

junction with proximal humeral resection and reconstructed using scapular prostheses with a proximal humeral prosthesis.

Plate and screw fixation was performed after curettage, dental burring, treatment with phenol and alcohol and finally, cementation of the bone defect. This was performed mainly for distal lesions. Plate osteosynthesis for diaphyseal lesions was only performed in 2 cases.

Amputations were not done as primary procedures. The 2 cases involved were due to complications of previous intramedullary nailing. One patient had extensive local tumor compression of the axillary neurovascular bundle 6 months following the primary procedure, resulting in gangrene of the arm. The other patient had a previous intramedullary rod which was causing persistent pain. The primary tumor involved was breast and renal carcinoma respectively.

Results

Of the 93 patients, 76 (82 %) had died of disease. The remaining 17 patients were alive at the time of the study or no mortality data was available. Mortality data was obtained from the patients' medical records or from the State registry of births, deaths and marriages. The mean length of follow up for the patients who were still alive was 31.7 months (The longest period of follow up being 58 months). The mean survival time of the patients who died was 13.2 months with a maximum of 51 months. 50% of patients were still alive 8 months after surgery (Figure 3).

Operative time and length of stay

The operative time was recorded from the time of skin preparation to application of the dressing. Prosthetic reconstructions took the longest operative time for completion (median 150 minutes) while insertion of intramedullary fixation was the quickest (median 75 minutes). A similar pattern was noted for length of acute hospital stay. The longest median time for hospital stay following resection and prosthetic reconstruction was 6 days compared to a median of 3 days for intramedullary nailing.

Pain control and function

Pain control was very good after intramedullary rod insertion and prosthetic reconstruction with only 8% and 13% respectively of patients having any persistent post-operative pain (Table 2). Restriction of any function was the highest after prosthetic replacement (35% for proximal prostheses, see Table 2).

Complications

Nerve palsy was the commonest complication (6 %) and the radial nerve was the one affected (Table 3). Another important and unexpected complication was pulmonary embolic phenomenon which was observed in two cases. Re-operations were performed in 2 patients (Table 2), one in a patient who had intramedullary nailing, the other in a patient who had a total elbow replacement for a distal humeral lesion. The first patient had local vascular invasion of the tumor resulting in gangrene of the arm necessitating amputation. The second patient had loosening of their prosthesis 2 years after the initial surgery and was changed to a long stem Conrad-Morrey elbow replacement (Zimmer, Warsaw, IN).

Discussion

Our results show that half of patients with metastatic disease to the upper limb remain alive at 8 months, with a mean of 13.2 months. These patients thus deserve adequate treatment of their disease despite being generally palliative. Adequate treatment should involve surgical intervention as conservative management (splints or casts) of these fractures has shown poor results. Fleming *et al* [7] demonstrated non union in 50% of cases and inadequate pain relief in 88% with conservative measures.

Pain, whether it be a result of a fracture or not, was a significant presenting symptoms in all but 2 of our patients. The surgical options addresses the primary aim of pain control, but also needs to be durable enough to allow early mobilisation in pathologically weakened bone to preserve limb function.

The majority of our patients had treatment for pathologic fracture (56%). Prophylactic treatment has been advocated by many [2,7,8] because it makes the operation technically easier, reduces the risk of complication and may also reduce the risk of developing systemic metastases [8]. We performed prophylactic surgery on 37 of 93 patients (39%) referred with persistent pain following radiation therapy. Measures to predict the risk of pathological fracture are available (Mirre's scoring system [9]) but were not formally evaluated in this study.

We used predominantly rigid intramedullary nailing with cementation in the canal and this has been successful in our hands. It is chosen when there is sufficient normal proximal and distal bone for the rod to span. If this is the case, then it is highly likely that the rotator cuff will be left intact apart from a lateral entry point for the nail which is easily repaired. These patients may be reassured that their shoulder function can be mostly preserved. Only 8% had any persistent pain and 6% restricted function of the affected limb. We have been unable to find any comparable reports of this technique in the literature. There are