

Review Article

The deep inferior epigastric artery perforator flap: a review

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ABSTRACT

Breast cancer is recognized worldwide as a major health problem among women due to its high incidence and high mortality and morbidity rates. Breast reconstruction is an approach of great value for those patients who underwent mastectomy, impacting their quality of life and psychological stress. The deep inferior epigastric artery perforator (DIEP) flap was described as the preferred graft for breast reconstruction with an autologous flap by surgeons because it represented a decrease in complications for the time and obtained better results. DIEP flap reconstruction requires microsurgical skills as well as continuous monitoring of the patient to identify and resolve possible associated complications.

Keywords: DIEP flap, Breast cancer, Microsurgery, Breast reconstruction

INTRODUCTION

Breast cancer is recognized worldwide as a major health problem among women due to its high incidence and high mortality and morbidity rates.¹ It has been described in different research projects that patients carrying some heterozygous mutations have a high risk of suffering from breast cancer if it is found mainly in the BRCA 1/2 gene, high risk if it is found in PALP 2 and moderate risk if it is found in the genes RAD51C, ATM, BRIP1, CDH1, CHEK2, NBN, PTEN. These patients have a significantly higher risk of developing breast cancer or ovarian cancer throughout their lives.² Breast reconstruction is an approach of great value for those patients who underwent mastectomy, impacting their quality of life and

psychological stress.^{3,4} Breast reconstruction has its beginnings in the 1960s, when Cronin and Gerow introduced the first reconstruction using a silicone implant, positioning this method as the most frequently used by surgeons between the 1960s and 1970s. It was not until 1994 that the DIEP flap was first described by Koshima, which was popularized by Allen in America and by Lantieri and Bondeel in Europe.⁵ The deep inferior epigastric artery perforator (DIEP) flap was described as the preferred graft for breast reconstruction with an autologous flap by surgeons because it represented a decrease in complications for the time and obtained better results.⁶ The use of autologous grafts in breast reconstruction has evolved over time, meeting new patient needs, achieving a better understanding of the anatomy,

and generating techniques with better results.⁷ Breast reconstruction with DIEP flap consists of making a flap using the skin and subcutaneous tissue of the patient's lower abdomen for breast reconstruction. It will have the blood supply through the deep inferior epigastric artery and one or two veins. concomitant procedures through a perforator, subsequently the anastomosis of the perforator to the internal mammary artery will be performed for optimal blood supply of the reconstructed breast.⁸ Although the use of the thoracodorsal artery as a recipient is possible, the use of the internal mammary artery is more frequently reported, as well as achieving an improvement in appearance with low donor site morbidity has further promoted its practice, achieving great developments around regenerative medicine and tissue engineering.^{9,10}

EPIDEMIOLOGY

Breast cancer is the most common cancer among female patients. It currently affects around 2.1 million women worldwide per year. A figure of more than 3 million annually is estimated by 2040. Associated with this, it is the main cause of cancer-related death in women, approximately a third of these patients undergo mastectomy and only 1 in 7 undergo breast reconstruction surgery. Furthermore, in recent years, the implementation of prophylactic mastectomies has been occurring more frequently in patients with confirmed genetic mutations, medical indications for high-risk lesions, or media cases that recommend it.¹¹ Of these procedures, 50% were performed with autologous tissue, in 32% of cases DIEP flaps were used.⁸

BREAST RECONSTRUCTION WITH DIEP FLAP

The justification for breast reconstruction with DIEP flap is attributed to patients who have undergone radical mastectomy due to breast cancer. This reconstruction represents a significant improvement in the quality of life and the psychological impact of the patient. The candidate patients must be carefully selected to obtain the best result and avoid potential complications. Other indications where the possibility of performing breast reconstruction with a DIEP flap is: prophylactic mastectomy due to confirmed genetic mutations in BRCA 1, BRCA 2, capsular fibrosis after reconstruction with a breast implant or unsatisfactory cosmetic result.² The abdominal wall is supplied by the superior, inferior, and superficial epigastric arteries, which are interconnected. The deep vascular system is the main one in charge of arterial supply. Partially, venous drainage is carried out by the superficial vascular network, accompanied by multiple branches originating from the deep inferior epigastric artery, throughout its course. After the passage of the rectus abdominis muscle, these perforating branches continue their way to the hypodermis to perfuse the skin and subdermal layers. Due to this, every patient must undergo a preoperative computed tomography (CT) angiography to visualize the route of the perforators branches that can also be identified intraoperatively with a

