The Cervicodeltopectoral Flap for Single-Stage Resurfacing of Anterolateral Defects of the Face and Neck

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Objective: To evaluate prospectively the feasibility and utility of adding a cervical extension to the standard deltopectoral flap. We postulated that this cervicodeltopectoral (CDP) flap will allow for single-stage reconstruction of large defects of the anterolateral face and neck.

Methods: As is the case with the deltopectoral flap, the CDP flap is based on the perforating branches of the internal mammary artery. However, the superior and posterior limbs of the CDP flap are not limited by the clavicle and the deltoid muscle. Instead, they extend in a subcutaneous tissue plane to the margins of the neck or facial defect and transfer the entire intervening skin bridge with the deltopectoral flap.

Results: Eighteen patients underwent closure of complex cutaneous defects of the face and neck with the CDP flap. We found no evidence of flap loss in any of these patients. Twelve patients had received preoperative radiation therapy encompassing the cervical extension of the CDP flap. No evidence of adverse healing was noted in this subset of patients.

Conclusions: The CDP flap may represent an alternative in the surgical treatment of various cutaneous defects of the face and neck. It allows for single-stage, reliable reconstruction of these defects. The transfer of intervening cervical skin in conjunction with the deltopectoral flap provides for a more aesthetically pleasing reconstruction, as skin immediately adjacent to the defect is more closely related to the excised skin in terms of color and texture.

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ALTHOUGH FIRST described by Aymard[1] in 1917 for nasal reconstruction, the versatility of the deltopectoral flap was not fully elucidated until a 1965 report by Bakamjian.[2] The *Bakamjian flap*, as it was commonly termed, became the workhorse of pharyngoesophageal reconstruction and provided deltopectoral skin coverage for a variety of cutaneous defects of the face and neck.[3]

The deltopectoral skin has a dual blood supply arising from the medially based second and third perforators of the internal mammary artery and laterally based cutaneous branches from the thoracoacromial, subscapular, and circumflex humeral vessels.[4] A rich dermal-subdermal plexus connects the medial and lateral blood supply. The deltopectoral flap is generally raised on the more robust and reliable medial perforators as an axial pattern flap. Anatomic studies have described the following 2 distinct areas of the deltopectoral flap: a medial arterial pedicled flap and a lateral cutaneous (random pattern) flap.[4] The line of demarcation between these 2 portions of the flap is the cephalic vein, with all tissue harvested lateral to the vein relying solely on the dermal-subdermal plexus of perforators, whereas tissue medial to the vein receives direct arterial-axial pattern flow. In an effort to increase the arc of rotation and reach of this flap into the face and upper neck, surgeons have extended the lateral limit of the flap well over the shoulder tip and into the upper lateral arm region. Unfortunately, with such extended flaps, even a delay procedure (incising and/or raising the flap to condition it to a reduced, reoriented blood supply) has been associated with partial or complete flap loss in 10% to 25% of cases.[5,6] Unlike random pattern skin flaps, the ideal method of delaying an arterial flap such as the deltopectoral flap has not been clearly elucidated. As such, delaying this flap does not increase the length that may be safely harvested or its reliability.[7]

In addition, the deltopectoral flap is generally transferred in 2 stages to the recipient site. The staged secondary procedure is required to excise or to return the tubed component to its donor site. Attempts at converting this procedure into a single stage have centered on de-epithelializing the proximal portion and passing

Characteristics of the Study Patients

Patient No./Sex	Defect Location*	Defect Size, cm²†	Primary Tumor Type	Radiation
1/M	Cheek (complete)	130	SCC	Postoperative
2/M	Neck	180	SCC	Preoperative
3/M	Cheek (complete)	140	SCC	Preoperative
4/M	Cheek (partial)	150	Melanoma	None
5/F	Neck	160	SCC	Preoperative
6/F	Neck	170	SCC	Preoperative
7/M	Cheek (complete)	90	SCC	Postoperative
8/M	Cheek (complete)	140	Merkel cell carcinoma	Preoperative
9/M	Neck	110	SCC	Preoperative
10/F	Neck	180	Mucoepidermoid cell carcinoma	Preoperative
11/M	Cheek (complete)	130	SCC	Postoperative
12/M	Cheek (partial)	140	Melanoma	None
13/M	Neck	160	SCC	Preoperative
14/M	Cheek (partial)	130	Melanoma	None
15/M	Cheek (complete)	140	Sebaceous cell carcinoma	Preoperative
16/F	Neck	160	SCC	Preoperative
17/M	Neck	170	SCC	Preoperative
18/F	Neck	170	SCC	Preoperative

Abbreviation: SCC, squamous cell carcinoma.
*Complete indicates through and through; partial, partial thickness.
†Approximated to the nearest 10 cm².

Figure 1. A 10×11-cm left cervical cutaneous defect after extirpation of N3 neck disease with overlying cutaneous involvement. The cervicodeltopectoral flap extended to inferior margin of defect and posteriorly to trapezius. CL indicates clavicle; 2, 3, and 4, perforators from internal mammary artery.

