CASE REPORT

Massive wrist prosthesis for giant cell tumour of the distal radius: A case report with a 3-year follow-up

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Summary We report the case of a 72-year-old woman in whom a mega wrist prosthesis was used to reconstruct the distal radius after en-bloc resection of a giant cell tumour. Three years later, her pain score was 2/10 and motion ranges were 20° of flexion, 70° of extension, 70° of pronation, 60° of supination, 20° of radial deviation, and 20° of ulnar deviation. The QuickDASH score was 52.27/100 and the Enneking score was 83%. Radiographically, the prosthesis was well aligned, with no evidence of loosening but with dorsal subluxation of the ulnar head. The outcome in this patient, together with published data, indicate that mega prosthesis use is among the treatment options for distal radius reconstruction after en-bloc resection of a giant cell tumour, provided a biocompatible, bipolar, unconstrained prosthesis is used.

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Introduction

Among giant cell tumours (GCTs), 10% involve the distal radius [1,2]. The conventional treatment is primary curettage with filling of the defect. However, the recurrence rate with this strategy is 25% to 80% and is particularly high when the tumour has breached the dorsal radial cortex and spread to the carpal bones [1,2]. Consequently, primary en-bloc tumour resection has been advocated, as lower recurrence rates have been reported with this technique [2,3].

Several methods have been suggested for distal radius reconstruction after en-bloc resection: allograft [4,5], autologous vascularised fibular graft [6,7], non-prosthetic radio-carpal [4,5,7] or mid-carpal [6] arthroplasty, partial [6] or total wrist arthrodesis, and distal ulnar translocation [8]. None of these reconstruction techniques is satisfactory.

The use of a massive prosthesis has been suggested for distal radius reconstruction in patients with recurrent GCTs [9–12]. We report the case of a 72-year-old woman managed using this technique.

Case report

This 72-year-old woman had been treated at another centre in 2008 for a GCT of the left distal radius. Curettage was performed. Given the risk of fracture due to breaching of the posterior radial cortex by the tumour, an anterior plate on the distal radius was used to achieve fixation.

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A tumour recurrence with spread to the carpal bones was diagnosed 8 months later (Fig. 1). At diagnosis, the pain intensity score on a visual analogue scale was 2/10 and motion was 40° of flexion, 60° of extension, 80° of pronation, and 90° of supination. Grip strength as measured using a Jamar® dynamometer (Arex, Palaiseau, France) on setting 2 was 21 kg on the right and 12 kg on the left.

Surgery was performed via the dorsal approach under local and regional anaesthesia as an outpatient procedure. En-bloc resection removing 7 cm of the distal radius and the proximal carpal row was performed (Fig. 2). A massive bipolar unconstrained prosthesis was used for reconstruction. The custom-made radial component was composed of a cobalt–chromium alloy in a polyethylene sleeve (Argomédical, Cham, Switzerland). The stem was introduced into the radial medullary canal and secured with acrylic cement (Palacos® gentamicin, Heraeus Kulzer, Hanau, Germany). The carpal component was taken from a standard total prosthesis (Re-Motion™, Small Bone Innovations, Morrisville, PA, USA). Primary fixation of this metal-backed carpal component was with two 4-mm screws and secondary fixation with a central peg coated with hydroxyapatite and inserted into the capitate bone. A polyethylene spacer served as the interface between the radial and carpal components (Fig. 3). The head of the ulna did not impinge on the prosthesis intraoperatively and was therefore left in place. After wound closure in layers with no drainage, a palmar splint immobilising the wrist in the neutral position was put in place. The splint and sutures were removed on day 15 and self-rehabilitation was started with no forceful movements.

The patient was re-evaluated at regular intervals. At last follow-up after 33 months, her pain score was 2/10 and motion ranges were 20° of flexion, 70° of extension, 70° of pronation, 60° of supination, 20° of radial deviation, and 20° of ulnar deviation. Grip strength was 27 kg on the right and 17 kg on the left. The QuickDASH score [13] was 52.27/100 and the Enneking score [14] was 83%. Radiographically, the prosthesis was well aligned and showed no signs of loosening. Dorsal subluxation of the head of the ulna was noted but had no major impact on pronation and supination (Fig. 4).
Massive wrist prosthesis

Discussion

Patients with GCT of the distal radius have high functional demands. The tumour does not affect their life expectancy. However, spread to the adjacent soft tissues and the close proximity of crucial anatomic structures raise challenges when reconstructing the distal radius after en-bloc resection.

An advantage of allograft reconstruction of the distal radius is the absence of donor-site morbidity and the shorter operating time compared to other techniques. However, motion range limitation can be expected after allograft reconstruction, with studies reporting 21° to 51° of flexion, 36° to 37° of extension, 72° of pronation, and 58° of supination [4,5]. In addition, complications such as infection, non-union, and allograft fracture occurred in non-negligible proportions of patients [4,5]. Finally, limited availability of allografts may create difficulties.

