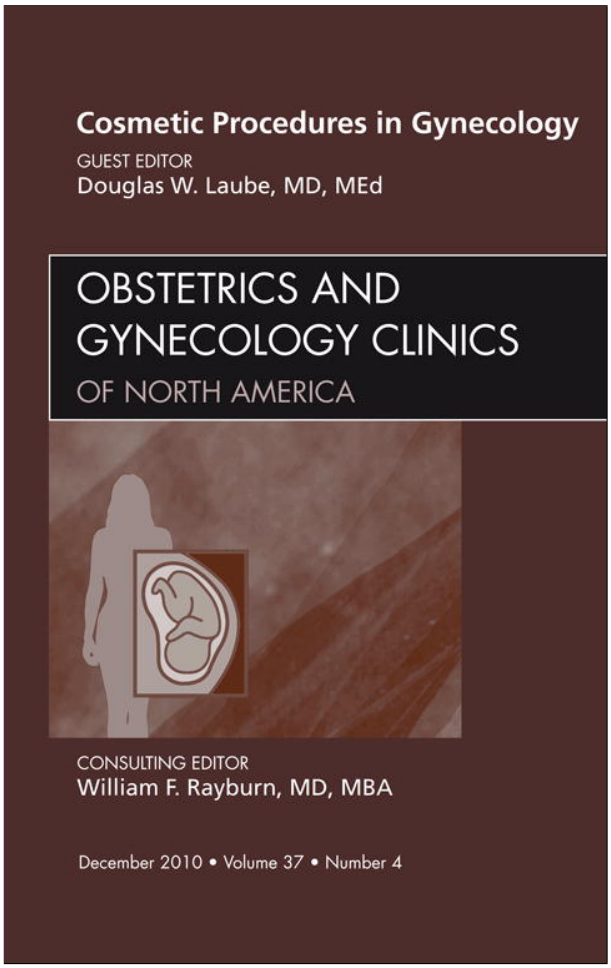

Breast Augmentation

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KEYWORDS

• Breast • Augmentation • Implants • Aesthetic • Cosmetic
• Saline • Silicone • Fat

Breast augmentation is the most commonly performed cosmetic procedure among American women.[1] There are presently 5 ways to augment the breasts in the United States: saline implants, silicone implants, autologous fat injections, external tissue expanders, and tissue flaps. Implants comprise most cosmetic requests, but fat injections are gaining popularity among patients undergoing concomitant liposuction. External tissue expanders are effective for small-volume augmentation, but are not widely used because they are cumbersome and produce variable results. Tissue flaps are a mainstay of reconstructive surgery, but are occasionally used in selected aesthetic cases. The direct injection of synthetic materials into the breast for the purpose of augmentation is not presently approved by the Food and Drug Administration (FDA).

HISTORY

Czerny,[2] credited with the first breast augmentation in 1895, transplanted a lipoma from a woman's back to her chest wall following a mastectomy for benign disease. Gersuny[3] introduced paraffin wax injections for breast, face, and body augmentations in 1900, but subsequently abandoned them because of frequent granulomas, migration, and infections. Liquid silicone breast injections originated as an illicit practice among prostitutes in post-World War II Japan using stolen aircraft fluids.[4] Even after medical-grade silicones became available, continued illicit use, improper medical use, and a tendency to migrate led to many complications and, consequently, this application was made illegal in certain locales. From the late 1940s to the early 1960s, synthetic sponges made from a variety of plastic polymers were tried, but demonstrated numerous problems.[5]

The modern breast implant device was introduced in 1962 by Cronin and Gerow in conjunction with the Dow Corning company.[6] The first-generation silicone prosthesis

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contained a viscous silicone gel within a thick teardrop-shaped silicone shell with prominent seams and Dacron fixation patches on its posterior surface to promote adherence to the chest wall. These implants had a very high incidence of capsular contracture. Second-generation silicone implants were introduced in the early 1970s with the goals of reducing the risk of capsular contracture and of producing a more natural result. These devices were filled with a softer silicone gel, possessed a smooth thinner shell, were round, and no longer displayed fixation patches. Thinner shells led to a new condition known as "gel bleed" in which components of the silicone gel would diffuse through the shell and generate a sticky film and a persisting problem with capsular contracture.[7] A third generation of silicone implants was introduced in the 1980s featuring a stronger double-layered shell and a thicker silicone gel aimed at reducing "gel bleed."[8] Textured surfaces and more viscous cohesive silicone gel marked the next (fourth) generation of silicone implants, which became available in the mid-1980s.[9] Enhanced cohesive (highly cohesive, form-stable, "gummy bear") silicone gel distinguishes the fifth and latest generation of silicone implants, which were introduced in the mid-1990s and are used extensively worldwide, but are presently in FDA clinical trials.[9] Because of FDA mandate, in brief, silicone breast implants for cosmetic enhancement were not available in the United States from 1992 to 2006.

Saline-filled breast implants were introduced in 1965 in an effort to permit smaller skin incisions by filling the device after insertion.[10] The first of these devices had a fill valve permanently attached to its posterior surface that would be sealed manually by the surgeon with a Teflon plug. It was eventually discontinued because of a very high incidence of spontaneous deflation.[11] Modifications in valve design and a thicker shell introduced in the late 1960s led to an acceptable low deflation rate and entry into the American market. At the present time, all saline implants available in the United States are designed to be filled at surgery; prefilled saline implants exist, but have not been cleared by the FDA.

Breast augmentation with injections of autologous fat harvested by liposuction was first described in the early 1980s.[12] Early enthusiasm worldwide was soon tempered by concern, albeit speculative, that such transplants would confound or delay the radiologic diagnosis of breast cancer.[13] Ongoing critical analysis over recent years has demonstrated, however, that these concerns do not appear to be heightened in comparison with other cosmetic breast procedures and these findings have stimulated a renewed interest in this type of breast augmentation.[14,15] To date, this procedure appears best suited for small-volume augmentation and for cosmetic tissue remodeling around existing synthetic breast implants and frequently requires multiple treatment sessions to achieve a desirable lasting result (**Fig. 1**).

