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Giant Cell Tumour Distal Radius in Patient with Functional Outcome after Reconstruction by En-Bloc Resection and Non-Vascularized Fibular Bone Graft: A Case Report

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Abstract

Giant cell tumour of the distal radius is the 3rd most common site after proximal tibia and distal femur. It is locally aggressive and is associated with a high rate of recurrence. Although it is usually treated with various modalities of treatment, wide resection and reconstruction with proximal fibular autograft is most commonly accepted in recurrent cases. The following is a case report of such a case with surgical management. A 22-year-old female patient complaining of pain and lump in left wrist since two years ago. The pain worsened since 1 month before consultation, but did not radiate elsewhere. Pain was aggravated by movement and relieved with rest. Physical examination revealed a 3 cm mass with tenderness over left wrist and lump size 2.5 cm, no venectasis, no shiny skin and no deformity. With clinical suspicion of benign bone tumor on left wrist, further evaluation was needed. Plain radiograph revealed an expansile, lytic lesion and soap bubble appearance on her left distal radius like a GCT. Open biopsy result revealed similar morphology with GCT. Reconstruction by en-bloc surgical excision, followed with non-vascularized fibular bone graft fixed with dynamic compression plate (DCP) and wrist ligament reconstruction and fixation of the head of the fibula with carpal bones and distal end of the ulna using K-wires along with palmaris longus tendon were performed. Reconstruction with non- vascularized fibular graft, internal fixation with DCP with trans fixation of the fibular head and wrist ligament reconstruction minimizes the problem and gives satisfactory functional results.

Keywords: Giant cell tumour; Distal radius; En-bloc resection; Fibular graft

Introduction

Giant Cell Tumour (GCT) of the bone is a locally aggressive lesion with a high tendency for local recurrence [1]. The distal radius is the third most common site for GCT occurrence and it also has the highest incidence of recurrence [2,3]. The distal radius is the third most common site of occurrence following the distal femur and proximal tibia. Many methods have been advocated for the management of distal radius GCT [4,5]. Treatment goals for GCT of the distal radius are complete excision of the tumour and preservation of wrist function. Treatment options for GCT at this site include curettage with bone grafting or cementing, en bloc resection and reconstruction with non-vascular or vascular fibular autograft, osteoarticular allograft, ulnar translocation, or end prosthesis [6-12]. These tumours are graded via the Campanacci grading system. Grade I, the tumour, is confined within the

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bone; Grade II is where the bone is expanded, and Grade III is where the tumour has broken through the cortex with soft tissue extension [13]. Therefore, Campanacci Grade II and III tumours in this region are generally treated with wide local resection and reconstruction [14,15]. The reconstruction options described in the literature include vascularized and non- vascularized osteoarticular fibular arthroplasty or arthrodesis [16-18], use of allograft [19] or osteoarticular allograft [20], the fusion of wrist with iliac crest autograft [21] and transposition of the ulna with the fusion of wrist [22,23]. We describe our series of patients treated with non-vascularized fibular graft arthroplasty. Although amputation would seem likely to be curative, it is seldom warranted in a tumor that rarely metastasizes. Usually, it can be treated by en-bloc resection and reconstruction using autogenous non vascularized ipsilateral proximal fibular graft [8-12]. This improvised technique was found to be useful in preserving the movements and functions as well as stability of the wrist. The problem of selecting proper treatment is complicated by the failure of its histologic appearance to indicate its biologic behavior [24]. The goals of treatment are to achieve satisfactory removal of the tumor, to decrease the chances of local recurrence and to preserve as much wrist function as possible. Treatment options are 1) curettage alone or with bone grafting; 2) curettage of the tumor and packing of the cavity with methyl methacrylate or 3) resection of the lesion followed by reconstruction. Although curettage and bone grafting can preserve the joint functions, it has been associated with local recurrence rate of 27% - 54% [25]. A low rate of recurrence has been noted after resection of the lesion, but a complex reconstruction procedure (arthroplasty) or arthrodesis of the wrist is required. Other procedures that may be employed to reconstruct the defect include vascularised or non-vascularised bone graft from tibia or proximal fibula, osteo-articular allograft [26] and transposition of corpus [27]. All these procedures have certain morbidity and complications associated with them, nevertheless, resection and reconstruction may be the only option in case of aggressive tumor, which erodes the cortex. Here, authors report a case of GCT of the left distal radius treated by en-bloc resection and reconstruction using autogenous non-vascularized ipsilateral proximal fibular graft.

