

Breast Augmentation

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Learning Objectives: After studying this article, the participant should be able to: 1. Assess patient physical characteristics that influence implant selection. 2. Adopt a system to aid in implant size selection. 3. Become cognizant of the advantages and disadvantages of incision, pocket plane, and implant options. 4. Understand implant positioning concepts and aseptic implant handling methods. 5. Manage untoward postoperative sequelae. 6. Understand secondary surgery concepts.

Summary: Breast augmentation is the most commonly performed aesthetic surgical procedure. Choices of incisions, pocket plane, and myriad implant characteristics constitute the basis for surgical planning. Analysis of physical characteristics and inclusion of the patient in implant selection contribute to overall satisfaction and reduce requests for secondary surgery. Technical expertise in implant positioning and aseptic handling helps to prevent capsular contracture, implant malposition, and other shape problems. Despite the need for secondary surgery in some, patient satisfaction is high. (*Plast. Reconstr. Surg.* 133: 567e, 2014.)

Breast augmentation is the most common aesthetic surgical procedure, with more than 300,000 performed in 2011.¹ Choices of incisions, pocket plane, and implant characteristics, including shape, texture, filler, and volume, constitute the key decisions in surgical planning. Thoughtful analysis of physical characteristics and patient participation in the process are the most important factors in size selection. Knowledge of implant positioning and aseptic handling concepts contributes to successful outcomes and minimizes the need for secondary surgery. Patient satisfaction is high with this procedure, despite significant reoperation rates to treat capsular contracture, implant deflation, malposition, and other problems (**References 2 and 3: Level of Evidence: Therapeutic, IV**).^{2,3}

ESSENTIALS OF PREOPERATIVE ASSESSMENT AND MANAGEMENT

Patient Evaluation

Each patient's psychology, aesthetic sense, and anatomy must be critically assessed. Emotional stability is a mandatory prerequisite.⁴ Style of dress, makeup, tattoos, piercings, previous aesthetic procedures, community, and occupation reflect

personality and aesthetics. Anatomic limitations must be explained to the patient.

Height and weight influence implant selection. For example, tall patients require larger volumes than short patients to achieve a similarly proportioned result. Thin patients are not well suited to saline implants. Idiosyncrasies in body morphology also play a role: patients with wide hips or shoulders look better with larger implants compared with those who are narrower.⁵

Chest wall shape is important to note.⁶ Pectus excavatum occurs occasionally, whereas pectus carinatum and Poland's syndrome are rare.⁷ Central deformities are typically ameliorated sufficiently by breast augmentation alone. Deep pectus excavatum deformities can be treated simultaneously with a custom solid silicone implant made from a plaster moule, but most patients decline this option. Poland's syndrome, when severe, may require adjunctive procedures, such as tissue expansion, fat grafting, and latissimus muscle transfer.^{7,8} A round thorax shape makes the breast axes diverge, causing the breasts to appear farther apart following augmentation. A

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rectangular thorax makes the axes parallel, so that the breasts appear closer together postoperatively.⁹ Hemithorax asymmetry due to differences in shape or relative protrusion can create an uneven breast foundation, suggesting different size implants despite equivalent breast volumes (Fig. 1).¹⁰ Scoliosis can cause vertical breast asymmetry requiring thoughtful implant positioning to minimize it.¹¹

Existing breast volume influences implant filler choice. Small volume is not very compatible with saline implants, but as volume increases, there is less difference between saline and silicone.

Breast shape may limit implant selection. Vertically short breasts are prone to lower pole deformities as implant diameter increases. Similarly, breasts with constricted base diameters, such as tubular breast deformity, are challenging to aggressively augment and may require a more complex treatment strategy.¹²⁻¹⁴

Inframammary crease anatomy is also important. Minimal crease definition imposes little restriction on implant diameter selection, and therefore size. Glandular ptosis with a sharply defined crease located close to the areola represents the opposite extreme. This type is prone to double-bubble deformities as implant diameter increases.¹⁵

Tissue characteristics and skin quality are equally important factors. Postpartum patients

with atrophic tissue and poor skin elasticity make visual and tactile implant concealment challenging, and also pose a risk of late lower pole descent. Conservatively sized silicone implants are the best choice in these patients. A concomitant mastopexy allows excision of some of the inelastic lower pole skin and enables placement of a smaller, lighter implant in more extreme cases.

Nipple hypertrophy and ptosis, common in postpartum patients, may be improved by circumferential skin excision at the nipple base. (See **Video, Supplemental Digital Content 1**, which demonstrates a nipple reduction. This video is available in the “Related Videos” section of the full-text article on PRSJJournal.com or, for Ovid users, at <http://links.lww.com/PRS/A952>.) Reduction in both height and diameter can be achieved by the top-hat reduction method.¹⁶ Treating this condition is simple and enhances the overall result.

Nipple-areolar position asymmetry is magnified by breast augmentation (Fig. 2). A unilateral circumareolar mastopexy or a Y-scar mastopexy can be considered depending on the severity of the problem.¹⁷

The larger the areolar diameter, the more it tends to stretch following surgery. Conservative circumareolar excision should be considered with diameters approaching 6 cm. Circumareolar

