Table 2.1 The complete classification of a flap

Primary characteristics	Pedicled flap	Free flap	Secondary characteristics	Pedicled flap	Free flap
Circulation (blood supply)	Direct vessels	Direct vessels	Contiguity (destination)	Local	Free flap
	Axial	Axial		Regional	
	Septocutaneous	Septocutaneous		Distant	
	Endosteal	Endosteal	Construction (flow)	Unipedicled	Orthograde flow
	Indirect vessels	Indirect vessels		Bipedicled	Retrograde flow
	Myocutaneous	Myocutaneous		Orthograde flow	Turbocharged
	Periosteal	Periosteal		Retrograde flow	Supercharged
Constituents (composition)	Fasciocutaneous	Fasciocutaneous		Turbocharged	
	Muscle/ myocutaneous	Muscle/ myocutaneous		Supercharged	
	Visceral	Visceral	Conditioning (preparation)	Delay	Delay
	Nerve	Nerve		Tissue expansion	Tissue expansion
	Bone	Bone		Prefabrication	Prefabrication
	Cartilage	Cartilage	Conformation (geometry)	Special configurations	Tubed
	Other	Other		Tubed	Combined flaps
				Combined flaps	

(Adapted from Cormack GC, Lamberty BGH. Alternative flap nomenclature and classification, the arterial anatomy of skin flaps, 2nd ed. Edinburgh: Churchill Livingstone; 1994. p. 514–22.)

a special classification nomenclature just for VCA tissues as the tissues themselves are no different from one person to another. Composite tissues would be named according to the region transferred, with VCA written as a suffix just to clarify the source, e.g., "face composite VCA" or "face VCA" for short. Individual flaps or combinations would follow the same schema as outlined earlier in this chapter. Thus, a DIEAP flap transferred from one individual to another would simply be a DIEAP VCA free flap, again to differentiate appropriately the tissue source.

CONCLUSION

Although there are a bewildering array of classification schemes, some, such as the muscle flap classification of Mathes and Nahai,[45] have become well established. It would be just as convenient to categorize all cutaneous flaps as either direct or indirect perforator flaps,[40] which also alerts the surgeon to anticipate differences in the requisite dissection techniques to preserve the blood supply to the flap. However, the terms *axial*, *fasciocutaneous*, and *musculocutaneous* are so entrenched that this will be unlikely. Some other uncommonly used types of flaps have not even been discussed in this context but venous flaps, for example, could be considered to be indirect perforator flaps, since all superficial veins at some point pierce the deep fascia with their intrinsic and/or extrinsic arterial supply.[41] Visceral flaps could be distinguished by the anatomic origin of the flap, e.g., colon, jejunum, appendix, etc. To compound this dilemma, so many other potential permutations or combinations exist that it is just not possible to clearly stratify all possibilities. A complete classification of flaps will always be an elusive goal,[56] but it is important to use surgical principles and a keen awareness of vascular anatomy to try to simplify classifications rather than make them unusable due to complexity. Muscle perforator flaps are the prototypical example of this controversy, in which several classifications have been proposed.[23,63–65] The overall goal of classifications should be to aid in communication between surgeons in the quest to continually improve our results and try to use the best flap for each reconstructive challenge.

Expert Commentary

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Regardless of origin and distribution, any single perforator holds a unique vascular territory (Perforasome) and if large enough, can be used as either a pedicle, or free, perforator flap. With over 350 clinically relevant perforators in the body, this allows for a tremendous number of options in flap choices and design. Knowledge of the location of the most dominant perforators is critical and will help facilitate flap design and harvest. Most perforators in the body are distributed within "cold spots" and "hot spots," with hot spots being high perforator–concentrated locations and cold spots being relative poor areas of perforator distribution. Most hot spots can be found adjacent to articulations and mid-point between two articulations in the extremities, whereas in the trunk, perforators are clustered parallel to the posterior and anterior midline as well as midaxillary regions. Designing the skin paddle over the hot spots will ensure that as many perforators are incorporated within the flap, and this will help maximize interperforator flow via linking vessels between each perforator. Interperforator flow is ensured by a series of direct and indirect linking vessels as well as multiple communicating branches between the former two. The flap's long axis should be parallel to the direction of these linking vessels in order to maximize interperforator flow, and hence, increase flap perfusion. Linking vessels are usually oriented parallel to the extremities and perpendicular to the midline in the trunk. A perforator flap based on a perforator that originates from a source artery with multiple sequential perforators, will have more of an axial pattern of vascularity, compared with a single dominant perforator. Perforators from the same source artery will fill preferentially first before adjacent source artery perforators (e.g., perforators of the descending branch of the LCFA, lateral circumflex femoral artery). Mass vascularity of a perforator found close to an articulation will also be directed, in general, away from that same articulation, whereas mid-point perforators (perforators found between two articulations) will have a multidirectional distribution. With a significant number of clinically relevant perforators available in the body, customized ad-hoc, or freestyle, perforator flaps can be designed to reconstruct a panoply of defects.

