

Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

## International Journal of Surgery Case Reports

journal homepage: [www.casereports.com](http://www.casereports.com)

# Vascularized fibular graft as a surgical option for osteosarcoma of distal humerus: A case report



Achmad Fauzi Kamal\*, Anggaditya Putra, Wahyu Widodo

Department of Orthopaedic and Traumatology Cipto Mangunkusumo General Hospital/Faculty of Medicine Universitas Indonesia, Jakarta, Indonesia

## ARTICLE INFO

### Article history:

Received 7 July 2017

Received in revised form 14 August 2017

Accepted 14 August 2017

Available online 23 August 2017

### Keywords:

Osteosarcoma

Interpositional elbow arthroplasty

Fibular graft

## ABSTRACT

**INTRODUCTION:** Distal humerus is a very rare predilection site of osteosarcoma. Limb salvage surgery has widely replaced amputation for surgical treatment of most types of malignant bone sarcomas.

**PRESENTATION OF CASE:** We presented a 42 years old male with rapidly growing osteosarcoma on his right distal humerus. After induction chemotherapy, wide excision and reconstruction using free vascularized fibular graft followed with interpositional elbow arthroplasty technique was done.

**DISCUSSION:** One of the option for surgical treatment for distal humerus osteosarcoma is limb salvage surgery with free vascularized fibular graft technique. Good functional outcome and no signs of local recurrence were found during 2,5 years follow up.

**CONCLUSION:** Free vascularized fibular graft with interpositional elbow arthroplasty is a good option for management of bone sarcoma of distal humerus.

© 2017 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

The most frequent predilection sites of osteosarcoma are metaphyseal regions of the distal femur, proximal tibia and proximal humerus [1]. Osteosarcoma of distal humerus is quite unusual. Nowadays, limb salvage surgery has widely replaced amputation for surgical treatment of most types of malignant neoplasms [2]. However, skeletal reconstruction following tumor resection remains challenging with regard to limb length preservation, cosmetic, and function especially in upper extremity [3]. In reconstructing the defects, beside allograft, autograft and endoprosthesis, free vascularized fibular graft is the most favorable technique [4].

In this report, we presented a case of 42-year-old male who was diagnosed with osteosarcoma of the right distal humerus and was treated by en block resection and reconstruction with free vascularized fibular graft technique. This work has been reported in line with the SCARE criteria and cite the following paper: Agha et al. [5].

## 2. Presentation of case

A 42 years old male was referred to our institution with rapidly growing mass on his right elbow since 1 year before admission. No history of similar disease in the family. Patient work as a labour, a right hand dominant and has a normal BMI. He was a smoker until

he felt ill. The physical examination revealed a mix cystic and solid mass sizing 15 × 15 × 6 cm. The elbow was fixed in slight flexion, but no neurovascular disturbances were found (Fig. 1). Laboratory findings showed unremarkable result in complete blood count, ESR, and alkaline phosphatase. Lactic dehydrogenase was increased at level of 425 U/L (<220).

Elbow radiograph demonstrated a lytic lesion on the lateral side of the humerus that extended to the lateral condyle (Fig. 2). Magnetic resonance imaging (MRI) was suggestive to malignant bone tumor that extended to the surrounding soft tissue. No metastatic lesion were found on chest radiograph and bone scintigraphy. Histopathological result was consistent with conventional osteosarcoma (Fig. 3).

After 3 cycles of induction chemotherapy, the surgical procedures were performed by the oncologic orthopaedic team led by the author. Patient was placed on supine position without the use of pneumatic tourniquet. A double curved-S-incision was made on the lateral aspect from proximal humerus extending to the posterior elbow across the tumor mass. A careful blunt dissection was performed to separate the tumor mass with the normal tissue. During the dissection, the neurovascular bundle (radial nerve, ulnar nerve and the brachial artery) were located outside the mass, thus was able to be salvaged. Most muscle groups were conserved except for the part of muscles attached to the tumor mass (Fig. 4-A).

After exposing the whole tumor mass, osteotomies were performed outside of the transitional zone for both proximal and distal ends, ensuring a clear margin of the tumor. Distal resection margin was performed on the olecranon and the proximal one was on the proximal shaft of humerus (Fig. 4-B). Wide excision of the

\* Corresponding author at: Department of Orthopaedic and Traumatology Cipto Mangunkusumo, General Hospital/Faculty of Medicine Universitas Indonesia, Jl. Diponegoro No. 71, Jakarta, Indonesia.

E-mail addresses: [fauzikamal@yahoo.com](mailto:fauzikamal@yahoo.com), [orthofkui@gmail.com](mailto:orthofkui@gmail.com) (A.F. Kamal).