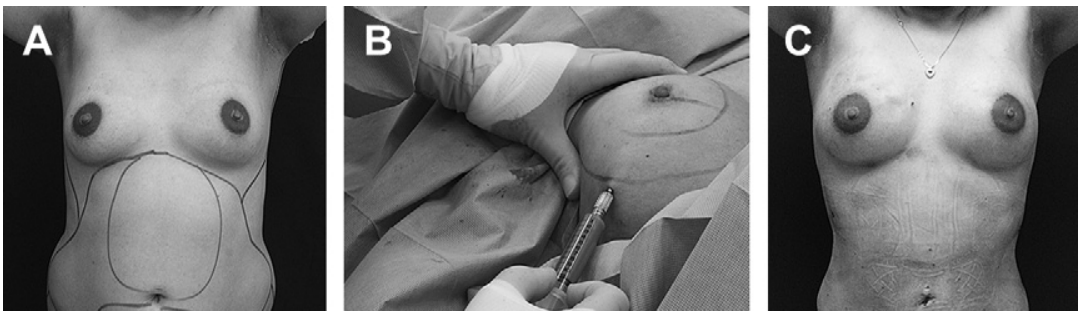

Fig. 1. Breast augmentation with autologous fat. (*A*) Liposuction fat harvest areas are marked. (*B*) Fat is transplanted into the breast with multiple small-volume injections. (*C*) Appearance 1 day after surgery with 200 mL of fat injected into each breast.

Breast augmentation with external tissue expanders was introduced in 1999.[16] The method, currently known as the Brava system, uses a pair of self-sealing rigid polyurethane domes that are applied directly over the breasts to create a negative pressure that causes tissue distraction, which, in turn, stimulates tissue growth (**Fig. 2**). Although the technology is effective, it has not gained popularity because it requires a minimum of 10 hours of continuous daily use for a minimum of 10 weeks to produce results, and the results, under the best of circumstances, are typically less than a 1-cup-size augmentation.

PATIENT SELECTION AND ASSESSMENT

The best candidates for breast augmentation with implants are nonobese women displaying relatively symmetric breasts, a symmetric frame, and lacking breast ptosis (**Fig. 3**). Ptosis is evaluated with the patient standing and is defined as descent of the center of the nipple-areola complex (NAC) below the level of the inframammary fold (IMF) and is commonly graded as mild (0 to 1-cm descent), moderate (1- to 3-cm descent), or severe (>3-cm descent). Subcategories and alternate classification systems have been proposed primarily for the design of mastopexy (breast-lifting) procedures rather than for augmentation and are not addressed herein. The tissues into which the implants are to be placed are referred to as the tissue envelope and the characteristics of the envelope define both the implant dimensions and tissue planes best suited for the individual patient.

A complete documented medical evaluation including appropriate screening for preexisting breast disease and risk factors should precede any cosmetic breast surgery. Any anatomic distortion with the potential to increase the risk of injury or asymmetry should be assessed and managed by appropriate means before surgery. Blood work analyses include testing for signs of infection, anemia, coagulopathy, and liver disease. Pregnancy testing is performed or repeated on the day of surgery irrespective of history. If the physician performing the medical evaluation is not the surgeon and is unfamiliar with the proposed operation, basic relevant details of the planned anesthetic agents and surgical interventions should be provided along with the request for medical clearance.

Patients most frequently verbalize their desired goal in terms of brassiere cup size, but do not always have a well-defined concept of their appearance at the requested size. To facilitate the selection process, it is helpful to use a photographic portfolio of women of similar build augmented with implants of various sizes preferably operated

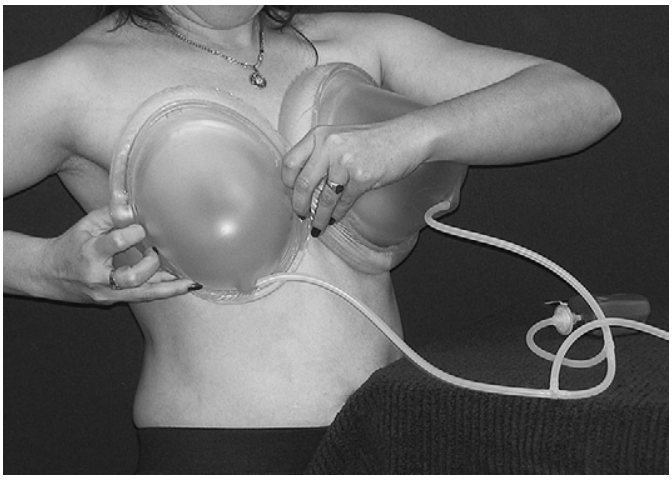

Fig. 2. The Brava external tissue expansion device is being applied. Negative pressure created by a vacuum pump causes tissue distraction, which, in turn, causes tissue growth. Prolonged use is required and augmentation results are modest.

