A utologous breast reconstruction provides both a natural appearance and highly aesthetic restoration with long-term results. Over the past 4 decades, free flaps from buttocks as an alternative to lower abdominal flaps have become recognized as a good option for autologous tissue breast reconstruction.

The superior gluteal artery perforator (SGAP) flap was first described for breast reconstruction by Allen and Tucker\(^1\) in 1993. The inferior gluteal artery perforator (IGAP) flap was subsequently introduced for ischial pressure sore reconstruction by Higgins et al\(^2\) in 2002, followed by Guerra et al\(^3\) in 2004 for breast reconstruction. Although gluteal artery perforator (GAP) flaps require intraoperative positioning change, substantial dissection, and...
mismatched venous caliber anastomosis, these flaps provide a longer vascular pedicle than gluteal musculocutaneous flaps and adequate soft tissue for breast reconstruction with preservation of gluteal muscle function and decrease the exposure risk of the sciatic nerve.\textsuperscript{4,5} In addition, GAP flaps have a high fat-to-skin ratio\textsuperscript{4} and thicker, firmer, and more globular fat tissue, providing the reconstructed breast good projection, in contrast to abdominal flaps.

SGAP flap has become a popular breast reconstruction procedure as an alternative to the deep inferior epigastric artery perforator flap and is now extensively used when abdominal tissue cannot be used. Use of IGAP flap, however, is not widespread, and there are only a few articles describing its use for breast reconstruction.\textsuperscript{3–9}

If a unilateral SGAP flap is harvested without extensive beveling, inferior gluteal crease displacement is uncommon. However, if a unilateral small IGAP flap is harvested in a slim hip patient, buttock projection and the inferior gluteal crease are easily distorted. Despite such limitations, our patients prefer that we use IGAP flaps—from both inferior buttocks. In this way, donor sites remain symmetrical, and the donor liner scars are camouflaged with the gluteal crease. Respecting their concern for buttock aesthetics, we introduced bilateral IGAP flap harvesting for unilateral breast reconstruction.

We have performed 20 breast reconstructions using bilateral IGAP flaps with favorable outcomes. There are several points in the use of bilateral IGAP flaps for unilateral breast reconstruction. One is to provide sufficient tissue to restore a relatively large and high-projection breast in a slim patient. Another is to harvest 2 smaller IGAP flaps from both donor sites to preserve natural inferior buttock volume and shape. At the recipient site, breast projection can be easily enhanced using the shape of gluteal crease or by stacking the flaps. Also, there is more flexibility when using 2 flaps to cover various large breast defects. Moreover, though bilateral IGAP flaps require 2 free flaps with microsurgical anastomosis, each flap is closer to the corresponding recipient vessel than a single IGAP flap, which decreases donor morbidity.

Here, we present a retrospective review of the clinical results of our unilateral autologous breast reconstruction using bilateral IGAP flaps to outline the indications and surgical techniques.

**PATIENTS AND METHODS**

**Indications**

Figure 1 shows our standardized approach for flap selection and indications for the use of gluteal flaps instead of a lower abdominal or thigh flap. Gluteal and thigh flaps\textsuperscript{10} are indicated for those who are nulliparous and have inadequate abdominal tissue (even when double-pedicle abdominal flap is used), prior abdominal surgeries, prior abdominal flap reconstruction, or prior liposuction (with damaged abdominal perforator). Recent report indicates nulliparity as a significant risk factor for perfusion-related complications in deep inferior epigastric artery perforator flap breast reconstruction.\textsuperscript{11} Therefore,
we should consider alternative reconstructive procedure for nulliparous patients. A breast size greater than a C cup with moderate projection and mastectomy weight more than 350 g is a candidate for bilateral IGAP flaps for unilateral breast reconstruction in our institute, especially for patients with slim hip and high-projection breast.

Because the gluteal skin color and texture differ from those of native breast skin, IGAP flaps are especially indicated for nipple-sparing (Fig. 2) or skin-sparing mastectomy patients (Fig. 3). For delayed reconstruction after modified radical mastectomy, tissue expansion is indicated before reconstruction (Fig. 4).

Patients

A series of 20 Japanese patients (age ranging from 24 to 48) underwent unilateral breast reconstruction with bilateral IGAP flaps in 1 operation between November 2007 and December 2012 by a single surgeon. Thirteen patients underwent immediate 1-stage reconstruction, and 7 patients underwent delayed 2-stage breast reconstruction. Mean follow-up was 44 months. The medical records of all patients were retrospectively reviewed with regard to preoperative status, intraoperative and postoperative course, complications, and touch-up surgery. The institutional review board of our institution reviewed and approved the study.

