

# The impact of liposuction on perforator-based free flap breast reconstruction: a review

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**Abstract.** Objective: The present review aims to analyse evidence regarding a contraindication of surgical flaps: prior surgical intervention to the donor area. Recent case reports have shown favourable outcomes of flaps harvested from areas previously having undergone liposuction. Material and method: Two evaluators performed searches on Pubmed and Cochrane databases using the terms: liposuction, DIEP flap, breast reconstruction, perforator vessel, retrieving 10 studies relevant to the aim of the present review. Result: 7 of 10 studies included case reviews, which were analysed regarding pre-operative assessment and outcomes. The remaining 3 studies revealed information regarding the localisation and patency of perforator vessels, without reporting on a patient case. Conclusion: Surgical flaps may be harvested from donor sites with previous surgical intervention, however pre-operative investigations regarding presence, localisation, and patency of relevant perforator vessels should be used to minimise flap ischemia and further complications.

**Key Words:** breast reconstruction, liposuction, free-flaps

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## Introduction

The use of autologous tissue in breast reconstruction was promoted by Olivari (Olivari 1976), who described the latissimus dorsi muscle flap, being followed by the application of abdominal muscle flaps, such as the rectus abdominis muscle flap (TRAM) (Hartrampf et al 1982).

According to Clough et al (Clough et al 2001), using autologous tissue for breast reconstruction may have a superior cosmetic result, compared to implant-based reconstruction.

One of the classic contraindications of flap harvesting was previous surgery to donor sites, however recent literature reports favourable surgical outcomes in spite of prior procedures; still, there is limited availability of data and, until today, no protocol in place for pre- and post-operative care for these patients. According to The American Association of Plastic Surgery, liposuction is one of the most popular procedures in aesthetic surgery (354.015 in 2000, 265.209 in 2019, 211.067 in 2020) (American Society of Plastic Surgeons, 2020), alongside rhinoplasty, blepharoplasty and facelift.

Due to its constantly increasing popularity, the necessity of understanding the impact of harvesting a flap from the abdominal

region that previously underwent liposuction is essential in breast reconstruction.

Perforator flaps are considered privileged in autologous tissue-based breast reconstruction, therefore it is important to evaluate the risk of perforator vessel damage prior to reconstruction, which could compromise flap survival in patients who previously underwent liposuction.

The aim of this paper is to evaluate current information in the literature and to establish a clinical management plan that may help reduce complications and optimize overall patient management.

## Material and methods

In order to obtain the necessary scientific material for this review, two medical data-bases were used: Pubmed and Cochrane. Scientific articles were collected until February 2023, using the following search criteria:

•((liposuction) AND (DIEP flap)) AND (breast reconstruction) – from which 16 articles were identified, between 2002-2023 on Pubmed, and 0 articles on Cochrane.

•((lipoaspiration) AND (DIEP flap)) AND (breast reconstruction) – 2 articles published between 2017-2023 on Pubmed, 1 article on Cochrane, respectively.

Table 1.

Authors	Article type	Patient number	Prior surgery	Flap harvest	Pre-operative imaging	Outcome
<b>De Frene et al (De Frene et al 2006)</b>	Case series	6	Liposuction	DIEAP flap reconstruction (5 patients), SGAP flap reconstruction (1 patient)	Color duplex ultrasonography	Favorable, no complications
<b>Jandali et al (Jandali et al 2010)</b>	Case series	6	Abdominal liposuction, abdominoplasty	DIEP, TRAM flap reconstruction	none	1 case of delayed wound healing, 1 case of minimal fat necrosis, 1 case of left arterial thrombosis, 1 flap aborted due to poor perfusion
<b>Farid et al (Farid et al 2014)</b>	Case report, review	2	Multiple abdominal liposuction, subsequent breast lipofilling	Free DIEP flap breast reconstruction	CT angiography/ MR angiography	Favourable, no complications
<b>Casey et al (Casey et al 2015)</b>	Original article	11	Liposuction	DIEP flap breast reconstruction	CT angiography, duplex ultrasound, indocyanine green laser angiography	Favourable outcome
<b>Zavlin et al (Zavlin et al 2018)</b>	Original research	9	Suction-assisted lipectomy	DIEP flap reconstruction (8 patients), SIEA flap reconstruction (1 patient)	CT angiography/ MR angiography/ Doppler imaging	No major complications, 1 case of fat necrosis, 1 case of delayed wound healing
<b>Pompei et al (Pompei &amp; Farhadi, 2020)</b>	Review, case series	28	Not specified	Calzone-style DIEP flap breast reconstruction	CT angiography	Favorable outcome, 1 congested flap healing well after readjustment
<b>Papas et al (Papas et al 2021)</b>	Case report	1	Abdominal liposuction	Free DIEP flap breast reconstruction	CT angiography	Flap loss due to ischemia

•(liposuction) AND (perforator vessel) -37 articles between 1997 – 2023 on Pubmed, 0 articles on Cochrane

The identified studies were evaluated by two authors, independently, and the selected articles were subsequently compared. All included articles were written in English, both case presentations and literature reviews, for DIEP flap or other perforator flaps performed on previously lipoaspirated anatomical region. Other inclusion criteria were extended to perforator vessel studies on lipoaspirated area. Only clinical or cadaveric cases were included.

One article has been disputed regarding inclusion in the study by the two authors, and subsequently eliminated due to lack of relevant data for the chosen subject, in comparison to its title and content.

Out of 56 articles, two were duplicated, 43 articles were excluded due to: lack of association of liposuction with consequent flap harvest or other perforator analysis studies. Animal model studies were excluded.

Consequently, 10 articles were evaluated in this study.

## Results

Table 1 summarizes 7 articles included in the present review, which report on clinical cases.