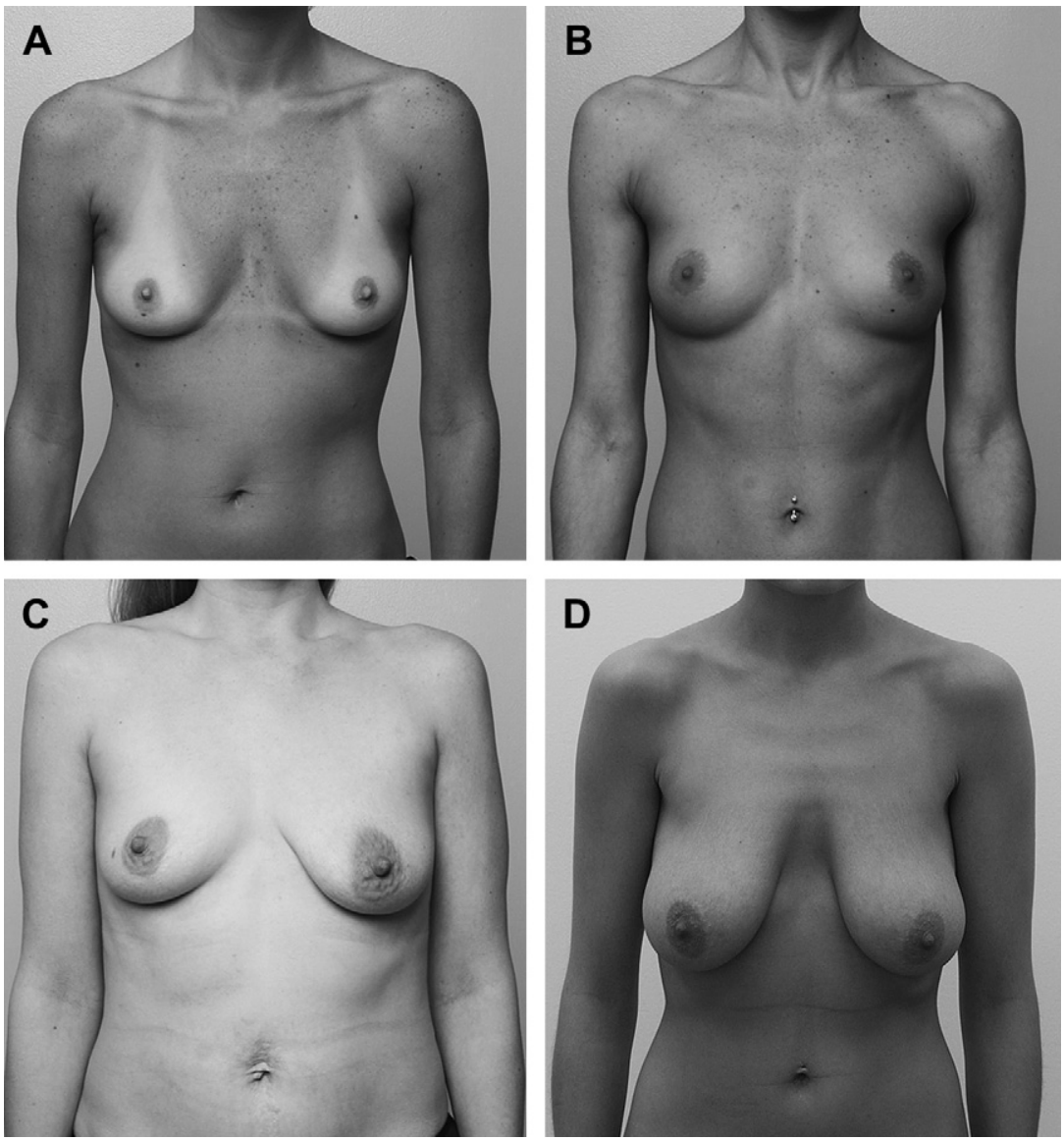

Fig. 3. Four distinct presentations for cosmetic breast surgery. (*A*) Symmetry and absence of ptosis are ideal for implants. (*B*) Slight size asymmetry requires larger implant on left side. (*C*) Unilateral mild ptosis, size asymmetry, and areolar asymmetry warrants unilateral mastopexy and bilateral implants. (*D*) Severe symmetric ptosis warrants bilateral mastopexy without implants.

by the same surgeon. Other aids include sizer implants and sizer brassieres, which permit the surgeon to evaluate the difference in volume between the desired cup size and the existing breast tissue. Computer-generated photographic imaging software is widely marketed, but currently lacks the sophistication necessary to produce realistic images of the many variations of the augmented breast as they relate to the specific tissue planes and the qualities of the native soft tissue coverage. The visualization process is further enhanced by having the patient spend a few days wearing sizer implants at her desired size in different styles of clothing. The counseling process should include a discussion about the degree of attention that the requested size may generate as well as the physical consequences that the implants may have on the body, especially if the request reaches or exceeds the limits of the soft tissue coverage. In general, the larger the implant, the greater the risk for unfavorable cosmetic outcomes.

Medications, supplements, herbs, and other substances with the capacity to impair coagulation should be discontinued in advance of surgery. Substances that interact

negatively with anesthetic agents and perioperative medications should also be withheld. If they cannot be discontinued or substituted, the surgical plan will need to be modified, delayed, or withheld. Cigarette smoking is not a contraindication to breast augmentation, but smokers typically display a higher incidence of capsular contraction and rippling than nonsmokers and must be counseled appropriately.

Expectations and motivations need to be explored in depth when addressing the cosmetic patient. Unrealistic expectations will never be fulfilled by surgery even if executed to perfection by any medical or aesthetic standard. The cosmetic surgery "addict," the "perfectionist," and the patient expecting cosmetic surgery to remedy interpersonal conflicts are examples of misguided personality types to be screened out at the initial consultation.

ANESTHESIA

Breast implants may be placed under local anesthesia with or without intravenous sedation or general anesthesia. Each modality has its advantages, disadvantages, inherent risks, and suitability for the unique demands of each operation and patient. Regardless of technique, the surgical team should be knowledgeable and prepared and the facility should be equipped to manage all potential adverse drug effects.

ANATOMY

Embryologically, the breast bud develops into the breast gland within Scarpa fascia, splitting it into an anterior and a posterior layer (lamellae) which are commonly termed the superficial and deep layers of superficial fascia, respectively. These lamellae remain connected to one another via fibers known as Cooper ligaments, which provide support to the breast. The posterior lamella of the breast rests primarily on the fascia of the pectoralis major muscle and to a much lesser extent on the fascia of surrounding muscles (serratus anterior, external oblique, rectus abdominis).

The vascular supply to the breast is diffuse. The main supply derives from the internal mammary artery (internal thoracic artery) via perforators through the medial chest wall and the lateral intercostal perforators, which derive from the lateral thoracic artery. Superiorly, the breast is supplied by the thoracoacromial artery perforators. The venous drainage system closely follows the arterial supply. The lymphatic system is not disrupted to any significant degree by breast augmentation procedures.