REFERENCES

1. Mathes SJ, Nahai F. The reconstructive triangle: a paradigm for surgical decision making. In: Reconstructive surgery: principles, anatomy, and technique. New York: Churchill Livingstone; 1997. p. 9–36.
2. Pearl RM, Johnson D. The vascular supply to the skin: an anatomical and physiological reappraisal – Part II. Ann Plast Surg 1983; 11:196–205.
3. Daniel RK, Kerrigan CL. Principles and physiology of skin flap surgery. In: McCarthy JG, editor. Plastic surgery, vol. 1. Philadelphia: WB Saunders; 1990. p. 275–328.
4. Milton SH. Pedicled skin-flaps: the fallacy of the length: width ratio. Br J Surg 1970;57:502–8.
5. McGregor IA, Morgan G. Axial and random pattern flaps. Br J Plast Surg 1973;26:202–13.
6. Orticochea M. The musculo-cutaneous flap method: an immediate and heroic substitute for the method of delay. Br J Plast Surg 1972;25:106–10.
7. McCraw JB, Dibbell DG, Carraway JH. Clinical definition of independent myocutaneous vascular territories. Plast Reconstr Surg 1977;60:341–52.
8. Tanzini I. Sopra il mio nuovo processo di amputazione della mammella. Gaz Med Ital 1906;57:141.
9. Owens NA. Compound neck pedicle designed for the repair of massive facial defects: formation, development and application. Plast Reconstr Surg (1946) 1955;15:369–89.
10. Hueston JT, McConchie IH. A compound pectoral flap. Aust N Z J Surg 1968;38:61–3.
11. Pontén B. The fasciocutaneous flap: its use in soft tissue defects of the lower leg. Br J Plast Surg 1981;34:215–20.
12. Esser JF, Schwerer S. Verschluss einer Brustwand perforation. Berliner Klin Wochenschr 1918;55:1197.
13. Gillies HD. The tubed pedicle in plastic surgery. New York Med J 1920;3:1–12.
14. Nakajima H, Fujino T, Adachi SA. New concept of vascular supply to the skin and classification of skin flaps according to their vascularization. Ann Plast Surg 1986;16:1–19.
15. Batchelor JS, Moss AL. The relationship between fasciocutaneous perforators and their fascial branches: an anatomical study in human cadaver lower legs. Plast Reconstr Surg 1995;95:629–33.
16. Nakajima H, Minabe T, Imanishi N. Three-dimensional analysis and classification of arteries in the skin and subcutaneous adipofascial tissue by computer graphics imaging. Plast Reconstr Surg 1998;102:748–60.
17. Manchot C. The cutaneous arteries of the human body. New York: Springer-Verlag; 1983. p. 136–7.
18. Ger R. The technique of muscle transposition in the operative treatment of traumatic and ulcerative lesions of the leg. J Trauma 1971;11:502–10.
19. Taylor GI, Townsend P, Corlett R. Superiority of the deep circumflex iliac vessels as the supply for free groin flaps. Clinical work. Plast Reconstr Surg 1979;64:745–59.
20. Taylor GI, Miller GD, Ham FJ. The free vascularized bone graft. A clinical extension of microvascular techniques. Plast Reconstr Surg 1975;55:533–44.
21. Taylor GI. Free vascularized nerve transfer in the upper extremity. Hand Clin 1999;15:673–95.
22. Robinson DW, MacLeod A. Microvascular free jejunum transfer. Br J Plast Surg 1982;35:258–67.
23. Geddes CR, Morris SF, Neligan PC. Perforator flaps: evolution, classification, and applications. Ann Plast Surg 2003;50:90–9.
24. Blondeel PN, Hallock GG, Morris SF, et al. Perforator flaps: anatomy, technique & clinical applications. St Louis: Quality Medical Publishing; 2006.
25. Harii K. Microvascular free flaps for skin coverage. Indications and selections of donor sites. Clin Plast Surg 1983;10:37–54.
26. Hallock GG. Simultaneous transposition of anterior thigh muscle and fascia flaps: an introduction to the chimera flap principle. Ann Plast Surg 1991;27:126–31.
27. Taylor GI, Palmer JH. The vascular territories (angiosomes) of the body: experimental study and clinical applications. Br J Plast Surg 1987;40:113–41.
28. Taylor GI. The "Gent" consensus on perforator flap terminology: preliminary definitions. Plast Reconstr Surg 2003;112:1384–7.
29. Cormack GC, Lamberty BG. A classification of fascio-cutaneous flaps according to their patterns of vascularisation. Br J Plast Surg 1984;37:80–7.
30. Cormack GC, Lamberty BG. The anatomical basis for fasciocutaneous flaps. In: Hallock GG, editor. Fasciocutaneous flaps. Cambridge, MA: Blackwell Scientific Publications; 1992. p. 13–24.
31. Hallock GG. Principles of fascia and fasciocutaneous flaps. In: Weinzweig J, editor. Plastic surgery secrets. Philadelphia: Hanley and Belfus; 1999. p. 419–26.
32. Cormack GC, Lamberty BG. The arterial anatomy of skin flaps. Edinburgh: Churchill Livingstone; 1994. p. 514–22.
33. Niranjan NS, Price RD. Govilkar P. Fascial feeder and perforator-based V-Y advancement flaps in the reconstruction of lower limb defects. Br J Plast Surg 2000;53:679–89.
34. Mathes SJ, Nahai F. Flap selection: analysis of features, modifications, and applications. Reconstructive surgery: principles, anatomy, and technique. New York: Churchill Livingstone; 1997. p. 37–160.
35. Wei FC, Jain V, Suominen S, et al. Confusion among perforator flaps: what is a true perforator flap? Plast Reconstr Surg 2001; 107:874–6.
36. Spalteholz W. Die Vertheilung der Blutgefasse in der Haut. Archive für Anatomie und Physiologie (Anat Abtheil) 1893;1:54.
37. Taylor GI, Palmer JH. McManamny D. The vascular territories of the body (angiosomes) and their clinical applications. In: McCarthy JG, editor. Plastic surgery, vol. 1. Philadelphia: WB Saunders; 1990. p. 329–78.
38. Taylor GI. Foreword. In: Manchot C, editor. The cutaneous arteries of the human body. New York: Springer-Verlag; 1983. p. i–ixiv.