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RARE CASE OF CHONDROMYXOID FIBROMA OF THE THIRD METACARPAL IN AN ADULT: DIAGNOSIS, EN BLOC RESECTION, AND FIBULAR BONE GRAFT RECONSTRUCTION

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ABSTRACT **Background:** Chondromyxoid fibroma (CMF) is an uncommon benign tumor of cartilaginous origin, comprising under 1% of all primary bone neoplasms. It typically affects the metaphyseal region of long bones, and its presence in the small bones of the hand — especially the metacarpals — is rarely documented, often complicating both diagnosis and management. **Case Presentation:** A 25-year-old man presented with a year-long history of gradually worsening pain and swelling of the left hand, of insidious onset. Examination and imaging identified a clearly demarcated lytic lesion of the third metacarpal, with enchondroma and low-grade chondrosarcoma considered as differential diagnoses. He underwent en bloc resection of the involved metacarpal segment, with the resulting defect reconstructed using a fibular strut graft from the ipsilateral leg, secured with K-wire and plate fixation. Histopathology confirmed chondromyxoid fibroma with tumor-free resection margins. **Conclusion:** Metacarpal CMF is an unusual diagnosis that demands correlation of imaging findings with definitive histopathology. Treatment by en bloc resection combined with structural bone grafting yields good functional results while limiting the chance of local recurrence. Given a reported recurrence rate of 20–25% and a small but real risk of malignant change, extended follow-up remains essential.

KEYWORDS : Chondromyxoid Fibroma; Metacarpal; Hand Tumor; En Bloc Resection; Fibular Bone Graft; Benign Bone Tumor.

INTRODUCTION

Chondromyxoid fibroma ranks among the least common benign bone tumors, making up less than 1% of all primary bone tumors and roughly 2% of benign ones. Jaffe and Lichtenstein first characterised the entity in 1948 (Jaffe & Lichtenstein, 1948), noting its typical occurrence during the second and third decades of life with a modest male predominance. It most often develops in the metaphyseal region of long bones — particularly the proximal tibia, distal femur, and the bones of the pelvis and foot — while involvement of the small hand bones remains an uncommon finding, limited largely to isolated case reports (Kransdorf & Sweet, 1999).

Patients typically present with vague, slowly progressive symptoms: a dull ache and a gradually enlarging, painless swelling. Because the onset is so gradual, diagnosis is often delayed considerably. On imaging, the lesion classically appears as a sharply marginated, eccentric, lytic area bordered by a sclerotic rim, occasionally with associated cortical expansion. In small-bone disease, however, the typical lobulation and internal calcification may not be evident, which can make the radiological picture harder to interpret (Shimizu et al., 1994).

Distinguishing CMF from low-grade chondrosarcoma, enchondroma, and giant cell tumor poses the greatest diagnostic difficulty. Histopathology remains the definitive diagnostic tool, with characteristic lobules of stellate cells set within a chondroid or myxoid matrix, divided by fibrous septa and showing increased cellularity at the periphery — features not seen in malignant cartilaginous tumors (Nielsen et al., 1999). Because intralesional curettage alone is associated with recurrence in up to a quarter of cases, en bloc resection with clear margins is generally favoured (Wu et al., 1998). We describe an uncommon presentation of CMF affecting the third metacarpal in a young man, treated successfully by en bloc resection and fibular strut graft reconstruction.

Case Report

A 25-year-old man came to the Orthopaedics outpatient clinic at PESIMSR, Kuppam, reporting roughly one year of pain and swelling on the back of his left hand. He described a gradual, insidious onset with no preceding injury, fever, or other systemic symptoms, and the swelling had slowly enlarged over the year without causing any nerve or vascular symptoms.

Clinical Examination

Systemic examination was normal. On local examination, a single firm swelling — non-tender and without a pulsatile character — was noted over the dorsal aspect of the left hand, measuring roughly 3 × 2 cm and centred on the third metacarpal shaft. The skin over the swelling appeared healthy, with no erythema or sinus formation. Movement at the metacarpophalangeal and proximal interphalangeal joints of the middle finger was somewhat limited because of the mass, although the distal circulation and nerve supply were preserved.

