

Autologous Breast Reconstruction - A Brief Overview

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IMPORTANCE Breast reconstruction is one of the procedures in which detailed planning is needed to plan the surgery. The ultimate aim in the reconstruction is to achieve symmetric breasts. Both immediate and delayed reconstruction can be warranted in the cases and the result of delayed reconstruction is normally accepted well by the patient. There are two types of autologous reconstruction pedicled and free flap reconstruction. Lattisimus Dorsi Flap and TRAM flap are one of the best-known types of autologous reconstruction. The other flaps known are the SIEA flap, Rubens flap, and deep circumflex iliac artery (DCIA) flap.

KEYWORDS Breast Reconstruction, Autologous Breast Reconstruction, DIEP Flap, Latissimus Dorsi Flap, SGAP Flap

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Perspective

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Breast reconstruction is an integral part of the overall treatment of breast cancer patient. The reconstructive surgeon should be present on the initial consultation for decisions about primary treatment of the breast since the patient may want to know what her options are? Aesthetics plays a vital role in final decision making, and if immediate reconstruction is considered, careful coordination is critical. If delayed reconstruction is to be done, the plastic surgeon can advise on placement of the incision and drains, preservation of the pedicles, etc.¹

Cancer fear and fear of death are real concerns for the patient as well as loss of femininity and a desire to return to normal. Usually, a decision to opt for reconstruction indicates positivity and acceptance by the patient. The challenge lies not just in dealing with the patient but also in matching the correct technique with the patient's needs. The ultimate aim is to provide the patient with an aesthetically pleasing breast. Symmetry is an important consideration, and the other breast serves as a reference guide.

There are certain advantages of early reconstruction, including better recovery and rehabilitation with a reduced number of operations and admissions. Aesthetics are often easier to work with and pedicle already exposed during the surgery. However, there are some disadvantages like high patient expectations and higher incidence of wound complications.

Delayed reconstruction allows better prognostication and consideration of oncological, psychological and aesthetic factors. In patients who are to receive adjuvant therapy, Bostwick recommends waiting for 2-3 months after completion of therapy before reconstruction. This allows

blood count to return to normal and strength to be regained. Also, patients tend to gain weight during chemotherapy, and this may affect the final outcome, the modern indications for delayed breast reconstruction are either if the surgical capabilities are not available or if the histologic result will change the operative plan.²

When deciding the deformity, the surgeon needs to consider skin amount, quality, scar, radiotherapy damage and also examine thoroughly the anterior axillary fold and axillary roll along with pectoralis muscle status. It is imperative to examine the opposite breast: size, shape and ptosis. Main advantage of autologous recon is that, if available, it is the body's own tissue so changes proportionally with time and is better tolerant of radiotherapy. The size and volume is determined by the contralateral breast (assuming the patient is happy with it). Pedicled vs free flap is based on available surgical expertise. The exact flap is determined by available tissue at each donor site (and patient's preference of scar position).

TYPES OF AUTOLOGOUS FLAP

There are two types of autologous flap; pedicled and free flap. Pedicled flap includes Latissimus dorsi, transversus abdominis myocutaneous flap (TRAM)(unipedicled or bipedicled), Free flap included gluteus fasciocutaneous flap (superior or inferior gluteal pedicle), lateral transverse thigh flap, Ruben's flap (love handles based on deep circumflex iliac artery), free TRAM, free deep inferior epigastric artery perforator flap (DIEP flap) and free superficial inferior epigastric artery (SIEA) flap. Autologous reconstruction can be combined with the use of prostheses like breast implant or two stage expander-implant procedure.

To decide what sort of reconstruction is needed, take into consideration the patient fitness, laxity and thickness of remaining skin, condition of pectoralis major & serratus muscles, size of opposite breast, availability of flap donor site, radiotherapy, stage of disease, patient's wishes, patient's health, body habitus and need for adjuvant therapy. Commonly, Latissimus dorsi flap is used for medium-sized defects and for larger defects, pedicled or free TRAM or DIEP flaps are used.

