


Limb Salvage with Darrach Procedure and Single Bone Technique on Giant Cell Tumor of the Ulna (Campanacci Type 3)

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ABSTRACT

Introduction: Giant cell tumor of bone (GCTB) is a rare, benign but locally aggressive tumor that uncommonly affects distal ulna. **Case**: This case is a 30-year-old female with worsening pain, swelling, and limited wrist motion. Imaging studies revealed cortical destruction and soft tissue infiltration characteristic of an aggressive GCTB. Campanacci type 3 GCTB of the distal ulna was diagnosed and managed through limb salvage surgery using a combination of Darrach procedure and single bone technique. This combined approach aims to achieve tumor clearance while preserving limb function. Post-operative management included soft tissue closure using an abdominal flap. **Conclusion:** The case highlights the challenges in managing aggressive GCTBs of the distal ulna and demonstrates a viable limb salvage strategy. Long-term follow-up is recommended to evaluate functional outcomes and to monitor for recurrence, because tumor's aggressive nature.

Keyword: Campanacci, Darrach, giant cell tumor of bone, single bone technique.

ABSTRAK

Introduction: *Giante cell tumor of bone* (GCTB) adalah tumor jinak langka, namun agresif secara lokal yang jarang menyerang ulna distal. **Kasus:** Wanita berusia 30 tahun dengan rasa nyeri yang memburuk, bengkak, dan gerakan pergelangan tangan terbatas. Studi pencitraan menunjukkan kerusakan kortikal dan infiltrasi jaringan lunak karakteristik GCTB agresif. Diagnosis GCTB Campanacci tipe 3 ulna distal dan dikelola melalui operasi penyelamatan menggunakan kombinasi prosedur Darrach dan teknik tulang tunggal. Pendekatan gabungan ini bertujuan untuk mencapai pembersihan tumor sambil mempertahankan fungsi anggota tubuh. Manajemen pasca-operasi mencakup penutupan jaringan lunak menggunakan *flap* perut. **Simpulan:** Kasus ini menyoroti tantangan dalam mengelola GCTB agresif pada ulna distal dengan strategi penyelamatan ekstremitas yang layak. Tindak lanjut jangka panjang direkomendasikan untuk evaluasi hasil fungsional dan memantau kekambuhan, mengingat sifat tumor yang agresif. Rhyan Darma Saputra, Daffa Sadewa, Dykall Naf'an Dzikri. *Limb Salvage* dengan Prosedur Darrach dan Teknik Tulang Tunggal dan pada Kasus *Giant Cell Tumor* Ulna (Campanacci Tipe 3).

Kata Kunci: Campanacci, Darrach, *giant cell tumor of bone*, teknik tulang tunggal.

INTRODUCTION

Giant cell tumor of bone (GCTB) is a rare, benign but locally aggressive tumor that accounts for approximately 5% of all primary bone tumors.[1] While GCTB commonly affects the meta-epiphyseal regions of long bones, particularly the distal femur, proximal tibia, and distal radius, its occurrence in the distal ulna is exceptionally rare, representing only 0.3% to 0.42% of all primary bone tumors.[2,3] This rarity poses significant challenges in diagnosis and management, especially when the tumor presents as an aggressive Campanacci type 3 lesion.[4,5]

Campanacci type 3 GCTBs are characterized by indistinct borders, cortical destruction, and soft tissue infiltration, making them particularly challenging to treat.[5] The complex anatomy of the distal radioulnar and ulnocarpal articulations, combined with the proximity of the ulnar neurovascular bundle, further complicates surgical intervention in this region.[6] As a result, management of Campanacci type 3 GCTBs of the distal ulna requires careful consideration of both oncological principles and functional preservation.[6,7]

Limb salvage surgery, incorporating techniques such as the Darrach procedure and single bone reconstruction, has emerged as a viable option for treating aggressive GCTBs of the distal ulna.[4,8,9] The Darrach procedure, which involves resection of the distal ulna, can effectively remove the tumor while preserving wrist function.[8] However, this approach may lead to instability, necessitating additional stabilization techniques.[9] The single bone technique, which creates an osseous bridge between the radius and remaining ulna, can address this instability and maintain forearm function.[10] A 29-year-old male with recurrent

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distal ulna GCT underwent Darrach resection followed by constrained total joint arthroplasty, achieving excellent oncologic and functional outcomes at 2-year follow-up.[11] Similarly, a modified Sauvé-Kapandji procedure with ECU tenodesis restored stability in 9 patients, with mean Musculoskeletal Tumor Society (MSTS) scores of 28/30.[12]

CASE

History and Symptoms

A 30-year-old woman presented with worsening symptoms of pain, tingling, swelling, and limited wrist motion, accompanied by an ulcer on her left wrist. The swelling had gradually increased from the size of a marble in 2017 to a baseball in size. On physical examination, the mass was immobile, hard, and painful upon palpation, with a visual analog score of 4. These symptoms significantly impacted her daily activities and quality of life.