A quantitative outcome assessment was performed for 20 unilateral breast reconstruction cases using bilateral IGAP flaps and compared with a consecutive series of 22 unilateral breast reconstructions using a unilateral IGAP flap, all of which were performed by the same surgeon between June 2007 and March 2010. Use of unilateral IGAP flaps for unilateral breast reconstruction was abandoned after April 2010 due to a postsurgical asymmetric inferior gluteal shape and volume. Statistical analysis was performed using the Mann-Whitney U test, and a value of \( P < 0.05 \) was considered statistically significant. All statistical analyses were performed using IBM SPSS Statistics 21 (SPSS, IBM Corp., Armonk, N.Y.).

Anatomy

The inferior gluteal vessel is the terminal branch of the posterior division of the internal iliac vessel that exits the pelvis through the greater sciatic foramen and then passes inferior to the piriformis muscle.\(^{12}\) The inferior gluteal vessel is accompanied by the internal pudendal vessels, the pudendal nerve, the posterior femoral cutaneous nerve, and the sciatic nerve.\(^{13}\) The inferior gluteal vessel supplies the lower half of the gluteus maximus and provides perforators to the overlying gluteal skin. The mean number of IGAPs (≥0.5 mm) in a fresh cadaver study was 8 ± 4 per region.\(^{13}\) By contrast, an in vivo anatomi-

Fig. 2. Case 1. A, Preoperative view of a 24-year-old nulliparous patient with right breast invasive ductal carcinoma. Neoadjuvant chemotherapy was applied before a nipple-sparing mastectomy and immediate breast reconstruction using bilateral IGAP flaps. B, Postoperative view of the patient at 1 year after immediate breast reconstruction.
Fig. 3. Case 2. A, Preoperative view of a 33-year-old nulliparous patient with left breast ductal carcinoma in situ before skin-sparing mastectomy and immediate breast reconstruction using bilateral IGAP flaps. B, Postoperative view of the patient at 2 years after immediate breast reconstruction.

Fig. 4. Case 3. A, Preoperative view of a 39-year-old nulliparous patient after a right nipple-sparing mastectomy. B, Insertions of tissue expander under the pectoralis major muscle 12 months postoperatively. C, Postoperative view of the patient at 2 years after secondary 2-staged bilateral breast reconstruction with bilateral IGAP flaps following removal of the tissue expander. Both flaps were transferred subcutaneously. This patient had a left breast ptosis and requested mild breast ptosis reconstruction on the right side. In the future, we have a plan for mastopexy of the left breast to achieve symmetry.
cal study revealed 9 IGAPs per region with a 0.4-mm mean arterial internal vessel diameter.\textsuperscript{11}

Flap Design

Preoperatively, the skin islands of bilateral IGAP flaps are marked with the patient in a standing position. Although we used to design IGAP flaps based on in-the-crease IGAP flap by Allen et al.,\textsuperscript{4} we now indicate different designs according to the patient’s body type. A horizontal ellipse design is indicated for patients with a medium build and a thick inferior buttock (Fig. 5). A horizontal lazy-S skin paddle parallel to the inferior medial gluteal crease and lateral following curve is indicated for patients with slim hips to reduce lateral hip depression. The horizontal lazy-S skin paddle is centered with the longitudinal axis 3.5 cm superior to the inferior gluteal crease (Figs. 6A, 7A). The inferior border of the ellipse lies along the medial inferior gluteal crease and lateral following curve. The flap width is judged by a pinch test, and a flap width up to 7 cm is harvested.

The flap length may be up to 25 cm transversely. Patients undergo preoperative computed tomographic angiography before breast reconstruction to identify the size, location, and course of large perforators at the donor site preoperatively. Referring to the computed tomographic angiography images, a handheld Doppler probe is used to identify perforators within the skin paddle with patients in prone position.

Surgical Technique

The recipient site is prepared for smooth subsequent microsurgical anastomosis with the patients positioned supine. At least 2 recipient vessels in the medial (internal mammary perforator or vessel) and lateral (lateral thoracic vessel or serratus branch of thoracodorsal vessel) sites are prepared. Microsurgical anastomosis of the second IGAP flap to the recipient vessel is accomplished quickly to avoid a prolonged ischemia time. After the breast wound is temporarily draped with large occlusive dressing films, the patient is positioned prone.