Radiological Investigations

Anteroposterior and oblique radiographs of the left hand showed a sharply outlined, expansile, eccentric lytic area spanning the diaphysis and distal metaphysis of the third metacarpal, with the overlying cortex thinned and scalloped (Figure 1). No periosteal new bone, soft-tissue mass, or cortical breach was identified, and the pattern of bone destruction corresponded to a geographic lesion, Lodwick grade IB. MRI further characterised the mass as lobulated, isointense to muscle on T1-weighted images and heterogeneously hyperintense on T2, with internal septa visible and no aggressive soft-tissue component — findings more in keeping with a benign cartilage-forming tumor.

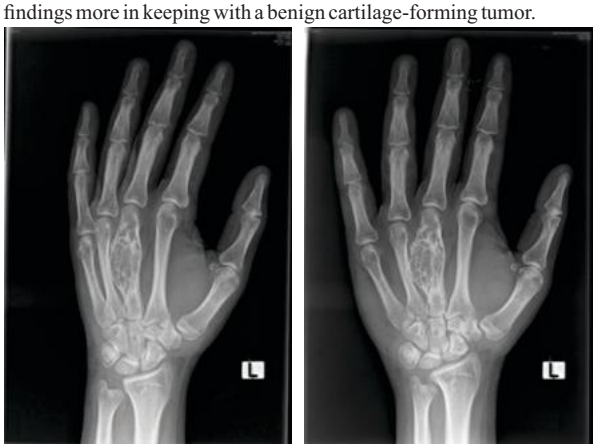

Figure 1: (a) Anteroposterior and (b) Oblique Radiographs of the Left Hand Showing a Well-defined, Eccentric, Expansile Lytic Lesion Involving the Shaft of the Third Metacarpal with Cortical Thinning and Scalloping, and no Periosteal Reaction or Soft Tissue Extension.

Differential Diagnosis

Based on the imaging appearance, enchondroma and low-grade chondrosarcoma were the two main alternative diagnoses entertained. Table 1 sets out the distinguishing features used to narrow the working diagnosis ahead of histopathological confirmation.

Table 1: Comparative Diagnostic Features of CMF, Enchondroma, and Chondrosarcoma

Feature	Chondromyxoid Fibroma	Enchondroma	Low-grade Chondrosarcoma
Location	Eccentric, metaphyseal	Central, diaphyseal	Central/eccentric, may be diaphyseal
Margin	Well-defined, sclerotic rim	Well-defined, stippled calcification	Often poorly defined
Cortical change	Thinning, scalloping	Minimal	Permeative destruction, breakthrough
Histology	Lobular, stellate cells, peripheral hypercellularity	Mature hyaline cartilage, low cellularity	Nuclear pleomorphism, permeation, mitoses
Behaviour	Benign; 20–25% recurrence if curetted	Benign; usually asymptomatic	Locally aggressive; metastatic potential

Operative Management

Following routine pre-operative assessment and after informed consent was obtained, the patient underwent surgery under general anaesthesia, positioned supine with a tourniquet on the left upper arm. A longitudinal dorsal incision was placed over the third metacarpal, full-thickness skin flaps were raised, and the extensor tendons retracted with care. After incising and reflecting the periosteum, the tumor-bearing segment of the metacarpal — roughly 4 cm in length — was excised en bloc, leaving a 5 mm margin of macroscopically normal bone on each side. Inspection of the cut bone surfaces intra-operatively showed no residual tumor.

The segmental gap left behind was reconstructed with a structural cortical strut graft taken from the patient's own ipsilateral fibula. The graft was trimmed to fit, placed in an intercalary position, and fixed using an intramedullary K-wire together with a supplementary plate, giving rigid stabilisation. The wound was closed in layers, and the resected tissue was submitted to histopathology in formalin.

