



# DIEP Flap for Head and Neck Reconstruction: An Underutilized Option!

Dushyant Jaiswal<sup>1</sup> Firoz Borle<sup>2</sup> Saumya Mathews<sup>1</sup> Mayur Mantri<sup>1</sup> Vineet Kumar<sup>1</sup>  
Ameya Bindu<sup>1</sup> Prabha Yadav<sup>3,4</sup> Vinay Kant Shankhdhar<sup>1</sup>

<sup>1</sup> Plastic and Reconstructive Surgery, Homi Bhabha National Institute, Tata Memorial Hospital, Parel, Mumbai, Maharashtra, India

<sup>2</sup> Siddharth Gupta Memorial cancer Hospital, Jawaharlal Nehru Medical College, Sawangi Meghe, Wardha, Maharashtra, India

<sup>3</sup> Plastic and Reconstructive Surgery, Sir H.N. Reliance Foundation Hospital and Research Centre, Maharashtra, India

<sup>4</sup> Department of Plastic and Reconstructive surgery, Tata Memorial Hospital, Parel, Mumbai, Maharashtra, India

**Address for correspondence** Firoz Borle, MCh, Consultant, Plastic Surgeon, Siddharth Gupta Memorial Cancer Hospital, Jawaharlal Nehru Medical College, Sawangi Meghe, Wardha, Maharashtra 442005, India (e-mail: firoz.borle02@gmail.com).

Indian J Plast Surg 2024;57:39–46.

## Abstract

**Background** The deep inferior epigastric artery perforator (DIEP) flap is a workhorse flap for breast reconstruction. Its use for head and neck (HN) reconstruction is rare. Abdomen provides a donor site abundant in skin and subcutaneous tissue, amenable to primary closure; sizeable, robust, and consistent perforators and a long, sizeable pedicle for comfortable microvascular anastomosis. Its offers all the donor variables needed for HN reconstruction in abundance.

**Methods** It is a quasiexperimental design study. DIEP flap use for HN reconstruction in our series was opportunistic, that is, when donor site matched the defect. Cases that had very thick thighs and lesser bulk in abdomen and cases that had very thin thighs but much more bulk in abdomen were considered for reconstruction using DIEP flap.

**Results** The DIEP flap was done in 11 cases for HN reconstruction. There were two re-explorations during postoperative period: one flap loss and another had partial necrosis.

**Conclusion** Abdomen is an excellent donor site option for HN reconstruction in selected cases, especially when harvested as a perforator flap.

## Keywords

- DIEP flap
- HN reconstruction
- large defects
- musculocutaneous rectus abdominis flaps

## Introduction

The deep inferior epigastric artery perforator (DIEP) flap is the gold standard for autologous breast reconstruction.<sup>1,2</sup> Abdomen as a donor site is very infrequently utilized for head and neck (HN) reconstruction.<sup>3</sup> The prime argument is bulk of the flap. We present our experience of 11 cases, where it was selected, as donor thickness was matching or could be matched by surgical thinning, to the defect require-

ment. The robust, sizeable, predictable perforators and long pedicle made the harvest and microvascular anastomosis predictable and safe.

## Materials and Methods

It is a quasiexperimental design study. Study period was from November 2016 to March 2021. All cases that underwent

article published online  
November 28, 2023

DOI <https://doi.org/10.1055/s-0043-1777076>.  
ISSN 0970-0358.

© 2023. Association of Plastic Surgeons of India. All rights reserved. This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

abdominal flap-based HN reconstruction during the study period were included in the study. The study was done retrospectively from data obtained from hospital electronic medical record, departmental logs, and personal logs of the first author. The sociodemographic parameters, intra-operative findings, and postoperative complications were noted and conclusions were drawn.

## Results

There were 11 consecutive cases where free flaps from abdomen were performed for HN reconstruction in the study period. In the same period, 180 DIEP flaps were done for breast reconstruction and 1,409 soft tissue free flaps for HN. Of these 11 cases were reconstructed using abdomen based (DIEP) free flaps, that is, 0.78%.

The median age of the patients was 54 years (interquartile range [IQR]: 46–57 years) of which 7 were males and 4 females.

The median follow-up duration was 7 months (IQR: 2–14 months), the least being 1 month and longest being 52 months.