Reconstruction using a vascularised fibular graft has been considered a technique of choice because of the anatomic similarities between the proximal fibula and distal radius [15]. Excellent outcomes have been obtained in children due to joint surface remodelling of the proximal fibular epiphysis [7]. In adults, in contrast, the absence of joint surface remodelling results in incongruity between the radial and carpal joints with gradual dorsal subluxation of the carpal bones. Radio-carpal osteoarthritis may develop as a result. In addition, studies found noticeable motion range limitation of the wrist [16–18], with 15° to 21° of flexion, 22° to 44° of extension, 30° to 72° of pronation, and 27° to 58° of supination. Finally, the non-negligible donor-site morbidity is a further disadvantage [19].

Radio-carpal arthrodesis produces a stable wrist but eliminates all motion in the coronal and sagittal planes. Potential complications include bone graft fracture, non-union, and donor-site morbidity [18]. Arthrodesis is poorly tolerated by patients who have high functional demands.

Few publications have described prosthetic reconstruction after en-bloc resection of the distal radius. In 1957, Gold [10] reported the case of a 23-year-old patient who underwent resection of a recurrent GCT followed by reconstruction of the distal radius with a unipolar prosthesis composed of an acrylic epiphysis and metal stem. Eight years later, he was diagnosed with both a tumour recurrence and a foreign body reaction to the acrylic. Amputation was performed [11]. In 2006, Hatano et al. [9] reported en-bloc excision of a recurrent GCT followed by reconstruction with a unipolar prosthesis composed of an alumina epiphysis and metal stem. After 14 years, there was no evidence of recurrence; the Enneking score was 83%; grip strength was 22 kg compared to 31 kg on the other side; and motion ranges were 15° of flexion, 30° of extension, 30° of pronation, and 45° of supination. The radiological findings were alarming: ulnar migration of the carpal bones, ulno-carpal impingement, dorsal subluxation of the carpal bones, and radio-carpal osteoarthritis. Natarajan et al. [12] reported a case series in which 16 patients with GCT whose distal radius was reconstructed using metallic bipolar hinge prosthesis. They felt the outcomes after 6 years were encouraging, with no cases of tumour recurrence, an Enneking score of 75%, and wrist motion ranges of 25° flexion, 20° extension, 60° pronation, and 40° supination. However, long-term outcomes with massive hinge prosthesis for all joints combined are consistently disappointing and affect the feasibility of further reconstruction [20].

The complications of massive wrist prosthesis can serve to determine the ideal characteristics of a massive wrist prosthesis. Biocompatible materials must be used, as shown by reports of foreign body reactions to acrylic [10,11]. The radiological complications seen with unipolar prostheses indicate a need for a bipolar design [9]. The prosthesis must be unconstrained, as hinge prostheses are associated with a high risk of loosening [12]. Finally, as with all joint prostheses, wrist replacement surgery should be reserved for older patients, given the risk of potential mechanical complications in the long term.

The prosthesis used in our patient met these specifications. It was custom-made based on the design of the Re-Motion™ (Small Bone Innovations, Morrisville, PA, USA). The Re-Motion™ total wrist prosthesis has produced encouraging preliminary results in patients with non-neoplastic conditions. In a series of 20 wrists with a follow-up of 32 months reported by Herzberg [21], the only complications were a radiolucent line around the radial or carpal component in two wrists, both of which were asymptomatic.

Figure 4 Radiograph at last follow-up. A. Anteroposterior view. Note the absence of a radiolucent line around the radial and carpal components and the shadow cast by the polyethylene sleeve around the prosthetic stem. B. Lateral view. Note the dorsal subluxation of the head of the ulna.
Previously published data and our case report indicate that reconstruction using a massive biocompatible bipolar unconstrained prosthesis after en-bloc resection of a GCT involving the distal radius has a number of advantages compared to other techniques. The procedure can be performed on an outpatient basis and raises few technical challenges for a surgeon with experience in wrist arthroplasty. There is no donor-site morbidity. Compared to other techniques, there are no additional obstacles to subsequent radio-carpal arthrodesis by massive grafting. In our patient, function improved rapidly after the procedure. The dorsal subluxation of the ulnar head seen on radiographs may be ascribable to the incongruity between the prosthetic radial component and the distal radio-ulnar joint. This subluxation did not limit the pronation-supination range in our patient and, consequently, did not require resection of the ulnar head. Continued follow-up in our patient and reports on additional patients are needed to confirm this good result.

Disclosure of interest

S.F.: none.

References