Doppler. The abdominal wall receives innervation from the last 6 intercostal nerves and the first lumbar nerve, innervating the parietal peritoneum, peripheral region of the diaphragmatic peritoneum and some superficial planes in charge of the perforating branches. Any injury to these nerves will generate both motor and motor alterations. as sensitive and vegetative, which can be found on physical examination as regions of muscle atrophy, hypersensitivity, and vasomotor alterations, among others.¹²

Different factors have been described to be considered when performing breast reconstruction using the DIEP flap. Initially, analyzing the risk factors to define patients with a greater possibility of experiencing postoperative complications is essential. Among these, it was found that patients with body mass index (BMI) >40, active smoking, type 2 diabetes mellitus with Hb1AC >7%, use of immunosuppressants and/or anticoagulants, previous history of reconstruction with a previously failed flap have a higher rate of postoperative complications.¹³ Also, some recommendations have been described for preoperative preparation, such as verification of adequate perfusion of the donor tissue, adequate pulse, temperature, and correlation of the diameter of the blood vessel. Intraoperatively, the importance of continuous monitoring of the patient's temperature has been described. Hypothermia was associated with the high risk of postoperative complications. For this reason, they recommend an adequate temperature, which has shown better results during vascular anastomosis. recommends in all cases to warm patients prior to the procedure until 24-48 hours postoperatively, thus avoiding a difference between peripheral temperature and central body temperature.³

A systematic review and meta-analysis suggests that the use of angiotomography compared to Doppler preoperatively has significantly reduced a reduction in graft loss following breast reconstruction with DIEP graft.¹⁴ To perform the DIEP flap, a portion of the perforating branch of the lower abdominal artery is used, which, unlike the transverse rectus abdominis musculocutaneous (TRAM) flap, does not require a resection of the rectus abdominis muscles, which can increase the risk of abdominal damage.¹⁵

The surgical procedure is performed under general anesthesia with the patient in a supine position. It begins with an ellipsoidal incision in the lower abdomen and around the superficial inferior epigastric vein, which must be preserved at least 5 cm in length; this will serve as a reserve in case venous congestion occurs. During the incision, it is important to preserve the perforating vessels that will be used in the cutaneous adipose graft and that will later be released from the rectus abdominis muscle. Once the release is performed, the anastomosis of the epigastric artery and vein to the internal thoracic vessels begins.² Although the implementation of the DIEP flap is frequently found in surgical practice, complications have

been found in 20% of cases that not only represent a greater risk for the patient, but also generate additional costs and possible new interventions. in the patient. Among the most frequent complications in the implementation of the DIEP flap is fat necrosis, possible loss of the flap or the need to convert it to a TRAM flap and sacrifice a portion of the rectus muscle.¹¹ Also, vascular compromise and lesions of the donor site such as: hematoma, seroma, infection, or wound dehiscence have been described. In cases where vascular compromise was detected by Doppler examination, an intraoperative examination was performed urgently. Adequate patient stratification is of great value to adequately stratify risk and provide appropriate recommendations that optimize patient safety.¹⁶ Postoperative flap monitoring is of great importance for detecting early signs of compromised perfusion. Currently, most surgeons use clinical presentation to evaluate flap perfusion, primarily observing skin color, flap turgor, capillary refill, and skin temperature as well as using an 8 Mhz linear ultrasound.

