The Profunda Artery Perforator Flap: A Versatile Option for Head and Neck Reconstruction

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Background: Although the profunda artery perforator flap has gained popularity in breast reconstruction, it has not been well described for reconstruction of head and neck defects. The authors report their experience with free profunda artery perforator flaps in postoncologic head and neck reconstruction.
Methods: A retrospective review of all free profunda artery perforator flaps used for head and neck reconstruction from 2016 to 2019 was performed.
Results: Overall, 61 profunda artery perforator flap reconstructions were performed: 45 single independent flaps, 12 in conjunction with a second free flap, and four in combination with two other free flaps. The profunda artery perforator flaps were most commonly used for reconstruction of the tongue ($n = 19$), cheek ($n = 11$), parotid ($n = 10$), and maxilla ($n = 6$). The profunda artery perforator flaps averaged 7.1 × 12.1 × 1.9 cm, with a mean pedicle length of 11.5 cm. The A, B, and C perforators were located at mean distances of 7.4 cm (range, 4 to 11.5 cm), 11.7 cm (range, 8 to 18 cm), and 16.1 cm (range, 14 to 20.5 cm) from the pubic tubercle along the axis of the adductor longus muscle and 7.9 cm (range, 7 to 11cm), 7.6 cm (range, 7 to 15.5 cm), and 7.2 cm (range, 6 to 16 cm) posterior and perpendicular to the axis. There were three partial flap losses. Eight patients (13 percent) had recipient-site complications necessitating operative intervention: four for vascular compromise of the profunda artery perforator flap, two for hematoma evacuation, and two for infection. Donor-site complications were noted in seven patients (11 percent), two of whom required operative intervention.
Conclusions: The profunda artery perforator flap is a versatile and reliable flap with consistent anatomy and a low complication rate. The profunda artery perforator flap seems to be a reasonable alternative for reconstruction of head and neck defects. (*Plast. Reconstr. Surg.* 147: 1401, 2021.)
CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

Throughout the evolution of microvascular reconstruction, several workhorse flaps have emerged in head and neck reconstruction, including the anterolateral thigh and the radial forearm flaps for soft-tissue reconstruction and the free fibula flap for vascularized bony reconstruction.[1–4] More recently, refinements in microsurgical technique have created a paradigm shift from a focus on flap survival to optimizing outcomes following microvascular free tissue transfer. As a result, perforator flaps using a variety of different donor sites have been studied to achieve the best possible functional and aesthetic outcome and minimize donor-site morbidity. In addition, there is a need to find alternatives in the event that traditional workhorse flaps are not available for use.

One flap that could serve as a viable option for head and neck reconstruction is the profunda artery perforator flap. First described by Angrigiani et al. in 2001 as an "adductor flap" using posteromedial thigh skin based on profunda femoris perforators for ischial and perineal wounds, the profunda artery perforator flap has recently gained popularity as an alternative flap for autologous breast reconstruction.[5–8] Small series have also described the use of the profunda artery perforator flap for other oncologic or traumatic defects, but its applications beyond breast reconstruction have been limited.[9,10] Numerous anatomical studies (angiographic/

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radiographic, cadaveric, and clinical) have demonstrated that the profunda artery perforator flap has consistent, reliable vascular anatomy with sizable vessel caliber and adequate pedicle length.[11–17] Given the plethora of perforators surrounding the profunda artery perforator flap, it can be designed in different orientations, and harvested as a true fasciocutaneous perforator flap, a myocutaneous flap, or a chimeric flap.[13,18] This flexibility makes the profunda artery perforator flap an attractive option for soft-tissue reconstruction of complex head and neck defects.[15] The present study aims to describe clinically relevant profunda artery perforator flap perforator anatomy and assess the suitability of the profunda artery perforator flap in microvascular head and neck reconstruction.

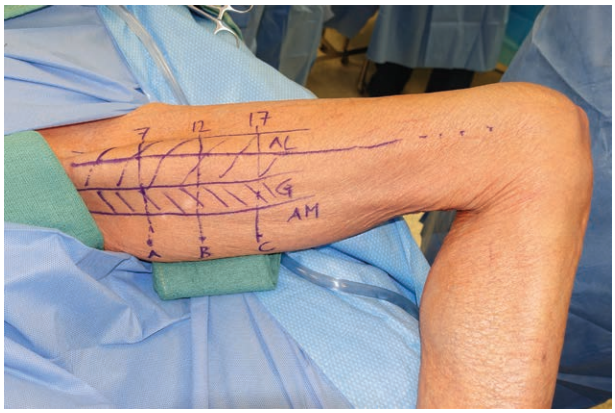


Fig. 1. The design of the profunda artery perforator flap was marked on the posteromedial thigh incorporating the A, B, and C profunda artery perforator location.