Out of the 11 flaps, 10 were DIEP and 1 was vertical rectus abdominis myocutaneous flap. The median size of the flaps done was  $24 \times 7$  cm, largest flap harvested was  $30 \times 15$  cm, and smallest was  $17 \times 6$  cm dimension. Periumbilical horizontal paddle was utilized in nine cases and vertical paddle in two cases. Adequate and aesthetically acceptable wound closure could be achieved in each case (►Table 1).

Re-exploration was needed in two cases for arterial insufficiency in the immediate postoperative period, of this one flap was lost and spiral pedicled pectoralis major myocutaneous flap was done for salvage. One case developed partial necrosis of the flap, for which deltopectoral flap was done. One case developed native skin necrosis in the frontal sinus region, for which debridement of necrosed tissue and frontal bone was done, and coverage was done using local transposition flap from the DIEP flap.

Primary layered closure of the abdomen was achieved in each case. Rectus sheath was closed with continuous Nylon No1 loop suture, after muscle approximation with polyglactin 910 2-0 suture. Preperitoneal polypropylene mesh was used in five cases. None of the patients had any abdominal donor site complications in short or long term, that is, wound dehiscence, bulges or hernia.

All cases required adjuvant radiation therapy; none had any delay in radiation due to complications related to reconstruction.

On long-term follow-up, two patients, with nonvascularized iliac crest for orbital floor, developed implant exposure of miniplates, which required removal. One patient developed recurrence of the disease during the early follow-up at 4 weeks.

## Discussion

The DIEP flap was first described by Koshima and Soeda.<sup>4</sup> Its use for breast reconstruction was first described by Allen and Treece and popularized by Blondeel.<sup>5,6</sup>

The DIEP flap utilizes the abdomen as the donor site. The abdomen pannus morphology is not a uniform entity, rather highly varied and highly deceptive to eyeballing. The abdomen morphology being a good match to defect dimensions makes indications for this flap. Some common examples are as follows:

1. Females with an apple-shaped body with abundant lower abdominal pannus. This would mean abundant skin and fat for large defect.
2. Females with a pear-shaped body, where the thighs are way bulkier than the abdomen. This would make it a good indication for limited defects, especially if an iliac crest bone graft is needed as it can be harvested from the same incision.
3. Males with a cushingoid body type, where the thighs are surprisingly thin but the abdominal fat and skin abundant, and a large defect.
4. Males with large defect and paucity of fat in whole body, but some extra-abdominal bulk in abdomen especially in the central part over the rectus abdominis muscle.

The flap offers abundant skin and fat even with primary closure; skin grafts are neither desirable nor usually needed. This makes it ideal for a large skin and soft tissue defect HN. The abdomen is blessed with abundant, large and reliable perforators enabling a perforator-based harvest thus preserving the rectus abdominis muscle.<sup>7</sup> Perforator-based harvest reduces the morbidity of harvest from the abdomen.<sup>8</sup> The pedicle length available is long especially with perforator dissection. Simultaneous harvest is also convenient along with HN resection.

Flap Designs Possible:

