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## Original Article

# Techniques of inserting deep inferior epigastric perforator flap obliquely in immediate breast reconstruction after total mastectomy

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## ABSTRACT

**Objective:** This study aimed to share the experience of inserting a deep inferior epigastric perforator (D.I.E.P) flap obliquely in immediate breast reconstruction after total mastectomy.

**Method:** Forty patients underwent immediate breast reconstruction with flap D.I.E.P after total mastectomy. The flaps were placed obliquely, with the upper edge facing downward and inward. After being placed in the recipient region, parts of the flap at both ends were removed, the upper end was fixed into the II–III intercostal space next to the sternum, and the lower end was folded to create a projection of the lateral lower pole of the breast. The flap pedicle was anastomosed to the thoracodorsal vessels (TDVs) if the contralateral flap pedicle was used; conversely, the mammary vessels (IMVs) were used. Satisfaction with breast shape was assessed after 6 months using the BREAST-Q questionnaire.

**Results:** A total of 37/40 flaps were well vascularized; 36/37 patients with a survival flap were interviewed, showing that the average BREAST-Q evaluation score of satisfaction with breast shape

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was 62.22 (51–78). The number of answers for satisfied and very satisfied with breast shape accounted for 94.44%.

**Conclusion:** Inserting the D.I.E.P flap obliquely has the advantage of being easy to shape the breast contour, creating a moderate projection and symmetry to the opposite breast. The author suggested using the IMVs as the receiving vessels when using the pedicle of the flap on the ipsilateral side and the TDVs when the contralateral pedicle flap was used.

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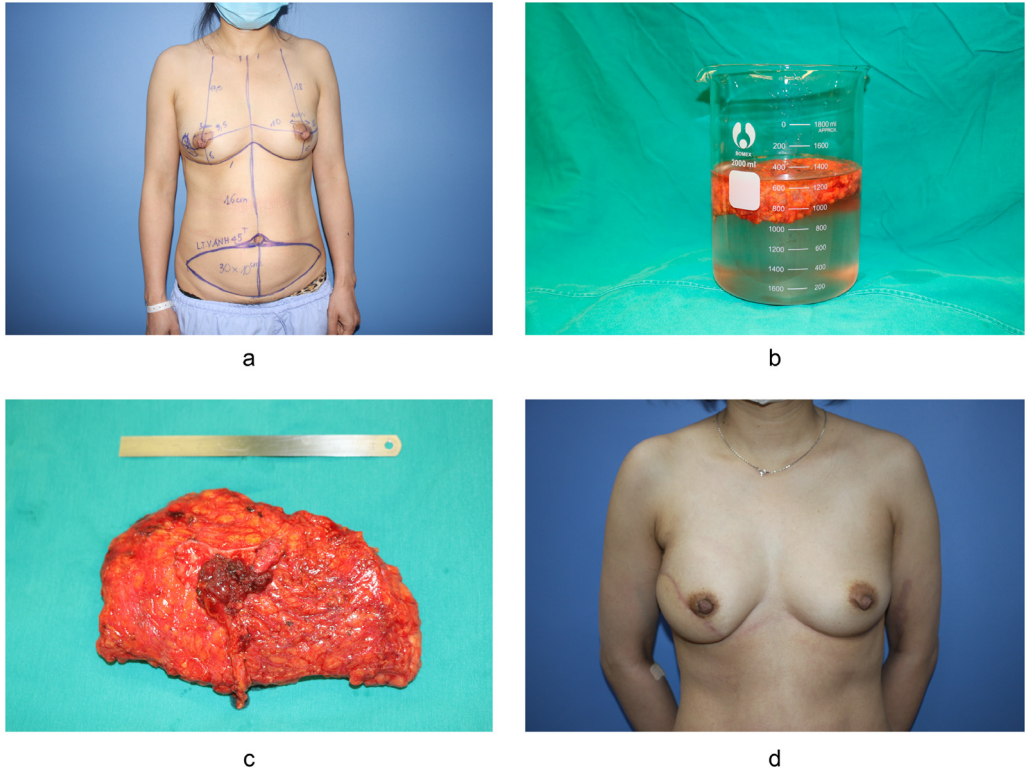
## Introduction

One of the most important goals of breast reconstruction after a total mastectomy is to recreate the breast volume and contour symmetrically with the contralateral side. D.I.E.P flap was described and used by Koshima and Soeda for breast reconstruction in 1989.<sup>1</sup> This flap has been considered the first choice for immediate breast reconstruction surgery using autologous tissue. D.I.E.P flap harvesting and anastomosis are basic techniques that are relatively similar among surgeons; however, the method of flap insertion and arrangement to create the breast shape is different for each author and depends on the characteristics of each patient. Some authors have a flap inserted horizontally or vertically; some may even have a cone shape; each method has its advantages and disadvantages.<sup>2–6</sup> This study aimed to share the experience of inserting a flap obliquely in immediate breast reconstruction surgery after total mastectomy using a D.I.E.P flap.