PATIENTS AND METHODS

Following institutional review board approval, we conducted a retrospective cohort study of all patients who underwent free profunda artery perforator flap head and neck reconstruction from January of 2016 to December of 2019. The primary endpoints were flap survival and postoperative complications at both the donor and recipient sites within 30 days of surgery. Major complications were defined as surgical-site complications requiring hospitalization, unplanned return to the operating room, or readmission for intravenous antibiotics; and minor complications were defined as any deviation from the normal postoperative course at the surgical sites without the need for hospital readmission or reoperation. Secondary endpoints were patient baseline characteristics (sex, age, body mass index, medical comorbidities, American Society of Anesthesiologists classification), diagnosis, prior oncologic treatment, defect characteristics, flap dimensions and orientation, pedicle length, number and location of perforators perfusing the profunda artery perforator flap, and tissue components. Pedicle length and the location and course of the profunda artery perforator flap perforator(s) were recorded, and perforators were categorized as A, B, or C perforators as described previously.[17]

Flap Harvest

Profunda artery perforator flap harvest was performed as described previously.[17] Briefly, the profunda artery perforator flap was harvested with the patient in the supine frog-leg position simultaneous with the oncologic resection to minimize operative time. A vertically or transversely oriented ellipse (depending on surgeon and patient preferences and patient body habitus) was marked on the

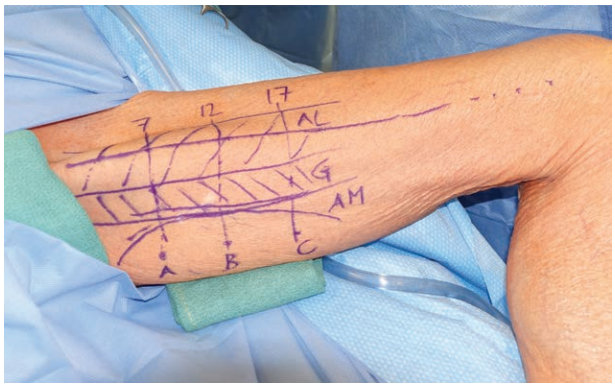
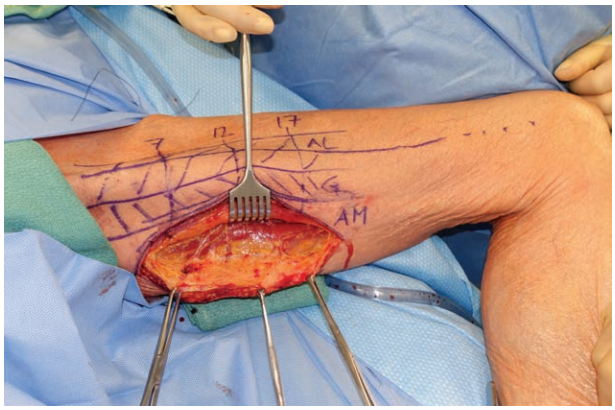


Fig. 2. Accurate marking of the anterior border of the flap design is paramount. Most commonly, the anterior flap is designed too anteriorly relative to the perforator location.

posteromedial thigh incorporating the A, B, and C profunda artery perforator location at 7.5, 12.7, and 17.6 cm from the symphysis along the adductor longus axis and 7.9, 7.3, and 6.1 cm posterior to the adductor longus axis, respectively, as described previously (Figs. 1 and 2).[17] After the anterior incision was made, the dissection was performed from anterior to posterior. The adductor magnus fascia was incised, and the most robust perforator was selected to be included in the flap on the basis of its location and size (Fig. 3). The perforator was typically dissected intramuscularly through the adductor magnus muscle up to its origin from the profunda femoral vessels (Fig. 4). A number of sizable muscular branches to the adductor magnus muscle need to be divided during the pedicle dissection. These branches can potentially serve as a recipient site to anastomose a second flap in the vessel-depleted neck or to include a portion of the adductor magnus muscle if a chimeric flap was needed. The flap is then transferred into the recipient site in a standard



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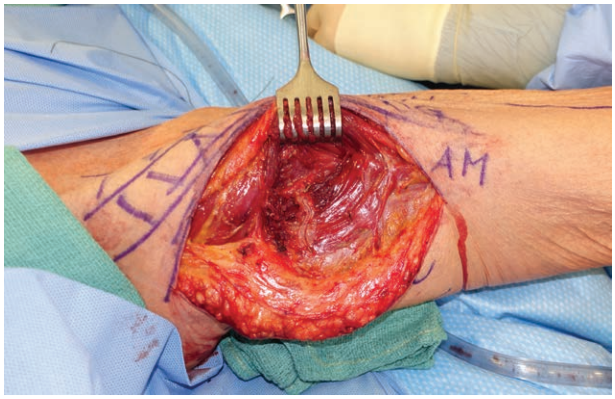

Fig. 4. The perforator was dissected intramuscularly through the adductor magnus muscle up to its origin from the profunda femoral vessels.

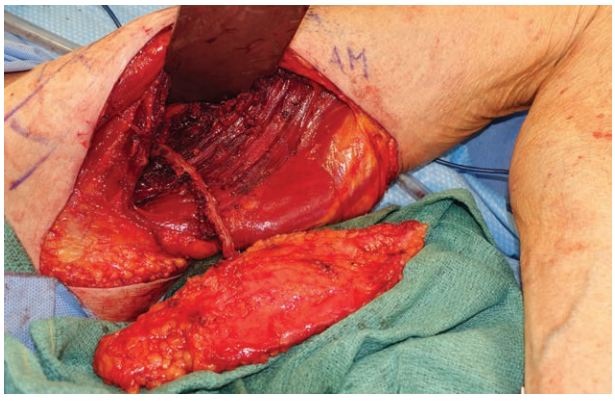

Fig. 5. A number of muscular branches to the adductor magnus muscle need to be divided during the pedicle dissection. The flap is then transferred into the recipient site in a standard fashion.

fashion (Fig. 5). The leg was straightened following flap harvest to avoid development of pressure sores or deep venous thrombosis. In all cases, the donor site was closed primarily.