INCISION SITES AND IMPLANT POCKETS

The 3 main decisions made in any breast augmentation are implant selection, incision site, and tissue plane (pocket plane). For a given patient, there are frequently a variety of acceptable approaches to reach the desired goal. Common incision sites include the inframammary fold, the periareolar region, and the axilla. Other options include the umbilicus and through the upper margin of an abdominoplasty flap. There are 4 possible pocket planes for implant insertion: the subglandular plane, the subpectoral or partial submuscular plane, the subfascial plane above the pectoralis major muscle, and the total submuscular plane.

The inframammary incision was the original approach to breast implant insertion and it remains popular among surgeons because it provides the most direct route of implant insertion, excellent exposure, and the greatest ability to expand the incision as needed. All 4 pocket planes can be accessed via the inframammary route. For certain types of larger prefilled devices, such as form-stable highly cohesive silicone gel implants, this may be the only viable approach that avoids damage to either

surrounding structures or to the prosthesis itself in the process of insertion. Nonetheless, this approach inevitably leaves a visible scar, which detracts from its popularity among women especially those in whom less than ideal scarring and keloid formation are of concern. Important technical aspects of the inframammary incision include a location slightly lateral to the midline to permit easy access to the border of the pectoralis major (**Fig. 4**), and the identification and preservation of Scarpa fascia along the natural inframammary fold to support the weight of the implant and avoid a bottoming out of the prosthesis over time.

The periareolar approach is technically easy, permits a rapid pocket dissection in any of the 4 pocket planes, and typically leaves an indistinct scar. Limitations include the inability to expand the incision in the presence of a small areola for the insertion of a large prefilled implant and the inevitable breach of the breast parenchyma that accompanies the requisite dissection process. Also, exposure may be difficult to generate if the areola is small. This route carries the highest risk of implant infection owing to the proximity of the breast ductal system, colonized with skin-borne bacteria, to the surgical field. This route is favored by many nonendoscopically trained surgeons especially for the subpectoral implant pocket because it provides good direct visualization for muscle division. Keys to an optimal cosmetic result include maintenance of the incision entirely within the border of the pigmented areolar skin, precise reapproximation of the incision edges, and selecting patients with an adequately large areolar diameter.

Transaxillary breast augmentation was originally developed as a blind approach in the early 1970s and evolved into an endoscopic approach in the early 1990s. All 4 pocket planes may be accessed via this route. The axilla scars well even in women prone to hypertrophic scarring because of the lack of skin tension in the area and incisions placed high within the axillary dome cannot be viewed in most positions of the arm (**Fig. 5**). The blind approach has its few stalwart “dying breed” proponents from the nonendoscopic era, but the inability to confirm hemostasis and accurate dissection of the pocket directly cannot be disputed. The endoscopic approach relies on basic techniques, equipment, and skills familiar to any surgeon with training and experience in laparoscopic surgery. Because of the magnified field of view, it affords unparalleled exposure and control of the surgical field and precise dissection. Essential details of the axillary incision include incision placement high within a skin crease in the axillary dome behind the lateral border of the pectoralis major to minimize scar

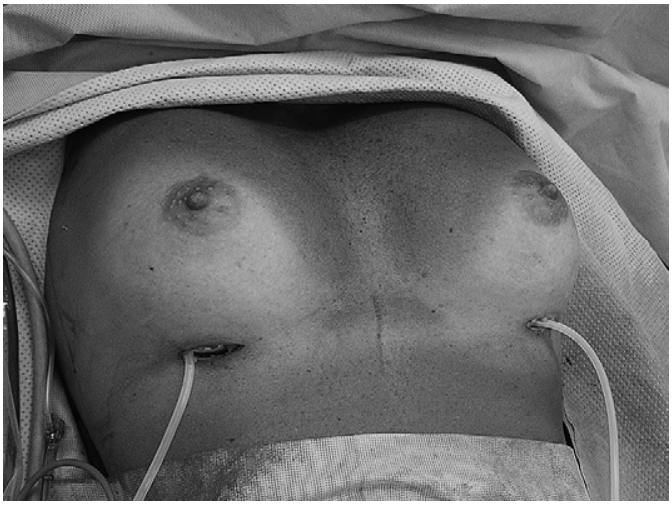

Fig. 4. Inframammary incision for subpectoral implants is made slightly lateral off-center from nipple to permit better access to lateral border of pectoralis major muscle.

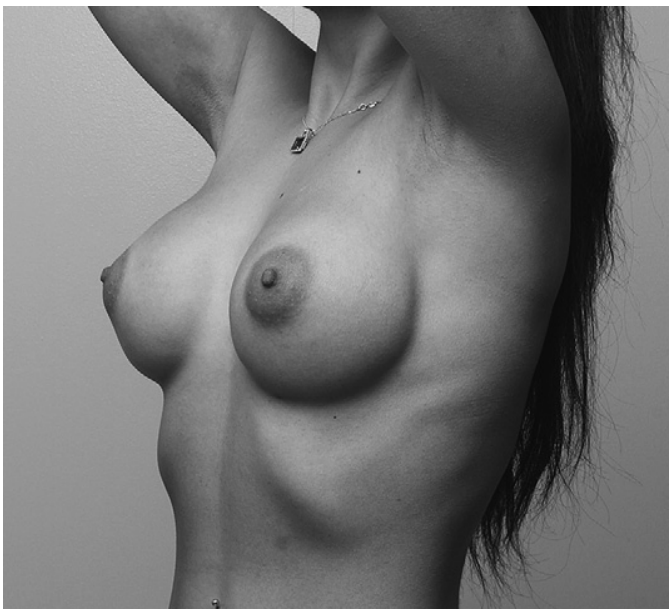

Fig. 5. The axillary incision placed high in the dome of the axilla along a natural skin crease is indistinct 1 year after surgery.

visibility and subcutaneous dissection around the intercostobrachial nerve, which provides sensory innervation along the posteriomedial upper arm (**Fig. 6**).

