■ REVIEW ARTICLE

The management of fractures with bone loss

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Historically, because of the problems involved in initial limb salvage and the subsequent difficulty of reconstructing large skeletal defects many fractures with significant bone loss were treated by primary amputation. Modern techniques of fracture stabilisation and soft-tissue reconstruction mean that many more severely injured limbs with bone defects can now be salvaged in the acute phase of treatment. However, the problems involved in subsequently bridging or regenerating areas of skeletal loss with viable bone while maintaining limb length and alignment commensurate with satisfactory function, remain a substantial challenge.

Attempting limb reconstruction in the presence of significant bone loss usually involves surgery which is technically difficult, time-consuming, physically and psychologically demanding for the patient, and with no guarantee of a satisfactory outcome. The function of the salvaged limb may be disappointing due to residual pain, joint stiffness and neurovascular deficit. The patient may require a secondary amputation due to refractory infection or nonunion. Thus, the correct initial decision as to whether to embark upon limb reconstruction or to perform a primary amputation is important, but difficult. Unfortunately, the relative rarity of these injuries and the considerable variation in their configuration dictate that prescriptive management based on established protocol is not possible. A flexible and individualised approach to treatment is required. In this review, we consider the assessment of these injuries with an overview of the current options available for treatment, and provide guidelines for their management.

Classification of skeletal defects

Bone loss may occur from extrusion of fragments at the time of injury or during debridement of an open fracture when devitalised segments of bone are removed, thereby creating a defect. In most European populations and in areas where blunt trauma predominates, most skeletal defects are created at the time of debridement, but in areas where penetrating trauma from gun or blast injuries are more frequent, extrusion of bone fragments can occur at the time of injury. Systems for classification of open fractures do take some account of bone loss,[1-3] but due to the large number of factors which determine the severity and outcome of these injuries none of the existing schemes are entirely satisfactory. However, it is customary to describe bone loss by its anatomical location in the bone as being diaphyseal, metaphyseal or articular. The extent of the defect can be considered in terms of the length of bone involved and whether the defect comprises partial or segmental circumferential loss. Segmental defects of greater than 2 cm are unlikely to heal spontaneously following skeletal stabilisation alone. Those involving more than 50% of the circumference can heal spontaneously but often require additional treatment to restore normal volume and strength. Articular defects are rare. Their treatment depends on the stability and extent of the defect and the capacity of the remaining joint surface to articulate normally with acceptable loads. In the case of the tibial plateau, defects of more than 3 cm of the joint surface and 1 cm in depth are considered to be an indication for allografting.[4]

Although these considerations are important, other factors also influence the prognosis. Bone loss in certain anatomical locations has a more favourable prognosis due to better blood supply and corresponding osteogenic potential. The degree of soft-tissue injury will have a substantial influence on the subsequent rate of healing. The age of the patient, the presence of chronic disease (e.g. diabetes mellitus), use of medications, alcohol consumption and tobacco usage may alter the potential of bone defects to heal. The way in which the fracture is treated will have a substantial influence on the local mechanical and biological environment, which in turn will influence the quantity and quality of the osteogenic response.

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