Case Report

A 22-year-old female patient complaining of pain and lump in left wrist since two years ago. The pain worsened since 1 month before consultation, but did not radiate elsewhere. Pain was aggravated by movement and relieved with rest. Physical examination revealed a 3 cm mass with tenderness over left wrist and lump size 2.5 cm, no venectasis, no shiny skin and no deformity. The swelling at presentation histopathological examination and confirmed to be a Giant Cell Tumor. Regular follow-up schedule was initiated at 2 weeks, 6 weeks, 3 months, 1 year, 36 weeks, and 2 years postoperatively. Her functional outcome was monitored by assessing the wrist range of movements and the Mayo wrist scores. The lump had hard consistency, fixed (+), and with well-defined margin (+), radial artery still palpable with normal distal neurovascular (Figure 1). With clinical suspicion of benign bone tumour on left wrist, further evaluations were needed. Plain radiograph revealed an expansile, lytic lesion and soap bubble appearance on her left distal radius like a GCT (Figure 2). Open biopsy result revealed similar morphology with GCT. Microscopic giant cell tumor is composed of many multinucleated giant cells in a sea of mononuclear stromal cells, the nuclei of the mononuclear cells are identical to the nuclei of the giant cells (Figure 3). Reconstruction by en-bloc surgical excision, followed with non-vascularized ipsilateral proximal fibular bone graft fixed with dynamic compression plate (DCP) and wrist ligament reconstruction and fixation of the head fibula with carpal bones and distal end of the ulna using K- wire. After the reconstruction of the left wrist, the function of the left wrist is still good and no lesion from

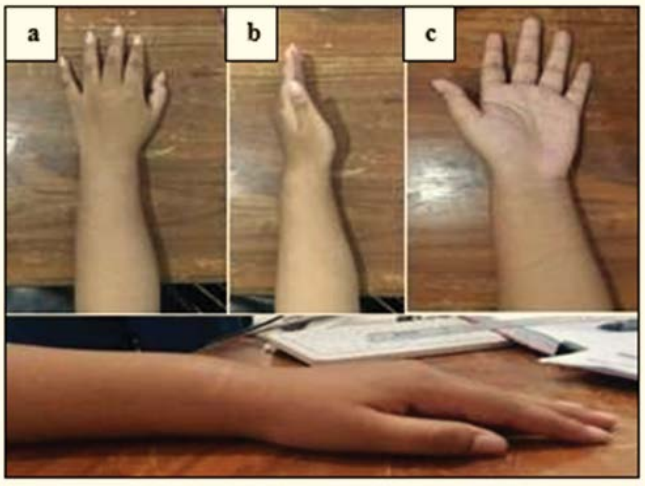

Figure 1: Physical examination on the left wrist from (a) dorsal view (b) volar view and (c) lateral view.

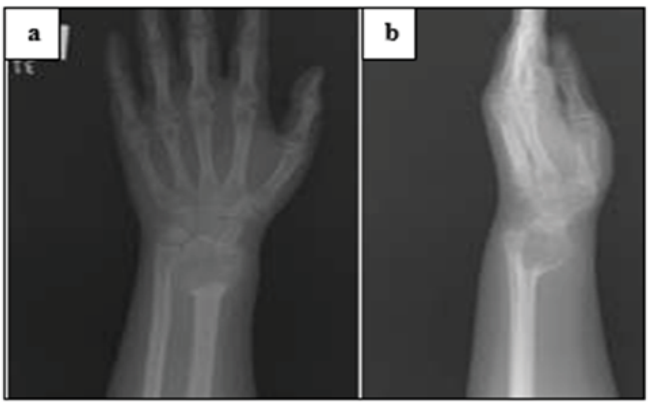

Figure 2: (a) Antero-posterior and (b) lateral from wrist radiograph showed expansile lytic lesion and soap bubble appearance like GCT.

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peroneal nerve (Figure 4 and 5). K-wire was maintained for 3 weeks and patient was planned for bisphosphonate therapy. After K-wire was removed, the function of the left wrist was still good (Figure 6). Her functional outcome was monitored by assessing the wrist range of movements and the Mayo wrist scores.

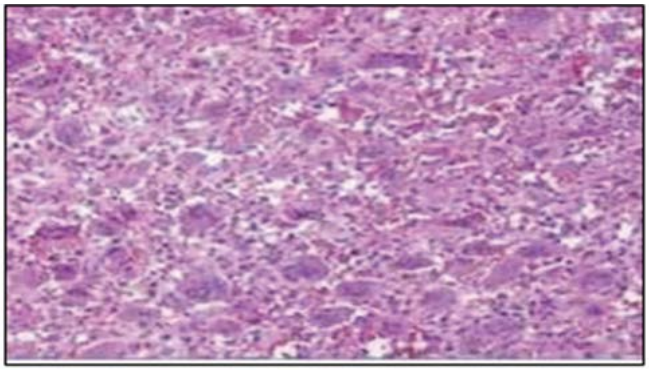

Figure 3: Microscopic giant cell tumor.