Transumbilical breast augmentation (TUBA) was developed in the early 1990s based on concepts and techniques derived from breast implant insertion via abdominoplasty flap dissections. The technique relies on the dissection of bilateral access

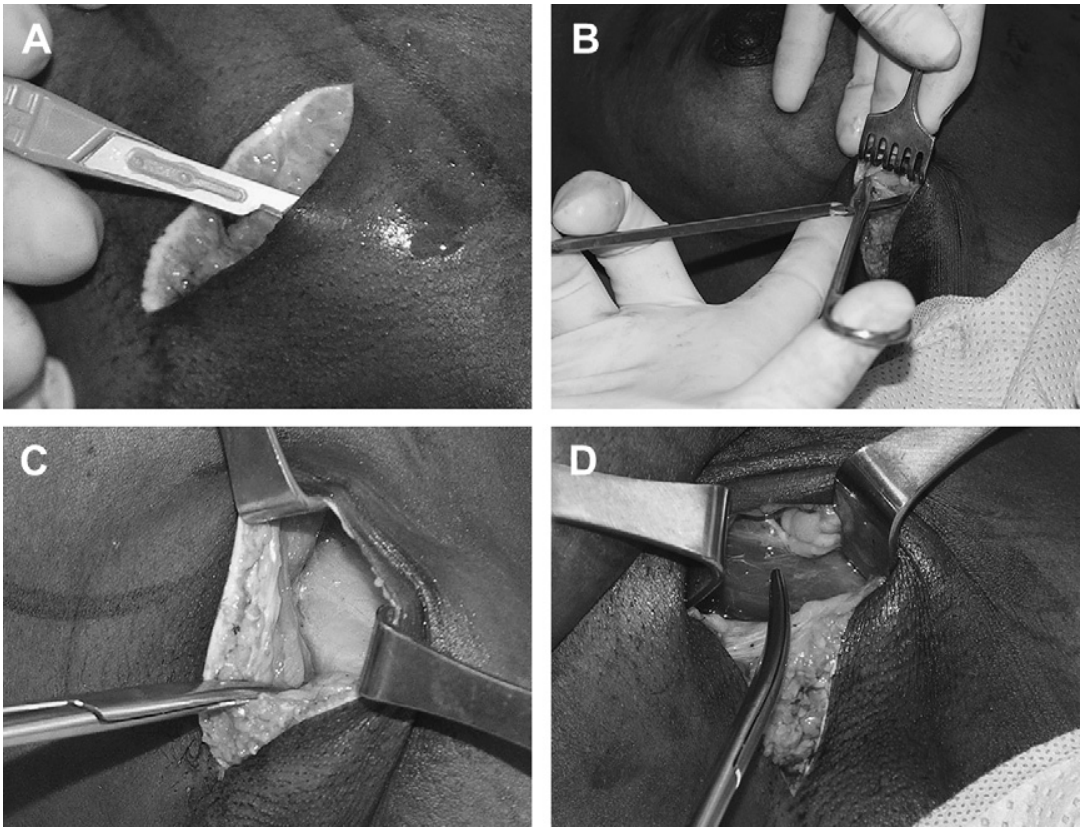

Fig. 6. Key steps of the axillary incision protect the intercostobrachial nerve, which crosses perpendicular to the skin incision in the superficial fat. (*A*) Undermining of skin from fat. (*B*) Superficial tunneling anterior to the nerve. (*C*) Atraumatic retraction of nerve and fat to expose pectoralis major fascia. (*D*) Lateral border of pectoralis major muscle exposed.

tunnels from the umbilicus to the inframammary fold by palpation using a large blunt-tipped tube and blunt development of the implant pocket with long dissectors and an expander. Only the subglandular and subpectoral pockets can be accessed by current methods. TUBA is a blind approach, but an endoscope is frequently used to verify the subpectoral plane and to confirm hemostasis. Bleeding and hematomas are less common with TUBA than with other techniques, but conversion to another incision is necessary if hemostatic control cannot be achieved by other means. The nature of the access tunnels limits this operation to inflatable saline implants.

The subglandular (prepectoral) pocket is made in the loose areolar tissue plane that exists between the deep superficial fascia of the breast envelope (posterior lamella) and the fascia overlying the pectoralis major and serratus anterior muscles. This pocket is generally acceptable for women with adequate subcutaneous tissue thickness in the upper pole of the breast to provide adequate coverage of the upper half of the breast implant. It is also frequently used when augmenting a slightly ptotic breast because it permits the lax tissues to spread evenly without clinging to the pectoralis fascia. The dissection is relatively simple and postoperative discomfort is minimal because muscle dissection is not required. Subglandular implants carry a higher risk of rippling around their periphery because the plane is close to the skin. They also carry a higher risk of capsular contracture than implants placed beneath the pectoralis muscles.

The subpectoral (partial submuscular, dual-plane, biplanar) pocket is created immediately beneath the pectoralis major muscle and above the rib cage and pectoralis minor muscle. Adequate dissection of the implant space warrants full-thickness division of the pectoralis major fibers along the inferior margin of the breast and blunt mobilization of the serratus anterior muscle along the lateral margin of the pocket. Division of the pectoralis major fibers creates a gap in the muscle that exposes the overlying breast tissue to the implant in the lower pole of the breast (subglandular plane) while muscle tissue remains to cover the implant in the upper pole of the breast (submuscular plane). Patients do not experience a loss of arm strength or function from this type of muscle division because most of the pectoralis major muscle remains intact along its medial and superior attachments to the chest wall. The subpectoral pocket is favored for women with minimal subcutaneous tissue in the upper pole of the breast. It also carries the lowest risk of capsular contracture presumably owing to the constant motion of the breast implant in response to the regular action of the overlying muscle. Subpectoral implants have a tendency to distort the contour of the breast to varying degrees when the pectoralis major muscle contracts. This is not a major issue for most women, but is of concern to female body builders in particular.

The subfascial pocket, a potential space between the pectoralis major and serratus muscles and their overlying fascia, was first described in the late 1990s, initially via the axillary approach and subsequently via the periareolar and inframammary routes.[17] Characteristics of the space are similar to those of the traditional subglandular pocket, but it offers slightly more tissue coverage at the implant edges and offers another option to women who will not tolerate implant distortion related to pectoralis muscle contraction.

