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EFFICACY AND SAFETY OF IMMEDIATE BREAST RECONSTRUCTION WITH DIEP FLAP

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Abstract: Immediate breast reconstruction with deep inferior epigastric perforator (DIEP) flap is one of the most widely used autologous techniques in post-mastectomy reconstruction, as it combines a high flap viability rate with lower abdominal wall morbidity when compared to myocutaneous flaps. This article delves into evidence of the efficacy and safety of DIEP in the immediate setting, detailing patient selection, preoperative planning, perforator mapping, essential technical steps, perioperative care (including ERAS protocols), clinical outcomes, complications, and risk factors, as well as specific considerations in the presence of radiotherapy and previous abdominal surgeries. The literature shows high rates of microsurgical success and good aesthetic and functional results, with complications that are generally predictable and mitigable through appropriate selection, technical standardization, and experienced teams. It is concluded that immediate reconstruction with DIEP is effective and safe, with significant advantages in quality of life, especially in centers with expertise in microsurgery.

Keywords: DIEP flap; immediate breast reconstruction; mastectomy; microsurgery; safety; efficacy.

Introduction

Although mastectomy is increasingly accompanied by conservative strategies when oncologically possible, it remains indicated in multiple breast cancer scenarios. Immediate breast reconstruction (IBR) is part of multidisciplinary care because it reduces the psychosocial impact of breast loss and decreases the number of procedures throughout treatment. Among reconstructive modalities, autologous techniques offer durable results, with more natural texture and ptosis and less dependence on late revisions than reconstruction with implants, especially in patients who will receive radiotherapy.

The DIEP flap uses infraumbilical skin and fat vascularized by perforators from the deep inferior epigastric artery, preserving the rectus abdominis muscle and, when compared to myocutaneous techniques, reducing functional morbidity at the donor site. This muscle preservation generally translates into a lower incidence of abdominal weakness and hernia, without sacrificing the volume and quality of the transferred skin-fat envelope. Reviews of donor site complications report generally low hernia rates (reported range of 0 to 7%), while bulging may vary more widely (approximately 2.3% to 33%), reflecting differences in definition, measurement method, and study heterogeneity.

Objectives

1. To evaluate the efficacy of DIEP flap breast reconstruction (flap

viability, need for reoperations and revisions, aesthetic results, and patient-reported outcomes).

2. To evaluate safety (complications of the flap and donor site, thrombosis/anastomosis, systemic complications, impact on adjuvant therapies).
3. Detail technical and perioperative aspects that influence results (perforator mapping, choice of recipient vessels, monitoring, anticoagulation, ERAS).
4. Discuss specific scenarios: post-mastectomy radiotherapy, obesity/diabetes, previous abdominal surgery.

Methods

A literature review was conducted focusing on contemporary evidence on immediate DIEP, prioritizing systematic reviews, meta-analyses, and cohorts with descriptions of complications and risk factors. Studies were included on: (a) immediate vs. delayed timing in the context of radiotherapy; (b) perforator mapping (CTA/MRA/US Doppler); (c) ERAS protocols in microsurgical reconstructions; (d) impact of previous abdominal surgery; (e) complications and risk factors in modern series.

Anatomical fundamentals and preoperative planning

Relevant anatomy

- Deep inferior epigastric system: perforators cross (or bypass) rectus abdominis fibers to supply infraumbilical skin and fat.
- Flap perfusion zones: selecting larger perforators with a favorable trajectory helps reduce the risk of congestion/edge ischemia and fat necrosis.
- Thoracic recipient vessels: internal mammary and thoracodorsal vessels are the most commonly used; the internal mammary vessel is often preferred due to its position, caliber, and flow, but the choice should consider the oncological plan and local conditions.

Patient selection: practical indications and contraindications

Typical candidates:

- Desire for autologous reconstruction with greater naturalness and long-term stability;
- Sufficient abdominal tissue;
- Patients at risk for radiotherapy (many teams prefer autologous when PMRT is likely).

Extra caution (not necessarily an absolute contraindication):

- Active smoking: increases risk of complications; prior cessation is ideal.
- Obesity and diabetes: associated with increased risk of late complications and donor site complications; recent data reinforce the association of these factors with complications in DIEP reconstructions.