Postoperative Care

All patients undergoing profunda artery perforator flap harvest were allowed to mobilize from postoperative day 0, but were instructed to avoid strenuous activity for 4 weeks. Patients undergoing transversely oriented profunda artery perforator flaps were also asked to avoid hip flexion of more than 90 degrees for 4 weeks.

Statistical Analysis

Frequencies and proportions were used to summarize the categorical variables. Means and ranges were calculated to summarize continuous variables. All analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, N.C.).

RESULTS

A total of 61 profunda artery perforator flap reconstructions were performed in 60 patients with a mean age of 63 years (range, 18 to 90 years) and a mean body mass index of 24 kg/m^2 (range, 16 to 36 kg/m^2) (Table 1). Twenty-five patients (42 percent) had previously been treated with chemotherapy, 23 (38 percent) had undergone radiation therapy, and six (10 percent) had undergone induction immunotherapy. Eight patients (13 percent) had free tissue transfers before the profunda artery perforator flap reconstruction (two patients had one prior free tissue transfer, three patients had two, one patient had three, and two patients had four prior free flaps). This included anterolateral thigh ($n = 4$), radial forearm ($n = 4$), fibula ($n = 3$), latissimus dorsi ($n = 3$), rectus abdominis ($n = 2$), serratus with rib ($n = 1$), tensor fasciae latae ($n = 1$), and scapular ($n = 1$) free flaps.

Table 1. Patient Baseline Characteristics

	Value (%)
No. of patients	60
PAP flaps	61
Age, yr	
Mean	63
Range	18–90
Sex	
Male	46 (77)
Female	14 (23)
BMI, kg/m^2	
Mean	24
Range	16–36
ASA class	
2	2 (3)
3	55 (93)
4	2 (3)
Tobacco history	32 (53)
Prior radiation therapy	23 (38)
Prior chemotherapy	25 (42)
Prior immunotherapy	6 (10)

PAP, profunda artery perforator; BMI, body mass index; ASA, American Society of Anesthesiologists.

Table 2. Diagnosis and Defect Characteristics

	No. (%)
Diagnosis	
Oncologic	54 (89)
Squamous cell carcinoma	40
Other*	14
Fistula†	3 (5)
Prior failed flap	2 (3)
Osteoradionecrosis	2 (3)
Location	
Tongue	19 (31)
Partial glossectomy with FOM	2
Hemiglossectomy with FOM	4
Subtotal glossectomy with FOM	9
Total glossectomy with FOM	4
Cheek	11 (18)
Outer cheek	9
Inner cheek	1
Cheek through-and-through	1
Total parotidectomy	10 (16)
Maxilla	6 (10)
Infrastructure	2
Suprastructure	2
Anterior	1
Maxillary sinus	1
Pharyngoesophageal	4 (7)
Neck	4 (7)
Temporal	3 (5)
Posterior mandibulectomy	2 (3)
Retromolar trigone	1 (2)
Orbital	1 (2)

FOM, floor of mouth.
*Other included desmoid tumor ($n = 1$), basal cell carcinoma ($n = 1$), salivary ductal carcinoma ($n = 2$), temporal bone meningioma ($n = 1$), sternoclavicular fibrosarcoma ($n = 1$), adenocarcinoma ($n = 1$), parotid poorly differentiated carcinoma ($n = 1$), adenoid cystic carcinoma ($n = 2$), Ewing sarcoma of maxillary sinus ($n = 1$), temporal villonodular synovitis ($n = 1$), metastatic ear melanoma to parotid ($n = 1$), and alveolar soft-part sarcoma of the tongue ($n = 1$).
†Sinocutaneous fistula ($n = 1$), orocutaneous fistula ($n = 1$), and oroantral fistula ($n = 1$).

Fifty-five patients (92 percent) had an American Society of Anesthesiologists score of 3, two patients (3 percent) had an American Society of Anesthesiologists score of 2, and two patients (3 percent) had an American Society of Anesthesiologists score of 4. Thirty-two patients (53 percent) had a history of tobacco use. Reconstruction was most commonly performed following primary oncologic resection [$n = 54$ (90 percent)], with squamous cell carcinoma ($n = 40$) as the most common pathologic diagnosis. Other indications for surgery included intraoral fistula ($n = 3$, 5 percent), prior failed flap [$n = 2$ (3 percent)], and osteoradionecrosis [$n = 2$ (3 percent)]. The profunda artery perforator flaps were used for variety of head and neck defects (Table 2).

Flap Characteristics

The average profunda artery perforator flap dimensions were 12.1 cm (range, 5 to 24 cm) in length, 7.1 cm (range, 4 to 14 cm) in width, and 1.9 cm (range, 0.5 to 4 cm) in thickness (Table 3).