Figure 2. The cervicodeltopectoral flap rotated into position. A split-thickness skin graft has been applied to the donor site.

Figure 3. The patient in Figures 1 and 2 seen at 1 month postoperatively with reasonable contour and color match in the neck.

Figure 4. Massive neglected squamous cell carcinoma of the right cheek with complete thickness involvement.

it deep to the neck skin between the defect and the clavicle, or on simply excising the intervening skin between the clavicle and the defect.[8] The former approach may jeopardize flap viability, and the latter unnecessarily discards normal cervical skin.

As a result of these limitations, the deltopectoral flap has been largely relegated to a salvage role in the era of microvascular free-tissue transfer and widespread acceptance of the single-stage pectoralis major myocutaneous flap.

In this article, we will outline our approach to complex defects of the face and neck with the addition of a cervical extension to the classic deltopectoral flap, allowing for single-stage, reliable resurfacing of large defects of the face and neck.

Figure 5. The cervicodeltopectoral flap designed with a superior border at level of defect and posterior border along trapezius down to the fourth intercostal interspace.

Figure 6. The cervicodeltopectoral flap has been raised as outlined in Figure 5. Linear deepithelialization of a portion of the distal flap has been performed to allow for turning in of the flap at the level of the neo-oral commissure and to provide for internal lining.

METHODS

PATIENT POPULATION

We used the cervicodeltopectoral (CDP) flap in 18 patients for reconstruction of a variety of cutaneous defects of the face and neck (**Table**).

TECHNIQUE

Before starting the ablative portion of the procedure, the anticipated cutaneous defect is delineated on the patient. Next, the planned CDP flap is outlined with the superior border at the inferior aspect of the defect and the lateral border at the trapezius muscle superiorly and the cephalic vein inferiorly. The inferior limb is carried from the lateral edge of the sternum inferior to the third or fourth intercostal interspace, laterally, parallel to the clavicle, to the lateral border of the pectoral muscles, connecting it at this point with the vertical component of the incision. The inferior aspect of the incision may be safely carried to the contralateral side to improve the flap reach if required. The basic flap design will not change if the cutaneous defect needs to be made larger during tumor extirpation. Rather, the donor site will require the placement of a skin graft. The flap is then incised superiorly, laterally, and inferiorly and raised in the neck to across the midline, and, in the chest, to within 2 cm of the lateral border of the sternum. The entire flap is harvested in a subcutaneous tissue plane. Flap elevation will allow for broad access to the ipsilateral neck for lymph node dissection in continuity with the primary site if this is deemed necessary. Once the ablative portion of the procedure has been completed, the CDP flap is rotated into the defect. A small standing-cone deformity may result on the superomedial portion of the flap. This may generally be safely excised at the primary procedure. Wide undermining of the skin inferior to the chest wall donor site will usually allow for primary closure of the donor defect. Closure is generally accomplished over 2 suction drains, one passing beneath the cervical portion of the dissection, and the other, below the thoracic portion. If primary closure at the donor site is not possible, a split-thickness skin graft is applied to the donor site and a standard Aquaplast bolster (WFR/Aquaplast Corporation, Wyckoff, NJ) is applied.[9] The bolster, if used, is removed at day 7 (**Figures 1** through **10**).

RESULTS

The CDP flap was successfully used in 18 consecutive patients after ablative procedures in the face and neck that resulted in significant cutaneous defects. Defects ranged in size from 90 to 180 cm^2 (mean, 147 cm^2). Twelve patients had received preoperative irradiation therapy to the head and neck region, with the radiation field encompassing the cervical extension of the flap. Three patients received postoperative radiation therapy. No evi-

Figure 7. Four-month postoperative result of the patient in Figures 5 and 6 demonstrating intraoral lining of the cervicodeltopectoral flap.

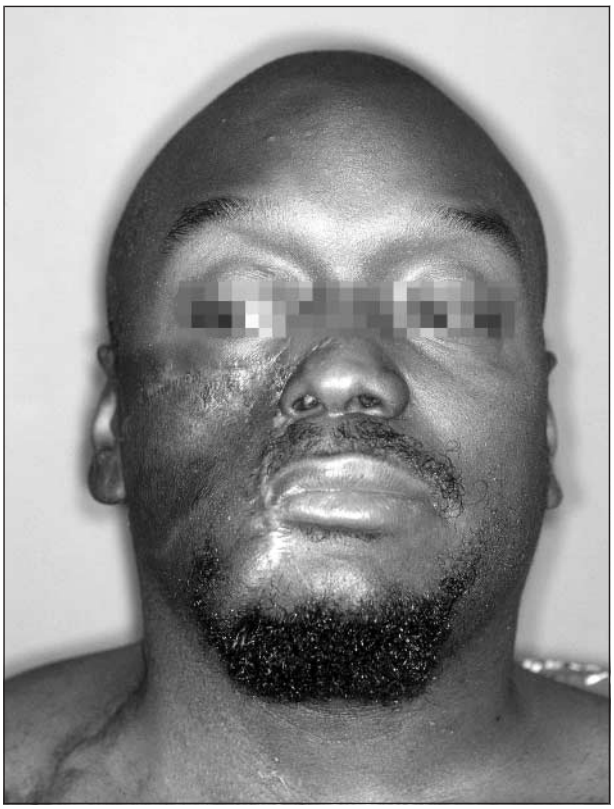

Figure 8. External facial contour at 4 months. The patient will require a secondary commissuroplasty.

dence of partial or complete flap loss was found in any of the patients studied. Two cases of localized wound infection responded with conservative dressing changes of 0.25% acetic acid. Both of these cases occurred in the subset of our patient population undergoing irradiation therapy. We were not able to identify any significant donor-site morbidity.