Before flap harvesting, redesign of the skin paddle and fat pad outline based on the mastectomy specimen or anticipated tissue defect is again performed. The incision is made along the skin markings, and subcutaneous dissection is performed above the superficial fascial plane to harvest an ample amount of adipose tissue in the flap. The adiposal lobe including the flap is extended more superiorly to maximize transferable tissue as necessary (Fig. 8A). Dissection then proceeds laterally to medially under the deep fascia of the gluteus maximus muscle to detect the perforators. During dissection, you will observe large drops of fat arranged in a deep layer on the iliotibial tract and light color fat preserved on the ischium. Proceeding with subfascial dissection, several musculocutaneous perforators arise from the inferior gluteal vessels at the inferior half of the gluteus maximus muscle. Among them, we select 1 or 2 large perforators located close to the medial or lateral one third of the IGAP flap to facilitate easy microsurgical anastomosis and flap inset (Fig. 9A). For deeper dissection into the gluteus maximus and down to the sacral fascia, a large surgical field with wide splitting of the originating muscle is required for safety and easy development. Pedicle dissection proceeds toward its origin from the inferior gluteal vessel to harvest the desired pedicle length and vessel diameter. Under the sacral fascia, the perforating artery and vein diameter differ from each other and have

![Fig. 5. Case 2. Preoperative view (A) and postoperative view (B) of the patient 2 years after the flap with a horizontal ellipse skin paddle was harvested.](image-url)
multiple communications with several branches that must be ligated before pedicle resection. After assessing flap perfusion with indocyanine green angiography, the pedicles of both IGAP flaps are divided and donor wounds are closed.

The patient is then positioned supine, and the bilateral IGAP flaps are placed on the pectoralis major muscle and anastomosed medially and laterally to the recipient vessels (Fig. 6B). A size mismatch of microvascular anastomosis with the recipient vein

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**Fig. 6.** A, Design and harvesting of bilateral IGAP flaps. The horizontal lazy-S skin paddle centered with a longitudinal axis 3.5 cm superior to the inferior gluteal crease. B, The bilateral IGAP flaps are placed vertically on the pectoralis major muscle and anastomosed medially and laterally to the recipient vessels.

**Fig. 7.** Case 1. A, Preoperative design of the donor site shows the bilateral IGAP flaps. The skin paddle (measured 7.0 × 25 cm) of the bilateral IGAP flaps was designed to be above both inferior gluteal creases. B, Postoperative view at 1 year shows both flap donor sites.
should be excluded to avoid compromising venous outflow. These skin paddles of both flaps are de-epithelialized and placed vertically (Figs. 8B, 9B). In patients with high-projection breasts, the boundary lines of both flaps are overlapped to achieve thickness. In patients with breast ptosis, the inferior limbs of the flaps are folded and mounted to protrude beyond the inframammary fold (Figs. 3, 10).

**RESULTS**

**Flaps**

In immediate reconstruction cases, mean mastectomy weight was 416.9 g, and mean flap weight at final inset was 448.5 g. In delayed cases, mean tissue expander weight was 530.6 g, and mean flap weight at final inset was 487.9 g (Table 1).

Mean flap ischemia time in all bilateral IGAP flaps series was 2 hours 26 minutes for medial IGAP flaps and 3 hours 32 minutes for lateral IGAP flaps. Mean operating time for unilateral reconstruction with bilateral IGAP flaps was 11 hours 34 minutes in immediate reconstruction cases and 10 hours 29 minutes in delayed reconstruction cases.

**Recipient Vessels and Pedicles of IGAP Flaps**

Internal mammary vessels were used as the main recipient vessels for 12 medial IGAP flaps (60%),
and the serratus branch of the thoracodorsal vessels was used for 10 lateral IGAP flaps (50%; Table 2). There were 26 flap pedicles (65%) with 1 artery and 1 vena comitans and 14 flap pedicles (35%) with 1 artery and 2 venae comitantes. Mean pedicle length was 4.6 cm. Mean diameter of the artery and vein was 1.4 mm and 2.1 mm, respectively.

