



Reconstruction of the Breast after Cancer An Overview of Procedures and Options

by Karen M. Horton, MD, MSc, FRCSC

What is Breast Reconstruction?

Reconstruction of the breast involves recreating the breast form following its removal for disease. Although the function of the breast is gone and sensation may be altered, restoration of the breast form and recreating symmetry helps to reestablish body image, self-esteem and a sense of femininity and completeness to a woman.

Women facing breast cancer should be reassured that reconstruction of the breast can be a positive experience. Recent advances allow for options in reconstruction that were not available a few years ago. These exciting, state-of-the-art techniques are increasingly being offered around the world. Women who are facing the challenge of a breast cancer diagnosis, and who are making difficult decisions about cancer surgery, can benefit from these new techniques.

Options for Breast Reconstruction

Breast reconstruction techniques are as widely varied as women are. Some procedures make use of prosthetic materials (tissue expander and breast implants), other procedures make use of the body's own tissue, and some procedures use a combination of both. This article will describe the various techniques, and their advantages and disadvantages.

Immediate versus Delayed Reconstruction

Immediate reconstruction refers to a procedure that reconstructs the breast form at the same time as the mastectomy. *Delayed* reconstruction implies that there has been a period of time between the breast removal and the reconstruction procedure. The advantage of immediate reconstruction is that it allows for a skin-sparing mastectomy and preservation of the majority of the breast skin. A delayed reconstruction can be done at *any* time after removal of the breast – however, much of the breast skin must be replaced by tissue expansion or replacement using skin from elsewhere on the body.

Alloplastic versus Autogenous Reconstruction

Alloplastic reconstruction refers to the use of prostheses to assist in the reconstruction process – tissue expanders and/or permanent breast implants. Advantages of alloplastic

reconstruction include a shorter operation time, shorter recovery time, and usually a single scar on the breast. Disadvantages of expanders and implants include the risks of *capsular contracture* (hardening of scar tissue around the implant), infection and the need for implant removal, and a less natural shape to the breast, particularly if only one breast is reconstructed. Use of expanders and implants in tissue that has been radiated greatly increases the risks of complications. In addition, implants have a risk of failure (leakage or rupture) over time, and will likely need replacement of the prosthesis at least once during your lifetime.

Autogenous reconstruction means using the body's own ("auto") tissue for the reconstruction. Advantages of autogenous reconstruction include recreation of the breast using warm, soft, living tissue that moves, grows and ages with you. Disadvantages of autogenous reconstruction include the creation of a "*donor site*" (the area of the body where the tissue was taken from), additional scars, longer surgery and a longer recovery time. However, once recovery from surgery is complete, the reconstruction lasts forever.

Expander – Implant Breast Reconstruction

Breast reconstruction using implants is an alloplastic reconstruction. It can be performed as a *two-stage* operation (where the remaining breast skin is slowly expanded using a tissue *expander*, and a permanent *implant* is placed as a second operation), or as a *single-stage* reconstruction (where an *adjustable* implant with a removable "*port*" is placed at the reconstruction and its volume is can be altered as an outpatient in the office). The process of tissue expansion usually takes 3 months to complete, and the expander is often "*over-inflated*" to help stretch the skin before it is exchanged for a permanent implant. Both *saline-filled* and *silicone gel* implants are used for reconstruction – their respective advantages and disadvantages can be explained in detail by your Reconstructive Surgeon.

Autogenous Reconstructions – Pedicled Flaps

A "*flap*" is a segment of tissue that has its own blood supply. "*Pedicled*" flaps refer to tissue that is transferred to the breast area using a muscle as a carrier for the blood supply. Examples are the Latissimus dorsi flap and the TRAM flap. Pedicled flaps use a major muscle from the back or abdomen as a carrier for the blood supply, and may create weakness or a contour deformity at the donor site where the muscle is taken from.

1. Latissimus Dorsi Flap

This procedure takes one of the major muscles (the *Latissimus dorsi*) from the back and rotates it around to the chest area. It may also take some skin and fat tissue from the back with the muscle to add bulk to the reconstruction. However, an implant is usually also needed under the flap to create projection of the breast reconstruction. This operation can create a large scar on the back, a contour deformity at the donor site, and is not usually the procedure of choice for most women.

2. Pedicled TRAM Flap

TRAM stands for **T**ransverse **R**ectus **A**bdominis **M**yo-cutaneous Flap. This flap is taken from the lower abdomen, in the same distribution as a tummy tuck. The pedicled TRAM flap takes an entire rectus abdominis muscle with it as a carrier of its blood supply. Although aesthetically pleasing reconstructions can be achieved with this technique, the pedicled TRAM can result in abdominal wall bulge (from the loss of resting muscle tone and the strong fascial layer), weakness (inability to do sit-ups), and abdominal hernia after surgery.

