The prevention of infection in open fractures

In the second half of the last century an open fracture resulted in death or amputation for the majority of patients (Billroth, 1886). Today, they are still a major problem whose management is debated. Although amputation is now seldom necessary, the development of chronic osteomyelitis is a disaster for the patient. Eradication of the infection is extremely hard to achieve and will usually result in both functional and cosmetic deficits. It is thus imperative that strenuous efforts are made to prevent bone infection. Even with the advent of antibiotics many authors reported high infection rates following open fractures (Carpenter, Dobbie & Siewers, 1952; Claffey, 1960; Olerud & Karström, 1972), but in the last decade improvements in management have reduced the incidence of post-traumatic osteomyelitis.

There are many facets to the prevention of infection after an open fracture and all are important. In the accident unit any obvious dirt and debris should be removed from the wound which should then be superficially washed and covered to prevent subsequent colonization with hospital organisms. The patient should then be transferred to the operating theatre as soon as possible for proper treatment of the wound. It is generally accepted that thorough excision of all dead or devitalized tissue is essential. This will require extension of the wound to allow adequate debridement and if there is any possibility that the bone end has come out through the skin it must be inspected to ensure that no foreign material is left behind. Gustillo & Anderson (1976) recommend irrigation of the wound with some 10 to 14 l of normal saline or with an irrigating jet in order to provide a thorough mechanical wash out and thus remove small particles. Whether the irrigating fluid should contain an antibiotic or antiseptic remains a contentious issue. Both topical antibiotics and povidone iodine spray have been found to help control wound infection (Halasz, 1977; Naunton Morgan et al., 1980) but as yet no controlled trial of their use in open fractures has been published.

At the end of the operation, all except the most minor wounds should be left open. The area must be covered either with a pack or temporary skin such as epiguard. It should be closed or skin grafted as soon as the risk of infection has passed in order to prevent drying of the tissues or subsequent bacterial contamination.

When cultures are taken from open fracture wounds approximately 70% yield positive results (Gustillo & Anderson, 1976; Patzakis, Harvey & Ivler, 1974). These authors have isolated a large variety of organisms including coagulase-negative staphylococci, diphtheroids, and Klebsiella, Enterobacter and Pseudomonas, spp. Fortunately, only a small proportion of open fractures become infected, but when they do, both the above groups found Staphylococcus aureus to be the most common causative organism.

Since most wounds are initially contaminated the use of systemic antibiotics could be considered as therapeutic rather than prophylactic. In a controlled study Patzakis, Harvey & Ivler (1974) found an infection rate of 13.9% in untreated cases which was reduced to 9.7% by the use of penicillin and streptomycin (not significant) and to 2.3% by cephhalothin given as 100 mgm/kg/day intravenously in divided doses (a significant difference). More recently Rittmann (1981) has reported a randomized prospective controlled trial of the use of cloxacillin in open fractures and has shown that the deep infection rate was reduced from 18% to 2%. It therefore seems that there is good evidence to support the use of prophylactic antibiotics though the duration for which they should be used has yet to be established. In hip replacement a short course of prophylactic antibiotic
is as effective as a long one (Pollard et al., 1979), so it seems logical to treat compound fractures in a similar way. However, there are two essential differences; firstly, the wound is contaminated and secondly it may be left open. Therefore, the recommendation that antibiotics may be continued until three days after the wound is closed (Gustillo & Anderson, 1977), seems logical even if unproven.

Traditionally, internal fixation of open fractures has been considered unwise because the presence of foreign material has been thought to encourage infection, and infection rates of 25% and 35% have been reported (Claffey, 1960; Olerud et al., 1972). However, over recent years this view has been challenged on the grounds that rigid immobilization of the fracture helps to prevent the formation of bacterial nutrients, while movement of a fractured bone held by plaster or traction can produce dead tissue which will support bacterial growth. La Duca et al., (1980) reported only two infections in 50 open fractures treated by primary internal fixation—an acceptable infection rate, if one believes in the benefits of internal fixation. Chapman & Mahoney (1979) have also used primary internal fixation in open fractures, reporting a 1-9% infection rate on injuries with minor wounds rising to 41% in the most severe types of injury, despite the use of prophylactic antibiotics. However, many of these severe injuries require skeletal stabilization in order that the soft tissues can be treated and the limb salvaged. This is probably better achieved by external skeletal stabilization using a modern fixator which allows the fracture to be rigidly immobilized without the need for implanting metal into a contaminated wound. (Widenfalk, Pontén & Karström, 1979).

In recent years, both prophylactic antibiotics and better fracture stabilization have improved the results in open fractures, so that fewer patients are left with osteomyelitis or functional impairment. However, these treatments must always remain secondary to proper management of the wound for without adequate debridement no antibiotic or fixation device will be adequate to prevent infection.

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References