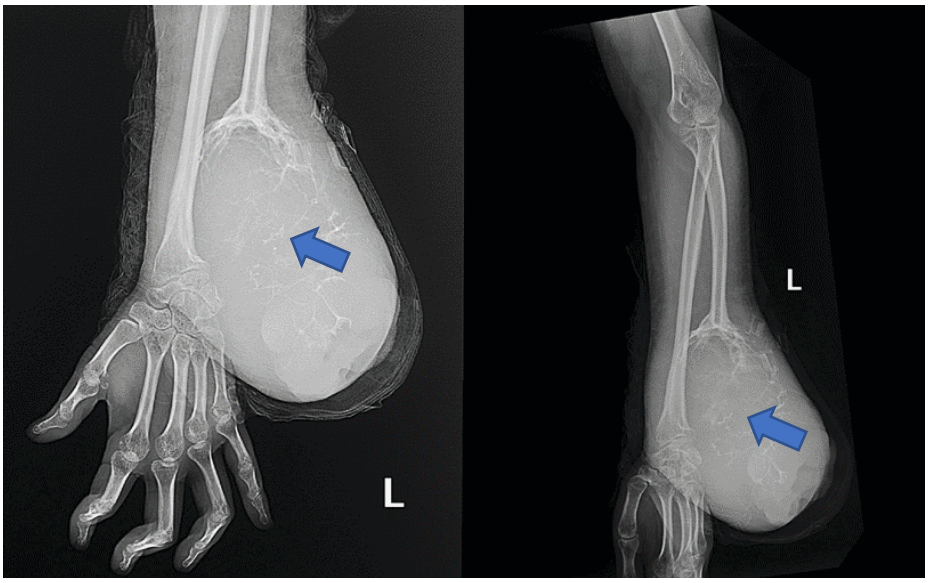

Figure 1. X-rays of the left wrist in AP and lateral views show cortical destruction and soft tissue swelling on1/2 distal left ulna (blue arrows).

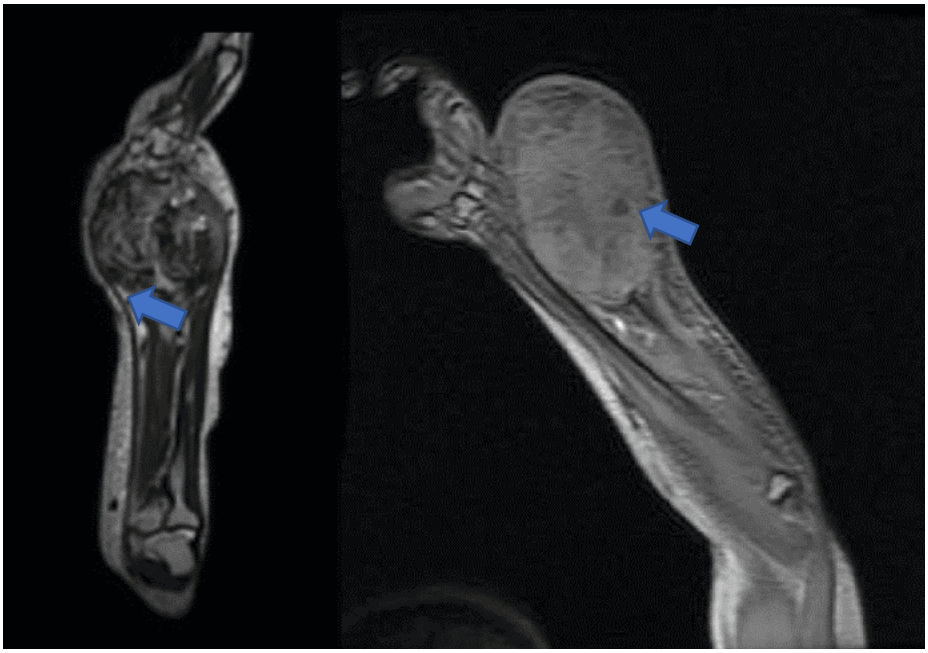

Figure 2. MRI left upper extremity with contrast shows heterointense lesion, rounded shape, firm margin, irregular border with necrotic component and blood in 1/3 distal of the left ulna bone. Lesion infiltrating surrounding soft tissue (blue arrows).