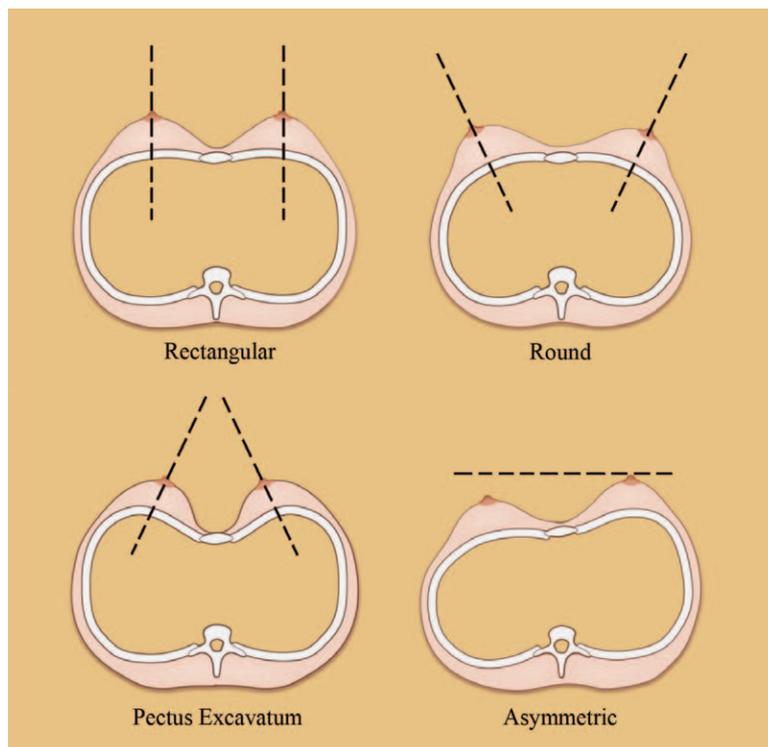


Fig. 1. Chest wall shape can affect the axes of the breasts and their relative projection.



Video 1. Supplemental Digital Content 1, which demonstrates nipple reduction, is available in the “Related Videos” section of the full-text article on PRSJournals.com or, for Ovid users, at <http://links.lww.com/PRS/A952>.

excision must be coupled with a periareolar purse-string suture, typically with nonabsorbable suture material, in order to provide a lasting result.

Implant Selection

Size (volume and diameter) is arguably the most critical aspect of implant selection, followed by filler type. Second-tier factors include shape, profile, and surface texture.

The differences between textured and smooth implants have been debated (**Reference 19: Level of Evidence: Therapeutic, I**).^{18,19} Current evidence holds that smooth implants are more prone to capsular contracture in the subglandular plane.²⁰ A difference between the two types has not

been proven in the subpectoral plane.¹⁹ Smooth implants are currently used in approximately 90 percent of patients in the United States.²¹

Round implants are used in 95 percent of patients in the United States today.²¹ Superior aesthetic results using anatomic implants remain unproven. Implant rotation requiring additional surgery can occur with these devices (**Reference 23: Level of Evidence: Therapeutic, IV**).^{22,23} Unlike in breast reconstruction, a different scenario, there is no clear role for anatomic implants in breast augmentation.

Implant profile is a variable that aids in achieving maximum volume in patients having narrow chests, breast base diameters, or both. Higher



Fig. 2. (Left) Preoperative nipple-areolar position asymmetry. (Right) The asymmetry is magnified following augmentation, but within acceptable limits.

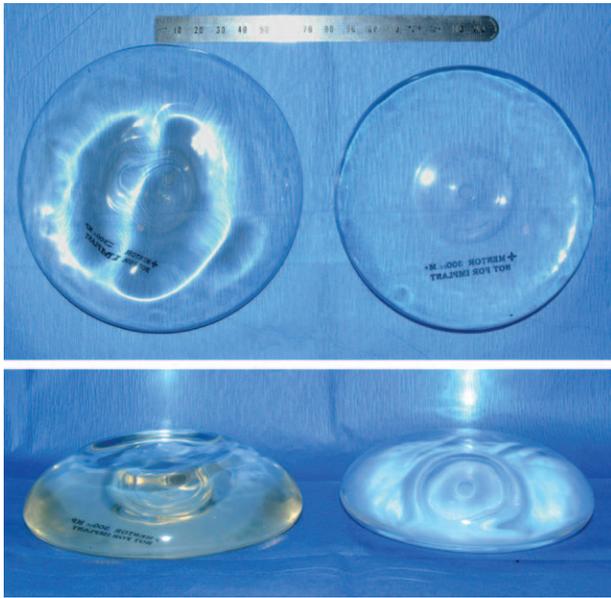


Fig. 3. A 300-cc standard profile implant is shown on the left. The 300-cc implant on the right has a higher profile but a smaller diameter in comparison. It also appears to be filled tighter and does not exhibit the wrinkling evident in the standard profile implant. The latter feature is an indication for its use in thin patients.

profile implants have smaller diameters that allow placing maximum volume in these cases. Patients with wide chests or breast base diameters do best with regular profile implants (Fig. 3 and Table 1).

Selection of saline versus silicone filler is influenced by anatomy, as previously described. Advantages of saline implants include smaller incisions with possible remote locations, no special long-term monitoring, and results that may endure for decades. Silicone implants have less wrinkling and palpability, and no risk of deflation. Approximately 60 percent of implants used in the United States today are gel filled.²¹

Table 1. Implant Profile Selection

Normal height	
Allergan Natrelle moderate	Adequate parenchymal volume
Mentor moderate	Wide chest
Sientra low projection	Breasts far apart
	Long lower pole
	Tall patient
	Large areolar diameter (correction not planned)
Intermediate height	Thin tissues
Allergan Natrelle moderate plus	Wrinkling or knuckle with normal height implant
Mentor moderate-plus	Narrow chest
Sientra moderate projection	Maximum volume with narrow breast base diameter
	Maximum volume and minimum lateral fullness
	Petite patient

Size is usually the most important implant variable to the patient. Magazine photographs, cup sizes, and friends' experiences are not reliable measures for determining size. One recommended method computes optimal size based on breast base width, anterior skin stretch, upper pole pinch thickness, inframammary fold pinch thickness, and stretched nipple-to-fold distance.²⁴⁻²⁶ This analytic method determines optimal implant dimensions based on individual anatomic characteristics.