## Patients and Methods

All 40 patients had stage I or II breast cancer, with excess skin and fat in the abdominal wall after pregnancy, and underwent a total mastectomy and immediate breast reconstruction with a D.I.E.P flap at the Hanoi Medical University Hospital from September 2019 to September 2022. The follow-up period ranged from 6 to 24 months.

All patients underwent surgery according to a unified procedure (Figure 1). The surgery was performed by two teams simultaneously. The oncology surgeon team performed the mastectomy and removed the lymph nodes. The plastic surgeon team harvested the D.I.E.P flaps. Only strong perforators capable of pulsation were selected for the flap pedicle. Following the perforator, dissection of the inferior epigastric pedicle was deep into the inguinal crease, and the pedicle was cut at this position. The breast parenchyma was removed, the full flap was harvested, and the flap was used for reconstruction. The volume was measured using the water displacement method to determine whether the remaining flap volume was greater than the volume of the breast parenchyma by approximately 10%. Usually, the two ends of the flap (a part of zone III and a part of zone IV) are excised. The flap at the receiving site was rotated 120° clockwise so that the umbilical edge of the flap was facing downward and inward, and the pubic border was facing upward and outward. If the pedicle of the flap is on the contralateral side of the removed breast, then it is anastomosed to the thoracodorsal vessels (TDVs). Conversely, if the pedicle is on the ipsilateral side of the removed breast, internal mammary vessels (IMVs) at the II–III or III–IV intercostal space were used (Figure 2). After vessel anastomosis and excision of the excess at both lateral ends of the flap, the upper end is fixed to the II–III sternum intercostal space, creating the upper medial pole. The other end of the flap is folded to create a projection for the lower lateral pole, while the medial inferior projection is created by the thickest part of the flap near the umbilicus. A suture test was performed to determine the defected breast skin, and the rest of the flap was de-epithelialized. The donor site was closed, similar to that in total abdominoplasty with the



**Figure 1.** Surgery procedure. (A) Preoperative design; (B) breast tissue was measured by the water displacement method; (C) flap after harvesting; (D) six months post-operation.

**Table 1**  
Flap characteristics (n=40)

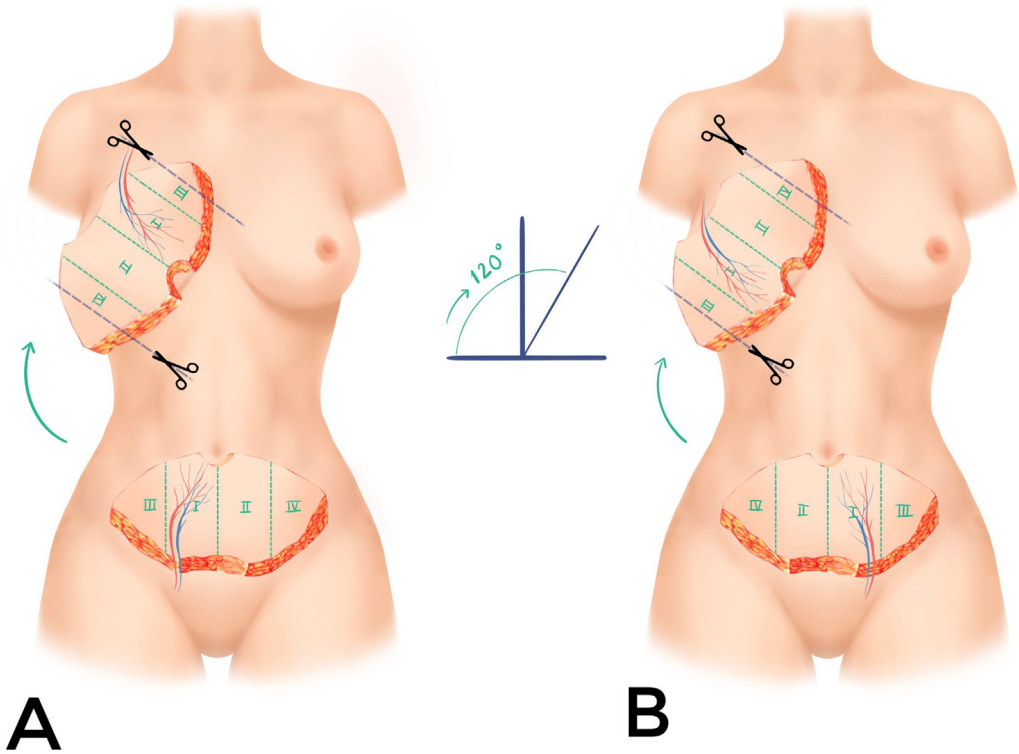
Characteristics	Value (min–max)
Volume of total flap (cc)	578.25 ± 132.93 (340 – 930)
Volume of used part of flap (cc)	431.5 ± 120.2 (240 – 800)
Volume of removed breast (cc)	397.38 ± 118.14 (200 – 750)
Flap length (cm)	34.95 ± 5.42 (27– 57)
Flap width (cm)	13.0 ± 2.55 (9 – 24)
Flap pedicle length (cm)	9.6 ± 1.63 (6 – 13)