Table 3. Flap Characteristics

Variable	Value
Flap length, cm	
Mean	12.1
Range	5–24
Flap width, cm	
Mean	7.1
Range	4–14
Flap thickness, cm	
Mean	1.9
Range	0.5–4
Flap area, cm^2	
Mean	92.2
Range	20–240
Flap volume, cm^3	
Mean	189.8
Range	10–784
Flap orientation	61
Vertical	48 (79)
Transverse	13 (21)
Perforators*	
A	7 (11)
B	32 (52)
C	2 (3)
A and B	5 (8)
B and C	12 (34)
A and C	0 (0)
A, B, and C	1 (2)
Pedicle length, cm	
Mean	11.5
Range	8–15
Perforator course	
Musculocutaneous	60 (98)
Septocutaneous	1 (2)
Vein grafts	8 (13)
Additional free flap(s) with PAP	16 (27)
PAP and fibula	8
PAP and gracilis	3
PAP, fibula, and ALT	2
PAP, PAP, and ALT	1
PAP, fibula, and AMT	1
PAP, fibula, and VL	1

PAP, profunda artery perforator; ALT, anterolateral thigh; AMT, anteromedial thigh; NA, not available; VL, vastus lateralis.
*These were the perforators harvested to supply the PAP flap.

Flap orientation was vertical in 48 flaps (79 percent) and transverse in 13 flaps (21 percent). Duration of flap harvest was 55 minutes (range, 35 to 85 minutes). Pedicle length averaged 11.5 cm (range, 8 to 15 cm). The A, B, and C perforators were located at mean distances of 7.4 cm (range, 4 to 11.5 cm), 11.7 cm (range, 8 to 18 cm), and 16.1 cm (range, 14 to 20.5 cm) from the pubic tubercle along the axis of the adductor longus muscle and 7.9 cm (range, 7 to 11 cm), 7.6 cm (range, 7 to 15.5 cm), and 7.2 cm (range, 6 to 16 cm) posterior and perpendicular to the adductor longus muscle axis, respectively. The harvested flaps were most commonly based on perforator B [$n = 32$ (52 percent)], followed by both perforators B and C [$n = 12$ (34 percent)] and perforator A [$n = 7$ (11 percent)]. Use of perforator C [$n = 2$ (3 percent)] and perforators A, B, and C combined [$n = 1$ (2 percent)] was rare. All but one flap had perforators that were musculocutaneous

traveling through the adductor muscle [n = 60 (98 percent)], with one flap that had a septocutaneous A perforator. A myocutaneous profunda artery perforator flap was harvested in five patients (8 percent). Fifteen patients (25 percent) underwent a chimeric flap reconstruction. One profunda artery perforator flap had two separate skin islands, based on two different perforators, converging into a single pedicle. Vein grafts were used in eight patients (13 percent) because of lack of recipient vessels from prior operations and radiation therapy. Additional free flaps were combined with a profunda artery perforator flap in 16 patients (27 percent), including fibula (n = 8), gracilis (n = 3), fibula and anterolateral thigh (n = 2), fibula and anteromedial thigh (n = 1), and fibula and vastus lateralis (n = 1) flaps. One patient had two profunda artery perforator flaps harvested from the same extremity along with an anterolateral thigh flap.

Postoperative Outcomes and Complications

All 61 profunda artery perforator flaps survived, but partial flap loss occurred in two flaps (3 percent) (Table 4). Both partial flap losses were distal losses because of intraoral flap folding. Recipient-site complications were reported in 12 flaps [10 major (16 percent) and two minor (3 percent)]. Major complications included reoperation for partial flap necrosis (n = 2), infection (n = 2), hematoma (n = 2), hardware exposure (n = 1), arterial thrombosis (n = 1), and readmission for intravenous antibiotics (n = 2). One patient with partial flap necrosis required an additional anterolateral thigh free flap. Minor recipient-site complications included wound dehiscence, which healed with conservative management (n = 2). Donor-site complications were identified in seven patients (11 percent), of which two patients required surgical management. One patient had an infected hematoma requiring drainage and one patient suffered from delayed wound healing requiring débridement and wound closure.

There were no reported cases of lymphedema or neurologic or functional impairment of the lower extremity following profunda artery perforator flap harvest. Ten flaps (16 percent) required revision procedures such as flap debulking, local tissue rearrangement, or fat grafting after an average of 9.5 months postoperatively (range, 1.7 to 30.1 months). Overall, 13 patients (22 percent) developed recurrence, either locally [n = 10 (16 percent)] or with distant metastasis [n = 7 (11 percent)]. Fifty-three patients (88 percent) are currently alive, whereas seven (12 percent) are dead. The mean follow-up period was 7 months (range, 0.2 to 30 months).

Table 4. Postoperative Outcomes and Complications

	Value (%)
No. of PAP flaps	61
Total flap loss	0 (0)
Partial flap loss	2 (3)
Major complications	11 (18)
Recipient-site complications	12 (20)
Major complications	10 (16)
Minor complications	2 (3)
Donor-site complications	7 (11)
Major complications	2 (3)
Minor complications	5 (8)
Operative take-backs	8 (13)
Revision procedures	10 (16)
Recurrence	13 (22)
Local recurrence	10 (17)
Distant metastasis	7 (12)
Alive	53 (88)
Follow-up, mo	
Mean	7
Range	0.2–30

PAP, profunda artery perforator.

