A RADIOLOGICAL METHOD FOR PRODUCING PRECISE LIMB ALIGNMENT

M. SALEH, P. HARRIMAN, D. J. EDWARDS

Modern methods of fracture fixation allow absolute control and fine adjustment of bone alignment. Whilst it is possible to hold the bone in the corrected position, the method of checking the correction peroperatively using plain radiographs is slow, awkward, potentially inaccurate and may involve disturbance of the surgical field. A new method of assessing the reduction in the operating theatre and subsequently is illustrated and its advantages discussed. The method is most suited to the tibia but may be used for any long bone.

of the knee. The horizontal line is adjusted so that it is parallel to the plane of the joint space, along the tibial plateau (Fig. 2). The limb must be in neutral rotation with the patella facing upwards (Moreland, Bassett and Hanker 1987). The intensifier is then tracked linearly and distally to the ankle; any residual angulation and translation is corrected. If the alignment is correct then the plane of the ankle joint space will be parallel to the nearest horizontal line (Fig. 3). The rotation of the foot in relation to the knee must be checked clinically.

Fig. 1

Fig. 2

Fig. 3

Method. A perspex grid measuring $600 \times 400 \times 4$ mm with grooved lead-impregnated reference lines is used in conjunction with a mobile image intensifier. It has a central longitudinal reference line and perpendicular parallel lines at regular intervals (Fig. 1). The grid is placed in a sterile bag and positioned under the limb. Following reduction of the fracture, or corrective osteotomy, the median reference line is aligned with the centre

Difficulty in visualising the knee may be overcome by angling the intensifier 10° caudally along the axis of the limb. With a sandbag under the opposite hip the limb may also be rotated so as to align the lateral projection. The overall mechanical axis of the limb can similarly be demonstrated using a longer grid aligned with the centre of the femoral head and the centre of the ankle.

The central beam of the X-ray is perpendicular to the joint line and hence less peripheral distortion occurs than with conventional plain films. Coned radiographs of the proximal and distal joints are geometrically similar to this method. When these views were compared with conventional radiographs there was less than 0.25° difference. We have used this technique in over 50 cases, including corrective osteotomies, and both tibial and femoral fractures. Postoperative radiographs were taken for each case, demonstrating a mean accuracy of 2.5° (range 0 to 7°).

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Discussion. Accurate reduction of a long bone fracture is important, since it has been shown that degenerative changes can follow even minimal malalignment (Kettelkamp et al 1988). The maximum acceptable angular deformity in the tibia or femur has not been accurately determined (Ting et al 1987), but 15° of femoral and 5° of tibial angulation have been accepted (Mooney and Claudi 1984). Values greater than this may lead to deterioration of the articular surfaces.

The method described here is simple, reproducible, does not affect the surgical field, is more accurate than conventional plain radiography, involves less radiation to the patient and theatre staff and saves theatre time.

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TOTAL KNEE REPLACEMENT FOR METASTATIC DESTRUCTION OF THE PROXIMAL TIBIA

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Total joint replacement for metastatic disease of the hip is well established (Galasko 1986). Metastatic deposits in the proximal tibia requiring surgical intervention are rare, and we have found only one published report of prophylactic total knee replacement using a standard prosthesis for such a deposit (Beauchamp and Sim 1988). This procedure may present considerable technical challenges, but this case report demonstrates that, where successful, it can dramatically improve the quality of life for the terminally ill patient.

Case report. A 46-year-old man with advanced multiple myeloma had already undergone internal fixation for pathological fractures in all four limbs, but was now wheelchair bound and disabled by an extremely painful, large lytic metastasis in the right proximal tibia (Figs 1 and 2). There was imminent danger of fracture as only a cortical shell was left intact.

At operation packing with cement, bone grafting or internal fixation were not feasible due to the extent of the bone destruction. The collateral ligaments and the patellar tendon were, however, intact. Total knee replacement was therefore performed using a kinematic long stem 'stabiliser' prosthesis with a 21 mm tibial

component (Fig. 3). A triple mix of cement was used for the tibia and a plastic spatula was held at the back of the tibia to form a 'mould' where the posterior cortex had been completely destroyed, the spatula being removed when the cement had hardened. The alignment and stability were satisfactory (Fig. 4). It can be seen from the radiograph that the opportunity was taken to pack with cement a large distal femoral lesion previously fixed with a locking nail.

Postoperatively the patient was discharged home at eight days, pain free and able to walk. He was readmitted for terminal care nine months after the operation with no failure of the prosthesis.

Discussion. Metastatic lesions of the proximal tibia are relatively uncommon, accounting for only 36 of 399 long-bone fractures in one large series (Harrington 1988). They typically present with pain and occasionally with fracture. Where fracture has occurred, open reduction and internal fixation with plate and screws preceded by curettage and possibly cement augmentation is required. In the absence of fracture, radiotherapy and external bracing may be appropriate, particularly where life expectancy is very short. Usually there is a vascularised lytic lesion surrounded by a shell of mainly intact but unsupported subchondral bone; the risk of fracture is high, increasing sharply when more than 50% of the cortex is involved (Fidler 1981). The weakened bone may be stabilised by curettage and packing with bone cement alone, or by rigid internal fixation. Rarely, amputation may be indicated for example, when a solitary metastasis is potentially curable. The major problem presented by reconstruction and arthroplasty is stability. Frequently

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