umbilical transfer. The patients were treated with anticoagulation therapy using heparin immediately after anastomosis, antibiotics, and pain relief after surgery. Six months after surgery, patients were surveyed for satisfaction with the breast shape using the BREAST-Q questionnaire.<sup>7</sup>

**Results**

Forty patients aged 30–73 (mean age, 43.43 ± 8.46) years underwent breast reconstruction surgery. The body mass index was 18.7–26.4 (average, 21.88 ± 1.81) kg/m<sup>2</sup>. The characteristics of the flaps are presented in [Table 1](#).

There were 14 cases of flap pedicle on the ipsilateral side, which were anastomosed to the IMVs; 26 cases of flap pedicle on the contralateral side were anastomosed to the TDVs. After surgery, 37/40



**Figure 2.** Illustration of inserting the flap obliquely and choosing the recipient's vessels. (A) The ipsilateral flap pedicle with the IMVs; (B) the contralateral flap pedicle with the TDVs.

**Table 2**  
Complications after surgery (n=40)

Complications	Patients (%)
Revised the anastomosis	1 (2.5)
Total flap necrosis	3 (7.5)
Delayed surgical wound healing	2 (5)
Hematoma	1 (2.5)

(92.5%) flaps were well vascularized. There were three cases of total flaps necrosis due to congestion. All complications are described in [Table 2](#).

The patient's satisfaction was assessed more than 6 months postoperatively on 36 patients (excluding three patients who suffered from flap necrosis and one patient whose time follow-up was under six months) using the BREAST-Q questionnaire with an average satisfaction score of 62.22 (range 51–78). Of these, 94.44% were satisfied and very satisfied with the breast contour ([Table 3](#)).

## Discussion

Because of differences in culture, race, and anthropology, there is no absolute standard for a beautiful breast. However, some criteria are consensual by many authors in breast reconstruction, such as breast width of 13–15 cm, the average distance from the nipple to the nipple of 19–21 cm, and distance from the nipple to the inframammary fold on an average of 5–6 cm. The reconstructive breast should be ideally symmetrical to the opposite breast. The breast volume distribution in each pole is

**Table 3**  
BREAST-Q questionnaire: Satisfaction with breast (n=36)

Questions	Very dissatisfied (%)	Somewhat dissatisfied (%)	Somewhat satisfied (%)	Very satisfied (%)
How do you look in the mirror clothed?	0	0.00	66.67	33.33
What is your reconstructed breast(s) shape when you wear a bra?	0	0.00	63.89	36.11
How normal do you feel in your clothes?	0	2.78	63.89	33.33
What is the size of your reconstructed breast(s)?	0	2.78	69.44	27.78
How equal in size are your breasts to each other?	0	2.78	69.44	27.78
How natural your reconstructed breast(s) looks?	0	5.56	69.44	25.00
How naturally your reconstructed breast(s) sits/hangs?	0	13.89	61.11	25.00
How closely matched (similar) are your breasts to each other?	0	13.89	66.67	19.44
How do you look in the mirror unclothed?	0	8.33	66.67	25.00
Average	0	5.56	66.36	28.09

not uniform, with the lower pole being fuller than the upper pole, the lateral pole being fuller than the medial pole, and the lower pole of the breast should be given preference for filling volume first over the other poles. The upper pole should be slightly curved and concave, whereas the lower pole should be more convex and full.<sup>3,4,8,9</sup>