Diagnostic Imaging and Findings

Radiographic evaluation, including x-rays of the left wrist in anteroposterior and lateral views, revealed cortical destruction and soft tissue swelling in the distal third of the left ulna **(Figure 1).** Further imaging with MRI of the left upper extremity with contrast showed a heterointense lesion with a rounded shape, firm margins, and irregular borders **(Figure 2).** The lesion contained necrotic components and blood, infiltrating the surrounding soft tissue. These imaging findings were consistent with a diagnosis of Campanacci type 3 giant cell tumor of bone (GCTB), characterized by aggressive behavior and indistinct borders.

Surgical Intervention

Given the aggressive nature of the tumor and its location, a decision was made to perform limb salvage surgery using the Darrach procedure combined with a single bone technique. The Darrach procedure involved resection of the distal ulna to remove the tumor **(Figure 3).** To address the resultant instability, a single bone technique was implemented, creating an osseous bridge between the radius and the remaining ulna. This approach aimed to maintain forearm function and prevent instability. Intraoperative photographs documented the resected tumor mass, and soft tissue closure was achieved using an abdominal flap **(Figure 4**). Post-operative management focused on rehabilitation to improve limb function and long-term follow-up to monitor for recurrence.

DISCUSSION

The management of giant cell tumor of bone (GCTB) in the distal ulna presents unique challenges due to its rarity and the complex anatomy of the wrist. In this case, the Campanacci type 3 classification of the tumor was characterized by indistinct borders and cortical destruction, necessitated an aggressive surgical approach to achieve adequate tumor clearance while preserving limb function. The occurrence of GCTB in the


epiphysis of the distal end of the ulna is rare and this may be influenced by age, gender, genetics, and trauma.[11,12]

The Darrach procedure, which involves resection of the distal ulna, was chosen as the primary surgical technique. This approach is particularly suitable for cases involving extensive tumor involvement of the distal ulna, as it allows for wide excision of the affected bone.[13] The procedure effectively removes the tumor-bearing segment while potentially preserving wrist function. However, it's important to note that the Darrach procedure alone can lead to instability of the remaining ulnar stump and potential ulnar translation of the carpals, which may result in reduced grip strength.[14]

To address the potential instability following the Darrach procedure, a single bone technique was implemented. This approach creates an osseous bridge between the radius and the remaining ulna, based on the principle that "the ulna makes the elbow and the radius makes the wrist".[10] The single bone technique is designed to address symptomatic angular, axial, or rotatory radioulnar joint instability that can occur after significant ulnar resection.[15] By creating this bony connection, the technique aims to maintain forearm function and stability, which is crucial for preserving the patient's quality of life and ability to perform daily activities.[14]

The combination of the Darrach procedure and single bone technique represents a balanced approach to limb salvage in this challenging case. It allows for adequate tumor removal while attempting to preserve as much function as possible.[8] However, it's important to acknowledge that this approach may still result in some functional limitations compared to a normal wrist joint.[13]

Long-term follow-up is essential in these cases, not only to monitor for tumor recurrence but also to assess functional outcomes. The aggressive nature of Campanacci type 3 GCTBs and their tendency for local recurrence necessitate vigilant post-operative surveillance.[16] Additionally, ongoing physical therapy and rehabilitation play a crucial role in optimizing functional outcomes and helping the patient adapt to any changes in wrist and forearm biomechanics resulting from the surgery.[13]

In conclusion, the use of the Darrach procedure combined with the single bone technique represents a viable limb salvage strategy for managing aggressive GCTBs of the distal ulna. While this approach aims to balance oncological clearance with functional preservation, careful patient selection, meticulous surgical technique, and comprehensive post-operative management are crucial for achieving optimal outcomes.

Figure 3. Intraoperative photographs of the resected tumour mass.

Figure 4. Soft tissue closure using abdominal flap.

CONCLUSION

A case of GTCB of the distal ulna with Campanacci type 3 in a 30-year-old woman was reported. This case was managed by Darrach procedure and single bone technique to salvage the limb. Further rehabilitation to improve the function of the limb is recommended. Although the current condition is benign, long-term follow-up is needed to evaluate the results.

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