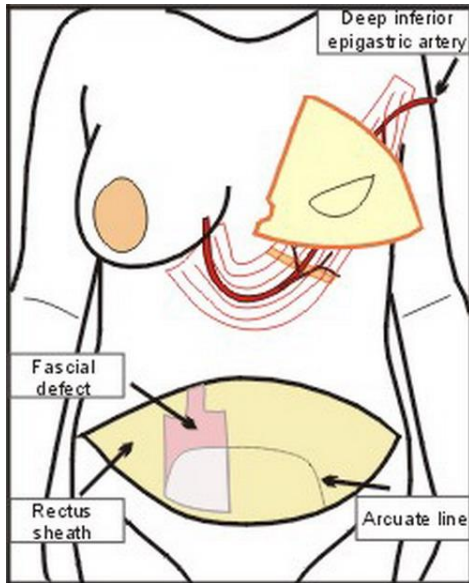


Figure: Pedicled TRAM Flap. Skin and fat tissue from the lower abdomen are transferred on the rectus abdominis muscle and its fascial sheath to the chest. *From Rudy Buntic, MD; used with permission.*

Autogenous Reconstruction – Free Flaps

“Free flaps” also transfer tissue from elsewhere on the body to the chest area, but the blood supply is isolated on an artery and 1-2 veins, detached from its donor site (“free” of a muscle pedicle) and then reattached to blood vessels in the new location using *microsurgery*. Microsurgery is surgery that reattaches blood vessels under the operating microscope, using magnification and specialized microinstruments.

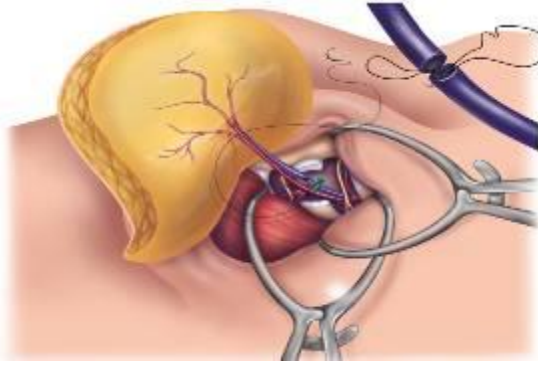


Figure: Microsurgery for Breast Reconstruction. Flap blood vessels are reconnected to blood vessels in the chest area using microsurgical techniques. *Inset:* Close-up of vessel ends being sutured together. *From Edward Buchel, MD; used with permission.*

Free flaps used for breast reconstruction include the free TRAM flap, the DIEP flap, the SIEA flap, and the TUG flap, among others. Because they use a woman's own tissues, these flaps are autogenous reconstructions. They have a robust blood supply that can counteract the effects of previous radiation or infection and are often the procedures of choice when other types of reconstruction are unsuccessful.

1. Free TRAM Flap

The *free TRAM flap* sacrifices all or part of the rectus abdominis muscle, which can lead to abdominal wall hernia, bulge, and weakness (inability to do sit-ups). Some surgeons perform "*muscle-sparing*" free TRAMs, which leave some of the muscle behind but still leave a defect on the abdominal wall.

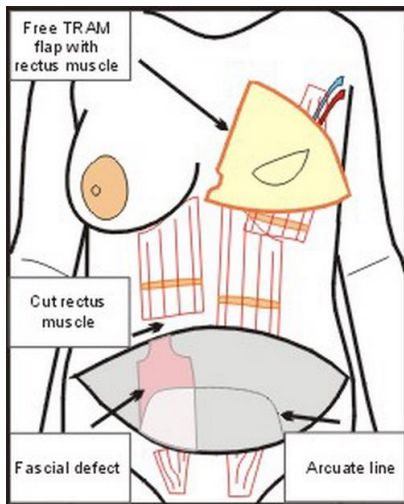


Figure: Free TRAM Flap. Skin, fat, muscle and rectus sheath are transferred to the chest; blood vessels are reconnected beneath the microscope. *From Rudy Buntic, MD; with permission.*

However, new microsurgical options that do not remove any abdominal muscles are now available. These procedures have the advantages of less pain, shorter recovery time, and less “donor site morbidity” (loss of function or appearance at the donor site).

2. DIEP Flap

The **Deep Inferior Epigastric artery Perforator (DIEP)** flap is named for the blood vessel that supplies the skin and the subcutaneous tissue of the lower abdomen in the same distribution as the TRAM flap. The DIEP flap, however, does *not* include any muscle.