COMMENT

The deltopectoral flap has remained a reliable method of resurfacing cutaneous defects of the face and neck. Primarily because of the need for 2 stages and flap loss in 10% to 25% of cases, this flap has been relegated mostly to salvage situations in the flap-depleted patient.[4,5] Its role remains important even in the era of routine microvascular free-tissue transfer for pharyngoesophageal reconstruction, in cases of fistula closure and salvage.

Figure 9. Stomal recurrence in a patient with a history of laryngectomy and chemoradiation for squamous cell carcinoma of the larynx.

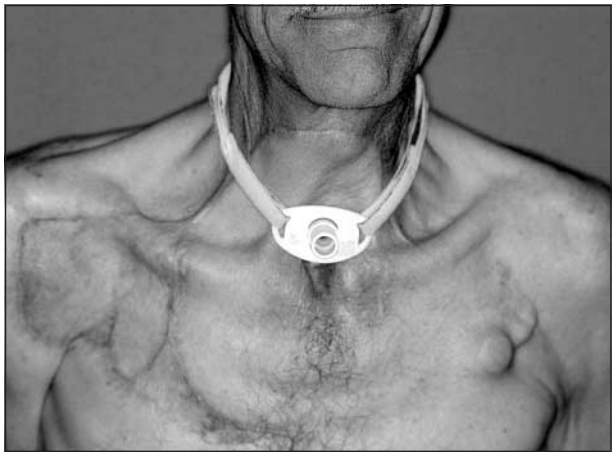

Figure 10. Four-month postoperative result after cervicodeltopectoral flap closure of a large stomal defect and gastric pullup for digestive tract reconstruction after total laryngopharyngoesophagectomy.

The CDP flap appears to overcome problems associated with the use of the deltopectoral flap while maintaining its advantages. The ability to transfer large amounts of healthy skin from an adjacent area has certain distinct advantages in terms of texture and color match. The entire island of skin between the inferior aspect of the defect and the traditional (infraclavicular) deltopectoral flap is transferred in continuity. Thus, there is a more gradual transition of skin quality across the reconstructed face and neck compared with any distant free-tissue transfer or a 2-stage deltopectoral flap, both of which generally contrast sharply with the skin surrounding the donor site. The pectoralis major myocutaneous flap, although providing for single-stage reconstruction, may be bulky and also suffers from significant color and texture mismatch at the level of the cutaneous paddle. The CDP flap is also useful in both male and female patients. Preoperative discussion with female patients in regard to some postoperative breast asymmetry is routinely performed. Given the severe head and neck

defects addressed with the use of this flap, our female patients have accepted the subsequent breast elevation that is noted as a consequence of CDP flap use. In female patients not willing to accept such an asymmetry, use of an alternate flap would be necessary. We have not encountered this situation in our practice.

Although cervicofacial rotation flaps have been well described for reconstruction of large cheek defects, they generally do not provide enough skin for single-stage, single-flap reconstruction of large through-and-through defects of the cheek.[10,11] Inferior extension of the standard cervicofacial flap into a CDP flap enhances flap reliability by providing it with a direct arterial axial blood supply. In addition, the CDP flap increases tissue availability to allow for the turning in of the superior portion of the flap, thus reconstructing the inner and outer aspects of the cheek, if required. Wallis and Donald[12] described the use of a pectoral extension to the cervicofacial flap and noted an increase in available tissue for facial reconstruction. By specifically incorporating the intercostal perforators and taking the dissection to the egress point of these perforators medially, one is able to consistently provide enough tissue for through-and-through cheek reconstruction if this is required. The use of a single flap for this particular defect and the expeditious resurfacing of significant cervical defects are important advantages to the use of this flap.

The CDP flap appears to be quite reliable in terms of its vascularity. In our series of patients, we found no evidence of flap loss. This reliability is partly attributable to the axial blood supply, but also to dermal-subdermal plexus interconnections from any remaining medial cervical attachments of the flap. Although a beneficial delay phenomenon in deltopectoral flaps may be documented experimentally with xenon blood flow studies, substantial clinical evidence of its routine use is lacking.[13,14] The reliability of the CDP flap, as seen in our study population, suggests that delay of this flap is also unnecessary.

CONCLUSIONS

We have found the CDP flap to be simple and expeditious to harvest. It provides for reliable single-stage resurfacing of complex cutaneous defects of the face and neck. It appears to represent an effective alternative to the traditional 2-stage deltopectoral flap by providing an improvement in skin color and texture match and enhanced reliability compared with historical control subjects.

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