I. Latissimus Dorsi Flap

The latissimus dorsi musculocutaneous flap is type IV flap, according to Mathes and Nahai, and has a dominant blood supply from thoracodorsal artery having a pedicle length of 8-10 cm. Other segmental perforators from intercostal and lumbar vessels also perfuse this muscle. The nerve supply is by thoracodorsal nerve from the posterior cord of the brachial plexus. This muscle arises from T7-T12 thoracolumbar spine, posterior iliac crest and angle of scapula and inserts in bicipital groove of humerus. Rowsel et al. studies the anatomy of subscapular-thoracodorsal axis and found 97% of subscapular artery was a branch of 3rd part of axillary artery, 94% thoracodorsal artery was a branch of subscapular artery, and 99% of thoracodorsal artery had serratus branch. Thoracodorsal artery had ~3mm diameter and was 8.4cm long.³ Latissimus dorsi flap is a robust, workhorse flap that can cover prosthesis, is aesthetically pleasing, single-stage (if used with breast implant), recovery time is moderate, operation time is not too long and can survive on reverse flow from serratus branch. Disadvantages include need to turn patient, often requires an implant, scar on back, seroma, shoulder stiffness in athletes or manual workers (e.g. decorator) and colour match. This flap is used when reconstructing a large breast where implant alone is not sufficient, chest wall tissues are unsuitable for tissue expansion, where there is requirement of additional tissue, in partial breast reconstruction, in congenital breast hypoplasia (e.g. Poland's) and at patient's will. It is contraindicated in case of previous thoracotomies, where there is an injury to thoracodorsal vessel or muscle itself. While harvesting the flap, patient needs to turn to a lateral position. The skin paddle may be oriented in transverse, longitudinal or oblique fashion.⁴ The origin can be detached to increase the reach. The muscle may be denervated to avoid muscle contraction. While closing the donor site, quilting stitches are applied to reduce the seroma or fibrin sealant or sclerosing agents may be used. During inseting, the upper and medial edge is sutured, implant is placed if needed, inframammary fold is created, and the skin paddle is tailored according to reconstruction requirements.⁵ Complications include wound breakdown, expander failure, implant complications – infection, extrusion, seroma, scar, muscle twitching, shoulder girdle dysfunction and lumbar hernia.⁶

II. TRAM (Transverse Rectus Abdominis Myocutaneous Flap)

Transverse rectus abdominis myocutaneous flap is type III muscle flap based on superior epigastric and deep inferior epigastric artery and intercostal arteries and has segmental nerve supply from T7-T12. It arises from the pubic crest and

inserts on 5-7 ribs. It gives good aesthetic results, usually provides enough tissue for total autologous reconstruction. There is no microsurgery involved and thus has short operative time. This option carries disadvantages of significant recovery time, is a tedious surgery, there is fullness in inferiomedial aspect from pedicle, a large amount of muscle is harvested so there are chances of abdominal hernia, poor vascularity in the peripheral zone, high rate of fat necrosis (up to 42%), reduced abdominal wall function, long recovery and costal nerve compression. It is indicated in immediate or delayed breast reconstruction, unilateral or bilateral breast reconstruction, young, athletic patients, large contralateral breast, when latissimus dorsi is not an option and in previous implant complications. Relatively contraindicated in physiologically old, obese, smokers and diabetic patients, patient with autoimmune disease, vasospastic disorders, cardiorespiratory disease, psychosocial problems, abdominal scars disrupting vascular anatomy, previous or planned radiotherapy, locally advanced breast cancer and by an inexperienced surgeon. To improve the flap survival, zone IV should be discarded, or strategical delay should be opted, anterior rectus sheath should be preserved, also by use of bipedicle muscle. Complications include partial flap loss in 8.5% of cases, haematoma, seroma, partial/total flap loss, hernias and abdominal wall laxity, fat necrosis and umbilicus necrosis.⁷ Transferring this muscle as a free flap increases vascularity, more tissue is readily transferred, smaller amount of muscle is harvested, less reduced abdominal function and reduced blood loss, all 4 zones can be reliably transferred, there is no medial fullness from tunnelling flap, shorter hospitalization time, fewer chances of fat necrosis and partial flap loss and is better in smokers and the obese. This needs a high level of surgical expertise post-op complications but still have functional impairment of abdominal wall, there is increased lateral fullness, may need rib resection for anastomosis and need mesh for abdominal donor site closure. Donor site complications include haematoma, wound infection, mesh infection, asymmetry, bulging, hernia and decreased abdominal strength.⁸ Main disadvantage of TRAM is that it is based on non-dominant blood supply (superior epigastric), that it violates the integrity of anterior abdominal wall muscles and leaves an unsightly bulge in epigastrium.

