intramuscular dissection of the requisite musculocutaneous perforator will cause some minor injury,[31] albeit usually undetectable.

Mathes and Nahai[32] clearly showed that the extent of viability of muscle flaps depends on the pattern of the intrinsic circulation to that muscle. Since this anatomy is fairly constant, the surgical approach to harvest a given muscle or portion thereof can be predictably reliable. The same has not been the case for cutaneous flaps, so most donor sites have been restricted to specific angiosomes fed by relatively large and relatively consistent source vessels. This opinion has changed dramatically with our realization that now any part of the body can be used as a "free-style" local[33,34] or "free-style" free flap[35,36] chosen on the basis of its special characteristics, as long as an identifiable and adequate cutaneous perforator exists. Even this has become a less haphazard experience and perhaps no longer even "free-style", as preoperative imaging studies such as computed tomography (CT)[37] or magnetic resonance angiography (MRA)[38] can pinpoint not only the location and size of the requisite perforator, but its course as it spreads out into the periphery on its way to the subdermal plexus.

Of course, the preferred perforator flap donor site can now also be selected on the basis of the potential donor site deformity. This must be comparable with that possible with muscle flaps, where direct closure leaving a linear scar is the routine that will always be preferable from an aesthetic standpoint. Endoscopic techniques for the harvest of muscle flaps have minimized even the extent of this residual scarring to little more than that required for access ports, although this does increase the complexity of flap harvest.[39]

Yet this preceding goal will never be obtainable for all perforator flaps. For example, a large cutaneous flap usually will need a donor site skin graft to avoid the risk of a compartment syndrome;[40] and the result may be unacceptable even if the skin graft could be readily hidden by clothing (Fig. 3.4). Preoperative tissue expansion techniques can ultimately eliminate the need for a skin graft,[21] but often as in traumatic wounds this may not be an option. Similarly, postoperative tissue expansion can reduce the non-cosmetic appearance of the skin grafted donor site, but either way this is a lengthy process requiring great patience.[41] Sometimes a second local flap can instead be used to avoid a skin graft at the donor site, but that may require comparatively more complex surgery while still causing additional local scarring at the least.[42]

ROLE OF COMBINED FLAPS

Compound flaps can be composite flaps such as any musculocutaneous flap, or a combination of flaps, e.g., the conjoined or chimeric flap.[43,44] The latter flap combinations can provide multiple tissue components in a single yet comprehensive unit of virtually unlimited size to simultaneously fill any volume deficit, re-establish any underlying framework, and provide immediate coverage.[43] The final shape and contour of this unit can be independently customized ex vivo and then inset with impunity, as is particularly true of the chimeric type of combined flap (Fig. 3.5).[45] The ideal scenario would allow all the necessary components of a flap to be obtained from a single donor site that can be closed primarily so as to minimize both the recipient site and donor site morbidity. Wei and colleagues[24] have shown this to be another "ideal" attribute of the anterolateral (medial) thigh region, which is also true of the subscapular axis, where the latissimus dorsi and serratus anterior muscles, parascapular or scapular fasciocutaneous flaps, and even scapular bone or rib can be assorted together into numerous combinations and permutations.[46]

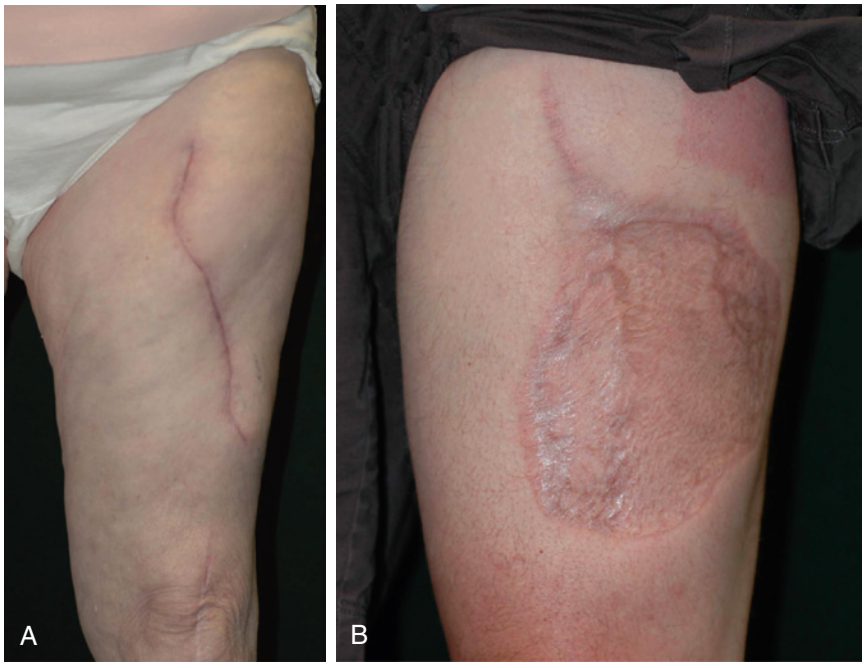

Figure 3.4 (A) A linear scar typical when primary closure of the anterolateral thigh free flap donor site is possible; (B) and the poor aesthetic result if a skin graft were necessary.