Fig. 1. Local state of the tumor mass at the right elbow.

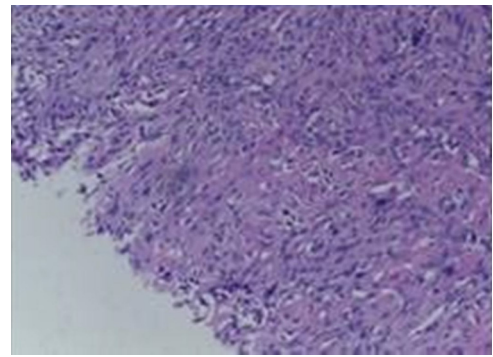


Fig. 3. Histopathological examination demonstrated pleomorphic cells with osteoid matrix (Hematoxylin and Eosin, 100×).

tumor mass was performed (Fig. 4C). Simultaneously, we harvested the ipsilateral vascularized fibular graft with 2 cm of biceps tendon and 2 cm of lateral collateral ligament still attached to fibular head. We implanted the vascularized fibular graft to the humeral defect with the head of the fibula was seated on the distal part and reshape it to articulate with the olecranon. In the proximal humerus region, we fixate the graft with the host bone using two interfragmentary screws. The olecranon was reattached with tension band construct. The articulating surface of the “new” elbow joint was optimized by interposing the biceps tendon and lateral collateral ligament between the fibular head and the olecranon (Fig. 4D).

On the postoperative radiograph (Fig. 5) the graft was well-positioned and stable. No complication nor adverse event occurred after operation. Three cycles of adjuvant chemotherapy were performed after the wound was healed. Patient adherence and

compliance was good showed by never missing a follow up visit and abide by the rule that was informed to the patient.

Six months after surgery, the patient had major functional improvement in his daily activity, showed by the increase of DASH score. The score was 37 point (ranging 0–100, with being 100 means most disable), which means the patient had a mild disability in his daily activities. After one year follow up, union was achieved on the control radiograph with no sign of local recurrence. No signs of metastasis were detected from the chest radiograph as well. The DASH score was improved to 27 point and improved even further (22.5) at 2 years follow up (Figs. 6 & 7). Unfortunately, at 2.5 years follow up, a lung metastasis occurred and created a massive pleural effusion which resulted in patient's death shortly after.

3. Discussion

As mentioned before, osteosarcoma in distal humerus is a rare entity. In this case, not only the predilection but also the age is not usual for osteosarcoma, which may give a false perception about the differential diagnosis during the first glance. But after a series of diagnostic evaluation, pathologic analysis and CPC meeting, the diagnosis of osteosarcoma was confirmed. As mentioned by Wittig et al. [6] multidisciplinary approach is mandatory to diagnose and treat osteosarcoma.