### 1.Pre-operative investigations

There is significant variability regarding pre-operative investigations and protocol: while Jandali et al (Jandali et al 2010) assess donor site pedicles intraoperatively, CT angiography and doppler ultrasound seem to be the most common imaging modalities used to assess the presence, location and calibre of perforators. Indocyanine green laser angiography was used by Casey et al (Casey et al 2015), with improvement in post-operative flap integration.

A prospective study (Salgarello et al 2005), describes the utility of pre- and postoperative colour Doppler US, in six patients, in order to follow existing abdominal perforators and their characteristics, based on the following parameters: localization, diameter, velocity (in cm/s).

After standard infiltration using the „super-wet” technique, superficial (with Mercedes 1.8-2.0 mm cannula) and deep (with

2, 3, 4 mm cannulas, progressively) liposuction with the same canula, was performed, in each case. Student T test was used for data analyses.

Results reveal the same number and location of perforators after liposuction, without noticing any statistically significant changes in their diameter or velocity.

Although the overwhelming majority of the analysed articles represent clinical studies, an experimental study (Blondeel et al 2003) using 20 specimens divided in four comparative studies, has been found and analysed. This paper takes in consideration the infraumbilical adipo-cutaneous tissue. In the first group the authors analyse the quality of tissue vascularization in un-infiltrated and infiltrated halves, after liposuction with ultrasound, in 5 cases. In the second group, infiltrated and lipo-suctioned half is being compared to infiltrated-only half, in an additional 5 cases. Group number 3 consists of 10 cases, which meant to compare classical vs. ultrasound assisted liposuction, and the final group (4), using the techniques presented in group 3 but with additional abdominoplasty performed.

On radiographic imaging, evident signs of extravasation from the deep epigastric vessels were observed, compared to the control site. Although the study reveals relevant results, it is difficult to evaluate the vascular impact of liposuction on a cadaver, due to the absence of vasoconstriction after injecting tumescent fluid. A review with a similar scope by Bond et al (Bond et al 2022) mentions that patients with prior surgical history on donor areas are not at increased risk of flap complications. Use of imaging techniques is not consistent throughout literature and there is not enough data available to support the hypothesis that preoperative imaging decreases risk.

## 2. Intraoperative techniques

Pompei et al (Pompei & Farhadi, 2020) have described the harvesting of a double-pedicle DIEP "Calzone" flap shaping, and reported its favourable outcomes in a group of 28 patients with insufficient abdominal tissue for the classical DIEP flap harvesting.

## Discussions

Regarding the quality of the harvested tissue, and ease of dissection during flap elevation, Salgarello et al (Salgarello et al 2005) offer optimistic results, revealing the absence of fibrotic tissue. Again, controversies may appear in the literature, as Zavlin et al (Zavlin et al 2018) describes scar tissue present during their DIEP and SIEA flap harvest (5 flaps for bilateral, 4 flaps for unilateral breast reconstruction).

Literature (Joshua et al 2016) shows that one single perforator is considered sufficient in harvesting a DIEP flap in 70% of cases, medial row perforators being preferred in 75%. On the other side, the Zavlin study reveals a mean of one medial row, and 1.8 lateral row patent perforator vessels after liposuction, which may contribute to viable flap harvest, but with increased operative risks, in comparison to the recommendations on deep inferior epigastric perforator-based breast reconstruction.

Although, the Salgarello (Salgarello et al 2005) study shows appropriate viability of abdominal perforator vessels at 6 months after moderate superficial liposuction, in combination with extended deep liposuction, the final result may differ. Young et al (Young et al 1981) describe the effect of vacuum as a potential source of vessel damage.

The results obtained by De Frene (De Frene et al 2006), may be encouraging for autologous breast reconstruction, taking in consideration the necessity of preoperative imaging (US Doppler or handheld Doppler) of the elective perforators, in 5 out of 6 cases included in the study.

Farid (Farid et al 2014) and Papas (Papas et al 2021) use in their papers angio-CT for a more efficient prediction, whereas Zavlin (Zavlin et al 2018) describes feasibility monitoring by angio-CT and angio-MRI as well. Although, there is no consensus in preoperative imaging, a suitable vessel status evaluation may contribute to successful surgery.

Infrared thermography (IRT) shows enhanced sensitivity (99.6% and 89.6%) and specificity (99.9% and 96%) in dominant perforator determination, according to a meta-analysis by Raheman et al (Raheman et al 2021), being a useful technique in previously liposuctioned areas, offering appropriate control and successful free tissue transfer (Casey et al 2015).

Consequently, there is a need of correlation between the number of perforators, the type of liposuction and the number of performed procedures (after 5 liposuctions, one single patent perforator was identified (Farid et al 2014)). Furthermore, the risk of insufficient residual abdominal tissue after extensive liposuction needs to be taken in consideration – De Frene (De Frene et al 2006) uses two vascular pedicles for their flap harvest. The particularity of the Salgarello (Salgarello et al 2005) study represents the cannula diameters in concordance with the tissue depth, thus being relevant strictly for the procedure used in the study, without offering precise prediction in classical or ultrasound-assisted liposuction, respectively.

In a constantly changing world, with ascending tendency for cosmetic procedures that enhance physical appearance, reconstructive surgery of the breast needs an adaptation to the current conditions, regarding flap harvest.

Consequently, the necessity of preoperative imaging is essential for appropriate flap viability, starting from traditional Doppler US to more sophisticated investigations – angio-CT, angio-MRI or indocyanine-green thermography.

In cases where abdominal tissue is considered inappropriate after liposuction, double-pedicle flaps may be used in order to enhance tissue volume.

## Conclusions

Liposuction does not represent a contraindication for subsequent abdominal perforator flap harvest, but appropriate preoperative imaging and surgical technique are essential in successful flap elevation.

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