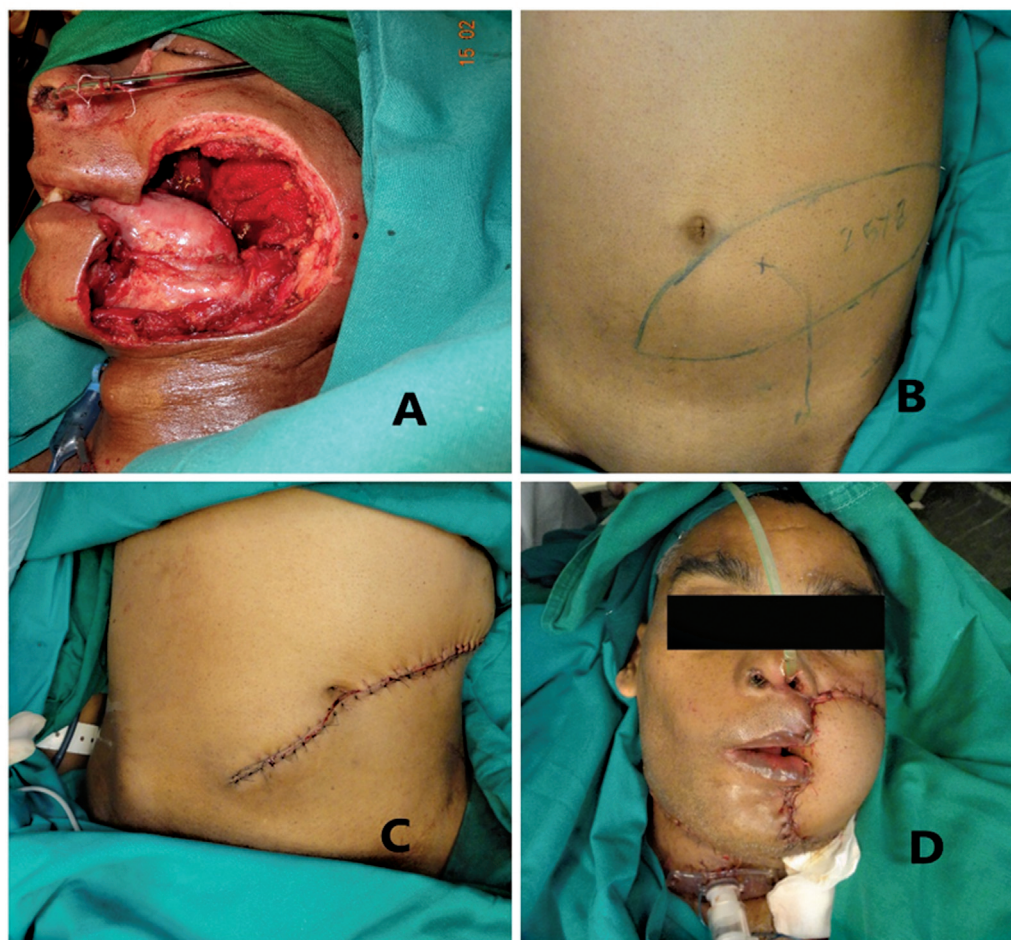
1. Periumbilical flap with primary closure from only hemi-abdomen (8 cases).<sup>9</sup> This preserves the other hemi-abdomen for another flap. The probability of finding a perforator is also high, even when preoperative imaging is not done. Indian males, even the thin ones, often have a fat roll at the level of umbilicus that lends itself to this design (►Figs. 1–4).
2. Vertical design on hemi-abdomen, centered over umbilicus (2 cases). This design is useful when excess skin and fat are centrally placed over the rectus sheath, again in Indian males, with abundant skin and soft tissue requirement (►Fig. 5).
3. Standard abdominoplasty design. This is useful when donor site, lower abdomen pannus in women, is abundant coupled with an extremely large skin and soft tissue requirement.
4. L-shaped and trifoliate designs can also be improvised for large and complex multidimensional defects or for large surface defects of limbs or trunk. Not used in the study yet.

Indian patients with HN cancer often present at a late T stage, sometimes with really large lesions.<sup>10</sup> Surgical excision of these results in very large and complex defects. This combined with low body mass index (BMI) and paucity of skin and fat in thigh, i.e., the anterolateral thigh (ALT) donor

**Table 1** Patient demographics, defect, and flap characteristics

Case no.	Age/ gender	Diagnosis, site	Defect characteristic	Follow-up (months)	Flap type	Skin paddle orientation	Size (cm)	Number of perforators	Complications	Secondary procedures
1	31/F	SCC Left upper alveolus	Left TM	52	DIEP	Periumbilical horizontal	17 × 6	1	–	–
2	52/M	SCC Left upper alveolus	Left TM + left MM	38	DIEP	Periumbilical horizontal	20 × 10	1	–	–
3	68/M	SCC Para nasal sinuses	Open CFR + left OE + skin	14	DIEP	Periumbilical horizontal	24 × 7	4	–	–
4	64/M	SCC Left buccal mucosa +RMT	Left SM + PM + skin	8	DIEP	Periumbilical horizontal	29 × 9.5	2	–	–
5	57/F	SCC, Right buccal mucosa	Right SM + BM + skin	7	DIEP	Periumbilical horizontal	27 × 11	1	Partial necrosis	Deltopectoral flap
6	50/F	SCC Right lower GBS	Right SM + upper alveolus MPS + skin	2	DIEP	Periumbilical horizontal	24 × 7	2	Flap loss	Free ALT flap
7	54/M	SCC Right buccal mucosa	Right HM + upper alveolus MPS + skin	2	DIEP	Periumbilical horizontal	23 × 7	1	Surgical site infection	Conservative management
8	54/M	SCC Left RMT	Left SM + PM + skin	2	DIEP	Vertical	21 × 7	3	–	–
9	56/M	Acinic cell ca Right maxilla	Right TM + OE + skin	2	DIEP	Vertical	20 × 8	Multiple	Wound dehiscence	Local transposition flap
10	46/M	SCC Left buccal mucosa	Left SM + PM + skin	1	DIEP	Periumbilical horizontal	29 × 10	2	–	–
11	44/F	SCC Left maxilla	Left TM + OE + skin	1	DIEP	Periumbilical horizontal	20 × 7	1	–	–