CASE REPORTS

Case 1

A 45-year-old man presented with a history of end-stage renal disease, hepatitis C, and squamous cell carcinoma of the left tongue treated with tumor excision, primary closure, left neck dissection, and adjuvant radiation therapy. The patient's disease recurred after 8 years, and the patient required a subtotal glossectomy and bilateral neck dissection (Fig. 6). Reconstruction was performed using a profunda artery perforator free flap with end-to-end anastomosis to the left lingual artery and end-to-side anastomosis to the

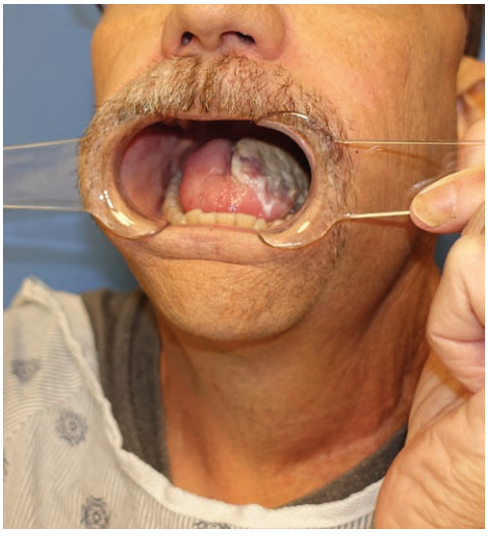

Fig. 6. Preoperative photograph of the tongue.

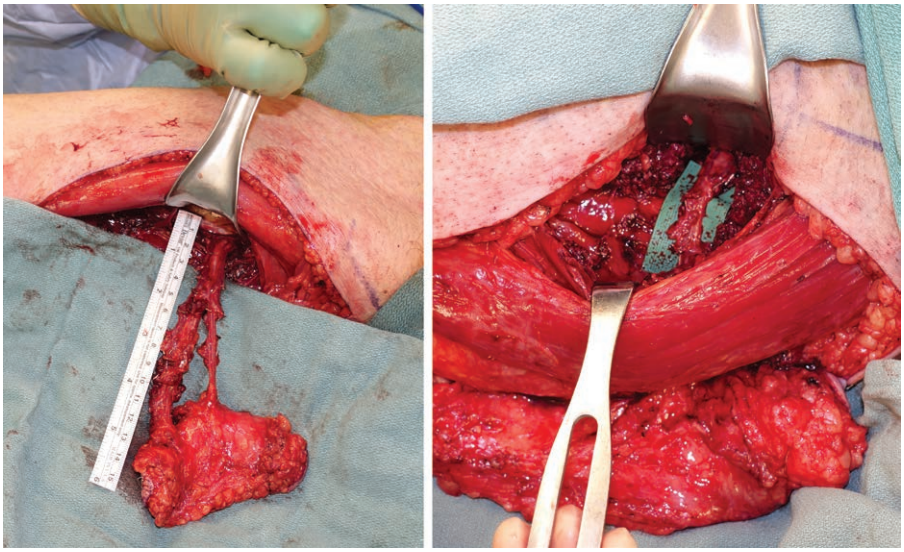

Fig. 7. (*Left*) Profunda artery perforator flap harvest. (*Right*) Origin of profunda artery perforator flap pedicle.

Fig. 8. (*Left*) Postoperative outcome following subtotal glossectomy reconstruction with a profunda artery perforator flap. (*Right*) inconspicuous scar in the posteromedial thigh.

internal jugular vein (Fig. 7). The inner thigh was the only donor site in this patient with sufficient subcutaneous adipose tissue to achieve the tissue bulk needed for a subtotal tongue reconstruction. The patient was discharged 9 days after surgery without complications (Fig. 8). Five months later, he died of extensive local recurrence.

Case 2

A 77-year-old man presented with a history of coronary artery disease and squamous cell carcinoma of the soft palate treated with chemoradiation therapy. Eighteen months later, the patient developed squamous cell carcinoma of the mandible. The patient underwent an extensive resection that included a right segmental mandibulectomy along with external skin, which was reconstructed using a free fibula osteocutaneous flap and a free profunda artery perforator flap for external coverage (Figs. 9 and 10). A profunda artery perforator flap was chosen because tissue bulk was needed for the external cheek area. Anastomoses of the right facial artery and the right common facial vein were performed for the fibula flap. The profunda artery perforator flap was connected to the right lingual artery and a second branch of the right common facial vein. The patient was discharged 7 days after surgery without complications. The patient developed minor wound dehiscence at the donor site, which