The total submuscular pocket is essentially a subpectoral pocket without any division of the pectoralis major fibers along the lower pole of the breast along with partial mobilization of the serratus anterior muscle fibers along the inferolateral pocket margin. The only advantage to this space is decreased palpability of the inferior border of the implant in the presence of minimal native tissue thickness along the inframammary fold. Dissection of the serratus anterior fibers is not along any natural plane and implants

placed in this pocket have a tendency to ride high (superior malposition) over time. This is the least commonly used pocket.

When the breast is augmented with autologous fat injections, the fat is layered throughout the periphery of the breast tissue rather than directly into the center of the stroma. It is sometimes also injected into the pectoralis major muscle. To maximize the surface area of injected fat in contact with an adequate blood supply in the recipient tissues, it is transplanted with multiple small-volume passes rather than with large-volume depot injections. Injection sites are commonly placed at the areolar border, the inframammary fold, and the axillary fold. The recipient sites are frequently injected with vasoconstrictive solutions to minimize bruising and to reduce the risk of intravascular injection; blunt-tipped needles are used exclusively.

PERIOPERATIVE CONSIDERATIONS

All techniques of breast augmentation begin with systematic and precise markings of the proposed pocket margins, incision sites, and anatomic landmarks, preferably in the standing position (**Fig. 7**). Volume asymmetry is carefully assessed, as are the thickness of the tissue envelope in the upper and lower poles of the breast, and the distance from the nipple to the inframammary fold. Measurements are recorded and markings are photographed.

Antibiotic prophylaxis before and after surgery is mandatory when implanting a prosthetic device and should target common pathogens of the skin and breast ductal system. Spare implants should be available in case the primary implants are damaged or contaminated; they should remain available in the immediate postoperative phase in the event that unexpected findings warrant explantation, revision, and replantation. If the surgeon wishes to have some flexibility in the choice of implants, a variety of sizes should be stocked. Implant makers provide consignment arrangements that make it relatively simple to maintain an array of different models and sizes.

The surgical suite should be equipped with an operating table that can flex the patient from supine to upright to assess final implant position. Noninvasive monitoring of blood pressure, electrocardiogram, and pulse oximetry should not encroach upon the surgical field. The skin is cleansed thoroughly with betadine or similar agents. Some surgeons prefer to cover the nipple-areola complex with an occlusive dressing for the duration of the surgery to minimize bacterial contamination of the surgical field. Frequent and copious irrigation is used, but the ideal solution has yet to be

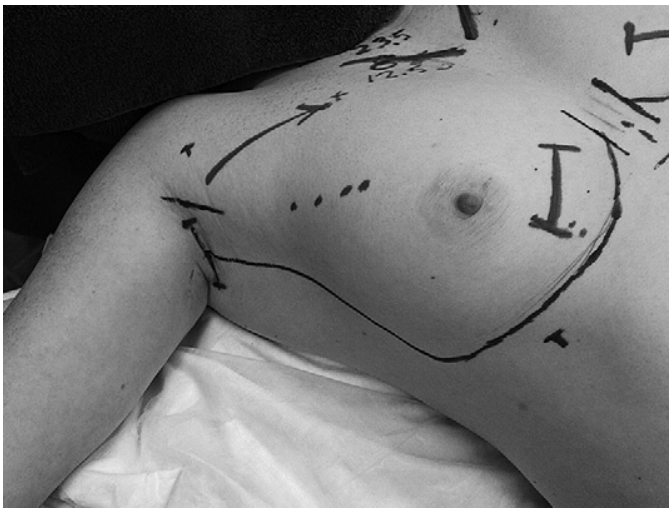

Fig. 7. Surgical markings indicate base anatomic dimensions, the margins of the implant pocket, incision location, and anatomic landmarks.

established. The most common irrigants are either dilute antibiotic mixtures or diluted betadine. Specialized blunt dissectors are commonly used to expand and shape the implant pocket (**Fig. 8**). Surgical drains are used when deemed necessary, but prolonged use may increase the risk of infection.

After surgery, absorbent dressings are placed over all incision sites and elastic stabilization bands are applied above and sometimes below the implants. For subpectoral implants, muscle relaxants aid in reducing postoperative discomfort especially for reflex tension of the back muscles. Most patients describe varying degrees of pressure over the chest from the implants, which increases with inspiration through the first day after surgery. General discomfort is proportional to implant size and is managed with either oral narcotic or nonsteroidal medications. Patients are reassessed for proper healing and band placement on the first day after surgery, then weekly for the first few weeks thereafter. Supportive and underwire-type brassieres are avoided until the implants have settled into proper position—a process that may take several weeks or even months. Until that time, nipple shields or sports bras are used. Patients with subglandular implants are instructed in the performance of breast exercises 2 to 3 times daily beginning in the second postoperative week to help prevent capsular contracture and may resume full activity in 3 weeks. Patients with subpectoral implants do not require breast exercises and are counseled to avoid exercise or vigorous use of the chest muscles for the first 6 weeks after surgery. The ability to turn a steering wheel without pain determines the patient's readiness to resume driving a motor vehicle.

Breast augmentation by autologous fat grafting is performed on the same day as the liposuction harvesting procedure to maximize tissue viability and to minimize the risk for infection. The fat is harvested using narrow-caliber liposuction cannulas to facilitate