### Complications
In the series of 20 patients, 1 patient underwent 2 additional operations for postoperative venous thrombosis between the pedicle and recipient veins, and we were unable to salvage lateral IGAP flap (Table 3). The deep fat layer of the congested flap was therefore removed and regrafted as a thin composite graft. Because the graft became necrotic, it

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**Table 1. Patients Reconstructed with Bilateral IGAP Flaps**

| Age (y) | BMI (kg/m²) | Brassiere Size (Cup) | NAC or XRT | Type of Mastectomy | Total Harvested Flap Weight (g) | Final Inset Flap Weight (g) | Flap Ischemia Time (Medial/Lateral) (h and min) | Operating Time (h and min) |
|---------|-------------|----------------------|------------|--------------------|-------------------------------|---------------------------|-----------------------------------------------|----------------------------|
| Immediate 1-stage reconstruction (mastectomy) |
| 27      | 21.8        | D No/No NSM          | 343        | 525 (291 + 234)    | 509                           | 2 h 40 min/3 h 40 min 9 h 57 min |
| 29      | 18.4        | D Yes/Yes SSM        | 275        | 290 (148 + 142)    | 248                           | 2 h 20 min/4 h 16 min 11 h 17 min |
| 33      | 22.0        | G No/No SS           | 518        | 462 (216 + 246)    | 452                           | 2 h 13 min/3 h 52 min 12 h 23 min |
| 33      | 19.7        | F Yes/No NSM         | 484        | 490 (254 + 236)    | 480                           | 1 h 58 min/3 h 18 min 11 h 39 min |
| 34      | 22.0        | G No/No NSM          | 374        | 414 (190 + 224)    | 390                           | 2 h 47 min/3 h 13 min 11 h 59 min |
| 24      | 25.8        | F Yes/No NSM         | 463        | 650 (322 + 328)    | 640                           | 3 h 00 min/3 h 57 min 11 h 26 min |
| 38      | 24.0        | D Yes/No SSM         | 533        | 530 (244 + 286)    | 506                           | 1 h 48 min/4 h 08 min 11 h 37 min |
| 42      | 28.7        | D Yes/No SSM         | 520        | 928 (496 + 432)    | 774                           | 2 h 31 min/4 h 23 min 12 h 27 min |
| 29      | 17.9        | F No/No NSM          | 317        | 298 (146 + 152)    | 280                           | 2 h 31 min/3 h 20 min 12 h 31 min |
| 40      | 21.6        | D Yes/No SSM         | 350        | 436 (208 + 228)    | 368                           | 2 h 24 min/3 h 25 min 11 h 40 min |
| 48      | 16.4        | D No/No NSM          | 352        | 336 (186 + 150)    | 314                           | 2 h 03 min/2 h 40 min 11 h 43 min |
| 31      | 20.4        | E No/No NSM          | 341        | 450 (190 + 260)    | 432                           | 2 h 31 min/3 h 19 min 10 h 09 min |
| 32      | 23.6        | F Yes/No NSM         | 550        | 454 (218 + 236)    | 438                           | 2 h 04 min/3 h 07 min 11 h 32 min |
| Delayed 2-stage reconstruction (tissue expander) |
| 31      | 20.4        | D No/No NSM          | 410        | 475 (272 + 203)    | 393                           | 2 h 54 min/4 h 25 min 11 h 24 min |
| 43      | 21.2        | E No/No MRM          | 734        | 799 (397 + 402)    | 771                           | 2 h 00 min/3 h 03 min 11 h 54 min |
| 39      | 21.8        | C No/No NSM          | 434        | 436 (216 + 220)    | 418                           | 2 h 08 min/3 h 02 min 10 h 07 min |
| 38      | 20.0        | C No/No NSM          | 490        | 430 (212 + 218)    | 412                           | 2 h 50 min/3 h 59 min 11 h 45 min |
| 37      | 19.6        | D No/No NSM          | 496        | 444 (230 + 204)    | 426                           | 2 h 50 min/3 h 06 min 8 h 10 min |
| 43      | 22.0        | F No/No MRM          | 610        | 568 (286 + 282)    | 550                           | 2 h 09 min/3 h 22 min 9 h 51 min |
| 43      | 18.7        | C No/No MRM          | 540        | 506 (246 + 260)    | 445                           | 3 h 07 min/3 h 56 min 10 h 10 min |

BMI, body mass index; MRM, modified radical mastectomy; NAC, neoadjuvant chemotherapy; NSM, nipple-sparing mastectomy; SSM, skin-sparing mastectomy; XRT, radiation therapy.
was removed and free fat grafting was required for re-reconstruction. One patient had palpable partial fat necrosis (2.5%), which was managed conservatively. Five patients (10 gluteal lesions, 25%) had seroma formation at the donor site. Wearing tight girdle and 3–5 times biweekly subcutaneous aspiration in outpatient clinic recovered the condition. Three patients had paresthesias bilaterally along the posterior thigh that resolved within 6 months.