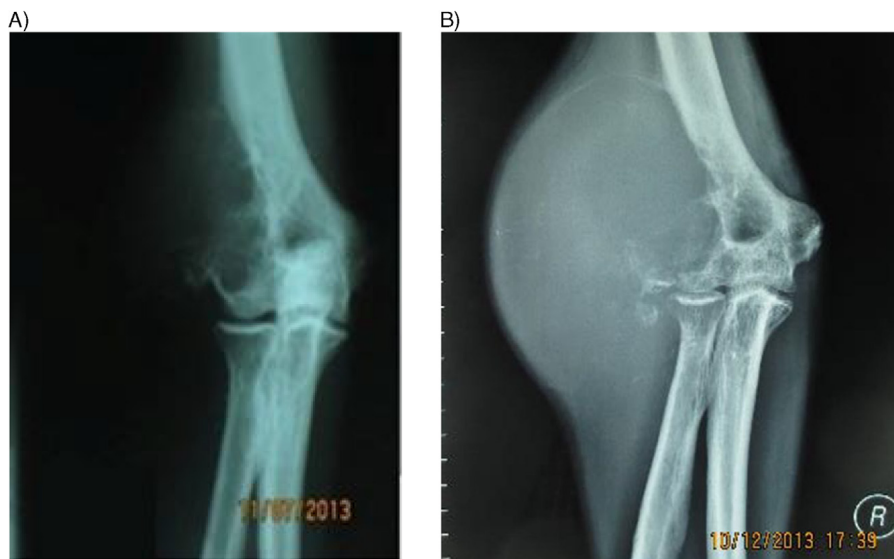
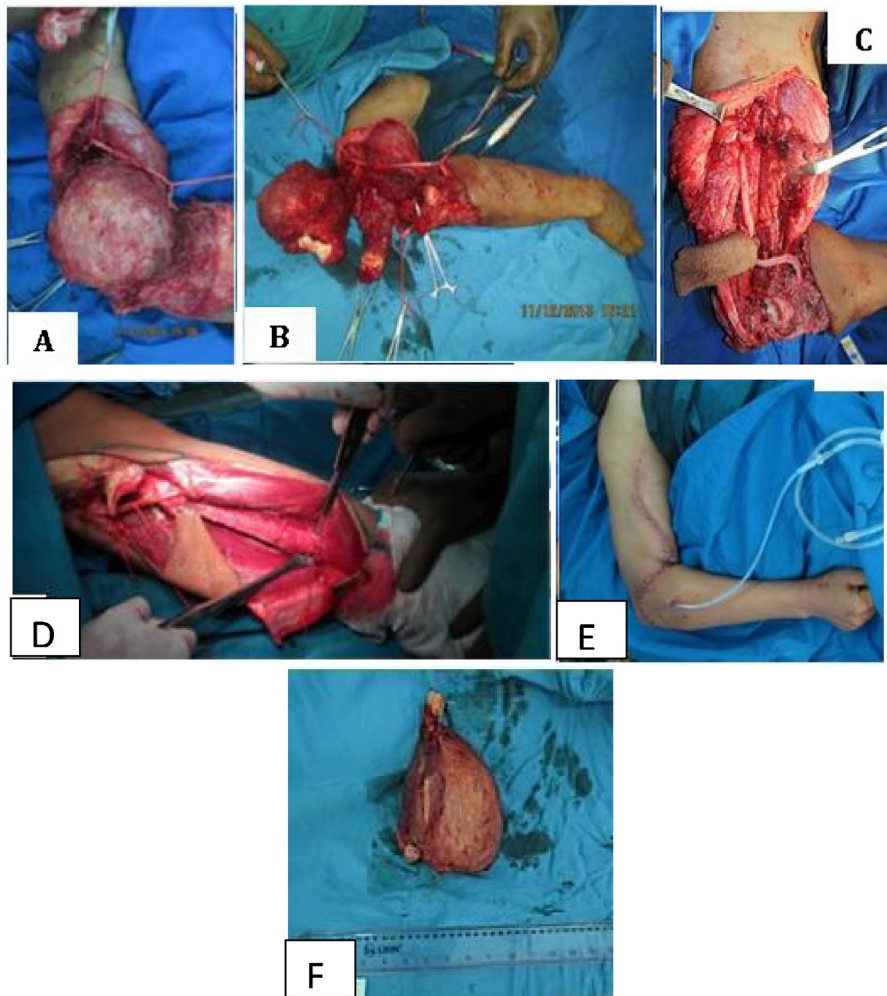


Fig. 2. Elbow radiographs: (A) a destructive lytic lesion on the lateral side of the humerus through the lateral condyle with osteoid matrix formation (before neoadjuvant chemotherapy); (B) After neoadjuvant chemotherapy, the tumor mass became bigger.



**Fig. 4.** Surgical technique. (A) Muscle groups were conserved except for the part of muscles attached to the tumor mass; (B) Osteotomy of the olecranon and of the proximal humerus for the sitting of the fibular graft, doing so exposing the whole mass; (C) Wide excision of the tumor mass was performed; (D) After implanting the fibular graft, we re-attached the olecranon back, positioned it so that the olecranon could glide along the head of the fibula and fix it with tension band wires to the proximal portion of the ulna; (E) Reconstruction of bone and soft tissues had been done; (F) Gross specimen of tumor mass.



**Fig. 5.** Postoperative X rays.

Regarding surgical options for limb-salvage, Windhager et al. [7] recommend resection–replantation, in which the tumor-bearing

area is resected as a ‘cylindrical segment’ and the distal arm is replanted with shortening. Guo et al. [8] reported 19 patients who



**Fig. 6.** Clinical picture of 2 years follow up the DASH score went up to 22.5.



**Fig. 7.** Postoperative X rays two years after surgery.

underwent total elbow arthroplasty after tumors excision at the distal humerus, had good functional outcome and decreased pain score.

