

Evidence-Based Medicine: Reduction Mammoplasty

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Learning Objectives: After reading this article, the participant should be able to: 1. Understand the multiple reduction mammoplasty techniques available for patients and describe the advantages and disadvantages associated with each. 2. Describe the indications for the treatment of macromastia in patients younger than 18 years. 3. Identify the preoperative indications for breast imaging before surgery. 4. Describe the benefits of breast infiltration with local anesthesia with epinephrine before surgery. 5. Understand the use of deep venous thrombosis prophylaxis in breast reduction surgery. 6. Describe when the use of drains is indicated after breast reduction surgery.

Summary: The goal of this Continuing Medical Education module is to summarize key evidence-based data available to plastic surgeons to improve their care of patients with breast hypertrophy. The authors' goal is to present the current controversies regarding their treatment and provide a discussion of the various options in their care. The article was prepared to accompany practice-based assessment with ongoing surgical education for the Maintenance of Certification Program of the American Board of Plastic Surgery. (*Plast. Reconstr. Surg.* 139: 230e, 2017.)

In 2014, the American Society of Plastic Surgeons annual statistics demonstrated that 101,192 breast reduction procedures were performed,¹ compared with 104,455 in 2006.² The major difference was that the number considered reconstructive (covered by insurance) was reduced to 59,883, and 41,309 were considered cosmetic (self-pay).¹ The number of patients with enlarged breasts desiring improvement of shape, size, and symptoms has not changed, but the willingness for insurance to pay for the operation has. The satisfaction rate from this procedure continues to remain extremely high; on RealSelf.com, the “worth it” rating is 97.5 percent—equal to the satisfaction of our patients that have had a breast augmentation³ (https://docs.google.com/presentation/d/1ICB8HxyGNUs-yVRxK79q0INSptgRUOIv4nHTYuWcy-s/edit#slide=id.g5abbcca99_1_207). This demonstrates why patients elect to pay for the relief of symptoms and improved body image out of their own pocket when insurance denies them.

This update will continue to use the American Board of Plastic Surgery data set for the Maintenance of Certification program to evaluate the changing trends in practice by our diplomates.

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The reduction mammoplasty Practice Assessment in Plastic Surgery module is one of 20 tracer procedures developed by the American Board of Plastic Surgery for the practicing surgeon to report activities to meet the obligations of the Maintenance of Certification program. During the reporting periods, 1343 surgeons have reported on breast reduction surgery, and of those, 507 have done so more than one time, allowing for an evaluation of the change of their surgical management behavior (Table 1). A limitation of these data is that they include only individual surgeons that are maintaining their certification through the Maintenance of Certification program. In addition, the data are self-reported and not audited, and the questions may be subject to misinterpretation; therefore, the data must be evaluated as trends in consideration of these restraints. However, the data present an incredible opportunity to look into the practice of

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Table 1. Statistics of Maintenance of Certification Breast Reduction Data: 2014 Data

Characteristic	Value
No. of patients	2010
Hospital inpatient	301 (15%)
Outpatient	1380 (85%)
Hospital outpatient	1305
ASC	365
Accredited office facility	39
Technique	
Skin pattern	
Wise pattern	1591 (79%)
Vertical with modifications	311 (15.5%)
Vertical	254
J or L vertical	57
No vertical scar	48 (2.4%)
Pedicle type	
Inferior pedicle	1177 (59%)
Medial pedicle	392 (19.5%)
Superior pedicle	267 (13.3%)
Central mound	105 (5.2%)

a cross-section of our entire plastic surgical community, and no other comparable data base exists.

A literature search was performed using PubMed to obtain the best available evidence on reduction mammoplasty and the treatment of macromastia patients. Search terms included “macromastia” or “reduction mammoplasty” or “breast reduction” individually for all articles published from 1995 to the present (2015).