**Touch-up Surgery**

Seven patients underwent nipple-areola reconstruction among 7 skin-sparing mastectomies and 3 modified radical mastectomies (Table 4). The size of the reconstructed breast in comparison with the contralateral breast was approximately the same in 75% (n=15) of the patients, smaller in 20% (n=4), and larger in 5% (n=1). Three patients with a smaller reconstructed breast underwent fat grafting, and 1 patient received contralateral reduction mammoplasty to achieve a symmetric breast shape and size. The patient with a larger reconstructed breast underwent reduction using a liposuction technique. One patient underwent fat grafting to correct bilateral shallow hollows created by flap harvesting at the gluteal donor site.

**Comparison with Unilateral IGAP Flap Reconstruction**

Perioperative data of 20 bilateral IGAP flap patients were compared with the data of 22 unilateral IGAP flap patients (Table 5). Mastectomy weight, flap weight at final inset, operating time, and estimated operative blood loss differed significantly between groups. Although bilateral IGAP flaps required a longer operating time and were associated with more intraoperative bleeding, there was no significant difference between groups in mean hospital length of stay.

**DISCUSSION**

GAP flaps allow for preservation of the structure and function of the gluteal muscles, providing thick and dense gluteal fat that facilitates reconstruction of the breast projection with and without ptosis. IGAP flaps have several advantages: they can be harvested without sciatic nerve exposure and have a longer vascular pedicle, up to 10 cm, compared with inferior gluteal musculocutaneous flaps. IGAP flaps provide a good option for patients with saddlebag hips because of the improved donor contour postoperatively. The unresolved disadvantage of single GAP flaps for unilateral breast reconstruction is the lack of volume. Boyd et al. reported that over 10% of SGAP flaps require revision implant augmentation. Krohnitz reported 83% of standard elliptical GAP flaps are insufficient in volume. IGAP flaps are superior to SGAP flaps in terms of available tissue volume. Mirzabeigi et al., however, reported that 14% of patients underwent ipsilateral implant augmentation.

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**Table 2. Recipient Vessels, Pedicle of IGAP Flaps, and Microvascular Anastomosis**

| Parameter                                | Medial IGAP Flap No. (%) | Lateral IGAP Flap No. (%) |
|------------------------------------------|--------------------------|---------------------------|
| Recipient vessels                        |                          |                           |
| Internal mammary perforator              | 8 (40)                   | NA                        |
| Internal mammary                         | 12 (60)                  | NA                        |
| Lateral thoracic                         | NA                       | 4 (20)                    |
| Serratus branch of thoracodorsal         | NA                       | 10 (50)                   |
| LD branch of thoracodorsal               | NA                       | 6 (30)                    |
| Microvascular anastomosis                |                          |                           |
| One artery and 1 vena comitans           | 14 (70)                  | 12 (60)                   |
| One artery and 2 vena comitantes         | 6 (30)                   | 8 (40)                    |

| Pedicle of IGAP flaps                    |                          |                           |
| One artery and 1 vena comitans          | 26 (65)                  |                           |
| One artery and 2 vena comitantes        | 14 (35)                  |                           |
| Average artery diameter, mm (range)     | 1.44 (0.6–2.5)           |                           |
| Average vein diameter, mm (range)       | 2.06 (0.8–3.2)           |                           |
| Average pedicle length, cm (range)      | 4.55 (3.0–6.2)           |                           |

LD, latissimus dorsi; NA, not applicable.

**Table 3. Complications**

| Parameter                                | No. (%)  |
|------------------------------------------|----------|
| Gluteal donor site                       |          |
| Seroma                                   | 10 (25.0) |
| Hematoma                                 | 0 (0)    |
| Wound infection                          | 2 (5.0)  |
| Stitch abscess                           | 3 (7.5)  |
| Hypertrophic scar                        | 2 (5.0)  |
| Sensory disturbance                      | 6 (15.0) |
| IGAP flap                                |          |
| Venous thrombosis                        | 1 (2.5)  |
| Flap loss                                | 1 (2.5)  |
| Partial fat necrosis                     | 1 (2.5)  |
| Breast recipient site                    |          |
| Partial breast skin flap necrosis        | 3 (15.0) |
| Partial nipple-areola necrosis           | 1 (5.0)  |
| Hypertrophic scar                        | 2 (10.0) |

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even after IGAP flap reconstruction. It may be that slim patients not only have inadequate abdominal tissue but also have inadequate inferior gluteal tissue volume. In such cases, bilateral IGAP flaps should be considered. Bilateral IGAP flaps for a single unilateral breast reconstruction provide more abundant gluteal tissue for high-projection breast reconstruction in a slim patient.