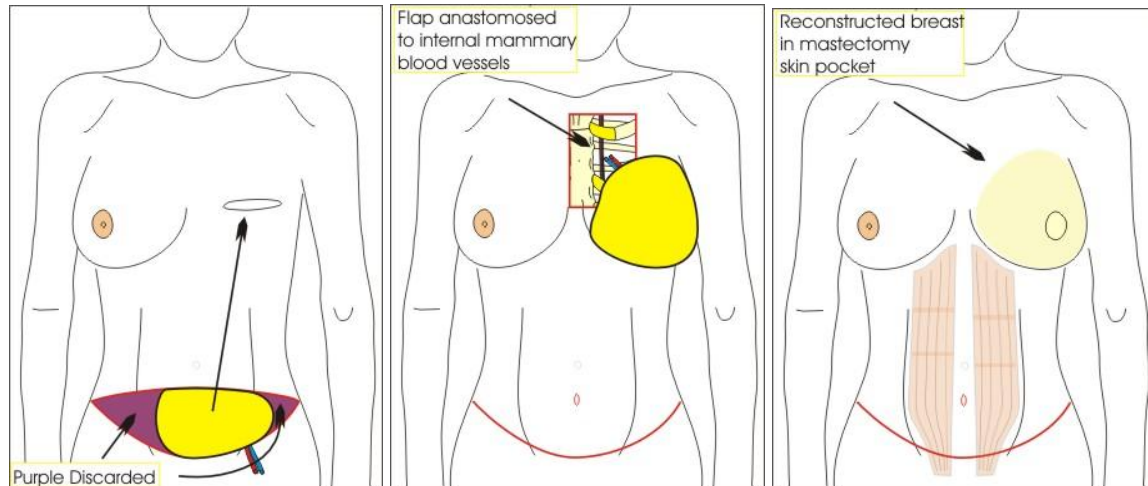


Figure: DIEP Flap. Skin and fat tissue from the lower abdomen are transferred to the chest area to reconstruct the breast. *From Rudy Buntic, MD; with permission.*

A particular advantage of the DIEP flap is that it can look almost exactly like the breast, with a consistency and feel similar to breast tissue. The DIEP flap is recommended following radiation therapy to the chest because it brings with it a new and robust blood supply to counteract the effects of radiation. The reconstruction is permanent – it is soft, reliable, and lasts for the rest of the woman’s life, without many of the disadvantages of breast implants. The abdominal scar can often be completely hidden by undergarments or a bathing suit, and closure of the donor site results in the bonus of a “tummy tuck.” Because no muscle is included with the flap, it obviates the potential complications of abdominal weakness, hernia, or bulge that can occur postoperatively with the TRAM flap. There is also significantly less postoperative pain compared with the TRAM procedure.

The DIEP flap is performed only by reconstructive microsurgeons with specific training and experience. This surgery can take longer than the conventional TRAM flap: standard operating times are 4 - 5 hours for a single (*unilateral*) reconstruction and up to 8 - 10 hours for a *bilateral* reconstruction (both sides). Being under general anesthesia for this length of time is still safe and is common for many reconstructive procedures.

With microsurgery there is a small (less than 2%) risk of failure of the microvascular anastomosis. If the blood vessels were to clot off, a return to the operating room would be necessary to redo the anastomosis and reestablish the blood supply to the flap. Hospital stay after surgery ranges from 3-5 days on average, depending on postoperative pain and the speed of the recovery. Recovery time following a DIEP flap is longer than after an implant reconstruction but much less than after a TRAM flap procedure. Generally, physically strenuous activities, such as running, aerobics, and lifting more than 5 pounds, are to be avoided for four to six weeks after surgery. Walking and light activities, however, begin in the hospital and continue at home.

3. SIEA Flap

The *SIEA flap* contains the exact same tissue as the DIEP flap but is based on a different blood vessel system. SIEA stands for the **S**uperficial **I**nferior **E**pigastric **A**rtery. The SIEA flap makes use of the *superficial* blood supply to the skin and the fat of the abdomen, whereas the DIEP flap uses the *deep* blood supply. Only approximately 30% of women have an SIEA vessel that is visible during surgery and that can be used for reconstruction – this cannot be determined until surgery.

Advantages of the SIEA flap include a shorter operating time, less surgical dissection, and little abdominal discomfort after surgery. Recovery time may be slightly less than the DIEP flap and is significantly less than the TRAM flap. The disadvantages of the SIEA flap include the fact a minority of individuals have this blood vessel, and it may or may not be large enough for microsurgery.

The DIEP or SIEA flap is usually the first-line choice of reconstruction due to the superiority of abdominal tissue over that of other donor sites. In certain cases, however, this tissue may not be available. If so, a free flap from elsewhere on the body, such as the inner thigh (the TUG flap), is rapidly becoming the second-choice technique for microsurgical breast reconstruction when abdominal tissue is unavailable.