UPDATE OF TRENDS OF AMERICAN BOARD OF PLASTIC SURGERY TRACER PROGRAM

Screening Mammography

Guidelines for screening mammography continue to be controversial.⁴⁻⁷ The gold standard for years was the American Cancer Society’s recommendations of routine breast self-examination, clinical breast examination every 2 to 3 years after the age of 20 to 30, and routine screening mammography every year after the age of 40 unless there is a genetic or significant family history of breast cancer to encourage earlier or more frequent examinations. The Department of Health and Human Services convened a group of independent health experts, the U.S. Preventive Services Task Force, to review the present literature and to develop computer-simulated models comparing the expected outcomes under many different screening scenarios. The Task Force had four main and controversial conclusions: (1) routine screening mammograms should begin at age 50 instead of age 40; (2) routine screening should end at age 74; (3) women should get screening mammograms every 2 years instead of every year; and (4) breast self-examinations have very little value, based

on findings from several large studies, and they should stop being taught. They also concluded that patients younger than 50 years should be evaluated on an individual basis, taking the patient context into account, including the patient’s values regarding specific benefits and harms of screening procedures.

The results of the American Board of Plastic Surgery diplomates demonstrated a reduction in preoperative mammography in all age groups studied younger than 50 years. Those younger than 35 years were reduced from 17 percent to 12 percent, those younger than 45 years were reduced from 35 percent to 31 percent, and those younger than 50 years were reduced from 41 percent to 38 percent. However, patients older than 50 years also saw a reduction in screening studies from 79 percent to 71 percent. Evidence supports the concept that the decision to perform a preoperative mammogram should be individualized by the patient’s family history of breast cancer, genetic testing results, evidence of mass on examination, and the age of the individual. Every patient older than 50 years should have a recent mammogram, and many believe that those older than 40 years should as well.

Location of Surgery

Health care continues to become more efficient and more ambulatory. In the past, all breast reductions were performed as an inpatient procedure, often requiring blood transfusions and prolonged hospital stays.⁸ Modern advances in anesthesia—including improved equipment, monitoring, training, evaluation of healthy patients, shorter acting narcotics, intravenous propofol, shorter acting inhalation gases, and the evolution of perioperative nursing care—have allowed for the development and performance of safe ambulatory surgery. Economic factors and patient preferences also have stimulated the impetus to create less invasive procedures and increased the popularity of ambulatory surgery.⁹

The American Board of Plastic Surgery tracer data demonstrated a continued shift away from inpatient breast reduction surgery. In 2012, 22 percent of all procedures were performed on an inpatient basis; in 2014 it was down to 15 percent. There will always be patients that have significant comorbidities that may require inpatient status (e.g., sleep apnea, massive obesity, permanent pacemaker); in addition, some surgeons may not have access to an ambulatory facility and must perform their surgical procedures on an inpatient basis.

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Use of Prophylactic Antibiotics

Although there are contradictory studies regarding the need for perioperative antibiotics for a “clean operation” such as a breast reduction, the American Society of Plastic Surgeons created a Patient Safety Task Force and reviewed 667 articles on the topic of prophylactic antibiotics for breast reduction operations.¹⁰ Their conclusions were that there was not definitive evidence in either direction and that one should individualize the risks and benefits to each patient; however, there was adequate evidence to suggest that the surgeon should consider using prophylactic antibiotics in their breast reduction operations. The American Board of Plastic Surgery tracer data demonstrated a 98 percent use of intravenous antibiotics within 1 hour of the commencement of the procedure. There are patients with multiple antibiotic allergies and others who may become very ill from the medicines so that 100 percent may never be attainable in a risk-to-benefit evaluation. In addition, although there are no data regarding the added benefit of antibiotic use after the perioperative dose, 58.2 percent of the diplomates use additional postoperative antibiotics.