The inferior gluteal volume, shape, and location of the medial crease are easily unbalanced by unilateral IGAP flap harvesting. Because bilateral IGAP flaps comprise 2 smaller flaps of the same size that share the breast defect compared with the original unilateral IGAP flap, gluteal skin and fat can be harvested without significant gluteal deformity or asymmetry of the inferior buttock volume and shape. Buttocks are an important element of sexual attraction, and iatrogenic gluteal irregularities pose significant embarrassment to the patient. Cuenca-Guerra and Quezada reported that supragluteal fossettes, a V-shaped crease, lateral depression, and an inferior gluteal crease are important aesthetic characteristics of the gluteal region.

Mirzabeigi et al reported that 39% of patients underwent local tissue arrangement at the IGAP flap donor site. There are some secondary procedures to restore resulting gluteal deformities using a de-epithelialized skin flap, infragluteal flap, or fat grafting. Although we had 1 patient who underwent fat grafting to restore lateral buttock depression, we think that the smaller 2 IGAP flaps reduce gluteal donor aesthetic complications. When breast reconstruction with bilateral IGAP flaps requires more tissue, it is important not to harvest excess gluteal soft tissue and in such a case simultaneous third flap harvesting or secondary fat grafting to the reconstructed breast should be considered. During GAP flap reconstruction, surgeons should make every effort to preserve these important anatomic landmarks.

In our clinical series, the IGAP flap pedicles were composed of 1 artery and 1 vena comitans in 65% of the flaps. Mean vein diameter was 2.06 mm, but maximum vein diameter was 3.02 mm. A larger caliber vein for GAP flap anastomosis to a smaller recipient vein sometimes leads to compromised venous outflow and the potential risk of thrombosis. One patient with venous thrombosis underwent 2 additional surgeries, maybe as a result of vessel caliber

### Table 4. Touch-up Surgery, Excluding the One Flap Loss Patient

| Parameter                                      | No. (%)       |
|------------------------------------------------|---------------|
| Reconstructed breast (n = 19)                  |               |
| Scar revision                                  | 2 (10.5)      |
| Local tissue rearrangement                      | 2 (10.5)      |
| Liposuction                                     | 2 (10.5)      |
| Contralateral breast (n = 19)                   |               |
| Mastopexy                                      | 1 (5.3)       |
| Reduction mammaplasty                          | 1 (5.3)       |
| Gluteal donor site (n = 40)                     |               |
| Fat grafting                                    | 2 (5.0)       |

### Table 5. Comparison of the Patient Perioperative Characteristics between Consecutive Series of a Unilateral IGAP Flap and Bilateral IGAP Flaps for Unilateral Breast Reconstruction