Abbreviations: BM, buccal mucosa; CFR, craniofacial resection; DIEP, deep inferior epigastric artery perforator; GBS, gingivobuccal sulcus; HM, hemimandibulectomy; MPS, mucoperiosteal stripping; OE, orbital exenteration; PM, partial maxillectomy; RMT, retromolar trigone; SCC, squamous cell carcinoma; SM, segmental mandibulectomy; TM, total maxillectomy.



**Fig. 1** (A) Segmental mandibulectomy + partial maxillectomy + buccal mucosa + skin. (B) Periumbilical flap from only hemiabdomen. (C) Donor site primarily closed. (D) Immediate postoperative result.



**Fig. 2** Follow-up 6 months of Fig 1 patient.

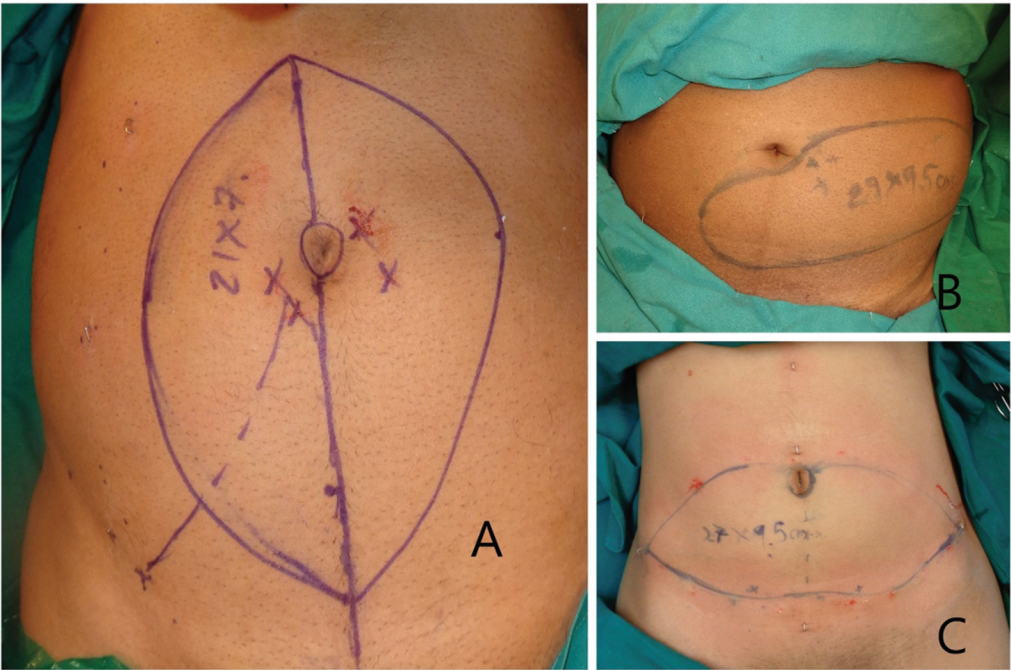




**Fig. 3** (A) Total maxillectomy defect. (B) Orbital floor reconstruction using autologous iliac crest bone graft. (C) Periumbilical flap from hemiabdomen. (D) Deep inferior epigastric artery perforator flap based on single perforator.



