

# A New Technique of Reconstruction of Metacarpal After Enblock Resection of The Metacarpal for Giant Cell Tumour of Bone

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**Abstract:** *Giant cell tumour of hand bones is uncommon especially in metacarpals. Considering its more aggressive behavior and higher recurrence rate in metacarpals as compared to the other long bones, enblock resection of involved metacarpal is often required. Following resection of metacarpal, the available reconstruction techniques include metatarsal substitution, vascularized or non-vascularized fibular graft, iliac crest strut graft and endoprosthesis. We describe a new technique of metacarpal reconstruction using a metacarpal shaped spacer molded from PMMA bone cement with a partially incorporated screw inside it. The part of the screw not incorporated inside the cement spacer was used for trapezio-metacarpal arthrodesis. This new technique ensures good local control of disease, good hand function, maintains aesthetic appearance of hand and avoids graft donor site morbidities associated with other reconstruction options.*

**Keywords:** giant cell tumour, metacarpal, hand bone tumours

## 1. Introduction

Giant cell tumour is a benign locally aggressive tumour involving epiphysio-metaphyseal region of long bones in young adults. Involvement of hand bones is rare<sup>1,2,3,4</sup>. In the hand bones, it is more common in phalanges. Very few cases have been reported involving metacarpals<sup>1,2,3,5,6</sup>. Giant cell tumour of metacarpals has some different features from that of other long bones. Firstly, it has more aggressive behavior with involvement of entire length of metacarpal and soft tissue extension. Secondly, there is a limited free space in hand and exquisite sensitivity; hence small mass can produce significant swelling, pain, dysfunction and bad aesthetic appearance. Thirdly, recurrence rate is higher as compared to other long bones even after wide resection and reconstruction<sup>1,2</sup>. Ray amputation ensures good local control, however, it may hamper hand function especially if it involves the thumb and cosmetically too it is not as aesthetic<sup>3,4,5</sup>. The goals of treatment of giant cell tumour of metacarpal include good local control of the disease meanwhile maintaining good hand function and cosmesis. Enblock resection of the involved metacarpal is required for local control of the disease. Various reconstruction techniques include metatarsal substitution, vascularized or non-vascularized fibular graft, iliac crest strut graft and endoprosthesis<sup>1,2,3,6</sup>.

We describe a new technique of metacarpal reconstruction using a metacarpal shaped spacer molded from PMMA bone cement with a partially incorporated screw inside it. The part of the screw not incorporated inside the cement spacer was used for trapezio-metacarpal arthrodesis. This new technique ensures good local control of disease, good hand function, maintains aesthetic appearance of hand and avoids graft donor site morbidities associated with other reconstruction options.

## 2. Case Report

A 22 years old lady presented with painful swelling over her left thumb, insidious onset, gradually progressive for the last 6 months with restriction of movements of thumb. There was no history of preceding trauma or any associated constitutional symptoms. On physical examination, there was a diffuse swelling 6x5x5 cms over the left first metacarpal involving both dorsal and volar surfaces (Figure 1). Movements of trapezio-metacarpal joint were painfully restricted. Radiographs of the hand revealed a large expansile osteolytic lesion of the first metacarpal involving the entire length of metacarpal suggestive of giant cell tumour (Figure 2). MRI of the hand was also suggestive of giant cell tumour with soft tissue extension without involvement of neurovascular bundle or tendons (Figure 3). An incisional biopsy was performed and the histopathological evaluation revealed aggressive giant cell tumour.

As the tumour involved the entire length of first metacarpal with soft tissue extension without encroachment of neurovascular bundle or tendons, enblock resection of first metacarpal was planned. The tumour was extending to both dorsal and volar aspects of hand, so a lateral approach was used for enblock resection with a cuff of normal tissue surrounding it (Figure 4). After tumour removal, the surgical wound was irrigated first with hydrogen peroxide solution and then with phenol to counteract any residual tumour cells or satellite lesions.

Using PMMA bone cement, a spacer was prepared according to the shape and size of excised metacarpal. While the cement was curing, a 4mm cancellous screw was incorporated partially inside the spacer-metacarpal leaving the threaded portion of the screw outside the base of spacer-metacarpal. Similarly, holes were made in the head of spacer-metacarpal using 2 k-wires in two perpendicular planes while the cement was curing (Figure 5). A drill hole was

made into the trapezium and the spacer-metacarpal was fixed to trapezium by passing the threaded portion of the screw into this drill hole. Two drill holes were made at the base of proximal phalanx in two perpendicular planes. The head of the spacer-metacarpal was stabilized to the base of the proximal phalanx by "figure of 8" wiring through head of spacer-metacarpal and base of proximal phalanx using stainless steel wire (Figure 6). Wound was closed in layers. Thumb was immobilized for 3 months using thumb spica followed by mobilization of the thumb.

