Chapter 13
Phase IV: Late Reconstruction: Reconstruction of Posttraumatic Soft Tissue Defects

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13.1 Introduction

The surgical care of wounds for patients with complex extremity trauma follows the principles of polytrauma care. The primary focus is to stabilize the patient. This may lead to the decision that a prompt amputation of the severely injured limb is necessary. The “life before limb” principle must be respected.

It is first essential to properly evaluate the wound condition. Therefore, it is important to understand the mechanism of injury. A high velocity injury or an injury with an extended crush zone may lead to secondary necrosis of the soft tissue.

Prior to wound closure the following questions should be addressed:

1. How big the defect will be after a serial debridement?
2. What are the requirements of the region to be covered?
3. Does the area of defect require sensation or is it an area that needs to sustain severe pressure load (e.g., heel) or great flexibility (e.g., elbow or knee joint)?
4. Is it necessary to maintain the integrity of the dominant vessels or subdermal plexus?
5. Is there a relevant comorbidity, such as diabetes mellitus or arteriosclerosis?
6. Is the patient compliant?

Success of wound treatment is no longer measured simply on the basis of closure, but also on the functional outcome. The advantage of a lower leg amputation with a rapid resumption of daily life activity must be weighed against the complex, lengthy reconstruction of a limb.
13.2 Radical Debridement

The initial débridement should be performed by using a tourniquet. All dead and devitalized tissue should be removed. At the end of the first débridement, the tourniquet is released and all questionable necrosed or compromised tissue is resected. The wound is washed out several times. Jet lavage may be used for further wound cleaning. Neither the prospect of developing a wound surface of great depth and size nor the utilization of second look surgery or the application of antibiotic will relieve the surgeon from performing the initial radical first débridement.

While small bone fragments are removed, large bone fragments are cleaned, handled with care to make sure that the periosteum will not be stripped, and then reinserted into the defect as a free graft. Major neurovascular structures should be preserved if possible, even if initially they have no soft tissue protection. The exposed vessels may be covered using surrounding muscle or, in exceptional cases, with a primary free or pedicled flap. Unprotected bone, nerve, and tendon undoubtedly require proper vascularized soft tissue for protection as quickly as possible, but, with the use of vacuum-assisted closure for temporary wound dressing, which was established in the late 1990s, one has the opportunity to delay further surgery. Other considerations regarding the timing of reconstruction are further described in the following sections.

13.3 Stabilization of Fractures

The fracture management depends mainly on whether the patient is stable enough to tolerate a definitive osteosynthesis or not. While in the 1980s the concept of early total care (ETC) was advocated in all patient groups regardless of the injury severity and distribution, in the 1990s the concept of damage control orthopedics (DCO) was established. The reason for leaving the general concept of ETC was that several studies showed that extended operative procedures during the early phase of polytrauma were associated with adverse outcome [1]. The principles of DCO contain the advantages of immediate temporary fracture stabilization and secondary definitive management [2]. For this reason, the fixateur extern is the preferred treatment in the beginning. For the definitive osteosynthesis, intramedullary unreamed nails are favorable because they are weight-bearing systems and need only a small incision. Plates do have the disadvantages of postoperative disturbed wound healing because of decreased skin perfusion around contused regions and incision lines.

13.4 Methods of Soft Tissue Closure

Soft tissue closure techniques are selected according to the wound ground, the exposed structures, and the local region of the defect. A stepwise algorithm is used to determine the closure technique, beginning with the simplest and least complex