

Review

Perforator flaps: the next step in the reconstructive ladder?

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Abstract

Perforator flaps are claimed to be a sign of major progress in head and neck reconstruction, but are they a further step up the reconstructive ladder? In this paper I provide a short summary of the development and current clinical use of perforator flaps in the head and neck, which is based on a presentation to the annual meeting of the British Association of Oral and Maxillofacial Surgeons in 2014. I will describe 4 flaps from the lower leg, which are useful specifically for covering intraoral defects, as examples. When we consider the spectrum of new donor sites, and the precision of flap design that is offered by perforator flaps, it becomes evident that the potential of this new technique has not yet been reached.

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Introduction

Since the first microvascular tissue transfers in humans by Seidenberg et al.,¹ Mc Lean and Buncke,² and Daniel and Taylor,³ this technique has spread worldwide. For at least 2 decades it has become the reconstructive procedure of choice for complex defects in all parts of the body, with success rates of about 95%. Efforts continue to evolve these techniques to improve aesthetic and functional results and reduce morbidity at donor sites. As a result of the comprehensive work by Taylor,⁴ who described the angiosomes of the human body, a basic anatomical concept was developed to allow new approaches to raising soft tissue flaps that rely solely on a single terminal vessel to nourish the skin. Unlike conventional lipocutaneous flaps such as those from the groin, with skin perfusion by many unnamed small branches of direct cutaneous vessels, the blood supply of the “new generation” of skin flaps is reduced to a single, small artery (usually 0.7–1.5 mm in diameter) that enters the anastomotic vascular plexus of the dermis. Using the rich anastomotic network,

and because of opening choke vessels, the vascular territory of such small terminal arteries is surprisingly large and always sufficient to cover any defect in the oral cavity. These small arteries have to perforate deep fascia before they enter the skin, which has given rise to the term “perforators”, and their dependent flaps have been named “perforator flaps”.

In nearly all cases, the raising of a perforator flap needs intramuscular dissection. This is painstaking and at times tedious. Hypothetically, these flaps can be raised in any region of the body if the perforators are sizeable enough to be detected and for direct anastomosis (“free style flaps”). These could be interpreted as “true” perforator flaps. Alternatively, the perforator can be traced to a source vessel, which then serves as the pedicle. Many commonly used early perforator flaps such as the anterolateral thigh (ALT) and deep inferior epigastric perforator (DIEP) are in fact anastomosed on large, long, named vessels not the short, small, unnamed, dispensable perforator.

Definition

We follow the simplified classification of Hallock,⁵ and name perforator flaps according to the course of the vessel that

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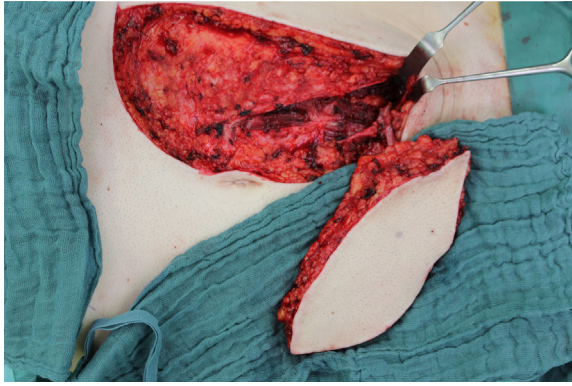


Fig. 1. Lipocutaneous deep inferior epigastric perforator flap with complete preservation of the muscles of the abdominal wall.

penetrates the deep fascia. Direct perforator flaps are perfused by a vessel that travels directly from the source artery to the deep fascia, whereas in indirect perforator flaps, the perforator courses through muscle or along intermuscular septa. In 2003, the “Gent consensus conference” provided a terminology which stipulated not only the definition of perforator vessels and perforator flaps but also the correct nomenclature of perforator flaps.⁶ The individual perforator flap is then specified according to the name of the source vessel (DIEP flap) or according to the muscle which has to be separated (vastus lateralis perforator flap). Since the anastomosis of a perforator flap can either be made without loss of the source vessel at the perforating vessel itself (short pedicle with small calibre) or at the source vessel (long pedicle with large calibre), the structure of the vascular pedicle should be mentioned as a further characteristic of the flap (soleus perforator only flap, vastus lateralis long pedicle perforator flap). The term “perforator-based” should further define those flaps harvested without loss of the proximal vessels.⁷