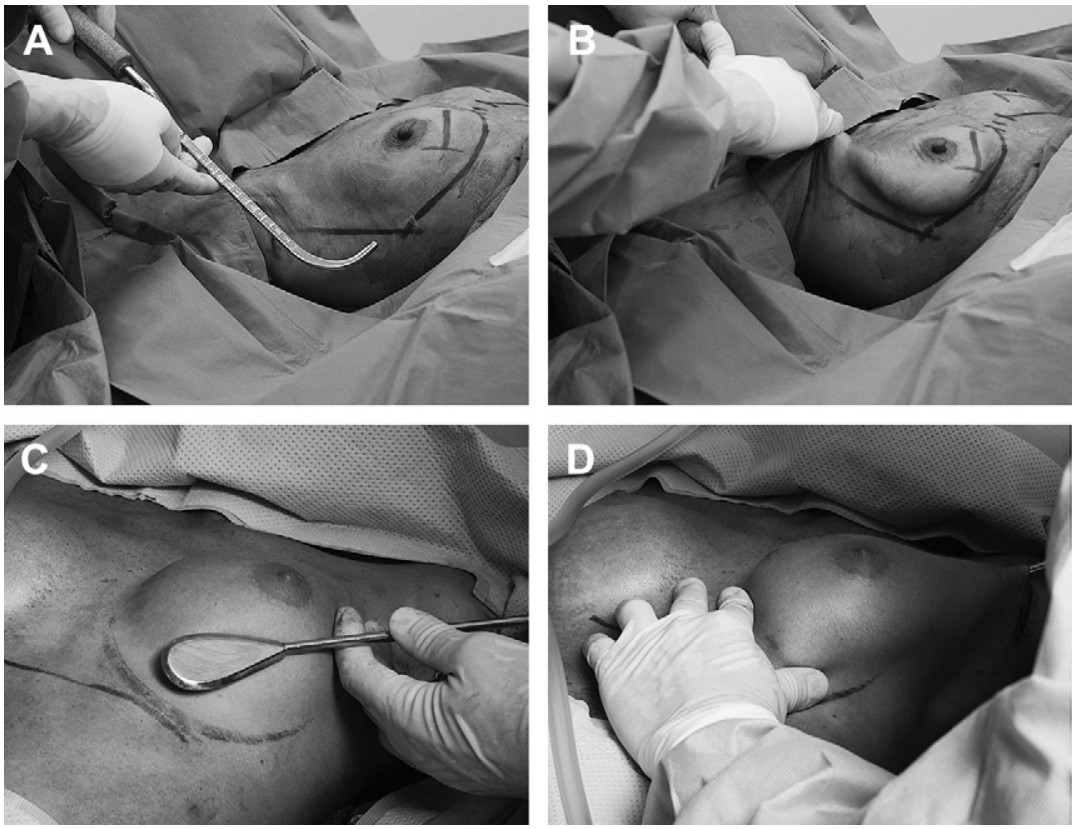

Fig. 8. Common breast dissectors. (*A, B*) Agris-Dingman "hockey stick" blunt dissector is used for general expansion of lateral and inferior implant pocket. (*C, D*) Flat paddle blunt dissector is used for minor pocket adjustments sometimes with implant or sizer in place.

reinjection with narrow-caliber fat transfer cannulas. Low-suction pressures are used to minimize barotrauma to the harvested fat and technologies that destroy adipocytes, such as ultrasound and laser, are avoided. These procedures are commonly performed under local anesthesia and the recipient site is often injected with a lower volume of the same anesthetic solution used for the liposuction procedure. The patient is fitted with a tight conforming surgical bra, which is worn continuously for the first few weeks after surgery. There is some loss of volume over time, but the final breast shape typically stabilizes by the sixth month. The need for additional fat-grafting sessions is common.

COMPLICATIONS

Complications of breast augmentation with either implants or fat may relate directly to the surgical procedure itself, to the immediate cosmetic outcome, to delayed long-term changes of the augmented breast, or to the prosthesis. Some cosmetic changes may be viewed either positively or negatively depending on the patient's expectations.

Bleeding-related problems may arise intraoperatively upon intended or unintended division of any of the high-pressure intercostal and internal mammary perforator blood vessels that course along the lateral and medial borders of the implant pocket at various levels of dissection. Control is straightforward provided the surgical field is well exposed, but delayed bleeding may result in hematoma formation. In the hypertensive patient, low-level oozing may be seen despite careful dissection and management may include the placement of temporary surgical drains. Although implants provide a degree of tamponnade, this effect should not be relied on as a substitute for hemostatic surgical technique. Blood left within the pocket may provoke significant discomfort and increase the risks for infection and capsular contracture. Hematomas of the implant pocket typically produce swelling, bruising, and extreme discomfort of the affected breast and warrant prompt surgical exploration. Seromas or delayed hematomas produce painless swelling and firmness of the breast, are not associated with bruising, and are treated with surgical drainage with or without implant exchange; sonography is a useful diagnostic aid.

Infection may complicate breast implant surgery at the external incision site or around the prosthesis itself. Incisional infections not involving the implant are treated with antibiotics and evacuation of any localized pus if present. Infections involving the implant warrant immediate bilateral explantation, antibiotic therapy, and a delay of replantation of several months. Delayed surgical intervention increases the risk for permanent disfigurement of the breast.

Damage to the integrity of the chest wall is a risk of any operation in the thoracic region and fortunately is not common with breast augmentation. Pneumothorax has been reported to occur with breast augmentations performed under both local and general anesthesia and has been diagnosed intra- and postoperatively. Various mechanisms of injury have been either identified or postulated to include pleural lacerations during dissection, needle puncture of the pleura with injection of local anesthetics, rupture of pulmonary blebs or bullae related to high anesthetic ventilation pressures, and barotrauma in cases where large implants are forcibly inserted through small incisions into pockets with trapped air.[18]

Capsular contracture is the most common complication of breast implant surgery and the risk is highest with silicone implants. The etiology is unknown, but is thought to be inflammatory and related to bacterial contamination.[19] The Baker grading system is commonly used to describe the degree of contracture with Grade I defined as the normal, soft breast texture; Grade II is a firm breast texture with normal contours; Grade III is a firm breast texture with altered breast contours; and becomes

Grade IV if the breast is painful as a result of the condition. Treatment is reserved for Grades III and IV only and involves total or partial capsulectomy depending on the risk of chest wall injury with dissection of deep, adherent capsules. The prevention of this condition drives many surgical protocols and implant design modifications and is an area of intense ongoing research.

Asymmetry relating to breast volume or contour or inframammary fold level may exist either before or after surgery (**Fig. 9**). The nipple-areola complex may vary significantly between both breasts and ptosis may be unilateral. Preoperative asymmetries must be pointed out at the initial consultation and variations in the surgical plan and choice of implants carefully and thoroughly discussed so that the patient understands the limitations of each step in the process, especially if the achievement of relative symmetry will require additional incisions. Postoperative asymmetries may affect any aspect of the breast contour as well as the level of the inframammary fold and some may require surgical revision of the pocket, whereas others may require repositioning of the nipple-areola complex.