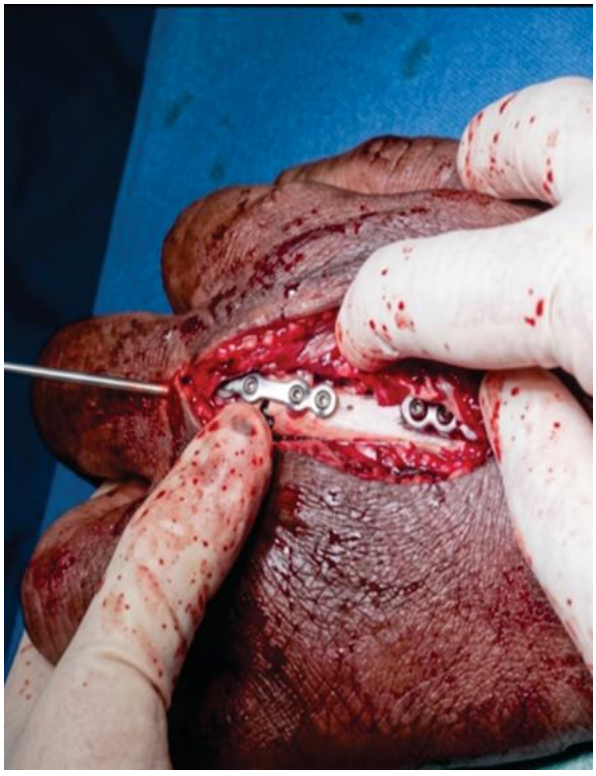

Figure 2: Intraoperative Photograph Showing the Stabilised Fibular Strut Graft Secured with Intramedullary K-wire and Mini Plates Following En Bloc Resection of the Third Metacarpal.

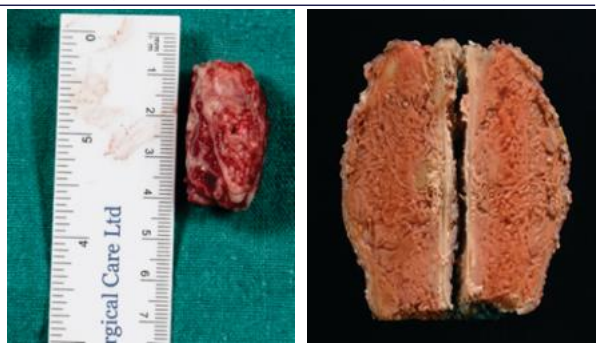

Figure 3: (a) Excised Surgical Specimen — The Third Metacarpal Segment Placed Next to a Ruler, Lesion Measuring Approximately 3.5 Cm in Maximum Dimension. (b) Bisected Gross Specimen Showing a Lobulated, Glistening Myxoid Cut Surface Filling the Medullary Cavity, Characteristic of Chondromyxoid Fibroma.

Post-operative Course and Follow-up

Recovery after surgery was unremarkable. A volar splint was used for immobilisation over the first two weeks, after which the sutures were removed and supervised active range-of-motion exercises began. Radiographs taken at successive visits showed the graft gradually incorporating into host bone. Review visits were scheduled at 2 weeks, 6 weeks, 3 months, and again at 12–18 months, by which time functional recovery had progressed steadily, as outlined in Table 2.

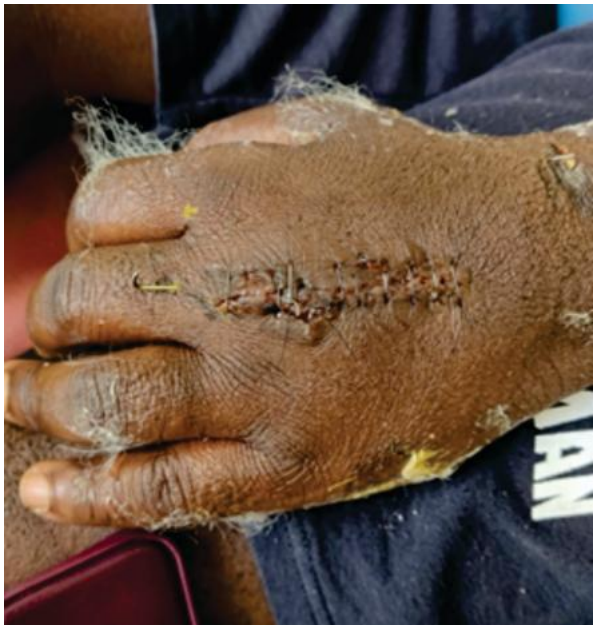

Figure 4: Clinical Photograph at Suture Removal (2 Weeks) Showing a Well-healed Dorsal Incision Over the Third Metacarpal with no Signs of Infection or Wound Dehiscence.

Table 2: Post-operative Follow-up Timeline

Time Point	Clinical Status	Radiological/Functional Findings
2 weeks (suture removal)	Wound healed, no infection	Graft in situ, hardware intact
6 weeks	Pain-free, early grip initiated	Early graft–host union on radiographs
3 months	Progressive return of grip strength	Graft incorporation progressing
12–18 months	Near-normal grip and pinch strength	Solid union, no recurrence

Histopathological Examination

Histopathology of the resected segment confirmed chondromyxoid fibroma. The microscopic picture showed lobules made up of stellate and spindle-shaped cells set in a generous myxoid and chondroid matrix, the lobules demarcated by fibrous septa with increased cell density at their periphery. There was no nuclear atypia, no mitotic activity, and no feature suggestive of malignant change, and the resection margins were clear of tumor — findings consistent with the

criteria for chondromyxoid fibroma described in the WHO Classification of Bone Tumors (WHO Classification of Tumours Editorial Board, 2020).