Preoperative sizing is another method that is more subjective in its approach. It consists of placing sample implants in a bra to preview a range of possible results.²⁷ The surgeon first determines a size range suggested by height, weight, and body habitus that is also mindful of breast anatomy restrictions. This process shares ownership of the final decision between the patient and the surgeon. It has been shown to minimize requests for size-change surgery.²⁷

Patient Education

Comprehensive patient education should include implant options, associated risks, anatomical restrictions, and potential problems that can lead to secondary surgery. Given that implants are prosthetic medical devices, providing informed consent requires imparting considerable information. Providing a written document in which the patient initials each paragraph is one effective way to disclose all possibilities and ensure that the information has been received (see Appendix).

Besides size, implant filler type is a key decision for the patient. When informed that the notion that silicone implants “look” more natural than saline is mistaken, the patient can base her choice between the two types on other reasons (Table 2).

Breast implants have a rare association with anaplastic large cell lymphoma.²⁸⁻³⁰ Current evidence indicates that the risk of developing

Table 2. Patient Education: Saline versus Silicone Implants

	Saline	Silicone
Appearance	Same	Same
Delectability to touch	More noticeable	Less noticeable
Wrinkles/ripples	Possible	Rare
Palpable “knuckle”	Rare	Possible
Spontaneous deflation	5% chance	Does not occur
Silent rupture	Does not occur	Typical
Incision	Short	Slightly longer
Cost	Less	More
Monitoring	None	MRI scans needed
Overall frequency of use	Less	More

MRI, magnetic resonance imaging.

anaplastic large cell lymphoma is 0.1 to 0.3 per 100,000. It usually presents as a seroma after 1 year.³¹ Anaplastic large cell lymphoma is typically indolent, and treatment by implant removal and capsulectomy is effective. Adjuvant therapy with radiation or chemotherapy is not routinely recommended.^{32,33} Approximately 34 cases have been reported in the medical literature to date. This notable new development should be included in the patient education process.

Breast augmentation by fat grafting following external tissue expansion is a recent alternative to using implants.³⁴ The developers claim safety of large-volume fat injections and acknowledge that final volume is more modest compared with implants, that there is benefit from simultaneous liposuction, and that the procedure can be performed in a few hours.^{35,36} This method is still under development and evaluation for long-term safety and efficacy.

ADVANTAGES AND DISADVANTAGES OF TREATMENT OPTIONS

Incisions

Axillary

Axillary incisions for saline implant placement are advantageous because they avoid breast scars (Table 3). Young patients with good shape and substantial volume are ideal candidates (Fig. 4).

Table 3. Incision Options and Indications

Incision	Indications
Axillary	Request for saline implants Request for incision, using silicone Age 18–22 (saline required) Small areolar diameter Ideal anatomy: Baseline breast volume 175 cc or more Excellent baseline breast aesthetics Normal body habitus (not thin)
Periareolar	Adequate areolar diameter Minimal to mild postpartum atrophy Challenging lower pole aesthetics Uncertain final inframammary crease position May need circumareolar mastopexy Capsulorrhaphy with preexisting inframammary incision
Inframammary	Small areolar diameter Glandular ptosis Implant size over 400–450 cc Large form-stable textured implants Simultaneous placement of pectus excavatum prosthesis
Transabdominal	Complete abdominoplasty with: Good baseline breast aesthetics “Short-waisted” or low breast position
Umbilical	Request for saline implants Surgeon preference

Either blunt or endoscope-assisted dissection can be used.³⁷ Blunt dissection is simpler but requires experience and finesse. Surprisingly, hematomas are rare. (See Video, Supplemental Digital Content 2, which demonstrates transaxillary subpectoral augmentation without endoscopy. This video is available in the “Related Videos” section of the full-text article on PRSJournals.com or, for Ovid users, at <http://links.lww.com/PRS/A953>.) Endoscopic technique is more complex and has a normal hematoma risk because sharp dissection is employed. Superior implant malposition is more likely using axillary incisions due to the remote approach to inframammary crease position management.³⁸ Silicone implant placement through this incision is not widely practiced but can be done.³⁹ Axillary incisions do not interfere with sentinel lymph node biopsy.^{40,41} Revisional surgery usually requires a second incision. This route can be more painful.

Periareolar

Periareolar incisions, given their central location, provide arguably the best exposure of the implant pocket. They facilitate controlled inframammary crease lowering under direct vision (Fig. 5).⁵ This exposure is particularly advantageous in secondary cases when capsulectomy or capsulorrhaphy is necessary. There is evidence, however, that periareolar breast tissue is less sterile and that the incidence of capsular contracture is higher.^{42,43}

Periareolar incisions are typically inconspicuous provided they are placed precisely at the junction of the color change. There is little tension, so scar quality tends to be excellent and hypertrophy rare.

A small areolar diameter may preclude its use for silicone implant placement. Periareolar incisions can also be problematic in postpartum women with thin, atrophic tissues. The forces of wound contraction may cause a depressed scar. This may require secondary correction using acellular dermal matrix to restore shape (Fig. 6).⁴⁴

Inframammary

Inframammary incisions remain the most popular choice today.⁴⁵ They afford immediate access to the subpectoral plane without disturbing the gland. This approach is typically less painful and affords the longest incision possible, an advantage with stiff “form-stable” textured silicone implants. It is preferred for postpartum patients with thin atrophic breast tissue (Fig. 7 and Table 3).

Optimal incision placement is challenging because the position of the inframammary crease changes with surgery. The scar is inconspicuous when it lies precisely in the new crease position.