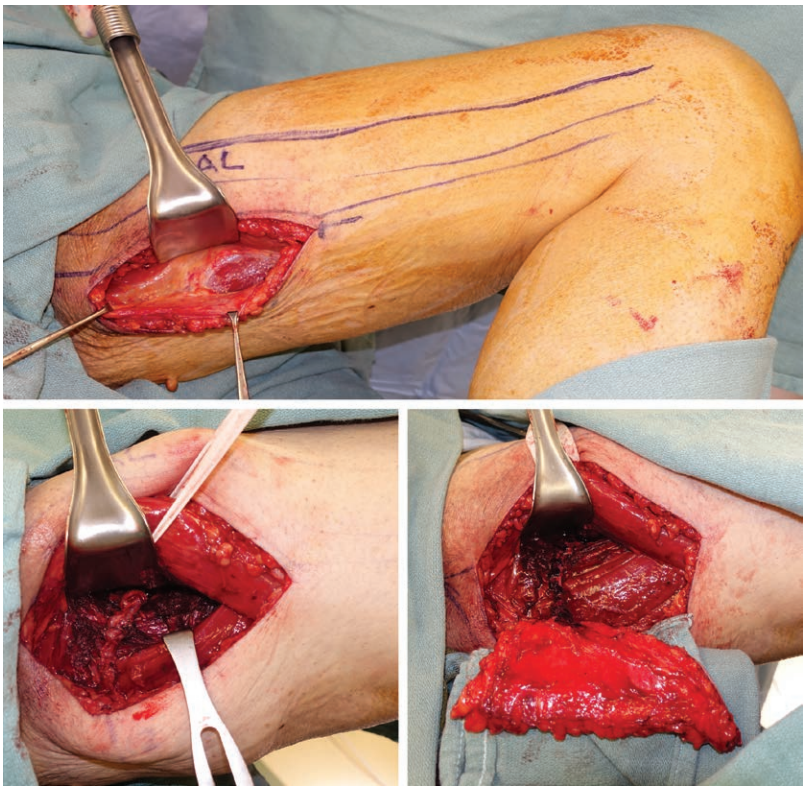

Fig. 9. (*Above*) Anterior incision and identification of the profunda artery perforator. (*Below*, *left*) Musculocutaneous course of the profunda artery perforator. (*Below*, *right*) Profunda artery perforator flap harvest completed.

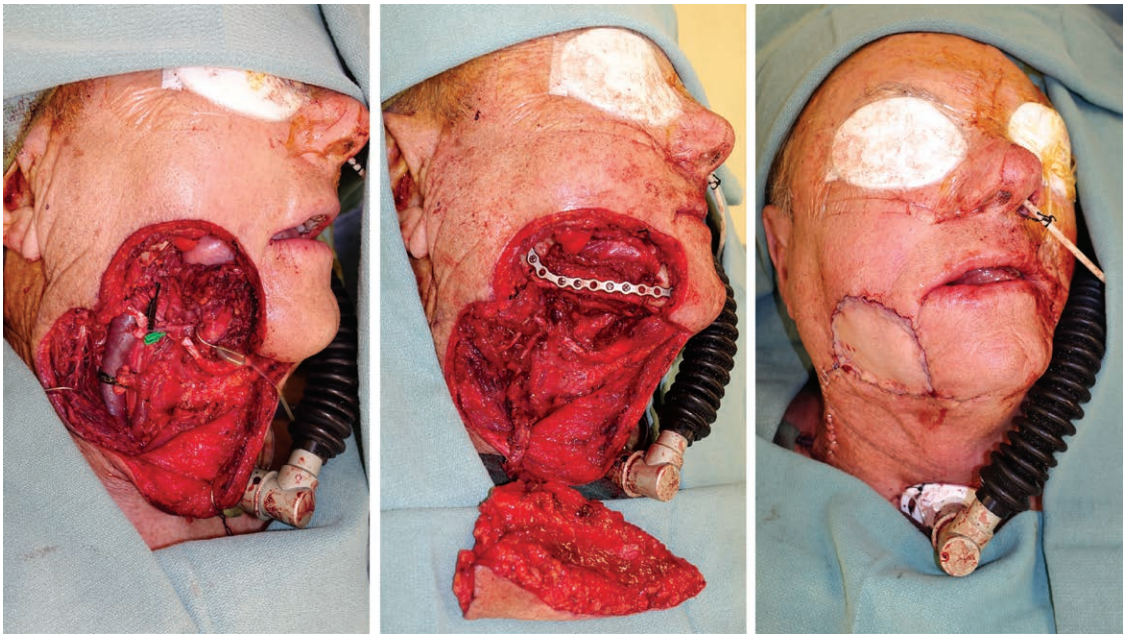

Fig. 10. (*Left*) Segmental mandibulectomy and through-and-through cheek defect. (*Center*) Inset of fibula osteocutaneous flap and microanastomoses between profunda artery perforator flap and neck vessels. (*Right*) Inset of profunda artery perforator flap.

Fig. 11. Postoperative outcome at 18 months after radiation therapy.

was managed conservatively. The patient underwent on-time radiation therapy and is alive with no evidence of disease (Fig. 11).

Case 3

A 53-year-old woman presented with a history of right tongue cancer resection and radiation therapy, followed by recurrence requiring composite resection. She underwent a latissimus dorsi and serratus anterior with rib free flap reconstruction at another institution, which failed, followed by an anterolateral thigh flap reconstruction, which also failed. Both flaps were anastomosed to the right neck vessels. A second anterolateral thigh flap to the left neck vessels also failed. Her wounds were then closed with a deltopectoral flap. The patient underwent a free fibula osteocutaneous flap and profunda artery perforator flap reconstruction, but vein grafts were needed for both flaps given the multiple prior free flaps and radiation therapy (Fig. 12). A profunda artery perforator flap was chosen because both anterolateral thigh donor sites were already used. The patient had no complications but required several revisions (flap rearrangement, fat grafting) and is alive with no evidence of disease (Fig. 13).