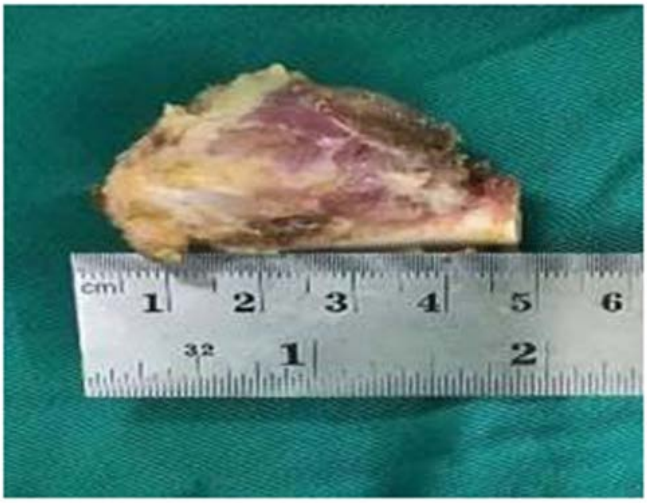

Figure 4: Tumor resection on distal radius.

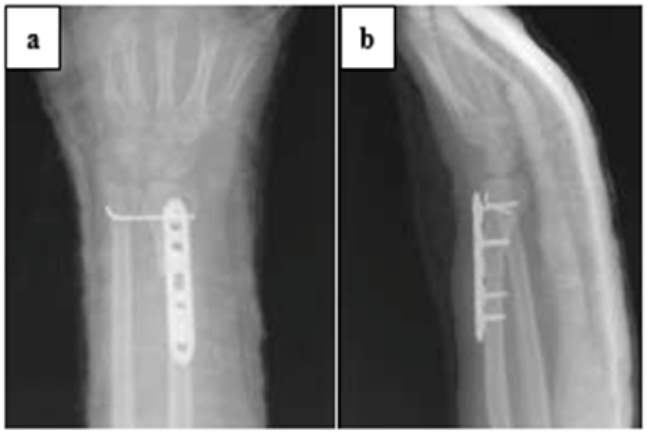

Figure 5: (a) Antero-posterior and (b) lateral view from wrist radiograph after reconstruction.

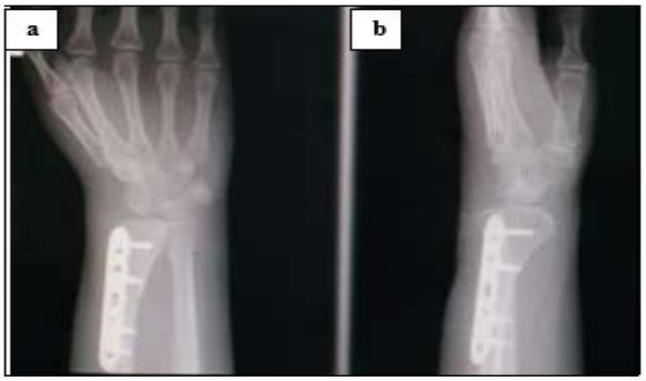

Figure 6: (a) Antero-posterior and (b) lateral view from wrist plain radiograph after removed K-wire.

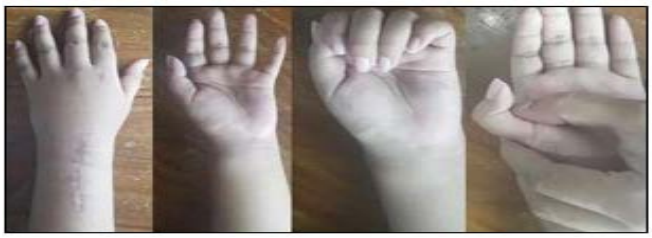

Figure 7: Clinical evaluation the active ROM of the wrist.