Use of Epinephrine as a Wetting Agent

The use of a dilute epinephrine wetting agent injected along the incision lines before commencement of the breast reduction operation has demonstrated a reduction in the amount of blood loss and the need for transfusions in these patients.¹¹ In addition, the amount of pain can be reduced when the epinephrine is mixed in a carrier of local anesthetic and is injected before surgery.¹² In 2012, Kerrigan and Slezak demonstrated in their review of the American Board of Plastic Surgery tracer data that 49 percent of the studied members did not use the epinephrine injections, 17 percent used it occasionally, and 34 percent used in the all of their cases.¹³ In our review of the 2014 American Board of Plastic Surgery data, 59 percent used epinephrine in the majority of their patients and 40 percent rarely used it. This is almost a 25 percent increase in use of this very valid and important improvement in patient care. Surgeons often cite the fear of delayed hematomas when the epinephrine dissipates, but the review by Kerrigan and Slezak of their 6271 American Board of Plastic Surgery tracer patients does not support this concern. Only 2.2 percent with injections suffered hematomas, in comparison with 1.9 percent in patients without injections. Continued education of the validity of this concept is necessary for our new generation of plastic surgeons to reduce the gap between evidence and practice.

The Need for Deep Venous Thrombosis Prophylaxis

Plastic surgery is often “elective” and is frequently performed on the patient’s skin and soft tissues, and therefore is considered to be “safer” than intraabdominal or vascular types of procedures. Deep venous thrombosis prophylaxis is often not adequately considered. The finding is exemplified by the study performed by the American Board of Plastic Surgery in 2007 that demonstrated that 48.7 percent of physicians performing face lifts and 60.8 percent of those performing combined procedures used thromboprophylaxis all the time.¹⁴ Any treatment requires that the physician considers the risks to the patient without treatment, the underlying health and risk of the individual patient, the risks to the patient from the treatment used, and the likelihood of the treatment reducing the patient’s risk of problems or creating a new or different problem.

Breast reductions are often performed on young, healthy women on an outpatient basis, with a relatively short operative time. The expectation is that the patient will be ambulatory later that day or the next morning. Older, sicker patients with significant obesity and the lack of mobility are an entirely different patient category and should be evaluated differently. This topic has been studied extensively and the strategies for prevention are extensive and are based on the individual patient’s comorbidities and the proposed procedure.^{15–18} In a review of 17,774 plastic surgery patients, Wes et al. found 46 patients with deep vein thrombosis and 44 with pulmonary emboli, for an overall rate of 0.51 percent. Variables that were correlated with an increase in these complications included general anesthesia; male sex; increased obesity; age older than 65 years; truncal contouring; multiple combined procedures; longer operative times; inpatient status; increased length of stay; and a history of diabetes, hypertension, malnutrition, and dyspnea.¹⁷

Most breast reductions are performed under general anesthesia, and there is some risk of deep venous thrombosis in all of these patients. Strategies that have been found to be effective with little risk to the patient include stopping oral contraception or hormone replacement 1 month before surgery and for 2 weeks after surgery.¹⁵ Preoperative instructions should include the importance of early postoperative ambulation.¹⁵ In addition, the use of graduated compression stockings and appropriate patient positioning in the operating room with 5 degrees of flexion at the knee to aid

blood return through the popliteal vein should be used. In addition, intermittent pneumatic compression devices can be placed on the extremities 30 minutes before induction of anesthesia. The boots help to reduce two of the three underlying pathophysiologic components of venous thrombosis (Virchow triangle). Venous stasis is reduced by intermittent peak and mean venous velocities in the common femoral vein secondary to the sequential intermittent pneumatic compression from the device. In addition, fibrinolytic pathways are targeted through multiple pathways, including the release of plasminogen activator inhibitor-1 and tissue factor pathway inhibitor from the vascular endothelium.¹⁶ Breast reduction operations often require large operative incisions and large planes of dissection, and create concerns for a higher risk of hematoma from anticoagulation. In a study by Lapid et al. using low-molecular-weight heparin for chemoprophylaxis, the risk of postoperative hematoma was on the high side in the breast reduction population (5.1 percent).¹⁸

In high-risk patients and those undergoing multiple procedures, especially abdominoplasties, consideration as to the use of perioperative chemoprophylaxis should be considered. The plastic surgeon should discuss with the patient the risks of hematomas and bleeding versus the potential to reduce the incidence of venous thrombosis; the use of subcutaneous heparin versus low-molecular-weight heparin; the consideration of postoperative-only dosing; and, in extremely high-risk patients, the addition of a preoperative dose of chemoprophylaxis. Even when doctors order chemoprophylaxis, occasionally nurses do not administer and often patients refuse them.¹⁹