**Fig. 4** Follow-up pictures of Fig. 2 patients. (A) Immediate postoperative image. (B) Follow-up 6 months. (C) Follow-up 2 years with plate exposure.



**Fig. 5** (A) Vertical paddle design. (B) Periumbilical hemiabdomen design. (C) Standard abdominoplasty design.

**Table 2** Comparison of DIEP flap (abdomen) with ALT (thigh)

	DIEP	ALT
Skin available	+++	+++ (with skin grafts)
Fat, filler, soft tissue available	+++	++
Donor site closure	Primary needed	Primary or STSG
Donor morbidity	Minimal	Minimal
Perforator configuration	Consistent	Variable but present
Pedicle available	Long	Variable
Lumen size	Large	Variable
Surgical thinning	Possible	Possible

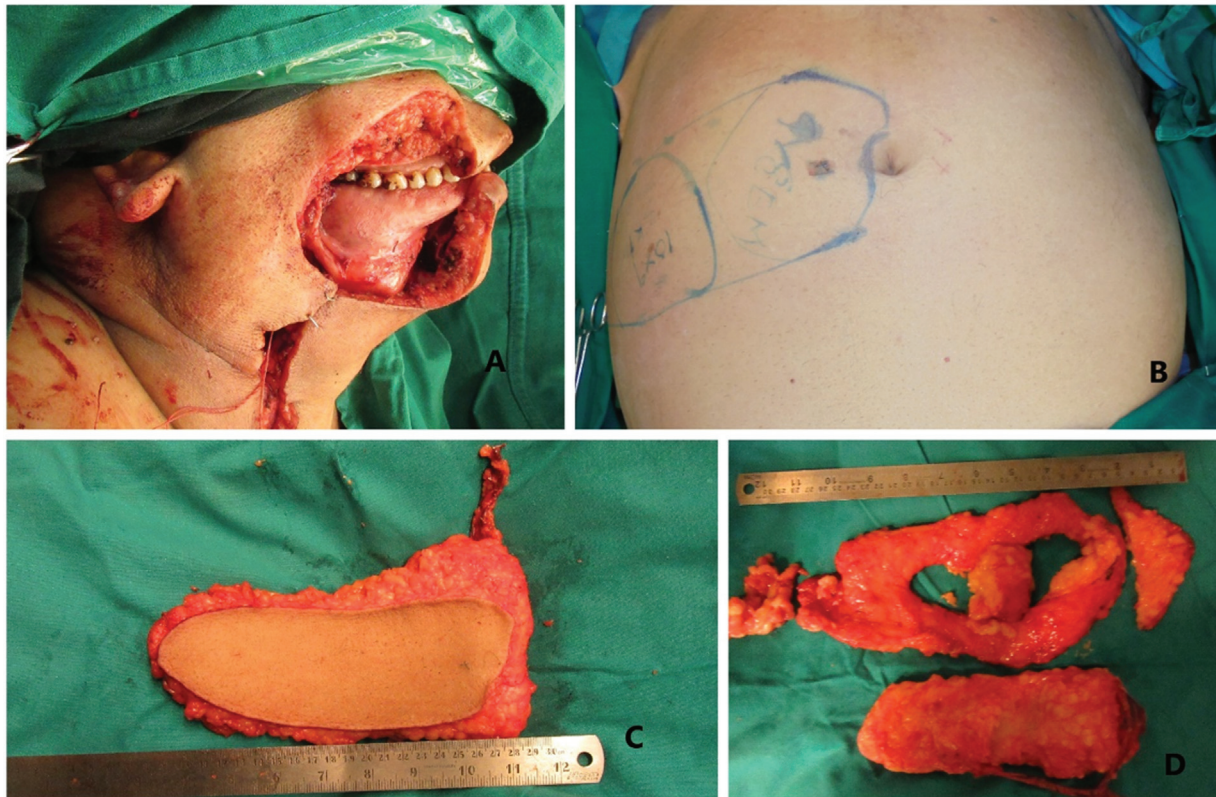
Abbreviations: ALT, anterolateral thigh; DIEP, deep inferior epigastric artery perforator; STSG, split-thickness skin graft.

site, and relative abundant tissue in abdomen makes for a compelling case for DIEP flaps for HN reconstruction. The use of ALT in these large defects would result in a large skin graft at the donor site (►Table 2).