DISCUSSION

CMF itself is uncommon, and its appearance in the small bones of the hand is rarer still. Surveying the available English-language literature turns up fewer than 50 reported cases affecting the metacarpals and phalanges combined. Because the radiological appearance overlaps with several other benign and low-grade malignant cartilage-forming lesions, this scarcity makes CMF one of the more diagnostically tricky bone tumors an orthopaedic surgeon is likely to encounter (Guner et al., 2024).

In our patient, the clinical picture — gradual onset, slow growth, and a firm lytic lesion in a young adult — matched what has previously been described for metacarpal CMF. The imaging too showed the expected pattern: an eccentric, sharply marginated lytic lesion with sclerotic margins, cortical thinning, and geographic bone loss, without periosteal reaction or soft-tissue spread. Such findings should prompt consideration of CMF whenever a young patient presents with a lytic metacarpal lesion, helping separate it from the more centrally located enchondroma and from the more aggressive imaging features typical of malignancy (Kransdorf & Sweet, 1999; Shimizu et al., 1994).

Perhaps the greatest diagnostic hazard is mistaking CMF for low-grade chondrosarcoma on histological grounds, since both share a chondroid matrix, stellate cell morphology, and areas of increased cellularity that can trip up a less experienced pathologist. What sets CMF apart is the absence of permeative destruction, cortical invasion, a soft-tissue mass, or nuclear pleomorphism, together with its characteristic lobulated growth and peripheral hypercellularity (Mirra et al., 1985). Where the picture remains ambiguous, immuno-histochemistry can offer additional clarity.

From a treatment standpoint, simple curettage is associated with recurrence in roughly 20–25% of cases, and some series report rates as high as 35% when small bones are involved (Wu et al., 1998; Rahimi et al., 1972). Table 3 sets these figures against the outcomes seen with en bloc resection, the strategy used in this case.

Table 3: Recurrence Rates by Treatment Modality (Literature Comparison)

Treatment Modality	Reported Recurrence Rate	Source
Intralesional curettage alone	20–25% (up to 35% in small bones)	Wu et al., 1998; Rahimi et al., 1972
En bloc resection (present case approach)	Low; consistently reduced vs. curettage	Zillmer & Dorfman, 1989
Malignant transformation (any treatment)	Exceedingly rare; isolated reports	Literature review

The en bloc approach we used here aligns with reports of consistently lower recurrence compared with curettage, and is particularly justified when the tumor occupies a structurally important segment of the metacarpal (Zillmer & Dorfman, 1989). A fibular strut graft was selected for reconstruction given its cortical strength, the relative ease with which it can be harvested, and its established record in bridging intercalary defects of the hand. Combining an intramedullary K-wire with a dorsal plate added further stability, supporting earlier graft incorporation and a smoother path to rehabilitation. Reported functional results after fibular grafting of the metacarpal are generally good, with most patients regaining near-normal grip and pinch strength by 12–18 months — a trajectory mirrored by our patient's recovery, as shown in Table 2.

Malignant transformation of CMF is an exceptionally rare event, documented only in scattered case reports and typically linked to prior radiotherapy. Even so, the possibility justifies sustained clinical and radiological follow-up — annual plain films for at least the first five years are a reasonable approach, with biopsy reserved for any recurrence that enlarges rapidly.

CONCLUSION

This case is a reminder to keep chondromyxoid fibroma on the differential when a young patient presents with a slowly enlarging lytic lesion of the hand, even though the diagnosis is uncommon. Metacarpal CMF can be difficult to recognise because of its rarity and its radiological similarity to more frequently encountered lesions, and histopathology remains essential for a definitive diagnosis. Treating it by en bloc resection with structural bone grafting achieves strong local control and preserves hand function while limiting recurrence, though careful, prolonged follow-up continues to matter.

Acknowledgements

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Conflicts of Interest

None declared.

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Ethical Approval

Approval was obtained from the Institutional Ethics Committee, and the patient provided written informed consent for publication of clinical details and accompanying images.

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