A review of the American Board of Plastic Surgery tracer data demonstrates that 450 of 469 plastic surgeons (96 percent) always used some type of deep venous thrombosis prophylaxis and 458 of 469 (98 percent) usually used it. Only six of 469 (1.3 percent) never used it. Pneumatic compression boots were used in 1940 patients before surgery (96.5 percent) and 329 after surgery, and low-molecular-weight heparin was used in 118 (7.8 percent). This is a remarkable change in *best practice* from the 40 percent (face lifts) to 68.7 percent (combined procedures) in 2007.¹⁴

Breast Reductions in Patients Younger Than 18 Years

The symptoms of macromastia do not know an age limit, and all patients suffer the same symptoms—back and neck pain, shoulder grooving, shoulder pain, intertrigo, and psychological

distress.^{20–26} Although many insurance companies have generically disallowed breast reduction surgery on patients younger than 18 years—it has been repeatedly shown that appropriate patients in this group will have a dramatic improvement of their symptoms and psychological status after reduction mammoplasty surgery. Over 97 percent of these patients have reported patient satisfaction,²⁰ and 95.9 percent would choose to have the procedure performed again.²¹

In a review of the 2014 American Board of Plastic Surgery tracer data, 103 (5.1 percent) of the 2010 patients were aged 18 years or younger. The youngest patient was aged 14 years. Symptomatic adolescent macromastia patients are not common, but when we meet the appropriate patient, we should be a vigorous patient advocate for our patient working with their insurance company to help them get approval for this very effective surgical solution.

Options for Surgical Techniques for Macromastia

The goals of the patient suffering from large breasts are as follows: to have relief of their physical symptoms; to have an improved self-image with regard to the shape, size, harmony, and symmetry of their breasts; for this to be performed in a safe manner and to not require additional surgery; and to have the best/least scars possible.²⁷ Excellent results can be achieved with one of many techniques, and the surgeon must take into account the patient's morphology, breast size, degree of nipple transposition and displacement, body mass index, smoking history, and underlying health issues; and the surgeon's training, experience, and comfort level with specific procedures in obtaining their optimal results. In addition, the patient's desired postoperative size and willingness to accept specific scars must be taken into account.

Wise Skin Pattern Reduction

The Wise pattern with an inferior pedicle technique has been the mainstay treatment for years^{13,28,29} (Figs. 1 through 3), and is still the most commonly performed procedure by our members. The 2014 American Board of Plastic Surgery tracer data demonstrate that certified plastic surgeons performed a Wise pattern operation on 79 percent of their patients, using an inferior pedicle on 59 percent of them (Table 1). This is a slow shift from 2012 data, where the Wise pattern was used in 83 percent and the inferior pedicle was used in 69 percent.¹³ (See Video, Supplemental Digital Content 1, which displays the Wise pattern and inferior pedicle technique. This video



Fig. 1. Wise pattern breast reduction. (Left) The drawing of the Wise skin pattern is displayed. This can be used with an inferior pedicle (center) or superior medial (right) technique.

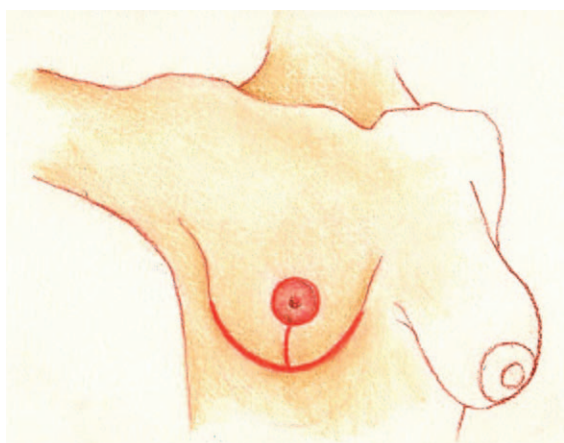


Fig. 2. Illustration of an anchor type skin closure of Wise pattern.