Discussion

Giant cell tumor of bone is locally aggressive and has a high incidence of recurrence [28] . It can also metastasize to the lung in less than 3% cases. Ten percent of the giant cell tumor of bone involved the distal radius [29,30]. They are recognized for variable behavior, which is not always related to radiographic or histological appearance [31]. Many authors reported that GCT of distal radius is particularly aggressive and has a high rate of local recurrence [32,33]. The goal of treatment is to remove the tumor, decreasing the chances of recurrence and preserve the joint function. Different modalities of treatment have been advocated for giant-cell tumor of bone, including curettage, curettage and bone grafting, curettage and cryotherapy with liquid nitrogen of the cavity, curettage and application of phenol, curettage and insertion of methylmethacrylate cement in the cavity and resection followed by allograft, autograft or prosthetic reconstruction [34] . This is a benign but locally aggressive tumour of bone composed of a proliferation of mononuclear cells with scattered macrophages [4,5]. GCT represent 5% of neoplasms of bone. GCT account for approximately 5% of all primary bone lesions and are most common between 20 and 45 years of age and there is a slight female predominance. Spinal involvement, other than the sacrum, is rare. GCT typically affect the metaphyses of long bones with preponderance for the distal femur, proximal tibia, distal radius and proximal humerus. GCT are rarely multicentric and rarely affect the tubular bones of the hands. GCT usually are solitary lesions;

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however, 1% to 2% may be synchronously or metachronously multicentric. It is unclear whether multicentric disease represents multiple primary lesions or simply bone metastases from a single primary lesion. Although these tumors typically are benign, pulmonary metastases occur in approximately 3% of patients [4]. Patients with GCT typically present with pain, swelling and often limitation of joint movement; pathological fracture is seen in 5-10% of patients. Plain x-ray of lesions in long bones usually show an expanding and eccentric area of lysis. The lesion normally involves the epiphysis and adjacent metaphysis; frequently, there is extension up to the subchondral plate, sometimes with joint involvement. Rarely, the tumour is confined to the metaphysis, usually in adolescents where the tumour lies in relation to an open growth plate, but occasionally also in older adults. Diaphyseal lesions are exceptional. Radiographically, the lesions are purely lytic. The zone of transition can be poorly defined on plain radiographs. In less aggressive tumors, a partial rim of reactive bone may be present. The lesion frequently expands or breaks through the cortex; however, intraarticular extension is rare because the subchondral bone usually remains intact. Matrix production usually is not evident within the bone but often is evident if there is soft tissue extension, soft tissue recurrence, or pulmonary metastases. Magnetic resonance imaging (MRI) is useful to determine the extent of the lesion within the bone and in the soft tissue. On MRI, the lesion usually is dark on T1 weighted images and bright on T2 weighted images. MRI also may reveal fluid- fluid levels typical of a secondary aneurysmal bone cyst, which occurs in 20% of patients. Treatment and rehabilitation of the patients with a distal radial GCT is a challenging problem for orthopedic surgeons. The importance of the radial bone in normal function of the wrist joint and significant effects of wrist malfunction on activities of daily living concern the surgeons about the treatment of these patients, especially when a young patient admits with a distal radial GCT. GCT is a challenge for orthopaedicians for cure as well as rehabilitation. The goals of treatment are to remove the tumor, reduce the chances of recurrence and preserve the joint functions as much as possible. The defect created by the resection of the distal radius can be filled by non-vascularized autologous proximal fibular graft. Local recurrence and loss of joint function are still major problems following surgery. The indications for en bloc resection would thus include pathological fractures, extensive bone involvement with large soft tissue involvement and collapse of articular surface. Frankly malignant and recurrent tumor may also undergo en block excision or amputation [6]. Resection of distal radius and reconstruction with autologous non-vascularized fibula offers several advantages like more congruency of carpal joint, rapid incorporation as autograft and easy accessibility without significant donor site morbidity. Structural change is also minimal. Moreover, immunogenic reactions are absent and bone banking facilities or graft matching procedures are not required [6-12]. In this case, reconstruction by en-bloc surgical excision, followed with non-vascularized fibular bone graft fixed with dynamic compression plate (DCP) and wrist ligament reconstruction and fixation of the head fibula with carpal bones and distal end of the ulna using K-wire. After the reconstruction we planned bisphosphonates therapy for 6 times. Bisphosphonates can treat giant cell tumor of bone because these drugs inhibit osteoclastic activity and promote osteoclast apoptosis [4]. Studies using systemic zoledronic acid in inoperable tumors have reported stabilization of both local and metastatic disease. Bisphosphonates have been proposed to be used as a surgical adjuvant or as an option in unresectable tumors; however, high-level evidence is still lacking, and further investigation is required to validate its use [35].

Conclusion

In conclusion, the en-bloc resection of giant cell tumours of the lower end radius is a widely accepted method. Reconstruction with non-vascularised fibular graft, internal fixation with DCP with transfixation of the fibular head and wrist ligament reconstruction minimises the problem and gives satisfactory functional results with good cosmetic and functional outcomes.

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