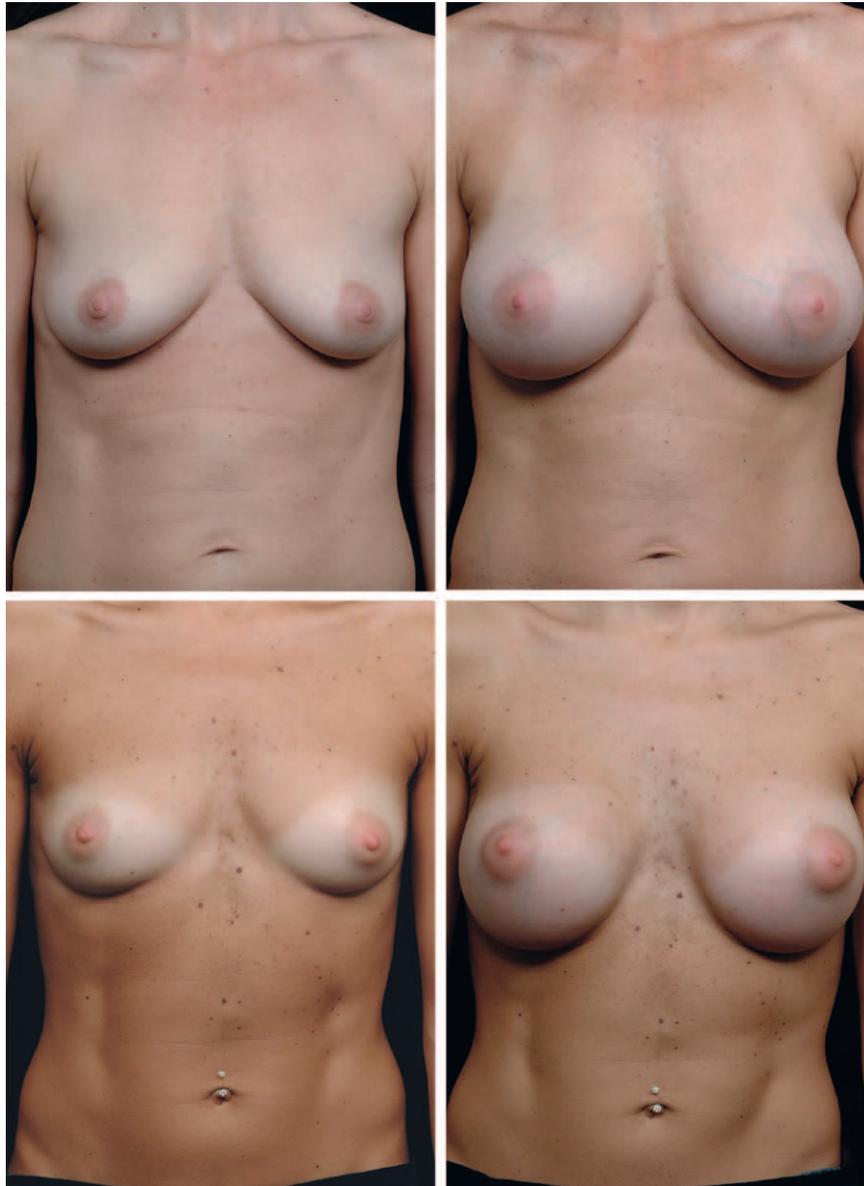


Fig. 4. Preoperative (*left*) and postoperative (*right*) views of two ideal candidates for the use of an axillary incision to place saline implants.

(See Video, Supplemental Digital Content 3, which demonstrates how to optimally position the inframammary incision. This video is available in the “Related Videos” section of the full-text article on PRSJJournal.com or, for Ovid users, at <http://links.lww.com/PRS/A954>.) The scar is more obvious and may spread or hypertrophy if it lies above the crease.

Inframammary incisions have the greatest potential for implant extrusion due to thin soft-tissue covering over the dependent implant. Exposure of the upper implant pocket is limited, particularly when performing a capsulectomy. Inframammary incisions also pose a challenge if the patient should subsequently require a capsulectomy to raise the implant position.

Transabdominal

Implants can be inserted through an abdominoplasty incision, although wide superior undermining is required. Ideal candidates have good breast shape, desire smaller implants, and are either “short-waisted,” have low breast position, or both. While remote incisions are sometimes tempting, breast incisions provide better control of implant positioning.

Periumbilical

Superior umbilical incisions have been used for the insertion of saline implants.⁴⁶ It is possible to develop a subpectoral pocket by blunt dissection through this incision. However, the implants



Video 2. Supplemental Digital Content 2, which demonstrates transaxillary subpectoral augmentation without endoscopy, is available in the “Related Videos” section of the full-text article on PRSJournals.com or, for Ovid users, at <http://links.lww.com/PRS/A953>.

cannot be revised for secondary problems through this route. While there are advocates, this option is not widely utilized.

Pocket Plane

Subpectoral

Subpectoral implant placement has the advantages of superior upper pole aesthetics, better tissue visualization by mammography, and a slightly decreased incidence of capsular contracture.^{47,48} Disadvantages include greater discomfort and potential breast distortion with pectoralis contraction. The latter is occasionally striking but typically minimal.⁴⁹

The “dual plane” technique is a variation on subpectoral implant placement.^{50,51} All subpectoral implants are dual plane because the implant is partially subpectoral and subglandular. Sometimes partially releasing the muscle from the overlying breast tissue will yield a better breast shape, a maneuver that is most specifically associated with the dual plane designation (Fig. 8).

Complete submuscular implant coverage includes the pectoralis major, the serratus anterior, and the rectus abdominis muscles. This approach is excessively morbid, limits the amount of lower pole expansion possible, and is generally not recommended.⁵²

Subfascial

Subfascial implant placement has also been described.^{53,54} Proponents claim that it offers equivalent protection against capsular contracture as subpectoral placement, although the supporting evidence is weak. Moreover, the fascial layer is generally thin and may prove tedious to dissect. The value of this method is presently unclear.