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Superior (13.3 percent) and medial (19.5 percent) pedicles have grown in favor with many surgeons, as they are thought to result in more superior fullness and less bottoming out over time. Patient satisfaction is very high with each of the reduction techniques.³ Thoma et al. used a randomized controlled study to compare T-shaped scar reductions to vertical scar reductions and found no significant difference in complication rate or patients’ objective Health Utilities Index Mark 3 and Breast Related Symptoms Questionnaire results.³⁰

Vertical Scar Breast Reduction

The vertical scar has had a recent surge of interest, and many authors are very ardent advocates of the procedure.^{31–34} The vertical reduction procedure has been based on a superior or medial blood supply (Figs. 4 and 5), although Hammond et al. have devised an inferior pedicle technique

for patients with reductions greater than 1000 g.³⁵ Its basic premise is that patients do not like the horizontal scar and that avoiding it is essential for obtaining a better reduction result (<http://journals.lww.com/plasreconsurg/Pages/videogallery.aspx?videoId=659&autoplay=true>).

The vertical reduction procedure has been used for over 80 years,³⁶ and the Wise pattern operation was designed to overcome some of the shortcomings of the previous short-scar techniques and to obtain a more predictable and aesthetically pleasing breast.³⁷ The vertical mammoplasty has been improved and designed to better control the shape of the postoperative breast with no horizontal scars by Lejour et al.,³⁸ Hall-Findlay,³³ and Lista et al.³⁴ Three-dimensional analysis of the postoperative breast demonstrated that the final shape of the Wise pattern breast was evident at 6 months and that of the vertical reduction at 9 months. In addition, the upper pole-to-lower pole ratios were the same for both techniques at 1 year: 70:30.³⁹ In early experiences, there was a relatively high conversion to a short T scar to deal with the redundancies or dog-ears.⁴⁰ In a recent matched cohort study, the complication and reoperation rates for Wise versus vertical reduction were identical.⁴¹

On review of the American Board of Plastic Surgery tracer data, the 2012 data demonstrated that 12 percent of all reductions were of a vertical pattern; in the 2014 data, 12.7 percent were vertical and 2.8 percent were J or L incisions (15.5 percent total). The shift has not been overwhelming.

No Vertical Scar Technique

Although it is believed by surgeons that the horizontal scar is the scar that bothers most patients, when 66 prospective reduction mammoplasty patients were asked to rate line drawings and postoperative photographs of all three