| Parameter                                      | Bilateral IGAP Flaps | Unilateral IGAP Flap | No. (%)       |
|------------------------------------------------|----------------------|----------------------|---------------|
| No. recipient sites                            | 20                   | 22                   |               |
| No. IGAP flaps                                 | 40                   | 22                   |               |
| Immediate 1-staged reconstruction              | 13 (65)              | 20 (90.9)            |               |
| Delayed 2-staged reconstruction                | 7 (35)               | 2 (9.1)              |               |
| Average body mass index ± SD, kg/m²            | 21.3 ± 2.8 (18.4–28.7) | 20.8 ± 2.5 (18–27.2) |               |
| Average mastectomy weight ± SD, g              | 416.9 ± 96.0 (275–518) | 186.9 ± 71.7 (100–310)* |               |
| Average tissue expander weight ± SD, g         | 530.6 ± 111.4 (410–734) | 364.0 ± 161.2 (250–478) |               |
| Average final inset flap weight ± SD, g        | 462.3 ± 138.4 (248–774) | 244.3 ± 74.3 (114–380)* |               |
| Average operating time ± SD, min               | 671.1 ± 66.2 (490–751) | 486.8 ± 50.6 (392–587)* |               |
| Average operative blood loss ± SD, g           | 291.6 ± 142.3 (114–735) | 203.1 ± 97.6 (50–435)† |               |
| Average postoperative discharge day ± SD, day  | 12.7 ± 4.1 (9–18)    | 11.4 ± 1.8 (9–15)    |               |
| Complications at gluteal donor site            |                      |                      |               |
| Seroma                                         | 10 (25)              | 4 (18.2)             |               |
| Sensory disturbance                            | 6 (15)               | 1 (4.5)              |               |
| Hypertrophic scar                              | 2 (5)                | 4 (18.2)             |               |
| Complications at GAP flap                      |                      |                      |               |
| Venous thrombosis                              | 1 (1.5)              | 1 (4.5)              |               |
| Flap loss                                      | 1 (1.5)              | 0 (0)                |               |
| Partial fat necrosis                           | 1 (1.5)              | 4 (18.2)             |               |
| Complications at breast recipient site         |                      |                      |               |
| Partial breast skin flap necrosis              | 3 (15.0)             | 1 (4.5)              |               |
| Partial nipple-areola necrosis                 | 1 (5.0)              | 1 (4.5)              |               |
| Hypertrophic scar                              | 2 (10.0)             | 1 (4.5)              |               |

*P < 0.001.
†P < 0.05.
mismatch anastomosis. Mirzabeigi et al⁷ reported 13% with delayed venous thrombosis. To avoid venous thrombosis, the surgeon should dissect the recipient vein proximally and consider a same caliber venous anastomosis between the pedicle and recipient vein, especially when the pedicle vein is only one vena comitans.

Recipient vessels selection for bilateral IGAP flaps is very important for flap inset. In this series, both internal mammary vessels and the serratus branch of the thoracodorsal vessels were common recipient vessels. When using the latissimus dorsi branch, the surgeon should be well aware that it may eliminate the future use of latissimus dorsi flap.

Combined use of the internal mammary vessels and the thoracodorsal vessels tends to restrict breast shape to a horizontal orientation with inadequate breast projection.⁸ Bilateral IGAP flaps are separated from each other and can be arranged freely on the pectoralis major muscle. None of the patients complained of bulkiness after reconstruction.

There are several reports of bilateral breast reconstructions using bilateral GAP flaps.⁵,²⁹,³⁰ In these articles, the operations were performed by 2 teams of surgeons, and the mean operating time for bilateral reconstruction was 9.0 hours,⁵ 9.5 hours,²⁹ and 9.5 hours,³⁰ respectively. In our series of unilateral breast reconstruction with only one team comprising 2 surgeons, the mean operating time was 11 hours 11 minutes.

Bilateral SGAP flaps are a suitable alternative for bilateral IGAP flaps for unilateral breast reconstruction using autologous tissues. Displacement of the inferior gluteal crease and pain with sitting during the early postoperative period are rare in patients undergoing reconstruction with SGAP flaps. Although the upper gluteal scar and depression resulting from SGAP flap harvesting can be concealed by underwear or swimwear, they are quite conspicuous when the patient is nude. In this regard, the postoperative gluteal aesthetics following bilateral IGAP flap harvesting is superior to those of bilateral SGAP flap harvesting, and for this reason, we prefer to use bilateral IGAP flaps.

The contralateral breast cancer risk and reconstruction procedure in patients for whom bilateral GAP flaps are indicated must be carefully considered. After using the bilateral gluteal tissue, autologous tissue, including the bilateral lower abdominal flaps, proximal medial thigh flaps, lumbar flaps, and latissimus dorsi musculocutaneous flaps, are candidate future donor sites. The quality of the fat tissue from these donor sites, however, differs from that of the buttock, and it is difficult to reconstruct breast of about the same shape and size as the other breast.

CONCLUSIONS

Bilateral IGAP flaps should be considered as an alternative for breast reconstruction in patients whose breast size is greater than a C cup with moderate projection and a mastectomy weight greater than 350 g, particularly those with slim hips and insufficient abdominal tissue.

Although the use of bilateral IGAP flaps for unilateral breast reconstruction requires technically demanding dissections, the procedure provides thick, dense, and abundant gluteal fat, without significant gluteal deformity or asymmetry of the inferior buttock volume and shape, as bilateral IGAP flaps are composed of 2 small flaps of the same size.

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