The bulk of the DIEP flap is ideal to fill the large cavities and cover critical structures, especially after large skull base resections, orbitomaxillary defects, total or neat total glossectomy defects, and complex defects of cheek, neck. The long pedicle length of the flap can also be an indication for its use in equivocal thigh and abdomen donor sites. This would be especially in case where microvascular anastomosis would be easier in the opposite neck to the defect, maxillary defects, and large craniofacial defects. The multiplicity of perforators and bilateral pedicles also opens up possibilities of chimeric flap designs and multiple flaps from the same donor site for complex multicomponent

HN defects. Occasionally, the DIEP flap can be used for resurfacing a large defect of the limbs or the trunk. Compared to the ALT this would avoid skin grafts. The thickness of the flap might present a problem to its use that can be overcome by surgical thinning. The DIEP flap is also amenable to surgical thinning as any other perforator-based flap.<sup>11</sup> The removal of deep fat, between deep and superficial fascia, is safe, if the main perforator and its branches reaching the dermis are preserved. Two flaps were thinned in our series (►Figs. 6 and 7). Even further thinning is possible guided by microscope and high magnification. Adding imaging (computed tomographic angiogram) to the process would make this even more predictable and reliable, as it has done to breast reconstruction.<sup>12</sup> Imaging can aid liberties in design, enable harvest of smaller flaps, and even guide thinning as needed.





**Fig. 6** (A) Segmental mandibulectomy + buccal mucosa + skin. (B) Periumbilical deep inferior epigastric artery perforator flap marking. (C) Harvested flap. (D) Flap thinning.



**Fig. 7** Immediate postoperative and 6-month follow-up pictures of Fig. 6 patient.

## Conclusion

The DIEP flap from abdomen offers an excellent alternative donor site, when it matches or can be thinned to match the defect. The abundant flap availability in terms of skin and fat, robust perforators, sizeable and lengthy

pedicle with primary closure of the donor site makes it an effective alternative-choice HN reconstruction in selected cases.

## Conflict of Interest

None declared.

### Acknowledgement

Department of Plastic and Reconstructive surgery, Tata Memorial Hospital, Parel, Mumbai 400012.

### References

- Cordeiro PG. Breast reconstruction after surgery for breast cancer. *N Engl J Med* 2008;359(15):1590–1601
- Healy C, Allen RJ Sr. The evolution of perforator flap breast reconstruction: twenty years after the first DIEP flap. *J Reconstr Microsurg* 2014;30(02):121–125
- McLeod GJ, Islur A. Donor site scar preference in patients requiring free flap reconstruction. *Plast Surg (Oakv)* 2020;28(02):88–93
- Koshima I, Soeda S. Inferior epigastric artery skin flaps without rectus abdominis muscle. *Br J Plast Surg* 1989;42(06):645–648
- Allen RJ, Treece P. Deep inferior epigastric perforator flap for breast reconstruction. *Ann Plast Surg* 1994;32(01):32–38
- Blondeel PN. One hundred free DIEP flap breast reconstructions: a personal experience. *Br J Plast Surg* 1999;52(02):104–111
- Rozen WM, Ashton MW, Taylor GI. Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery. *Clin Anat* 2008;21(02):89–98
- Weiler-Mithoff E, Hodgson ELB, Malata CM. Perforator flap breast reconstruction. *Breast Dis* 2002;16:93–106
- Koshima I, Moriguchi T, Soeda S, Tanaka H, Umeda N. Free thin paraumbilical perforator-based flaps. *Ann Plast Surg* 1992;29(01):12–17
- Borse V, Konwar AN, Buragohain P. Oral cancer diagnosis and perspectives in India. *Sens Int* 2020;1:100046
- De la Parra-Marquez M, Fernandez-Riera R, Romay-Chambers E, Escamilla Linaje T. Superficial thinning of the DIEP flap: a safe option to achieve an aesthetic reconstructed breast in the obese patient. *Plast Reconstr Surg* 2021;148(05):715e–719e
- Colakoglu S, Tebockhorst S, Freedman J, et al. CT angiography prior to DIEP flap breast reconstruction: a randomized controlled trial. *J Plast Reconstr Aesthet Surg* 2022;75(01):45–51