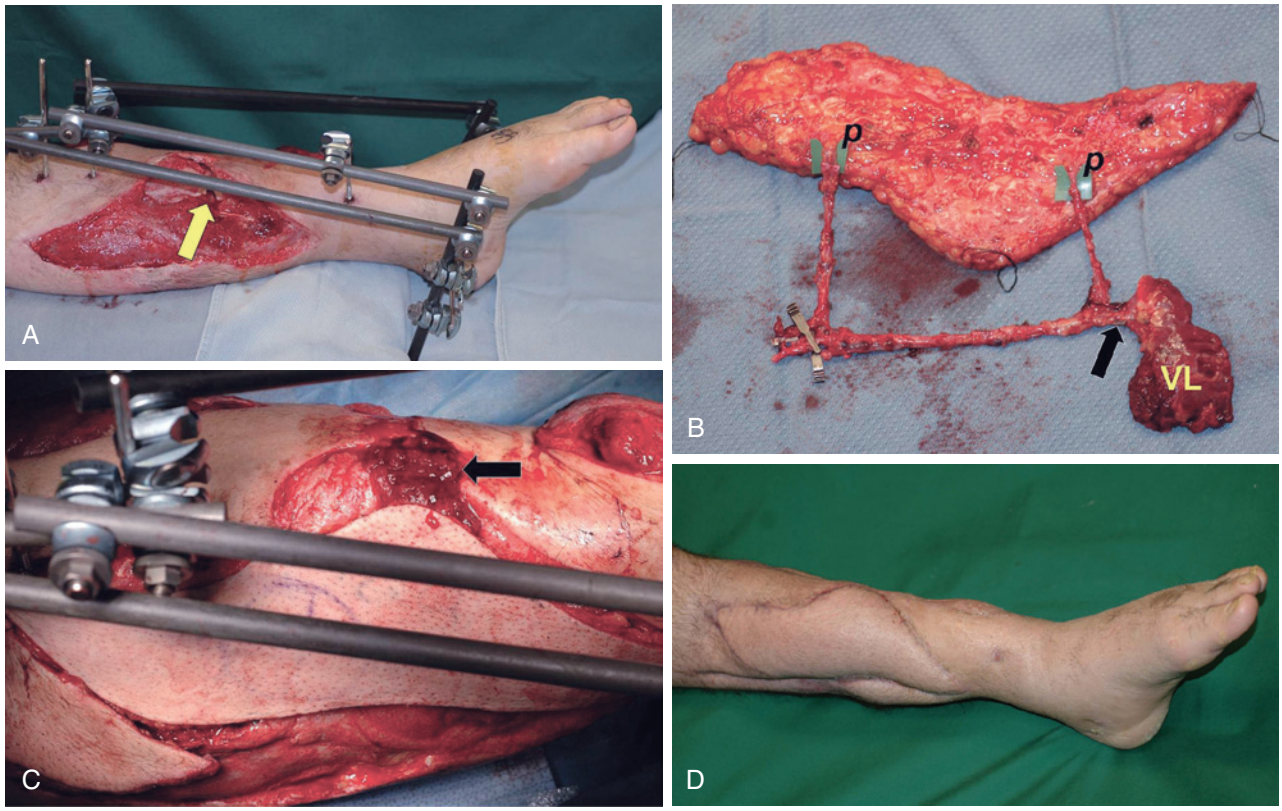

Figure 3.5 (A) Open left mid-tibia fracture with a large cavity surrounding the exposed bone (arrow); (B) undersurface of chimeric anterolateral (ALT) thigh free flap with two perforators (*p*), and a portion of vastus lateralis (VL) muscle that is separately supplied by the distal continuation (arrow) of the lateral circumflex femoral descending branch source vessel (proximal pedicle in microclamps). (C) The ALT flap was used to cover the bone and medial leg open wound, whereas the VL muscle (arrow) was independently inset into the cavity between the exposed ends of the tibia to eliminate all dead space. (D) Once coverage had healed satisfactorily, conversion to internal fixation of the tibia was possible with minimal risks of infection.

If a combined flap has a single source vessel that supplies all its independent portions, then only a single recipient site may be required for revascularization if used as a free flap. This is most advantageous if there is a paucity of recipient vessels, such as after bilateral radical neck dissections or in a single-vessel lower extremity. Other advantages include the capability of retaining a small independent cutaneous flap as part of a chimeric free flap that could relieve tension on insetting or provide coverage at a tenuous recipient site,[46] or perhaps serve as a monitoring flap for a muscle or buried free flap.[47]

FUTURE CONSIDERATIONS

Fear of iatrogenic morbidity at the donor site if a vascularized flap is the selected surgical strategy, must always be tempered by ensuring that the needs of the recipient site will be solved. Compromise usually is inevitable, even if an identical twin exists.[29,30] Until the day arrives when bioengineering technology can be used for the fabrication in the laboratory or via autogenous regeneration of parts, the only presently foreseeable recourse to avoid any donor site morbidity altogether, while still maximizing the desired outcome at the recipient site, may be via vascularized composite allotransplantation (VCA). Long-term successful VCA has already included the hand,[48] abdominal wall,[49] and skeletal muscle.[50] VCA of the face and its parts is in its infancy,[51] but the results so far have been spectacular, especially considering the relatively mediocre outcomes achieved using our currently limited flap capabilities. Of course, lifelong immunosuppression currently remains the obstacle for universal acceptance of this concept. Someday soon, however, it is conceivable that the flap of choice that has just the right size, color, vascular pedicle length and caliber, and exact secondary characteristics to perfectly restore a missing part such as an ear, nose, or eyebrow, could be taken "off the shelf" from where it is stockpiled in the storeroom of every hospital! Then, there would be absolutely no donor site morbidity, and the appearance of the final result truly predictable. We must remember that these will still be "free flaps" awaiting their replantation, and that the services of a skilled, dedicated, and interested microsurgeon will continue to be in demand.