The main difference from conventional flaps, therefore, is that to raise a perforator flap, a specific skin vessel (the location of which can be variable) must be exposed and followed to the source vessel by incision of the deep fascia and, depending on its course, septa or muscle tissue. This technique allows for preservation of structures not needed to cover the defect, particularly muscles including their motor innervation. This, for example, is important to protect the integrity of the muscular abdominal wall (Fig. 1). Perforator flaps therefore combine the reliable blood supply of musculocutaneous flaps with the reduced donor site morbidity of a skin flap.^{8,9}

Apart from the individual design of the skin flap, which can be tailored to fit the defect exactly, an advantage of perforator flaps is their minimal donor site morbidity. However, for a successful reconstruction, it is essential to master the subtle dissection that is required to raise a flap, to have exact knowledge of the vascular anatomy and its possible variations, and to be able to suture vessels reliably with a diameter of 1 mm or less.¹⁰

Because this technique theoretically opens up new possibilities, perforator flaps are considered to provide important improvements for our patients. It might therefore be asked whether perforator flaps may be the next step on the reconstructive ladder. To answer this question, we reviewed relevant published reports by searching MEDLINE, the Cochrane Collaboration, and Embase for “perforator flaps in head and neck reconstruction”.

Current clinical applications

The review uncovered 244 articles that described perforator flaps used in reconstructions of the head and neck. When we analysed whether the technique had led to new donor sites or obvious improvement in the results of reconstruction in clinical practice, they were inconsistent. The first description of a perforator flap without the source vessel was given by Koshima and Soeda of the thinned paraumbilical perforator flap in 1989.⁸ Many others followed that described numerous donor sites throughout the body. Although about 400 cutaneous perforators can be found that reach the integument,¹¹ only a few donor sites have made an appreciable impact on raising perforator flaps in routine clinical practice. In general, donor sites such as the lower abdomen (DIEP flap, paraumbilical perforator flap), thigh (ALT and vastus lateralis perforator flap) and the gluteal region (superior and inferior gluteal perforator flaps) are the most attractive and commonly used perforator flaps. Flaps from the thoracodorsal and circumflex iliac artery have proved their usefulness for reconstructive purposes all over the body,¹² but when we focus on free perforator flaps for reconstruction of the head and neck it becomes evident that the range of perforator flaps that are used is still quite limited.

As the review of previous reports showed, most of the free perforator flaps come from the thigh, which is extremely well-suited for raising flaps in the predominantly slim populations of the Asian countries.^{13–15} Despite the option to shape (Fig. 2) or thin out these flaps (Figs. 3 and 4), the thigh is a less attractive site for us, as the thickness of the subcutaneous fatty tissue is greater in Northern European and North

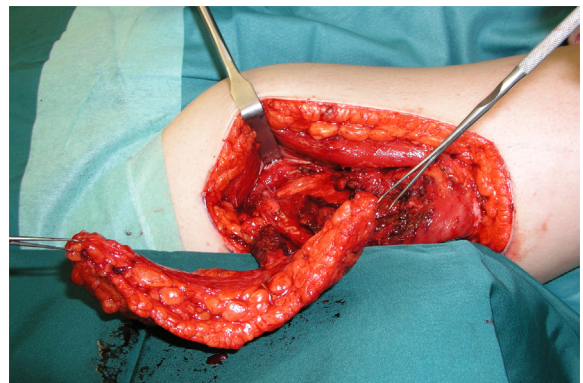


Fig. 2. Tailored, de-epithelialised, anterolateral thigh flap for augmentation of the contour.

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