Usui et al. [9] reported that inclusion of the fibular head in the free vascularized fibular graft. However, it carried a risk of fibular head collapse. As for our case, due to the tumor location on the diaphyseal area, the fibular head were also included in the vascularized fibular graft. Fortunately, in our case up until 2.5 years after surgery, no fibular head collapse were found. Elbow reconstruction were performed by replacing the distal humerus with the head of fibula and used interposition elbow arthroplasty technique to provide articulating surface to the olecranon. Interposition arthroplasty using the fascia lata is often considered to be a salvage option for the treatment of severe elbow arthritis [10,11]. We chose biceps tendon and lateral collateral ligament to wrap the head of fibula in providing cushion for the olecranon to glide. Even though in most cases, interposition arthroplasty itself doesn't provide full elbow range of motion nor good elbow stability, functional elbow movement was able to be attained. Subjectively, our patient was really satisfied with the surgery and could perform daily chores in orderly fashion. Objectively, the DASH score was increased up to 22.5 or the patient had a good functional outcome.

Unfortunately, in this case, the neoadjuvant chemotherapy showed minimal response. The postoperative histopathologic analysis showed less than 20% necrotic tissue which was consistent with HUVOS I classification. As the tumor had a little or no response to chemotherapy, the prognosis was poor.

#### 4. Conclusion

In conclusion, surgical treatment of bone sarcoma of distal humerus using vascularized fibular graft combined with interpositional elbow arthroplasty is a good option instead of shortening procedure or reconstruction endoprosthesis.

#### Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

#### Sources of funding

The authors declare that sponsors had no such involvement.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

The patient received an explanation of the procedures and possible risks of the surgery, and gave written informed consent.

#### Author contribution

AFK contributed to performed the operation, data collection, analysis and interpretation, manuscript drafting, revising, and approval for publishing; WW contributed to performed the operation, data collection, analysis and interpretation, manuscript drafting, revising, and approval for publishing; AP contributed to assist the operation, data collection, analysis and interpretation, manuscript drafting, revising, and approval for publishing.

#### Guarantor

Guarantor in this study is AFK.

#### Ethical approval

Ethical approval has been granted in this study.

## References

- [1] T.A. Damron, W.G. Ward, A. Stewart, Osteosarcoma, chondrosarcoma, and Ewing's sarcoma: National Cancer Data Base Report, *Clin. Orthop. Relat. Res.* [Internet] 459 (459) (2007) 40–47, Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17414166>.
- [2] M. Agarwal, C. Anchan, M. Shah, A. Puri, S. Pai, Limb salvage surgery for osteosarcoma: effective low-cost treatment, *Clin. Orthop. Relat. Res.* 459 (459) (2007) 82–91.
- [3] M.E. Leit, M.M. Tomaino, Principles of limb salvage surgery of the upper extremity, *Hand Clin.* 20 (2004) 167–179.
- [4] S. Onoda, M. Sakuraba, T. Asano, S. Miyamoto, Y. Beppu, H. Chuman, et al., Use of vascularized free fibular head grafts for upper limb oncologic reconstruction, *Plast. Reconstr. Surg.* [Internet] 127 (3) (2011) 1244–1253.
- [5] R.A. Agha, A.J. Fowler, A. Saetta, I. Barai, S. Rajmohan, D.P. Orgill, the SCARE Group, The SCARE statement: consensus-based surgical case report guidelines, *Int. Surg.* 34 (2016) 180–186.
- [6] J.C. Wittig, J. Bickels, D. Priebat, J. Jelinek, K. Kellar-Graney, B. Shmookler, et al., Osteosarcoma: a multidisciplinary approach to diagnosis and treatment, *Am. Fam. Physician* 65 (2002).
- [7] R. Windhager, H. Millesi, R. Kotz, Resection-replantation for primary malignant tumours of the arm. An alternative to fore-quarter amputation, *J. Bone Joint Surg. Br.* 77 (2) (1995) 176–184.
- [8] W. Guo, S. Tang, R.L. Yang, T. Ji, Total elbow arthroplasty after resection of tumors at the elbow, *Zhonghua Wai Ke Za Zhi* 46 (22) (2008) 1734–1737.
- [9] M. Usui, T. Murakami, T. Naito, T. Wada, T. Takahashi, S. Ishii, Some problems in wrist reconstruction after tumor resection with vascularized fibular-head graft, *J. Reconstr. Microsurg.* 12 (2) (1996) 81–88.
- [10] D.D. Chen, D.A. Forsh, M.R. Hausman, Elbow interposition arthroplasty, *Hand Clin.* 27 (2011) 187–197.
- [11] M.R. Hausman, P.S. Birnbaum, Interposition elbow arthroplasty, *Tech. Hand Up Extrem. Surg.* [Internet] 8 (3) (2004) 181–188.

## Open Access

This article is published Open Access at [sciedirect.com](http://sciedirect.com). It is distributed under the [IJSCR Supplemental terms and conditions](#), which permits unrestricted non commercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.