmentation

The use of breast implants was first documented in 1895. The procedure was conducted by Vincenz Czerny and involved using the woman's own adipose tissue.⁹ The use of paraffin wax for breast augmentation was attempted in 1889, followed by several other procedures involving various materials in the early to mid-1900s. The first flap procedure was developed by Berson and Maliniac and involved rotating the patient's chest wall tissue into the breast to add volume. Silicone injections were used as early as the 1950s and 1960s but resulted in adverse effects that included silicone granulomas and hardening of the breasts.

In 1992, the U.S. Food and Drug Administration (FDA) banned the use of silicone gel-filled breast implants for breast augmentation after reports of adverse events in thousands of women. Although the silicone implants remained available for breast reconstruction following mastectomy, the FDA did not allow their use in breast augmentation surgery again until 2006. The use of saline implants has not been banned by the FDA.

Today, silicone breast implants are available for women older than 22 years, and saline implants are available for women 18 years and older. The FDA designated these age restrictions to accommodate the difference in safety risks of the 2 types of implants and to allow for the complete development of breast tissue before implantation.¹⁰

Breast Implant Types

Breast implants are prostheses used to enhance or reconstruct the breasts. After mastectomy, breast implants can restore a woman's confidence and help decrease worry caused by the constant reminder of a missing breast.¹¹ In addition, women who have undergone breast augmentation as a cosmetic procedure often report improvements in their physical appearance and an increase in self-confidence and sexual function.¹²

Today, silicone and saline are 2 primary types of implants used in the United States for breast augmentation. Silicone implants consist of a silicone shell, called a lumen, filled with a viscous silicone gel. Saline implants are a hybrid: They have a silicone elastomer lumen filled with a saline solution.

Other types of breast implants exist, including polypropylene string implants or soybean oil implants, but these are uncommon and not approved for use by the FDA. Polypropylene string implants were removed from the market in 2001 because of complications. Because this type of implant continues to absorb body fluid

after implantation, abnormally large breasts can occur. Soybean oil implants were removed from the market in the United Kingdom in 1999 as a result of adverse-event reports and the concern that the breakdown of products of the soybean oil filler could cause cancer. The Medical Device Agency, which is the British equivalent of the FDA's Center for Devices and Radiological Health, issued a warning in 2000 that recommended the removal of soybean oil implants to avoid pregnancy and breastfeeding complications.⁴

The cohesive gel, or "gummy bear," implant is a fifth-generation silicone implant that has been in clinical trials and awaits FDA approval. This type of implant is filled with more cross-linked filler gel than its approved fourth-generation counterpart and is said to be more stable. However, these implants are only available to women enrolled in clinical trials.¹³

Silicone

Silicone and saline implants have different consistencies and internal structures. Silicone gel has a viscosity similar to human fat, lending it a more natural appearance.¹¹ Silicone implants were developed in 1961 in Houston, Texas, by plastic surgeons Thomas Cronin and Frank Gerow and were the first implants to be marketed. There are 5 generations of silicone gel implants, classified according to variations in manufacturing techniques (see Table 1).

There are 3 types of silicone implants: single lumen, which are filled by the manufacturer before they are implanted; double lumen with an inner lumen prefilled by the manufacturer and an outer lumen filled during the implantation procedure; and double lumen with an outer prefilled lumen and an inner lumen filled with saline through a valve during the procedure. This third type of implant combines the advantages of silicone and saline by having improved viscosity (like silicone) and the ability to be inserted through a small incision and inflated within the body (like saline). Moreover, the outer saline compartment can help keep the inner silicone compartment from leaking.¹⁴

One drawback to silicone implants is that if rupture occurs and the gel leaks into the surrounding tissue it will remain there unabsorbed. This can delay detection of rupture because deflation will not be as apparent as it is when a saline implant ruptures.¹⁴

Saline

Saline implants were first manufactured in 1964 in France in response to the adverse reactions associated