4. TUG Flap

The **T**ransverse **U**pper **G**racilis (*TUG*) flap is taken from the upper inner thigh area, in the same distribution as a cosmetic inner thigh lift. Part or all of the gracilis muscle is included with the flap ensure the most reliable blood supply. In contrast to the muscles of the abdomen or back, the gracilis muscle is *not* missed following its removal. The TUG flap provides a soft and shapely breast reconstruction and can also enable immediate nipple reconstruction.

The advantages of the TUG flap include good projection and volume of the reconstructed breast and no donor site morbidity, with the added benefit of an inner thigh. Candidates for TUG flap breast reconstruction include women desiring autogenous breast reconstruction with sufficient upper inner thigh tissue but who have had a previous *abdominoplasty* (tummy tuck) or a flap previously taken from their abdomen. Women

who are very thin or athletic (and thus have insufficient abdominal donor tissue) may also be candidates.

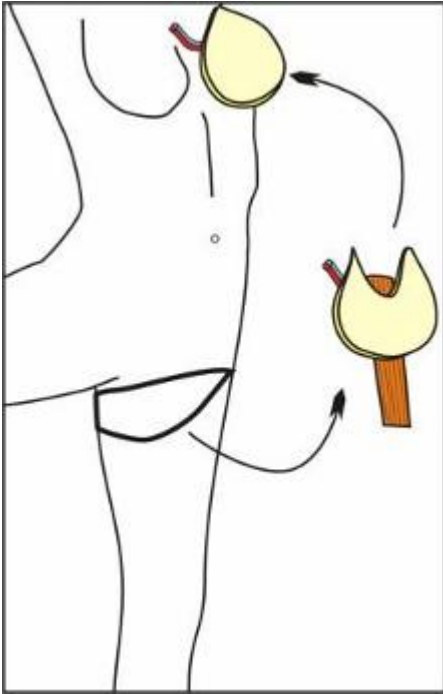


Figure: TUG Flap. Tissue is taken from the upper inner thigh and transferred to the chest area using microsurgery. *From Rudy Buntic, MD; with permission.*

5. S-GAP and I-GAP Flaps

Other options that involve microsurgery include the **Superior Gluteal Artery Perforator (S-GAP)** flap and the **Inferior Gluteal Artery Perforator (I-GAP)** flap. These flaps take skin and fat from the buttocks, which have a firmer and more fibrous consistency. The amount of tissue available to recreate the breast is often less than that for other free flaps. These flaps can result in a more conspicuous donor site contour abnormality and are lower on the list of choices for reconstruction.

Who Is a Candidate for Microsurgical Breast Reconstruction?

Healthy, physically active, nonsmoking patients with enough abdominal tissue to create a breast mound are good candidates. Often women with excess abdominal skin and fat following pregnancy can benefit from the tummy-tuck closure. In addition, radiation of the breast prior to reconstruction or anticipated radiation following surgery is another indication for microsurgical breast reconstruction.

Smokers and patients with diabetes or blood-clotting problems are not good candidates for microsurgery. Rarely, the location and the number of scars on the abdomen from previous surgeries can interfere with the blood supply to a DIEP flap or an SIEA flap. In

such cases a free flap from elsewhere on the body such as the inner thigh is often an option.

Artistry in Breast Reconstruction

The goals of breast reconstruction are to re-create the breast form following its removal, with consideration of aesthetics, symmetry, longevity, and minimal morbidity (no loss of body function). In addition to the technical aspects, a significant amount of artistry is involved in reconstructing a breast.

A *nipple prominence* and an *areolar circle* are reconstructed on the breast mound during a second procedure. This usually done 3-6 months after the flap to allow the tissue to “settle” and the reconstruction to assume its natural form. Skin and underlying fat are elevated and folded to make a nipple prominence that projects from the breast mound. A cosmetic tattoo or a skin graft is used to create an areolar circle. Often, a *balancing procedure* is performed on the opposite breast to match the reconstructed one. This may involve a breast reduction, a breast lift, or occasionally an implant to match the reconstructed side.

Reconstruction of the breast is an individualized procedure. The options, desires, and anatomy of each patient differ greatly. The best reconstructive option takes into account a woman’s goals, the way she uses her body, and her unique situation.

About Dr. Horton



Dr. Karen Horton is a Board-Certified Plastic Surgeon practicing San Francisco and the Bay Area. Dr. Horton’s training and interests include reconstruction of the breast following breast cancer using microsurgical techniques. She has published review book chapters on breast reconstruction and presented numerous clinical papers at national and international scientific meetings. In addition to participating as an active member of many professional associations, she serves as a mentor to young female surgeons and medical students in training. For more information or to contact Dr. Horton, please go to www.womensplasticsurgery.com.