DISCUSSION

The present study represents the largest series to date of patients undergoing oncologic head and neck reconstruction using free profunda artery perforator flaps and chimeric profunda artery perforator flaps that include the adductor magnus muscle. The experience adds to the existing body of literature describing the reliability and anatomy of the profunda artery perforator flap, confirming its utility beyond autologous breast reconstruction.[15] The profunda artery perforator flap can be tailored to the size of defects with a fairly broad range of dimensions.[16] The majority of the profunda artery perforator flaps (79 percent) were harvested in a vertical orientation. At least two perforators were present in all thighs along the longitudinal axis of the posterior medial thigh. Prior studies have demonstrated that nearly 85 percent of patients had three or more sizable perforators available.[13,17] Thus, the vertical orientation of the profunda artery perforator flap allows for the selection and inclusion of additional perforators and does not necessitate preoperative imaging.[9] However, when two skin paddles are required or if a transversely oriented flap is planned, we recommend obtaining a preoperative computed tomographic angiogram to visualize the flap branching pattern and perforator anatomy. In our series, most of the flaps were harvested based on the B perforator alone (52 percent) or on both the B and C perforators (12 percent). The profunda artery perforator flap can also be harvested based on the A perforator; however, this may favor a transversely oriented flap, as a vertical flap places the apex of the flap toward the perineum, which can be uncomfortable for patients and delay wound healing.

Although the anterolateral thigh flap is considered the workhorse flap for head and neck soft-tissue reconstruction, the anatomical variability of the perforators occasionally necessitates salvage options such as the use of the anteromedial thigh flap or even a contralateral thigh flap.[19–21] Studies have documented the lack of anterolateral thigh

Fig. 12. (*Left*) Preoperative photograph. (*Right*) Segmental mandibulectomy and through-and-through defect.

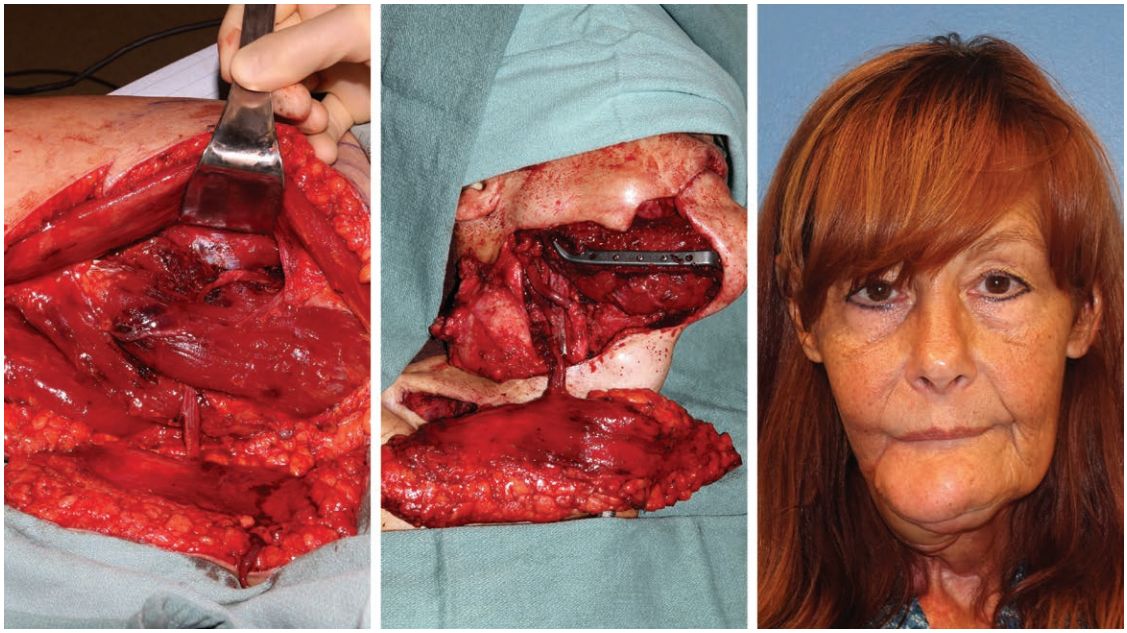

Fig. 13. (*Left*) Profunda artery perforator flap harvest. (*Center*) Reconstruction with a fibula osteocutaneous flap and profunda artery perforator flap, microanastomoses with vein grafts. (*Right*) Postoperative outcome.

perforators in 1.8 to 5.4 percent of cases, in contrast to the profunda artery perforator flap, for which the authors have yet to encounter a patient who did not have at least one sizable perforator. Often there are also muscular branches present that allow for harvest of a chimeric flap, as was performed in 15 patients in the present study.[16] The larger muscle branches can also be used for anastomosis of a second flap, a strategy especially useful in a vessel-depleted or previously irradiated neck. If the anterolateral thigh flap is not usable or if both have been harvested, the profunda artery perforator flap represents a feasible alternative donor site with reliable anatomy and can provide a large amount of soft tissue for reconstruction of a variety of defects.