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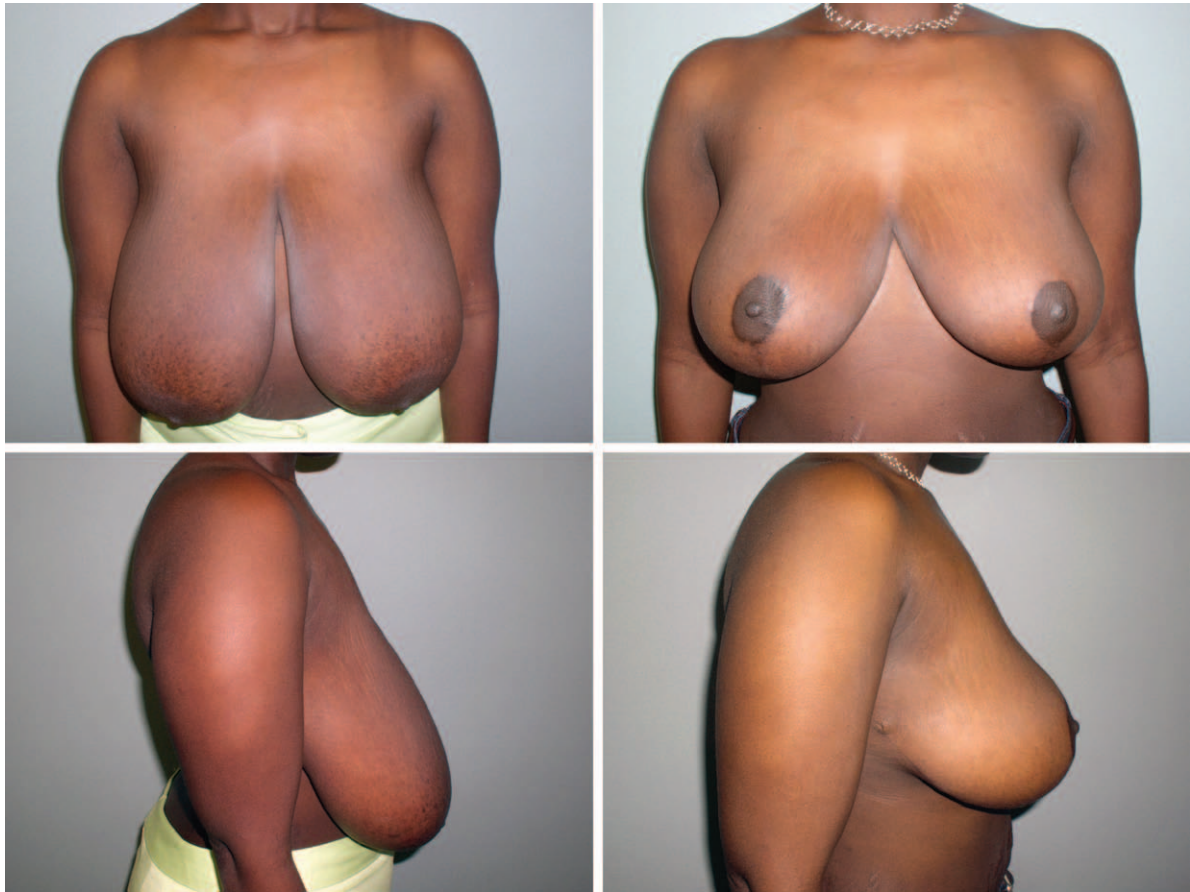
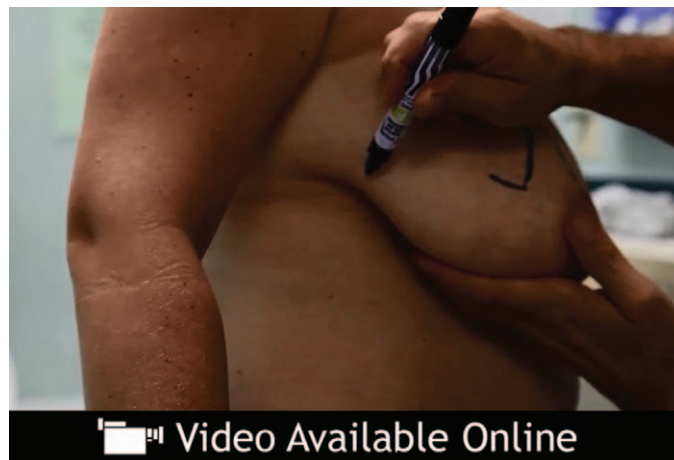


Fig. 3. Wise pattern breast reduction with the inferior pedicle technique. A 32-year-old, 5 foot 2 inch, 163-lb woman with a 796-g right and 874-g left resection (from G to D size breasts) is shown (*left*) preoperatively and (*right*) postoperatively.



Video 1. Supplemental Digital Content 1 displays the Wise pattern and inferior pedicle technique. This video is available in the "Related Videos" section of the full-text article on PRSJournals.com or at <http://links.lww.com/PRS/B938>.

reduction techniques, the no vertical scar operation was significantly preferred by the patient.⁴² This technique was brought to our attention by Passot⁴³ and later repopularized by Lalonde et

al.⁴⁴ and Nagy et al.⁴⁵ (Figs. 6 and 7). The ideal patient for this procedure is one with the need for significant nipple transposition. The preoperative nipple-areola complex lies below the inferior edge

