RECONSTRUCTION OF THE DISTAL RADIO-ULNAR JOINT WITH A PROSTHESIS OF THE DISTAL ULNA IN THE TREATMENT OF A RECURRENT GIANT CELL TUMOUR

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We present a case of 35-year old left-handed woman with recurrent giant-cell tumour affecting ¼ of the distal part of the left ulna, with associated ulnar nerve involvement. After resection of the tumour and 1 cm of the ulnar nerve, the distal ulna was reconstructed with an individually designed and matched prosthesis, followed by ulnar nerve reconstruction. At 12 months follow-up the patients was free of pain, had excellent recovery of ulnar nerve function, satisfactory wrist range of motion and moderately impaired function of the left hand (DASH score 42). She returned to her original work in the office. We believe that restoration of the anatomy of the distal forearm after en block resection of the distal ulna is desirable in young, active patients, and that the prosthesis we used provides a good anatomical framework for the recovery of the function of the wrist.

Key words: giant-cell tumour, ulna, distal radio-ulnar joint

Giant-cell tumor of the bone is a benign, locally aggressive neoplasm, with low metastatic potential and is associated with substantial skeletal morbidity. Histologically the tumour is rich in osteoclast-like giant cells and contains mononuclear (stromal) cells that express RANK ligand, a key mediator of osteoclast activation (1). Distal end of the ulna is very uncommon localization of the lesion, which more frequently affects distal end of the radius (2). Management of small lesions is similar to bone cysts and includes curettage of the lesion followed by filling the cave with cancellous bone graft or polymethylmetacrylate. There is, however, a high rate of recurrence after most methods of local treatment. To prevent frequent recurrences, an adjuvant local treatment with alcohol or phenol is used. In advanced, inoperable and recurrent cases with metastases, a human monoclonal antibody against RANK ligands – denosumab was successfully tested (1).

Giant-cell tumours of the distal radius or ulna are difficult to treat because of their proximity to the wrist, multiple tendons, nerves and arteries. Treatment of advanced tumours, involving the whole epiphysis is particularly demanding, requiring radical en block resection of the tumour followed by reconstruction of the osseous defect. It is routinely performed in the distal radius involvement, but not in the distal ulna, where a Darrach-type resection may be applied (3). However, there is evidence that lack of the ulnar support of the carpus often leads to ulnocarpal instability, unstable rotation around the ulnar axis and, finally, functional impairment of the wrist and hand (4, 5). Therefore, restoration of the continuity of the distal ulna is desirable, particularly in young, active persons. To date, reconstruction of the distal ulna after radical resection was performed by implant arthroplasty (4, 6). We present a case of recurrent giant-cell tumour affecting 1/4 of the distal part of the left ulna,
with associated ulnar nerve involvement, in which after resection of the tumour, the distal ulna was re-established with an individually designed and matched prosthesis, followed by ulnar nerve reconstruction.

CASE REPORT

A 35-year old left-handed woman was referred in 2009 to our institution with a recurrent giant-cell tumor of the distal ulna. She had a painful, huge tumor at the distal forearm, mostly on the ulnar border (fig. 1a). She complained from diminished sensation and paraesthesia localized in the little and ulnar half of the ring finger. She presented also typical „ulnar“ deformation of these fingers, suggesting ulnar nerve involvement. Six months earlier, the patient underwent (outside of the Department) a curettage of the primary lesion localized in the head of the ulna, followed by cancellous bone grafting of the defect. Histological examination revealed a giant-cell tumor of the distal ulna. Present X-ray revealed a huge bone tumor of the distal ulna, much greater than the primary lesion (fig. 1b). Lung CT scanning did not reveal any pathology. A wide resection of the distal ulna and inspection the ulnar nerve was planned. Bearing in mind the size of the tumor (approximately 6 cm length) and young age of the patient, we suggested also a replacement arthroplasty of the distal ulna with an individually designed and matched endoprosthesis. The prosthesis (Implantcast GmbH, Buxtehude, Germany) was designed, based on X-rays and CT scans of the healthy wrist and forearm of the patient, regarding the necessity of resection of the bone with an oncological margin (fig. 2). The prosthesis was assumed to restore the length of the ulna and – owing to a mobile unit – the function of the distal radio-ulnar joint.

Pre-operative assessment showed static 2PD in the ring and little fingers of 10 mm, touch threshold with blue filament (0.5 g), wrist flexion-extension of 135° (92% of the other side), pronation-supination 150° (86%), total grip strength of 16 Kg (59%) and DASH score of 30 (range 0-100).