Subglandular

Subglandular implant placement has significant disadvantages. Upper pole contour is compromised and may exhibit ripples.⁵⁵ Capsular contracture is slightly more common than that following subpectoral placement, and mammograms are more challenging. It may be a reasonable choice for large pendulous breasts or very low breasts that have little breast-muscle overlap. Advantages are ease of dissection and less pain, neither of which is critical enough to favor routine use.

KEY ELEMENTS OF SURGERY AND POSTOPERATIVE CARE

Breast augmentation practice varies not only in the choice of incisions, pocket plane, and implant variables but also with regard to anesthesia issues, systemic and irrigant antibiotics, the use of drains and sizers, intraoperative table positioning, postoperative management of implant position, and the prevention of capsular contracture.

Anesthesia

General anesthesia is standard for breast augmentation. Adjunctive intercostal nerve blocks have not been shown to be effective.⁵⁶ They are not recommended given the additional complexity and possibility of pneumothorax. The same study did show less pain when 1500 mg of methocarbamol, a muscle relaxant, was given preoperatively and then 750 mg every 6 hours for 5 days. Celecoxib, an anti-inflammatory and analgesic cyclo-oxygenase 2 inhibitor given as a single 400-mg dose preoperatively, has been shown to decrease postoperative opioid requirements.⁵⁷ Combining 1200 mg of gabapentin with celecoxib further reduces postoperative pain.⁵⁸ Whether these agents are used alone, in combination, or not at all is currently the surgeon’s prerogative, as definitive guidelines have not been established.

Pocket irrigation with bupivacaine and ketorolac decreases pain for up to 6 hours after surgery (**Level of Evidence: Therapeutic, I**).⁵⁹ However, a subsequent increase in narcotic requirement was observed due to pain rebound. Other studies have shown a quicker discharge and less pain early on, but have not demonstrated a decreased overall narcotic requirement (**Reference 61: Level of Evidence: Therapeutic, IV**).^{60,61} The benefit of this practice is therefore presently unproven.

Antibiotics

Antibiotics are most effective when given as a single preoperative parenteral dose and not



Fig. 5. (Above) Preoperative and postoperative views of an ideal candidate for a periareolar incision for controlled lowering of the inframammary crease. (Below) Preoperative and postoperative views of a patient with mild postpartum atrophy who preferred a periareolar incision for silicone implant placement.

postoperatively.⁶² However, postoperative antibiotics are commonly prescribed, presumably to prevent subclinical infection that can lead to capsular contracture, despite no proof of efficacy.^{62,63}

Pocket irrigation with antibiotics has been shown to be effective.⁶⁴ One option utilizes bacitracin (50,000 U), gentamycin (80 mg), and cephalexin (1 g) mixed in 500 cc of saline (**Level of Evidence: Therapeutic, IV**).⁶⁵ However, cephalexin may be redundant if it is also given systemically, and gentamycin may be superfluous,

since Gram-negative infections are rare in breast augmentation and not implicated as a common cause of capsular contracture. Solutions containing dilute betadine and antibiotics have also been proven effective, although the U.S. Food and Drug Administration asserted in 2000 that betadine use with saline implants may contribute to a higher deflation rate. This was based on detrimental effects of intraluminal betadine on silicone tubing, not external implant shell irrigation.⁶⁶ This entire premise was disproved in another study.⁶⁷



Fig. 6. An example of a periareolar incisional deformity seen in a postpartum patient with atrophic tissues.

Therefore, a solution combining dilute betadine and antibiotics appears to be a reasonable alternative to irrigation with triple-antibiotic solution.

Technical Elements of Surgery

Raising the back of the operating table to 90 degrees permits an accurate preview of results. This requires an anesthesiologist comfortable with this method, as well as proper patient positioning and immobilization. (See **Video, Supplemental Digital Content 4**, which demonstrates how to position and stabilize the patient on the operating table to allow safely raising the back to 90 degrees. This video is available in the “Related Videos” section of the full-text article on PRSJJournal.com or, for Ovid users, at <http://links.lww.com/PRS/A955>.)

Breast sizers aid in both accurate implant size selection and establishment of optimal breast shape. They reduce implant handling but may increase pocket exposure to skin flora, although the latter is only speculation. Single-patient use is recommended by the manufacturer, but multiple use (with adequate sterilization) is certainly common practice.

Subpectoral pocket dissection entails dividing the pectoralis origins from the ribs, including the accessory slips of origin. Release from the sternum risks implant rippling and symmastia (Fig. 9). Inferior dissection usually requires lowering the inframammary fold to center the implant behind the nipple (Fig. 10). (See **Video, Supplemental Digital Content 5**, which demonstrates how to lower the inframammary crease to establish optimal implant position. This video is available in the “Related Videos” section of the full-text article on PRSJJournal.com or, for Ovid users, at <http://links.lww.com/PRS/A956>.)

Excessive release can encourage either double-bubble deformity or late lower pole stretch. Lateral dissection should be done last and conservatively to avoid lateral malposition problems.⁵ Meticulous hemostasis is essential following pocket dissection. Drains are not necessary.⁶⁸

Additional surgical field sterilization is prudent prior to implant placement. This includes changing gloves, wiping the retractors with an antibiotic solution, and covering the incision site with an adhesive barrier. Implants should not be opened until implantation is imminent. The implants are bathed in the antibiotic solution, and handled minimally by the surgeon only.⁶⁹ A sleeve or funnel (Keller Funnel; Keller Medical, Inc., Stuart, Fla.) can be used to facilitate insertion and further reduce implant contact with the skin.⁷⁰

Postoperatively, either a surgical bra or a binder that exerts pressure on the upper pole can be used. The latter helps maintain implant position in patients with tight skin or when further stretch of the lower pole is desired.

