Aneurysmal bone cysts (ABCs) are benign bone tumors accounting for approximately 6% of all primary bone tumors. These lesions are locally aggressive and usually affect patients in the first 2 decades of life. About 5% of ABCs occur in the hand.1 The typical radiographic appearance of ABCs is a central, lytic, expansile metaphyseal or epiphyseal lesion that thins the cortex.2 Even though there is no evidence of malignant transformation, a high incidence of recurrence has been reported.3,4 Treatment commonly requires aggressive curettage or wide resection, which often leaves a bony defect requiring reconstruction.

Osteoarticular allograft has been widely used for postoncological reconstruction for many years.5 However, it has rarely been reported in the hand surgery literature.6

This case report describes the clinical and radiological outcomes, at 8 years’ follow-up, of an en bloc resection of an ABC of the fourth metacarpal, reconstructed using a metacarpal osteoarticular allograft.

CASE REPORT
A 21-year-old, right-handed man was initially seen owing to longstanding pain and swelling on the dorsal aspect of the right hand. Examination revealed a firm, 4 × 2 cm mass on the dorsum of the right hand. Radiographs and magnetic resonance imaging revealed an extensive osteolytic and expansile lesion with thinning of the cortical bone involving the fourth metacarpal shaft and the majority of the metacarpal head. There was also shortening of the metacarpal (Figs. 1, 2). A biopsy was obtained, and the pathology report confirmed the diagnosis of ABC. The patient
was initially offered a metatarsal bone autograft to reconstruct the postresection defect but preferred the use of allograft.

In order to avoid a significant mismatch, before surgery, we used the radiographs of the contralateral fourth metacarpal to confirm the approximate size of the allograft that was needed and plan our resection.

**Surgical technique**

A dorsal longitudinal approach was performed over the midaxis of the fourth ray. An *en bloc* resection of the tumor was completed preserving 2 cm of the fourth metacarpal base (Fig. 3). The resection specimen measured 5 cm in length. The defect was reconstructed using a metacarpal allograft and secured with a 2.0-mm locking compression plate (AO Compact Hand System; Synthes, Oberdorf, Switzerland) to the remaining fourth metacarpal base. Finally, the intact radial and ulnar collateral ligaments and volar plate were secured to the allograft head with 3-0 nylon sutures using bone tunnels (Figs. 4, 5).

After surgery, a functional position hand orthosis was applied for 4 weeks. At that point, the patient began gentle range of motion exercises and was placed in a custom volar thermoplastic orthosis for another 4 weeks.

At 8 years after surgery, he has 0° to 85° of motion at the metacarpophalangeal (MCP) joint and 0° to 95° at the proximal interphalangeal joint with a grip strength of 85% compared with the contralateral side.

**FIGURE 1:** Anteroposterior radiograph of the hand shows the expansile and lytic lesion involving the fourth metacarpal.

**FIGURE 2:** Magnetic resonance imaging demonstrates the involvement of the distal epiphysis with bony septae.

**FIGURE 3:** Intraoperative photograph demonstrates the excision of the ABC.
The patient’s pain at rest according to the visual analog scale was 0 and the Quick Disabilities of the Arm, Shoulder, and Hand questionnaire was 5. The patient was able to return to work at his full-time office position and perform all activities of daily living without difficulty or pain. Radiographs revealed no signs of recurrence of the ABC. However, partial reabsorption of the allograft joint surface was noted (Figs. 7, 8).

DISCUSSION

The treatment of ABC is still controversial. Curettage alone or combined with adjuvant therapy has been proposed.7 However, different studies have reported unacceptably high rates of recurrence and have recommended more aggressive resections, leading to challenging reconstructions.3,4

Whenever possible, preservation of the articular surface has been associated with satisfactory outcomes. Several alternatives have been reported to reconstruct nonarticular defects of the metacarpal using either vascularized or nonvascularized bone grafts. However, few reports are available regarding the reconstruction of large articular defects while preserving motion at the MCP joint.8,9 Athanasian et al10 described 2 cases of reconstruction of the distal metacarpal and MCP joint after resection of giant cell tumors using a nonvascularized fibular bone graft and a silicone MCP joint arthroplasty, positioned in the distal end of the fibular bone graft. Jones et al11 reported the same concept and reconstructed the MCP joint using a silicone prosthesis but used a free fibular vascularized bone graft instead of nonvascularized graft. Despite no recurrence being reported at 4.5 years follow-up, the authors noticed radial displacement of the proximal phalanx and subsidence of the prosthesis into the fibula.

Recently, Pallapati et al12 reported a nonvascularized metatarsal transfer as treatment of a large bony defect in 9 patients showing favorable results after a mean follow-up of 44 months. The defect was treated with a matched metatarsal autograft harvested from the foot aiming to preserve movement and function of the MCP joint.

Kotwal et al13 reported 2 cases of recurrent giant cell tumor of the head of the second metacarpal treated by marginal excision and reconstruction with vascularized toe joint transfers. In accordance with other authors, we believe that vascularized metatarsophalangeal joint may provide more sustainable results over time. However, our patient refused a proposal to harvest bone from the foot.

Ray amputation is another reasonable option for the treatment of large destructive metacarpal lesions. Several authors have reported good outcomes after fourth ray amputation, with or without translocation of the fifth ray, as a salvage alternative in difficult
The advantage of this approach is that it does not require bone graft or tissue transfer, and it can provide a good aesthetic outcome. However, loss of dexterity and grip strength have been reported after ray resection. Therefore, if possible, an attempt should be made to preserve as much of the affected ray as possible, particularly in younger patients. The use of osteoarticular allograft has been widely reported for reconstruction of segmental defects following resection of tumors. Potential complications of allograft use include risk of infection, fracture, delayed union, and resorption. However, the capacity to reconstruct large bone defects without donor-site morbidity may outweigh the risks of their use. Nonetheless, to our knowledge, there are no reports of a large metacarpal defect treated with an osteoarticular allograft at long-term follow-up.
Innocenti et al.\textsuperscript{16} reported the use of proximal interphalangeal joint allograft replacement. Their main goal was “to restore bone stock integrity that would make later prosthetic joint replacement feasible.”\textsuperscript{16} In our case, it is possible that the patient will require revision in the future owing to resorption of the metacarpal head and may eventually need a prosthetic joint replacement. Even so, thus far, the allograft has provided good bone stock that should facilitate further treatment if revision is required.

We believe that the use of large osteoarticular allografts to reconstruct metacarpal defects appears to be a suitable alternative when autograft reconstruction is not an option. Despite articular reabsorption observed at the metacarpal head on radiographs, the osteoarticular allograft alternative has provided a satisfactory outcome at long-term follow-up, without the donor-site comorbidities associated in harvesting autograft.

\textbf{REFERENCES}