Wrinkling and rippling of the tissues along the edges of the implant is sometimes seen, especially with large implants placed into small breasts where the tissue envelope is prone to thinning over time. No singular cause for rippling has been identified, but it is more commonly seen with textured saline implants, subglandular pockets, and cigarette smokers. Management options include replacing affected saline implants with silicone implants or targeting the ripples directly with injections of autologous fat.

Synmastia is a rare complication of breast implant surgery in which the implant pockets fuse across the midline resulting in a loss of cleavage. It is thought to result from aggressive medial dissection or excessively large implants.[20] Correction involves positioning implants in an alternate pocket and suturing the medial borders of the existing defects. Preventive measures include the avoidance of dissection close to the midline and preservation of the medial pectoralis fibers when placing subpectoral implants.

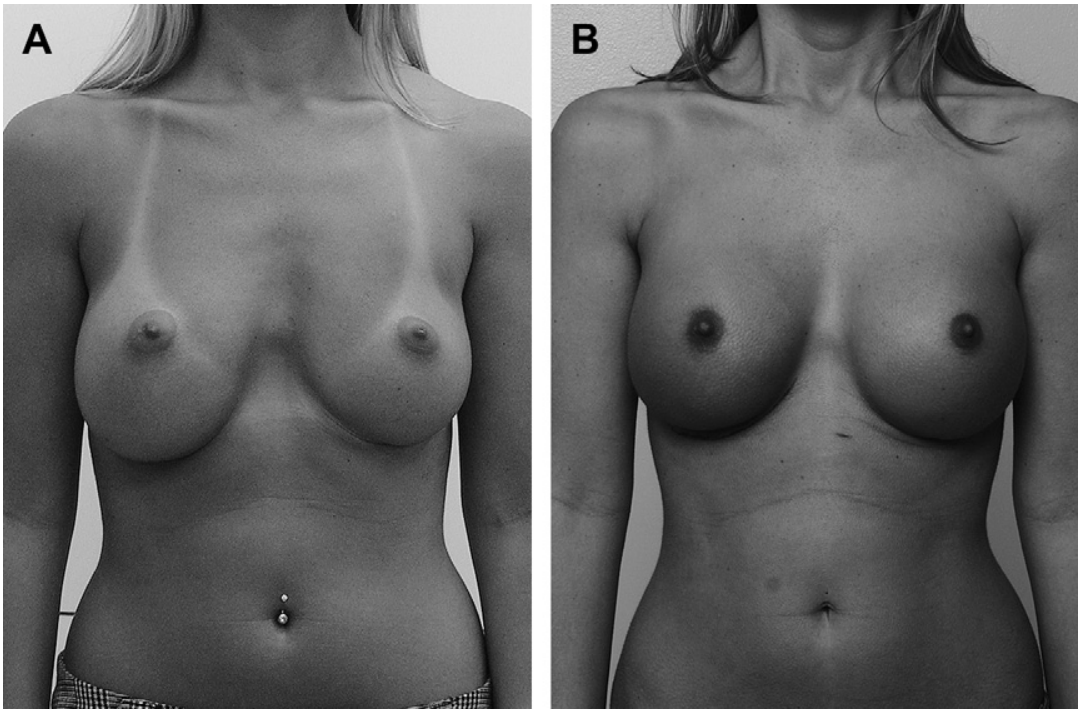

Fig. 9. (*A*) Presentation 17 months post inframammary subpectoral saline augmentation with acute deflation of left implant and inferior malposition "bottoming out" of right implant. (*B*) Treatment consisted of elevation of right inframammary fold and replacement of both implants via inframammary incisions and was performed under local anesthesia.

Device failure may present as deflation of a saline implant or rupture of a silicone implant. Saline implants may deflate as a result of valve failure, chronic creasing of the shell if underfilled, or trauma. Failure generates a rapid and obvious loss of volume as the saline is rapidly absorbed (see **Fig. 9**). Silicone implant rupture does not result in loss of volume and thus, may be unknown to the patient. Most ruptured silicone implants are diagnosed at the time of revisionary surgery for unrelated reasons and in most, the silicone is contained within the biologic capsule. Magnetic resonance imaging is advocated as the modality of choice for screening for implant rupture, but patients with claustrophobia or certain types of implanted hardware are not candidates and different generations of silicone implants demonstrate different radiologic characteristics of rupture.[21]

Breast cancer is not a complication of breast augmentation by any modality, but the augmented breast complicates standard mammographic screening.[22] Mammographic displacement studies and magnetic resonance imaging are frequently used to better assess areas that are obscured by implants on routine mammographic views. Tumors of the breast parenchyma are typically easier to palpate in the presence of implants and can be biopsied by standard open techniques, but deeper lesions may require temporary removal of the implant for access.[23] Although studies are limited, breast implants do not appear to affect breast cancer survival.[22]

Changes resulting from autologous fat injections to the breast may include palpable lumps, fat necrosis, liponecrotic cysts, and calcifications that are distinct from those of malignancy.[14] None of these changes are unique to fat transfer and may occur with any type of breast surgery including breast reduction, breast biopsy, reconstructive procedures, implants, radiation therapy, and liposuction.[14] The most common undesirable outcome of breast augmentation with transplanted fat is a partial loss of the implanted volume, which has been reported to range from 30% to 60% of the original volume in sonographic studies.[24]

SUMMARY

Breast augmentation is the most commonly performed cosmetic procedure among American women. Saline implants, silicone implants, and autologous fat injections are the most common options. The inframammary, periareolar, and axillary approaches with or without endoscopy are the most common routes of implantation. The subpectoral dual-plane and the subglandular plane are the most common pockets. The most common complications are capsular contracture for implants and volume loss for injected fat. Breast augmentation does not appear to increase breast cancer risk or survival rates.

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