Postoperative mobilization is largely at the surgeon’s discretion. There is only one report of return to normal activities within 24 hours.^{71,72} However, some restrictions are prudent to prevent hematoma. Implant massage by the patient is still practiced, despite a lack of documentation that it prevents capsular contracture.

COMPLICATIONS, AVOIDANCE, AND MANAGEMENT

Hematoma and infection each occur in less than 1 percent of patients.⁷³ Nipple sensory loss is more likely with larger implants and from aggressive lateral dissection.⁷⁴ Sensory loss of the lower pole skin can occur from extensive dissection and may be permanent.⁷⁵ Sensory loss can also occur in the upper inner arm as a result of intercostobrachial nerve injury when using an axillary incision.⁷⁶

The incidence of secondary surgery ranges from 0 to as high as 36 percent over 10 years, with implant failure, malposition, and capsular contracture being the most common causes (**References 78 and 79: Level of Evidence: Therapeutic, IV**).^{3,77-79} Size change surgery can be avoided by intimately involving the patient in the size selection process. Double-bubble and other lower pole deformities can be avoided by careful dissection and thoughtful implant selection.¹⁵ Lower pole deformities recognized intraoperatively can be corrected either by internal pocket plication or by placement of percutaneous bolster sutures that are left in place for 1 week. Underwire bras and shoestrings tied



Fig. 7. (Above) Preoperative and postoperative views of a patient with severe postpartum atrophy who is an ideal candidate for an inframammary incision to place silicone implants. (Below) Preoperative and postoperative views of a patient with small areolar diameters who required an inframammary incision to place silicone implants. Incision placement must precisely anticipate the new fold position so that the incision comes to lie in the fold and not above it.

around the neck and under the breast are less effective methods to adjust inframammary crease position postoperatively.³⁹ Lateral malposition is best treated with internal capsulorrhaphy using permanent sutures.^{80,81} Recurrent malposition or more extreme shape problems may require the use of acellular dermal matrix to support thin soft tissues and camouflage ripples.^{44,82,83}

The incidence of capsular contracture ranges from 5 to 8 percent after 3 years. It may increase to as high as 11 to 19 percent after 8 to 10 years, as demonstrated in the recent manufacturer core studies,⁷⁷ though other authors have reported much lower rates in their retrospective reviews.⁸⁴ Smoking is a major risk factor and therefore a relative contraindication to surgery. Capsular contracture



Video 3. Supplemental Digital Content 3, which demonstrates how to optimally position the inframammary incision, is available in the “Related Videos” section of the full-text article on PRSJourn.com or, for Ovid users, at <http://links.lww.com/PRS/A954>.

is effectively treated by capsulectomy with drain placement, a method typically required for saline implant deflations as well. Closed capsulotomy has been abandoned due to a high recurrence rate and associated morbidity that includes implant rupture, hematoma, and pain. There is debate as to whether anterior capsulectomy alone is equally effective as total capsulectomy.⁸⁵ The latter takes longer, is bloodier, and risks pneumothorax. Neopocket formation is a newer technique that leaves the capsule in place, plicates the cavity, and creates a new pocket anterior to it.^{86–88} This method is presumably quicker and allows the new pocket dimensions to vary from the those of the original. Capsular contracture following subglandular implant placement is best treated with capsulectomy and conversion

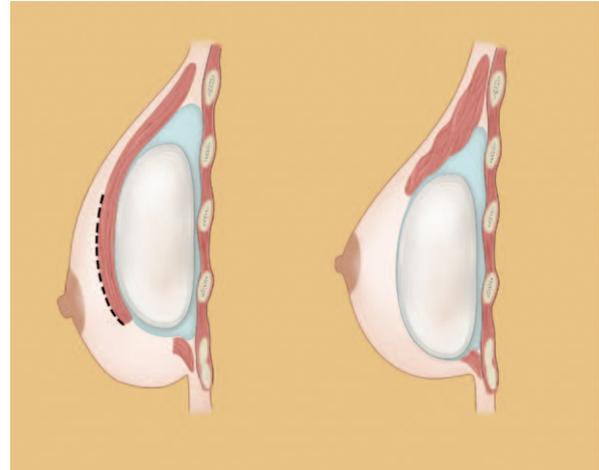


Fig. 8. (Left) Subpectoral implant placement with suboptimal implant positioning. (Right) Release of the pectoralis muscle from the overlying breast tissue causes the muscle to retract superiorly. This allows redistribution of the soft-tissue envelope to establish optimal breast shape.

to a subpectoral plane. Data on the frequency of recurrence of capsular contracture are sparse, although it can almost be expected in patients with bilateral capsules.

Pharmacologic treatment of capsular contracture has not proven very effective. Papavarine was one of the first agents used, with the belief that it inhibited myofibroblast contractility in capsules.⁸⁹ This agent appears to be effective if started early, but is difficult to obtain today. The effectiveness of leukotriene receptor antagonists has proven equivocal following initial enthusiasm.^{90–93} Zafirlukast (Accolate) has a risk of liver failure arguing against its use.⁹⁴



Video 4. Supplemental Digital Content 4, which demonstrates how to position and stabilize the patient on the operating table to allow safely raising the back to 90 degrees, is available in the “Related Videos” section of the full-text article on PRSJourn.com or, for Ovid users, at <http://links.lww.com/PRS/A955>.