At 34 months follow up, there was no recurrence of tumour and hand function was good. She was able to perform pincer grasp and palmar grasp though there was restriction of thumb opposition. The aesthetic appearance of hand was well acceptable to the patient. Moreover, there was immense psychological and emotional acceptance of the procedure to the patient as her ray was saved from being amputated.

### 3. Discussion

Giant cell tumour of metacarpal bones is rare<sup>1,2,3</sup>, however, when encountered it is a quite aggressive tumour involving almost the entire length of the metacarpal at the time of diagnosis. In order to achieve long term local control of disease and to minimize the recurrence, enblock resection of the involved metacarpal is often required<sup>1,2,3,6</sup>. Following resection of metacarpal, various reconstruction options include metatarsal substitution, fibular strut with metatarsal head grafting, iliac crest with metatarsal head grafting or endoprosthetic replacement<sup>1,2,3,6</sup>. In these reconstruction options, patient has to undergo surgeries at multiple sites i.e. foot, leg and iliac crest. The surgical time is prolonged, longer post op rehabilitation time as one has to wait for longer duration till graft gets incorporated. Also there is associated graft donor site morbidity. And moreover, if there is tumour recurrence after these reconstruction surgeries, one would have already burnt all the bridges.

We recommend this reconstruction option for metacarpal giant cell tumours using PMMA cement metacarpal- spacer with incorporated screw as this technique is simple, less time consuming, preserves good hand function as well as maintains cosmeses with no donor site morbidity. This technique can also be used for other aggressive tumours of metacarpals. However, long- term follow up and more number of cases are required to establish the overall outcome of this technique.

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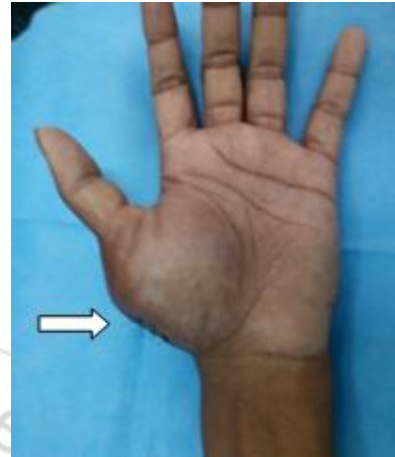
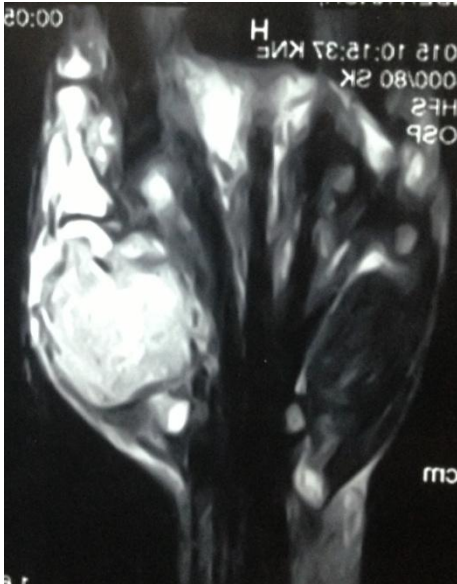


Figure 1: clinical photograph showing diffuse swelling over the first metacarpal



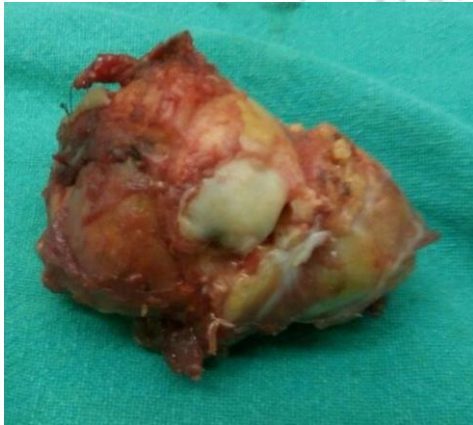
Figure 2: X-rays of the hand showing expansile osteolytic lesion involving entire length of first metacarpal



**Figure 3:** MRI image of hand showing lesion in the first metacarpal with soft tissue extension



**Figure 6:** X-rays showing first metacarpal reconstruction using spacer-metacarpal-screw technique



**Figure 4:** clinical photograph showing en-block excised first metacarpal tumour



**Figure 5:** metacarpal-spacer prepared using PMMA bone cement with a screw partially incorporated inside it. Note the holes kept at the level of metacarpal head