The average pedicle length of the profunda artery perforator flap, 11.5 cm, is comparable to that of the anterolateral thigh flap and sufficient for most patients undergoing head and neck reconstruction. Adequate pedicle length is particularly important in patients who have undergone

prior surgery, radiation therapy, and/or previous free flap reconstruction. Despite the pedicle length, in the previously irradiated and operated patient, vein grafts may still be necessary. In our series, eight patients required a vein graft, and none developed complications or experienced total flap loss. Four of the eight patients who required vein grafts needed multiple free flaps to complete their reconstruction, and the other four patients required a second venous outflow for which a vein graft was used to reach another recipient vein. In general, the authors avoid using vein grafts unless necessary, as they are associated with a higher complication rate.[22]

The profunda artery perforator flap is generally thicker, with more pliable skin than the anterolateral thigh flap, but is clearly dependent on the patient's body habitus. However, when the anterolateral thigh is insufficient and more bulk is needed, the medial thigh can provide more volume and thickness without the need to include muscle, such as when the vastus lateralis is added to increase volume.[23] In the authors' opinion, the profunda artery perforator flap is ideal for patients who require greater tissue volume and/or need adjuvant radiation therapy, as in subtotal and total glossectomy or reconstruction of the cheek area. If additional volume is required with a profunda artery perforator flap, the adductor magnus muscle can be included and/or the flap orientation can be altered to an oblique, S-shaped, L-shaped, or even trilobed pattern.[13,15,16,18]

Although the rate of major complications may seem high with 16 percent in the present study, the authors aimed to report all complications as accurately as possible. The patient population also presents inherent challenges, as the overwhelming majority of patients had undergone multimodality adjuvant therapies, were smokers, had prior surgery, or needed multiple free flaps to reconstruct the defect. All but two patients were American Society of Anesthesiologists class 3 or 4. In the authors' opinion, many of the complications are not attributable to the profunda artery perforator flap itself, and the majority (60 percent) of major complications were caused by infections and hematoma. In 27 percent of the cases, multiple free flaps were performed to complete the reconstruction; some of these patients had already had prior free flaps. Despite these challenges, there were no total flap failures in our early series. However, two patients experienced partial flap necrosis because of folding of the flap intraorally; one of these patients needed an additional free flap to reconstruct the defect. One patient had an arterial thrombosis caused by technical error with the anastomosis that was successfully salvaged; again, it was not related to the flap selection.

The posteromedial donor-site scar of the profunda artery perforator flap is generally preferred by patients over the more anterior scar of the anterolateral thigh.[24] The lateral femoral cutaneous nerve is often divided during anterolateral thigh dissection, which can cause numbness and paresthesia in up to 24 percent of patients, whereas no instances of medial thigh paresthesia were noted in our patients.[25] However, if a sensate flap is needed, the lateral femoral cutaneous nerve is reliable and can be harvested with the anterolateral thigh flap, whereas profunda artery perforator flap harvest does not routinely include a nerve in the flap harvest.

Most of our donor-site–related complications occurred in the beginning of our experience with the profunda artery perforator flap. With the increased use of the profunda artery perforator flap, the authors tended to harvest flaps with less width to facilitate wound closure of the donor site, leading to fewer complications. In our experience, flap widths of 6 to 8 cm can easily be closed primarily in most patients. The authors generally advise against skin grafting the donor site. An alternative flap should be considered if a wider flap is needed.

The profunda artery perforator flap is not without disadvantages. The flap harvest is often described as tedious because of the ergonomics of flap harvest in the frog-leg position. However, improved understanding of the vascular anatomy and refinement of the surgical technique can simplify harvest. Another significant limitation of the profunda artery perforator flap is that the fabrication of a composite or chimeric flap is unpredictable. Although a profunda artery perforator flap can be harvested with the adductor magnus muscle, inclusion of the adductor magnus will considerably shorten the functional pedicle length of the flap. Furthermore, the profunda artery perforator does not lend itself well to a multiple skin island design, as the perforators tend to arise independently from the profunda femoris vessels, whereas the anterolateral thigh perforators often converge on the main lateral descending circumflex femoral pedicle, allowing for multiple skin paddles to be based off a single pedicle.[26,27] For defects with a combined intraoral and extraoral component or if multiple tissue components are needed, a chimeric or dual skin island flap from the anterolateral thigh

or subscapular axis may be preferable. Another disadvantage is the lack of available nerve or fascial autografts in the medial thigh. If these tissue components are needed, as for example in patients undergoing extensive parotidectomy with facial nerve sacrifice, the authors recommend choosing a different donor site such as the anterolateral thigh.

Our study has several limitations. The moderate sample size limits the ability to identify risk factors for complications and flap loss. Moreover, we did not compare the profunda artery perforator flap to other flaps used for head and neck reconstruction, which is beyond the scope of this study but is an area of active investigation at our institution. The retrospective nature of the present study limits our ability to systematically analyze the rationale for profunda artery perforator flap selection. However, it is evident that our growing experience has led to expansion of the profunda artery perforator flap into the techniques we use for head and neck reconstruction.

CONCLUSIONS

Overall, the profunda artery perforator flap has been a successful addition to our selection of workhorse flaps for soft-tissue reconstruction of the head and neck. The profunda artery perforator flap offers a large, pliable, voluminous skin paddle; a reliable and large-caliber pedicle; and low donor-site morbidity; thus, it has great potential for a wide range of reconstructive indications, either as a primary or a secondary choice. The authors recommend expanding use of the profunda artery perforator flap for reconstruction of soft-tissue head and neck reconstruction.

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PATIENT CONSENT

Patients provided written consent for the use of their images.

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