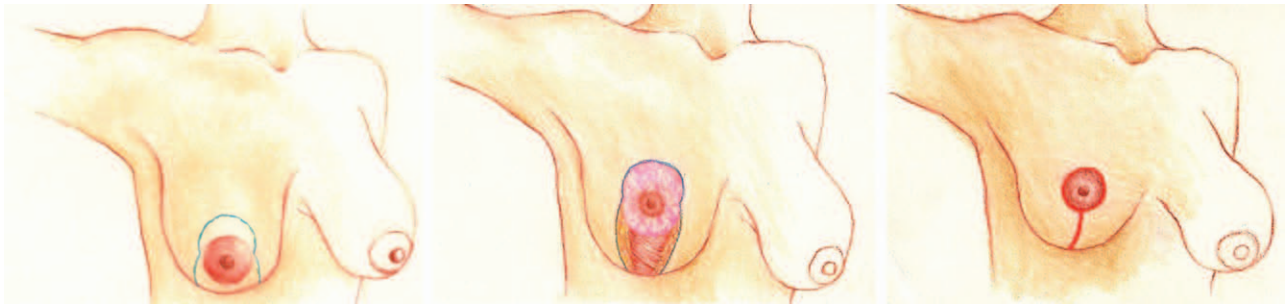


Fig. 4. Vertical breast reduction with the superior medial technique. (Left) Skin incision design. (Center) Superior medial pedicle. (Right) Skin wound closure.

