Giant cell tumor of bone (GCTB) is described as a locally invasive tumor with a high rate of recurrence and a possibility of mainly pulmonary metastases or transformation in a malignancy (1-5). It usually affects the meta-epiphyseal region of long bones, preferably the distal femur and the proximal tibia and accounts for about 4%–9.5% of all primary bone tumors in adults (1, 5-7). However, GCTB of the metacarpal bones is rare and accounts for only 2–4% of all GCTBs (6, 8-10). It occurs predominantly in the younger age group and displays more aggressive behavior (6, 11). A slight female predominance has also been suggested (6).

In this report we present a rare case of GCTB of the fourth metacarpal bone treated in two stages: the first stage included total resection of the metacarpal bone together with partial excision of the surrounding muscles and reconstruction with fibular autograft and carpo-metacarpal arthrodesis; the next stage cement-free endoprosthesis replacement of the metacarpophalangeal joint was performed.

Case report

A 41-year-old male presented with swelling over the fourth metacarpal of the right hand for the last 6 months. The swelling was sudden in onset and progressive in nature. The complaints were accompanied by a minimal reduction of the movements in the adjacent joint. On physical examination the swelling was firm in consistency and painful at palpation. The overlying skin was normal. There was no history of trauma. Screening laboratory studies were within normal limits. The radiographs (Fig.1a,b) and computed tomography (CT) (Fig. 2a-d) demonstrated a large expansile lesion involving the entire fourth metacarpal. The corticalis was strongly thinned, inflated and destroyed, but a periosteal reaction was lacking. The tumor had a characteristic X-ray cell-like look - “soap bubbles” (Fig.1a,b). The chest radiograph was normal.

An open biopsy confirmed the diagnosis of GCTB. Microscopically, the lesion consisted of mononuclear tumor cells with eosinophilic oval and short fusiform nucleus and osteoclastic multinuclear giant cells.

Precise preoperative planning was used concerning the resection of the fourth metacarpal bone and carpo-metacarpal arthrodesis. Two-stage treatment was performed. The first stage included en-bloc resection of the whole metacarpal bone together with partial excision of the surrounding muscles. The resected bone was replaced with fibular autograft transfixed with two K-wires to the fifth and third metacarpal bones and the carpo-metacarpal arthrodesis was performed. The radiographs six months after surgery presented good incorporation of the graft (Fig. 3a,b). No recurrence both clinically and radiologically one year after en-bloc resection of the fourth metacarpal bone was established. In the second stage a metacarpo-phalangeal cement-free endoprosthesis was performed (Fig. 4a,b). No recurrence was detected six months after the implantation of endoprosthesis (Fig. 5a,b).
Discussion

GCTB affecting the hand is a rare lesion that is usually diagnosed at an advanced stage and has a high rate of recurrence (2, 6, 12-14). The diagnosis of this tumor requires precise clinical evaluation, radiological imaging modalities and histopathologic evaluation (2, 6, 12, 14).

In the current literature GCTB is described as a predominantly osteoclastogenic stromal cell tumor of mesenchymal origin (15). It is composed of three cell types - the neoplastic giant cell tumour stromal cells, mononuclear monocyte cells and multinucleated giant-cells (15, 16). The cellular environment of GCTB is rich with cytokines and chemokines. A different array of them causes neoplastic stromal cells to fail to differentiate into osteoblasts and promotes the formation of excessive multi-nucleated osteoclastic cells (15, 17). Pro-osteoclastogenic cytokines (receptor activator of nuclear factor kappa-B ligand,
interleukin-6 and tumor necrosis factor) and monocyte-recruiting chemokines (stromal cell-derived factor-1 and monocyte chemoattractant protein) participate in osteoclast formation and bone resorption (15, 17).

Clinical imaging is basic for the diagnosis of GCTB (2, 6, 18). This tumor is typically presented as an eccentrically located, metaepiphyseal osteolytic lesion of long bones, but within the hand it tends to be less eccentric and most often central (2, 5, 11, 19). Periostal reaction is generally lacking. In indolent and static tumors, the margins of the lesion are well-defined, without sclerosis changes. In aggressive cases, margins are poorly demarcated and the cortex may be
thinned, distended, or destroyed with soft tissue extension (2, 5, 19). In 60% of the cases, the GCTB have a purely lytic picture, while in others it resembles a so-called “soap bubbles” type, as an expression of the reactive bone trabeculi formed in the tumor (20). Campanacci et al (21) classified GCTB in three grades: the grade-1 is a static form with minimal involvement of the cortex; the grade-2 is presented with thinned and bulged cortex and in the grade-3 the lesion penetrates the cortex and has a soft tissue component. As with the other musculoskeletal neoplasms, CT and magnetic resonance imaging (MRI) are essential in the evaluation and staging of the GCTB (19, 22). CT is useful in the evaluation of the cortical bone and could clearly present the thinning of the cortex, the pathologic fracture, the periosteal reaction and the absence of matrix mineralization (5, 23). In cases of cortex destruction and soft-tissue tumor extention MRI is superior to CT in the delineation of GCTB (5, 19, 24). Moreover, MRI could also present fluid-fluid levels typical for the aneurysmal bone cyst, thus helping in distinguishing the cyst areas from the GCTB (19).

Different treatment modalities of GCTB in the hand have been described in literature: curettage; curettage with or without different adjuncts and following packing the cavity with bone graft or methylmethacrylate bone cement; wide resection and reconstruction; amputation; disarticulation (6, 8, 12, 14, 25, 26). The curetage with or without bone grafting/bone cement is preferable in stage 1 or 2 GCTB, but carries a high risk for recurrences, from 47 to 90% (10, 14, 27). Recurrence rates seem much lower after careful curettage with additional adjuncts (6, 14, 27). In the hand, recurrence commonly presents within 1 year after surgery (8, 14, 25). In stage 3 GCTB, en-bloc resection of the affected part of the bone is the recommended treatment to avoid recurrence (6, 14, 28). The reconstructive methods include: prosthetic replacements, bony grafts from nonvascularised or vascularised fibula and from the iliac crest (6, 10, 12). However, even after en-bloc resection a high recurrence rate has been reported (6, 10, 14). In such instances amputation of the entire ray of the hand is applied (6, 10). Rarely, in cases when surgery is not feasible, radiation for the treatment of GCTB could also be an alternative option (29-31). Although rare, GCTB could metastasize in up to 10% of patients (14). Most commonly the metastases occur after repetitive local recurrences (6).

Conclusion

GCTB of the hand is a rare tumor, which nevertheless provokes quite difficult issues to solve. Prognosis, treatment and results are directly dependent on early diagnosis and adequate therapy. We present a rare case of GCTB of the fourth metacarpal with cortical destruction, treated in two stages - the first stage included en-bloc resection of the fourth metacarpal bone together with partial excision of the surrounding muscles and replacement of the defect with a fibular autograft; in the second stage a metacarlo-phalangeal endoprosthesis was performed. In conclusion, the two-stage treatment was the appropriate treatment modality of the presented case and lead to good results.

References


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