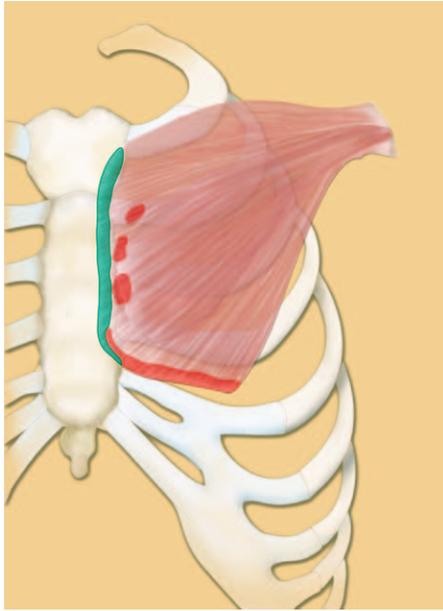


Fig. 9. Full-thickness pectoralis release from the lower ribs and partial-thickness release at the sternum is shown (red). Separate accessory fibers of origin from the upper ribs (red) should also be released to allow maximum medial positioning of the implant. The sternal origins (green) are left intact to prevent medial malposition and symmastia.

OUTCOMES

Several studies show patient satisfaction ranging from 85 to 95 percent, including increased self-confidence and improved body image (**Reference 95: Level of Evidence: Therapeutic, IV**).^{95,96} A recent study using the BREAST-Q Augmentation questionnaire showed improved satisfaction with

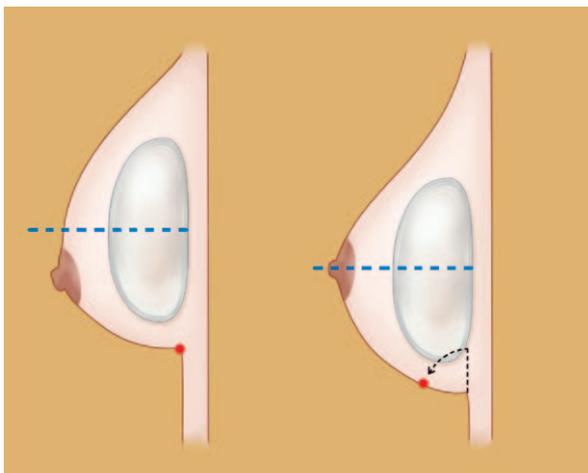


Fig. 10. (Left) Implant placement in a patient with a short crease-to-areola distance is suboptimal if the crease is not released. The nipple position will appear low and the upper pole excessively full. (Right) Release and lowering of the crease to center the implant on the nipple position produces optimal aesthetics.



Video 5. Supplemental Digital Content 5, which demonstrates how to lower the inframammary crease to establish optimal implant position, is available in the “Related Videos” section of the full-text article on PRSJournal.com or, for Ovid users, at <http://links.lww.com/PRS/A956>.

breasts (83 percent), psychosocial well-being (88 percent), and sexual functioning (81 percent).⁹⁷

CONCLUSIONS

Breast augmentation is the most commonly performed aesthetic surgical procedure. Careful analysis of patient psyche and physical characteristics is the foundation of sound surgical planning. A collaborative approach to implant size selection helps to avoid requests for size change surgery. Knowledge of incision and pocket plane options and implant variables, an intraoperative strategy to achieve optimal implant positioning, and avoiding implant contamination are essential. Although reoperation rates are significant due to deflations, capsular contracture, and malposition, patient satisfaction remains high with this procedure.

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APPENDIX

BREAST AUGMENTATION: INFORMED CONSENT (SAMPLE)

This information is provided to inform you of the risks and potential problems associated with breast augmentation. A complete discussion includes advising you of the alternative treatments available, which in the case of breast augmentation consists only of wearing padded bras. Please initial this paragraph and each one that follows as you read through this information.

Initial: _____

There are a variety of potential problems associated with breast augmentation. Some of these, like bleeding and infection, occur in the early postoperative period and are rare. Anesthesia related problems can occur although none have in my personal experience. Most other problems are associated with the implants themselves. While the surgeon has control over implant placement, size selection, and implant positioning, factors such as how you heal, how much tissue you have to help conceal the implants, and your skin elasticity can all influence the final result. Sometimes these factors can have a delayed adverse effect on an excellent early result. While

any of these problems can occur, the chance of having a problem that requires additional surgery is small, approximately 5%. The majority of problems that can occur and require further surgery are correctable. The likelihood of having to remove the implants and not replace them is very rare. Implant problems are aesthetic in nature and generally do not have health implications beyond this.

Initial: _____

Bleeding within the implant pocket after surgery may result in a *hematoma* if it accumulates in sufficient volume. This requires return to the operating room to remove it. The occurrence of a hematoma has been linked to the later development of capsular contracture (see below) in some cases. The cause for most hematomas is rarely found although asymptomatic bleeding disorders such as von Willebrand’s disease or the lingering effects of certain medications such as aspirin, ibuprofen, or homeopathics can be causative.

Initial: _____

Infection is unusual after breast augmentation but can occur. Antibiotics are given intravenously during surgery to prevent it. If an infection should develop it usually requires removal of the implant in order to treat it effectively. The implant is usually

not replaced for at least six months to be certain the infection is eradicated and all inflammation in the tissues has subsided. The implant can usually be successfully replaced when conditions are optimal.

Initial: _____

Scar tissue, which normally forms internally around the breast implant, can sometimes tighten and make the breast round, firm, and even painful. Excessive firmness of the breasts is called capsular contracture. It can occur soon after surgery or years later and happens in approximately 5 percent of women. There are no known factors on which its development can be predicted. Treatment for capsular contracture may require surgery to remove the scar tissue and replace the implant. This treatment is usually but not always successful. The need to permanently remove implants because of persistent capsular contracture is rare.