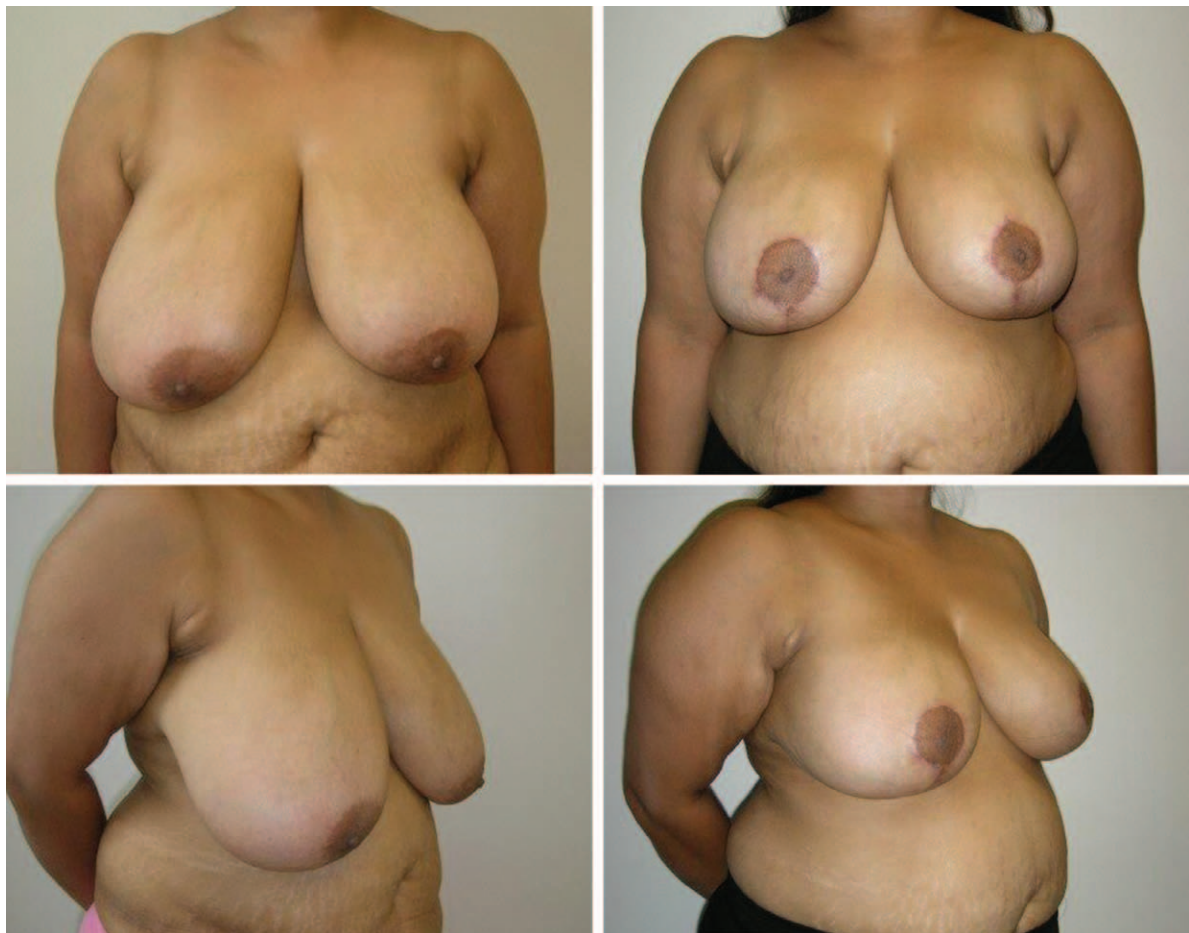


Fig. 5. Vertical breast reduction with the superior medial technique A 39-year-old, 5 foot 2 inch, 180-lb woman with 460 g plus 200 cc liposuction right and 340 g and 200 cc liposuction left resections (from 36 DDD to D size breasts) shown (left) preoperatively and (right) postoperatively. (Case courtesy of Jamil Ahmad, M.D., University of Toronto.)

of the proposed incision on the no vertical scar technique. (See Video, Supplemental Digital Content 2, which displays a no vertical scar reduction. This video is available in the “Related Videos” section of the full-text article on PRSJJournal.com or at <http://links.lww.com/PRS/B939>.) In addition to removing the vertical limb of the T scar, one does not have the disfiguring pull of the vertical limb

on the shape of the new areola, and it significantly reduces the healing complications of the inferior-T connection on a standard Wise procedure.

Use of Postoperative Drains

Despite multiple studies,^{46–48} an American Society of Plastic Surgeons Evidence-based Clinical Practice Guideline (reduction

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Fig. 6. No vertical scar technique. (Left) Skin pattern design. (Center) Inferior pedicle and superior flap. (Right) Final skin wound closure.



Fig. 7. No vertical scar breast reduction technique in a 29-year-old, 5 foot 7 inch, 225-lb woman with 1286-g resection on the right and 1052-g resection on the left (from DDD to D size breasts).

mammoplasty),¹⁰ and a cumulative study performed by the Cochrane Library⁴⁹ that have demonstrated that postoperative use of drains has led to no difference in hematoma rates, no difference in wound healing complications, greater patient discomfort,⁴⁷ more economic costs, and a longer hospital stay,⁴⁷ there has been no significant change in our diplomates' use of postoperative

drains. In 2012, 56 percent of the patients had postoperative drains used, and in 2014 there was only a 3 percent change to 53 percent. We do agree with the American Society of Plastic Surgeons Clinical Practice Guideline that in patients that have liposuction as an adjunct procedure in their breast or axilla, "drainage should be left to the surgeon's discretion."¹⁰ Understanding

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Video 2. Supplemental Digital Content 2 displays a no vertical scar reduction. This video is available in the “Related Videos” section of the full-text article on PRSJournal.com or at <http://links.lww.com/PRS/B939>.

evidence-based medicine should eventually lead to a reduction in the use of postoperative drains in reduction mammoplasty. In the future, the Maintenance of Certification American Board of Plastic Surgery tracer data may want to consider how many patients have adjunct liposuction with their reduction mammoplasties and what percentage of the patients with and without liposuction have postoperative drains used.

SUMMARY

The American Society of Plastic Surgeons Diplomate tracer data have allowed us to follow the practice trends in the treatment of patients with macromastia. There has been a good improvement in the use of preoperative local anesthesia with epinephrine, deep venous thrombosis prophylaxis, and the use of perioperative antibiotics. New information confirms the reasons for these trends, and with time we believe there should be a reduction in the use of postoperative drains. Wise pattern (inverted-T scar reductions) and the use of inferior pedicles are still the predominant operative techniques chosen by our diplomates, but there has been a trend to more superior- and medial-based pedicles and a slow growth in the number of vertical scar variations. There may be a best option for each patient based on the patient’s present breast size, her desired breast size, the degree of nipple transposition, the concern over shape versus scars, and the operative experience and comfort of the surgeon. This is supported by Nahabedian’s editorial,⁵⁰ and in the words of Dr. Hall-Findlay, “the best breast reduction is the one that the surgeon does best.”⁵¹

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