Expert Commentary

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A metaphor can inspire images, but cannot always sustain analysis. A picture of an assembled chess set, for example, can teach someone how to arrange the pieces but not how to play the game.

The reconstructive ladder and its associated elevator provide a framework for organizing procedures into patterns of relative complexity. These patterns, however, are only a small part of the surgeon's thought processes. How does a surgeon get a cleft lip onto the ladder or off the elevator?

In my practice, I have come to use grammatical patterns of diagnosis and treatment for problem analysis. These grammars are verbal, not pictorial, and consist of interlocking sets of rules. For primary disease processes, I define a problem element (tumor, osteomyelitis, etc.) and match it to a treatment strategy. Completion of this sequence is necessary prior to reconstructive planning.

I define three kinds of reconstructive elements: wounds (separation of parts); defects (absence of parts); and deformities (distortion of parts). These elements match three strategies: repair; replacement; and reconfiguration.

The significance of this kind of analysis is evident in the history of classic plastic surgery problems. Cleft lip had been treated as a kind of wound or a defect, until Millard considered it as a deformity and proceeded to operative approaches that reassembled distorted parts. Cleft palate was considered a deformity until Furlow proposed that it is a defect in length better managed by a Z-plasty. This simple pattern is capable of sustaining ongoing refinement of elements and strategies. Traumatic loss of a thumb, for example, is a defect. Simpler levels of technique resulted in defining the defect as loss of a post for opposition and a treatment strategy of bone grafts and staged skin flaps. Microsurgical technique redefined the defect as a loss of bone, joint, tendons, nerves, and an aesthetic unit treated by a toe transplant.

The reconstructive surgeon has the great good fortune of a career of exploration, in which problem analysis and technical achievements can evolve throughout a professional lifetime.

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Classification of Flaps

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INTRODUCTION

A BRIEF HISTORY OF FLAPS

The history of plastic surgery is in many ways a recapitulation of the history and corresponding evolution of flaps (Fig. 2.1). The earliest flaps were, as would be considered today, *random* skin flaps, as the skin was raised without regard to any known blood supply other than to maintain the presence of the subdermal vascular plexus.[1,2] The classification of flaps in the beginning was relatively easy, since they could be distinguished from one another only according to how they were constructed. This included how they were transposed (e.g., as an advancement, rotation, or transposition flap), their geometrical configuration (e.g., as a tubed flap), or by their destination (e.g., as a local or distant flap).[3] Because of their limited blood supply, there was a belief that random flaps had to be restricted to rigid length–width ratios to ensure viability. Still, some flaps lived and others died.

Such simplicity faded after Milton[4] disproved flap length–width ratios, and asserted instead that flap viability was dependent on the vascular supply of the given flap territory. This led to a renaissance in flap construction, based on an improved understanding of the anatomic basis of the circulation to the skin, initiated by McGregor and Morgan,[5] when they discovered that some regions of the body had discrete and relatively large subcutaneous vessels that had pierced the deep fascia to follow a predictable course. Comparatively large cutaneous flaps, if oriented along the axis of that vascular pathway, consistently maintained complete viability, and appropriately were called *axial* flaps (e.g., deltopectoral flap, groin flap).

Orticochea[6] reported that the inclusion of muscle in the flap could result in larger skin flap survival. McCraw et al.[7] more precisely explained the reasoning behind this association, and called the vessels coursing from the muscle to the skin "musculocutaneous" arteries. Interestingly, Tanzini[8] in 1906 had published the first report of such a musculocutaneous flap. Tanzini et al.,[9,10] were well aware of the existence of branches from the muscle necessary to form these compound flaps. Nevertheless, it was not until the late 1970s that musculocutaneous flaps became a standard reconstructive option.

The zeal to adopt cutaneous flaps relying on musculocutaneous vessels perhaps delayed the recognition of other important contributions to the "fascial plexus" that would

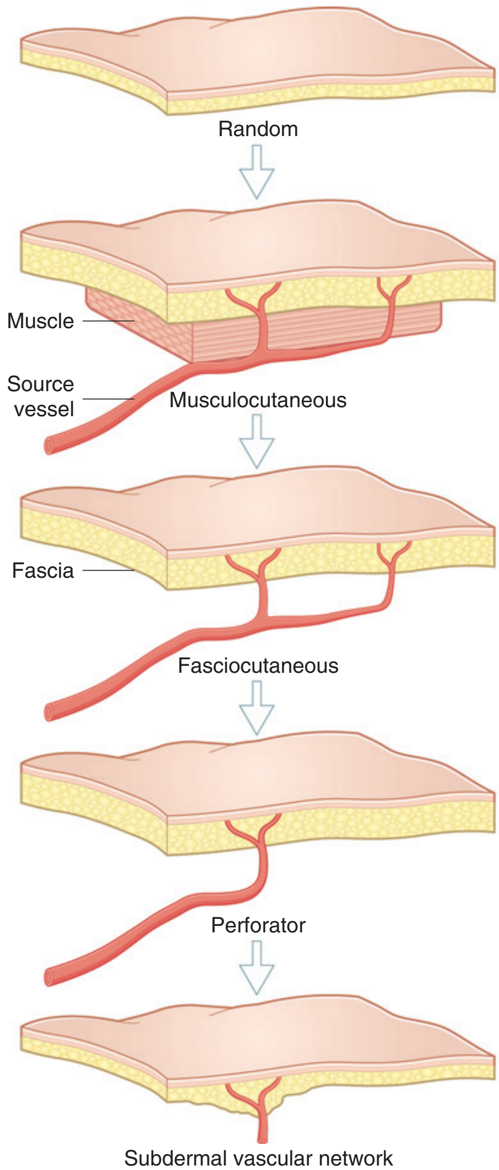

Figure 2.1 The evolution of flaps has reflected a progression to better ensure the adequacy of their intrinsic circulation, beginning with the least reliable, nourished only via the subdermal plexus, and ultimately coming back again full circle to the subdermal vascular network "supercharged" by retained perforators.