Initial: _____

Some change in nipple sensation is not unusual right after surgery. After several months, most patients have normal sensation. Partial or permanent loss of nipple and skin sensation may occur occasionally. The larger the implant, the more chance of overstretching the nerve to the point where sensation is lost. Numb skin following breast augmentation generally resolves completely after several months but may be permanent. Women who have armpit incisions may develop small areas of numbness on the inside of the upper arm.

Initial: _____

Excessive incision scarring is very uncommon. Most scars heal as fine white lines. They are inconspicuous but never disappear completely. Scars may be red, thick, and/or lumpy in rare cases. They may benefit from surgical scar revision at the appropriate time (after one year). A band of scar tissue that looks like a cord can develop in the armpit in those having armpit incisions. This results from failure to stretch the arms adequately after surgery and can be treated.

Initial: _____

All breast implants eventually require replacement. Most last 10 years although sometimes they last much longer. Breast implants, like other medical devices, can fail. Sometimes this happens prematurely, before 10 years. When a saline-filled implant deflates, the salt water it contains will be harmlessly absorbed by the body. Deflation can occur as a result of an injury or from no apparent cause. Theoretically they can be ruptured during mammography although I have never seen

this. Deflated saline implants require surgery for replacement.

Initial: _____

Lack of adequate tissue coverage or infection may result in exposure of the implant. This means that a small portion of the implant is directly visible through the skin incision. This is most likely to occur in thin women having a lift combined with an augmentation. The reason for this is that the implant pocket lies close to the overlying incisions used to lift the breast and this constitutes a potentially weak area of the wound. Smoking has an adverse effect on wound healing. It may contribute to the development of implant exposure and to capsular contracture.

Initial: _____

Visible and palpable wrinkling of implants can occur, most commonly in very thin women with little breast tissue. Almost all women can feel the implants close to the skin on the side and bottom of the breast. This is normal. Cases of extreme wrinkling, which are rare, may require surgery to exchange saline implants for a silicone gel type. While this yields an improved result in most, it may not solve the problem completely in very thin women.

Initial: _____

It is not believed that breast implants affect the ability to breast feed. The implants are located behind the breast tissue and do not interfere with the duct system in the gland. Most women who have breast implants have a small amount of breast tissue to begin with and may not be able to breast feed even without implants.

Initial: _____

Displacement or migration of a breast implant from its original position may occur. This most commonly occurs in women over thirty years of age who have had multiple pregnancies. The bottom of the breast may stretch in these cases due to either thin or poor quality skin or lack of bra support. The breasts look too low when this happens and may require further surgery to correct the problem.

Initial: _____

Both local and general anesthesia involve risk, though small. The risk of death from anesthesia is estimated to be one in 250,000. A collapsed lung (pneumothorax) can occur during the course of creating an implant pocket as a result of a small

tear in the very thin tissue that lies between the ribs. Treatment of this condition may require insertion of a chest tube. Clots can develop in the leg veins during surgery and possibly lead to the development of a pulmonary embolus (1 in 10,000). Inflatable boots are placed on the legs during surgery to help minimize the chance of developing leg vein clots.

Initial: _____

Current research indicates that the risk of breast cancer is *not* increased in women who have breast augmentation. However, breast disease can occur independently of breast implants. It may be more difficult for mammograms to fully visualize the breast tissue following breast augmentation. The implant compresses the normal breast tissue which may make it more difficult to see detail and the implant itself may obscure some tissue from being seen at all. However, most experienced radiologists can obtain a satisfactory exam using special techniques. Self-examination of the breast is not affected by the presence of breast implants. Other methods to detect breast disease such as ultrasound and MRI are not affected by breast implants. Studies have been done comparing women with breast implants who develop breast cancer with those who do not have implants. There is no increase in severity of the disease or long term prognosis in those who have implants compared to those who do not.

Initial: _____

A rare form of lymphoma called anaplastic large cell lymphoma (ALCL) has been reported in patients with breast implants (34 known cases worldwide out of as many as 5 to 10 million patients). This appears to be a low grade malignancy that responds to a variety of treatments. There have not been any deaths reported from this rare entity and the exact nature of the association with breast implants is under active investigation.

Initial: _____

Fluid may accumulate around an implant (seroma) following surgery and make the breast larger on one side. This most commonly occurs in patients who are having more involved surgery to replace old, neglected implants. Treatment of

seroma often requires additional surgery that may include temporary removal of the implant until the fluid buildup resolves.

Initial: _____

Some women with breast implants have reported symptoms similar to those of known diseases of the immune system, such as systemic lupus erythematosus, rheumatoid arthritis, scleroderma, and other arthritis-like conditions. To date, there is no scientific evidence that women with either silicone gel-filled or saline-filled breast implants have an increased risk of developing these diseases

.Initial: _____

It is possible that you may be disappointed with the results of surgery. Asymmetry in implant placement, breast shape, and size may occur after surgery. Unsatisfactory surgical scar location or displacement may occur. Pain may occur following surgery. It may be necessary to perform additional surgery to improve your results. Women with breasts that hang, are flat, and have very downward pointing nipples are extremely challenging cases and are the type most likely to require revisional surgery.

Initial: _____

Implant size selection is guided by a preoperative sizing technique where the patient places sample implants of various sizes into a larger bra to simulate a spectrum of possible results. This method is very helpful but is not infallible. Fortunately, second procedures to change implant size prove necessary in less than one percent of patients.

Initial: _____

Other very rare problems can occur with breast augmentation that are impossible to predict or enumerate completely. Despite all of the issues discussed above, most women have one operation until the time of eventual implant replacement, and are pleased with their results.

Initial: _____

I have read all of the above and have had the opportunity to discuss these issues to my satisfaction.

Signature: _____

Date: _____