Among the methods of breast reconstruction, free flaps may be the most suitable in terms of adjusting the shape and creating ptosis of the breast. In addition to the dissection and vascular anastomosis, the method of inserting the flap, folding the flap to create the breast contour, and systematically with the opposite side is the technical factor that determines the success of the reconstruction surgery. Some authors have also reported flap insertion methods in breast plastic surgery.<sup>3,5,10,11</sup> Jeong et al. described and compared two methods of flap placement in the horizontal and vertical directions; the authors noted the advantages of the vertical flap method, such as higher compatibility, volume, projection, and natural ptosis, over the horizontal flap placement.<sup>3</sup> However, according to Kim et al., vertical flap placement has the disadvantage of limited flap width, and at the same time, the upper pole of the breast tends to be more curved and convex, causing a long and narrow breast contour. Obtaining a D.I.E.P flap with a width commensurate with the original breast base is sometimes more difficult, especially for Asians whose breast size can be small.<sup>4</sup> Some authors chose transverse flap placement but advanced with the coning technique to reduce breast width while increasing breast projection. However, this method has some disadvantages: the upper pole of the breast is often missing and can cause step-off deformities.<sup>3</sup>

In this study, the flap was rotated approximately 120° clockwise so that the umbilical border of the flap was directed downward and inward, and the pubic border was turned upward and outward. Usually, part of the flap is removed according to the need for reconstructed breast volume. The flap volume used was  $9.6 \pm 6.71\%$  larger than the average mastectomy volume because according to many studies, the free flap had some reduction in volume 3–6 months postoperatively.<sup>12,13</sup> The excess flap at two ends of the flap was removed, usually occupying half of zones III and IV (according to the Hartrampf classification). Removing the flap also reduces the risk of necrosis because it is a poorly vascularized area. After anastomosis and resection, the upper end of the flap was fixed to the intercostal space II–III lateral sternum edges, creating the upper medial pole, and the lower end of the flap was folded to create a projection for the lower lateral pole. The projection of the medial lower pole is created by the thickest part of the flap near the umbilicus, which is the anatomical feature of the abdominal wall flap.<sup>3</sup> Thus, the entire medial and lateral lower poles of the breast are created, fuller than the upper pole, with little ptosis. In addition, inserting the flap obliquely and folding the end of the flap will help limit the volume to the upper pole, which prevents the longitudinal breast shape compared to the vertical flap method and also limits the disadvantage of lacking the breast length when the pubic umbilicus distance is low in transverse flap placement.<sup>9</sup> Also, this method prevents some distortions of the step-off deformity or excessive convexity of the upper pole. In postpartum

women, the breasts are often slightly ptosis and spilled out; therefore, breast reconstructions with oblique insertion create more symmetry with the opposite breast.

With a pedicle length of 6–13 cm (mean, 9.6 cm), to rotate and fold the flap flexibly without stretching the pedicle, the flap on the contralateral side of the removed breast was anastomosed to the TDVs, and anastomosis with IMVs was preferred when the pedicle was on the ipsilateral side. The study identified two cases of thromboembolism because of the anastomosis techniques, which were unrelated to pedicle tension or flexion. Six months postoperatively, 94.44% of patients reported being satisfied and very satisfied with the breast shape, and 86.11% answered that they were satisfied and very satisfied with the symmetry of the breasts on both sides. The survey average score according to the BREAST-Q questionnaire on breast shape was also very optimistic, with 62.22 points. This result is encouraging and demonstrates the technique's aesthetic effectiveness. According to Mundy's research, this index is, on average,  $58 \pm 18$  in normal people without breast cancer.<sup>14</sup> However, this may be because breast cancer patients have lower aesthetic expectations than the general population without cancer.

## Conclusion

The advantage of the technique of obliquely inserting the D.I.E.P flap was that it was easy to arrange the flap to shape the breast contour, create a moderate projection and little ptosis, symmetry to the opposite breast, and is especially suitable for postpartum women. Additionally, this technique has a lower risk of pedicle stretching and flexion when selecting the appropriate recipient vessel according to the flap pedicle position. The author suggests using the IMVS as the receiving vessel when the flap pedicle is ipsilateral, and TDVs are used when the pedicle is contralateral.

## Ethical approval and declaration of patient consent

This study was approved by the Ethics Committee of Hanoi Medical University (Ref:360/GCN-HĐĐĐNCYSH-ĐHYHN). All participants provided written informed consent before enrolment in the study. The privacy and confidentiality of patient records were adhered to in managing the clinical information in conducting this research.

## Conflicts of interest and financial declaration statement

There are no conflicts of interest to declare, and the authors have no financial interest or funding concerning this article.

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