- Vascular disease, thrombophilia, use of vasoconstrictors, significant anemia: may increase the risk of thrombosis/flap distress.

Previous abdominal surgery: not a mandatory contraindication, but may increase abdominal complications; recent meta-analysis suggests that previous abdominal surgery did not increase flap complications, although it did increase donor site complications.

Perforator mapping: why it matters

Preoperative mapping aims to:

1. locate dominant perforators;
2. anticipate intramuscular trajectory;
3. reduce dissection and ischemia time;
4. decrease morbidity at the donor site.

CTA is often described as the modality of choice ("gold standard") in DIEP planning because it provides accurate anatomical details, despite involving contrast and radiation.

Recent evidence suggests that CTA may improve surgical outcomes, although the overall quality of evidence varies.

Alternative modalities include MRA and Doppler ultrasound, with meta-analyses pointing to better performance of cross-sectional methods (CT/MR) over ultrasound in mapping accuracy.

Surgical technique:

The following describes a typical technical sequence, highlighting critical points for safety.

Marking and preparation

- Marking of the abdominal spindle similar to abdominoplasty, respecting future scarring and closure tension.
- Planning of the position of the navel and fascial closure.
- Antimicrobial and thromboembolic prophylaxis according to risk.

Flap dissection

1. Incision and elevation of the skin-fat flap.
2. Identification of perforators (usually periumbilical).
3. Selection of 1–3 dominant perforators (balance between flow and intramuscular aggression).
4. Meticulous intramuscular dissection to the pedicle (deep inferior epigastric).
5. Maximum preservation of motor nerves and fascial integrity.

Key point: delicate dissection reduces hematoma, denervation, and abdominal weakness.

Preparation of recipient vessels

- Exposure of the internal mammary (often in the intercostal space) or thoracodorsal vessels.

- Hemostasis control to reduce the risk of compressive hematoma (one of the enemies of microvascular flow).

Microvascular anastomosis

- Arterial and venous anastomosis (veins with "coupler" in many centers).
- Checking flap flow and perfusion: edge bleeding, intraoperative Doppler, evaluation of color/temperature/turgor.

Breast modeling

- Flap insertion and breast cone shaping.
- Proper distribution of tissue for symmetry and projection, avoiding excess tension in distal areas (reduces fat/skin necrosis).
- Drains according to protocol.

Closure of the donor site

- Careful fascial closure; consider reinforcement (e.g., meshes) in high-risk patients or those with high tension, according to institutional practice.
- Special attention to the prevention of seroma and dehiscence.

Postoperative care and ERAS

The safety of DIEP is not just a matter of "well-performed microsurgery": standardized postoperative care is crucial.

Flap monitoring

- First 24–72 h: critical period for thrombosis/venous compromise.
- Serial evaluation (color, turgor, capillary refill, Doppler).
- Early re-exploration when suspected: improves chance of flap salvage.

Anticoagulation and thromboprophylaxis

- Protocols vary; usually include mechanical and pharmacological measures according to risk.
- Balance between prevention of microvascular thrombosis and risk of bleeding/hematoma.

ERAS in microsurgical reconstruction

ERAS protocols have shown benefits such as shorter hospital stays, less pain, and lower opioid consumption, without an increase in complications in autologous reconstructions, including DIEP.

This involves: multimodal analgesia, early mobilization, nausea control, fluid optimization, early nutrition, and clear functional goals.

Efficacy: what the literature shows

Flap viability and microsurgical success

In contemporary series, total flap loss is usually low. A recent study in JPRAS reported flap loss of approximately 1.9% and an overall complication rate of around 31%,

with obesity/diabetes associated with late and donor site complications.

Individual institutional series may have higher or lower rates, reflecting the volume of the center and patient profile.

Aesthetic outcome and "naturalness"

Autologous reconstruction with DIEP tends to offer:

- more "natural" texture and temperature (well-perfused living tissue);
- more physiological ptosis;
- superior volumetric stability compared to implants in the long term;
- good integration with the chest (with refinements by lipoenxertia when necessary).