III. Deep Inferior Epigastric Artery Perforator Flap (DIEAP)

DIEAP is the standard of breast reconstruction in most of Europe and USA. Koshima first described the use of muscle sparing deep inferior epigastric artery perforator flap to avoid abdominal wall complications.⁹ Vandervoort did a study on vascular perforator in 100 flaps and found 65% had short intramuscular course, 16% perforators were at tendinous intersection, 9% had long intramuscular course, 5% were subfascial, and 5% had a paramedian course.¹⁰ Advantages of using perforator flap from abdominal wall include harvesting of only what is needed, respect of donor site anatomy and function. Like other free tissue transfer, this flap also requires a high level of surgical expertise and increased operating time. Complications include

microsurgical problems, haematoma, total flap loss, partial flap loss (zone IV), fat necrosis and delayed healing.

The use of superficial inferior epigastric artery (SIEA) flap poses no damage to muscle or aponeurosis. There is no risk of post-operative abdominal wall weakness, is quick to harvest, and easier dissection and post-operative morbidity is comparable to abdominoplasty. SIEA is not present in 30-35%, pedicle can easily be damaged by other surgical procedures, has short pedicle length and small diameter of vessels (1.5-2mm), and has higher risk of partial or total flap necrosis. It was first described by Arnez.¹¹

IV. Common Miscellaneous Options

Many other options are available for breast reconstruction using free tissue transfer. Contralateral latissimus dorsi flap can be used as a free flap if ipsilateral muscle is not available. The lateral transverse free thigh flap has an obvious scar and contour deformity.¹² Rubens flap or deep circumflex iliac artery (DCIA) flap without the bone is for patients who have had previous abdominoplasties or who may need a balancing procedure for other hip. This flap includes harvesting full-thickness square of abdominal wall muscle, including both obliques & transversalis muscle (need to be reattached to iliac crest afterwards). There is a high seroma rate.¹³ Superior gluteal artery perforator flap gives an abundance of adipose tissue even in thin patients, has long vascular pedicle, the scar is obscure, provides an improved projection of reconstructed breast and preserves gluteus maximus muscle and its function and can be sensitive but is technically demanding surgery.¹⁴ Inferior gluteal artery perforator flap and transverse gracilis myocutaneous flap have also been described, but both have their limitations.

The gracilis myocutaneous flap represents a useful alternative in small-breasted patients with ample medial thigh tissue¹⁴. The flap can be oriented vertically or transversely, but the transverse upper gracilis flap results in a more well-concealed scar. The gracilis muscle is harvested

with the overlying skin, including a perforator arising from the medial circumflex femoral artery, but has a shorter pedicle measuring 6 to 8 cm, with a relatively smaller artery. The length and caliber of the transverse upper gracilis pedicle is often better suited for internal mammary vessel perforators or distal internal mammary vessels to minimize the size mismatch. The amount of tissue harvested should allow a tension-free closure to avoid scar widening and migration¹⁴.

For patients who have more fat distribution in the flanks, the lumbar artery perforator flap represents a reasonable option that provides soft, pliable tissue closely resembling breast tissue and also achieves a pleasing aesthetic contour in the donor site. Likely the greatest limitation of the lumbar artery perforator flap is the pedicle length and caliber.

Some flaps have also demonstrated spontaneous return of sensation without a nerve repair. Nonetheless, there are studies supporting the efficacy of performing nerve coaptation. Flaps with a neurotomy generally demonstrated superior and earlier return of sensation compared to noninnervated flaps. The reinnervation can be performed directly or using a nerve graft or conduit. Further studies are needed to decipher the best technique for innervating a sensitive breast flap, but the current literature demonstrates promising results.

What reconstruction should be opted, is multifactorial decision including appropriate patient selection, patients' needs, and patients' will. Women who underwent breast reconstruction with flaps from either the latissimus dorsi or the rectus abdominis had similar satisfaction scores.¹⁵ Although a significantly decreased number of patients reported satisfaction with the appearance of the breast in the case of DIEP flap, almost all patients would have chosen breast reconstruction again, and the consistency of the reconstructed breast was evaluated as improved.¹⁶

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