Table 1: Clinical parameters for detecting early signs of compromised perfusion.

| Parameters | Signs |
|----------------------------|--|
| Color and condition | Pale skin, there may be associated turgor. Especially identify venous congestion |
| Capillary refill | Absence or delay of capillary refill, important evaluation with 8 Mhz linear Doppler |
| Temperature | Coldness in the flap |



Figure 1: Preparation of the DIEP flap.

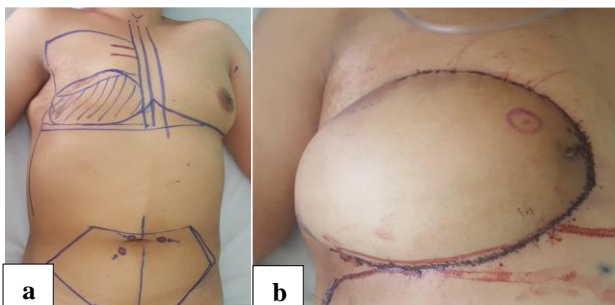


Figure 2: Breast reconstruction with DIEP flap (a) planning and skin marking for the flap, and (b) the DIEP flap is observed after 24 hours.

DISCUSSION

A The impact that breast reconstruction has on those patients who underwent a mastectomy after breast cancer results in a true change of life, by restoring security and self-esteem, which facilitates their return to their ordinary life, which is why it is considered that breast reconstruction is an irreversible procedure with the possibility of drastically influencing the patient both in their family and social environment. The aesthetic result depends directly on the experience of the surgical group, as well as the anatomy, current conditions of the patient and factors specific to the patient.¹⁷ Despite the preoperative care and planning, this procedure is not free of complications such as infection at the donor site, which is one of the most frequent complications and is generally associated with prolonged surgical times and may not only affect the aesthetic results in the affected area, if not the viability of the flap itself.¹⁸ Within the spectrum of complications, flap thrombosis, fat necrosis, venous congestion and partial or total loss of the flap stand out, which have been described among the most frequent complications and which must be warned to the patient before reconstruction and lymphedema.¹¹ They carried out a systematic review in which they discussed the recommendation of the use of subcutaneous Aspirin and heparin as prophylaxis of thrombotic complications. They concluded that the systemic administration of heparin intraoperatively does not influence the incidence of complications, but a higher rate of flap loss with high doses of heparin.^{3,19} However, in another study it was shown that the use of local heparin infusion is effective and safe in cases where a surgical reintervention was performed due to complications of venous congestion of the flap.²⁰

Lymphedema is a non-fatal and frequent complication that is directly related to the resection of axillary nodes as well as multiple sessions of radiotherapy. Given this potential complication, the use of microsurgery has been described in the individual transfer of vascularized lymph nodes where the use of lymph nodes inguinal is the most common donor site. This reconstruction strategy is based on 2 theories: lymph node transfer can generate an increase in the expression of endogenous lymphatic growth factor, which together with vascular endothelial growth factor - C play a key role in the process of the regeneration of the vessels; and by intervening in the axillary region, the axillary veins can be released, giving way to the growth of new vessels. Also, it has been described in TRAM/DIEP flap reconstruction that the lymphatic flap is useful in minimizing lymphedema, but it has not been proven to be completely curative. In a retrospective study conducted by Yang et al. The effectiveness of the TRAM/DIEP lymphatic flap and physical therapy in the effect of lymphedema was compared, concluding that the TRAM/DIEP lymphatic flap is more effective than physical therapy as a management for post-mastectomy lymphedema and that the flap will additionally offer simultaneously the benefits of breast reconstruction, especially in those cases of bilateral breast

reconstruction.²¹ In a study conducted at an institution experienced in breast reconstruction with high volume of patients, bilateral DIEP flap reconstruction was shown to represent a higher incidence of flap complications compared to unilateral reconstruction. Therefore, it is important to discuss it with the patient before the procedure.²²

CONCLUSION

Reconstructive procedures with breast implants remain the most common option for breast restoration, but in select patients' free flap reconstruction is the best option. DIEP flap reconstruction requires microsurgical skills as well as continuous monitoring of the patient to identify and resolve possible associated complications.

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