Patient-reported outcomes (PROs)

Recent studies compare the impact of timing (immediate vs. delayed) on PROs when radiotherapy is part of the treatment plan, reinforcing that this decision must balance aesthetics, complications, and preferences.

Safety: complications, risk factors, and how to prevent them

Flap complications

1. Venous congestion/venous thrombosis: may require re-exploration; rescue depends on speed.
2. Arterial thrombosis: less common, but critical.
3. Fat necrosis: related to marginal perfusion, volume, and tissue distribution; may require revisions or lipografting.
4. Partial loss of skin/flap: usually manageable with dressings/minor procedures.
5. Hematoma: risk to both the flap (compression) and the donor site.

Donor site complications

- Seroma, dehiscence, wound infection: influenced by tension, hemostasis, and patient factors.
- Bulging and hernia: although generally low for hernia (0–7%), bulging may be more frequent depending on the definition.
- Chronic pain/sensory alteration: may occur due to manipulation of cutaneous nerves; multimodal analgesia and atraumatic technique help.

Clinical risk factors with consistent evidence

- Obesity and diabetes: associated with an increased risk of late complications and donor site complications in contemporary series.
- Smoking: classically associated with wound and perfusion complications (strongly recommended to quit).
- Previous abdominal surgery: does not appear to increase flap complications in a recent meta-analysis, but increases abdominal complications at the donor site (OR ~1.9).

Immediate DIEP and radiotherapy.

- Post-mastectomy radiotherapy (PMRT) is a watershed in reconstructive planning. There are traditional concerns that irradiating an autologous flap may worsen cosmesis and increase revisions; more recent reviews point to a more balanced scenario.
- A meta-analysis comparing immediate vs. delayed autologous reconstruction in the context of PMRT concluded non-inferiority for major complications and suggested that immediate reconstruction may be a viable option when PMRT is necessary.
- At the same time, reviews on radiotherapy in reconstructed breasts describe an association with worse cosmetic results and a higher complication rate in some contexts, reinforcing that timing should be individualized and discussed on the board.
- There is literature addressing volume changes/fibrosis in flaps after RT, suggesting a risk of contraction/volume loss, although there is methodological heterogeneity.

Practical implication: if PMRT is likely, immediate DIEP can be defended for its durability and for avoiding classic complications of irradiated implants, but the patient should be advised about the possibility of aesthetic changes and the need for touch-ups.

Special situations

Previous abdominal surgery

Recent evidence in meta-analysis indicates that previous abdominal surgery is not a contraindication for DIEP, with no increase in flap complications, but with a higher risk of donor site complications.

In practice: CT/MRA and scar planning become even more important.

Bilateral surgery and prophylactic mastectomy

Bilateral reconstructions can increase operating time and tissue demand, requiring rigorous planning of perforators and realistic volume/symmetry goals.

Low-volume vs. high-volume centers

Outcomes in microsurgery are sensitive to the learning curve. Centralization in centers with trained staff and consolidated protocols tends to reduce flap loss and reoperations.

Discussion

DIEP flap reconstruction is highly effective because it delivers high flap viability and satisfaction, in addition to reducing abdominal morbidity compared to myocutaneous alternatives. The safety profile is robust but depends on: (1) clinical selection and optimization (especially obesity/diabetes/smoking); (2) vascular planning (CTA/MRA when available); (3) standardized microsurgical technique and low tolerance for early signs of failure (re-exploration); (4) modern perioperative care (ERAS), associa-

ted with less pain and shorter hospital stays without an increase in complications.

In the PMRT scenario, the "immediate vs. delayed" debate persists, but meta-analyses and recent studies support that immediate autologous reconstruction may be non-inferior in complications, provided that the patient is adequately guided and monitored, and that oncological planning is aligned.

Conclusion

Immediate breast reconstruction with DIEP flap is an effective and safe technique, with high microsurgical success rates, natural aesthetic results, and lower abdominal morbidity when compared to myocutaneous flaps. Safety is optimized by careful patient selection, adequate preoperative mapping, refined technical execution, and modern perioperative protocols (ERAS). In patients likely to undergo radiotherapy, immediate DIEP may be a viable alternative, and the decision should be individualized and shared.

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