The operation was performed under general anaesthesia and with the tourniquet. Using a dorsal ulnar incision reaching the half of the forearm, the tumor was approached, exposed (fig. 3) and resected with 0.5 cm margin of adjacent soft tissues. The length of the resected ulna was 8 cm (fig. 4). Ulnar nerve was found infiltrated at the distal forearm with tumor and scar tissue and, therefore, 1 cm of the nerve had been en block resected with the tumor, after failed attempt of its detachment. Then the distal ulna with the radio-ulnar joint was re-established with the prosthesis. The stem of the radial module was inserted in the hole drilled in the distal radius. The stem of the ulnar module was preliminary inserted in the distal stump of the ulnar shaft, without cementing. Next, both parts were united by insertion of the rod of the ulnar module into a hole in the ball of the radial module. Protrud-
ing of the distal part of the ulnar rod over the ball was eliminated by deeper insertion of the stem of the module in the ulnar distal stump (fig. 5). Any necessary adjustments were made before the definitive fixation of the ulnar module of the prosthesis. Ulnar margin of triangular fibrocartilage was sutured with the sheath of flexor carpi ulnaris tendon over the radial module. Passive movements were performed to confirm a satisfactory range of pronation and supination of the forearm (fig. 6). Finally, the ulnar nerve was repaired end-to-end with the epineural suture. The forearm was immobilized for 4 weeks in an above elbow splint, in supination. Post-operative course was uneventful. Active exercises of the wrist were initiated at 4 weeks (because of nerve repair) and continued until achieving satisfactory range of motion.

The patient was followed-up at 12 months and the X-ray of the wrist and forearm showed identical situation as immediately post-operatively (fig. 7). She had no pain at movements of the wrist and no paraesthesiae. Post-operative assessment showed static 2PD in the ring and little fingers of 7 mm, touch threshold with blue filament (0.5 g), suggesting excellent recovery of the ulnar nerve. Wrist flexion-extension of 120° (82% of the other side), pronation-supination 170° (identical as in the other wrist, fig. 8), total grip strength of 15 Kg (57%) and DASH score of 42 (worse than pre-operatively). Nine months after surgery the patient returned to her original work in the office. Histopathological examination confirmed the diagnosis of benign giant-cell...
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Fig. 7. X-ray of the distal forearm at 12 months after the operation

tumor and complete resection of the lesion to healthy tissue.

DISCUSSION

Restoration of the anatomy of the distal forearm after en block resection of the distal radius or ulna is challenging (7). To date, the most common types of surgery for giant-cell tumors of the distal ulna included curettage and packing, or Darrach-type resection in more advanced stages (4, 8). Unlike in distal radius, reconstruction of the distal ulna with free vascularized fibular graft or structural allograft was not reported. However, ulnar head prosthesis combined with a simple soft tissue repair was used for failed resection arthroplasties of the distal radioulnar joint with good results (6). Distal ulnar implant arthroplasty for recurrent giant-cell tumour of the distal ulna was reported by Roidis et al. (4). An E-Centric ulnar head prosthesis (Wright Medical Technology, Arlington, TN, USA) was used to replace a 4 cm segment of the distal ulna, which was resected. The stem of the prosthesis was fixed in the distal stump of the ulna with bone cement. Two years after surgery the patient was symptom free, without any functional impairment of the upper limb (4). Our result is not so good as that of Roidis et al. (4), but our patient had more advanced and almost double-sized tumor, with additional ulnar nerve involvement. To our knowledge, this type of prosthesis was only once used in patient in the other country.

Fig. 8. Range of motion of the wrist at the final assessment at 12 months: flexion and extension (a, b) and rotation (c, d)
One year after surgery the functional outcome is in our patient slightly worse than status before operation (higher DASH score). However, the patient had resected a big segment of the distal ulna for the oncological reason, which is always associated with some impairment of the hand function, regardless of the use of implant arthroplasty. Moreover, the necessity of resection of ulnar nerve might have negative effect on final outcome, regardless its excellent recovery. Restoration of the power and acceptable dexterity of the hand allowed the patient to return to her previous job and activities and, therefore, we believe that our treatment option was correct and this case is a success. We believe that re-establishment of the anatomy of the distal ulna after resection is desirable in young, active patients, and that the prosthesis we used provides a good anatomical framework, re-establishing good function of the distal radio-ulnar joint. However, we do not know how will be patient’s wrist function in the future, since long-term observations of such prostheses are lacking.

REFERENCES


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