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Case Report

Symptomatic Pedicle Ossification Following Fibular Free Flap Reconstruction: Case Report and Review of the Literature

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Abstract

Ossification of the vascular pedicle following fibula free flap (FFF) reconstruction is an uncommon and typically asymptomatic complication. Symptomatic cases requiring intervention are rare. We report a 29-year-old man with anterior maxillary osteosarcoma who underwent tumor resection followed by reconstruction with an osteocutaneous FFF. Calcification within the surgical site region was noted on imaging at two months after fibular reconstruction. By five months, he developed progressive trismus and pain with mastication. Computed tomography demonstrated a calcified structure extending from the mandible to the reconstructed maxilla along the flap pedicle, raising concern for tumor recurrence. Surgical excision was performed, and histopathology revealed benign woven bone without evidence of malignancy. Postoperatively, trismus improved, and flap viability was preserved. Retained periosteum during FFF harvest maintains osteogenic potential and may result in pedicle ossification. In symptomatic patients, particularly when recurrence is suspected, surgical resection is both diagnostic and therapeutic.

Keywords: pedicle ossification; fibula free flap; head and neck cancer; head and neck reconstruction; osteosarcoma; plastic and reconstructive surgery; case report

1. Introduction

The fibula free flap (FFF) is widely used for reconstruction of large maxillofacial defects requiring osseous tissue, particularly in the maxilla and mandible. Subperiosteal dissection during flap harvest may increase pedicle length; however, retained periosteum combined with mechanical stress can lead to ossification of the vascular pedicle [1–10]. This phenomenon may present clinically as a facial mass, trismus, or mastication pain and is typically diagnosed with computed tomography imaging. Symptomatic cases may require surgical excision. We present a case of a 7 cm ossified vascular pedicle following maxillary reconstruction for osteosarcoma, describe its surgical management, and review the current literature.

2. Case Presentation

A 29-year-old man presented with a progressively enlarging anterior maxillary mass associated with upper lip deformity and dental displacement. Physical examination revealed a firm, fixed, violaceous lesion involving the anterior maxilla. Computed tomography

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demonstrated a 4 cm × 3 cm × 3 cm expansile lesion with bony destruction, local invasion, and associated cervical lymphadenopathy. Incisional biopsy confirmed low-grade osteosarcoma (Figure 1A), while nodal biopsy was negative for metastatic disease. The tumor was staged as cT4aN0M0, and the patient began neoadjuvant chemotherapy consisting of cisplatin, doxorubicin, and high-dose methotrexate.

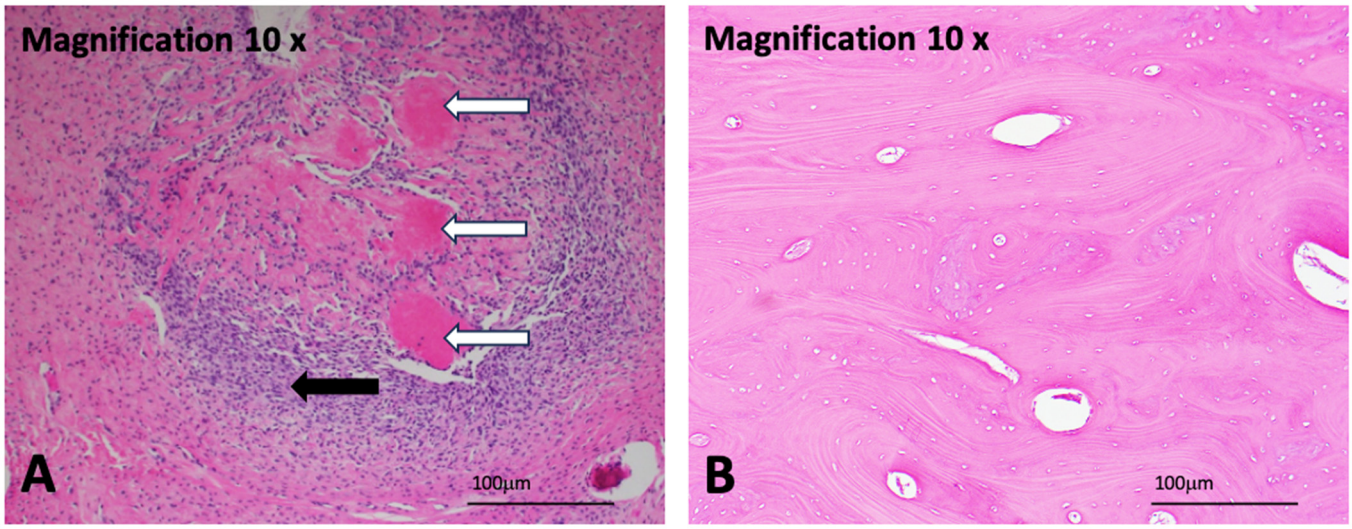


Figure 1. (**A**) Pathology slide with hematoxylin and eosin staining from the tumor excision demonstrates well-differentiated, low-grade osteosarcoma with characteristic hypercellularity and ovoid neoplastic cells with eosinophilic cytoplasm (black arrow). There is collagenous amorphous stroma consistent with osteoid formation. The neoplastic bone is fibrillar in appearance (white arrows). Hematoxylin stains nuclei blue-purple, while eosin stains cytoplasm and extracellular matrix pink. (**B**) Pathology slide of the ossified pedicle demonstrates a benign fragment of dense woven bone.

After three cycles, interval imaging demonstrated tumor reduction, and the patient underwent maxillectomy, palatectomy, and neck dissection with immediate reconstruction using a scapular tip free flap. The scapular flap subsequently failed due to postoperative vascular compromise and was removed, and the defect was temporarily managed with an obturator. Secondary definitive reconstruction (after initial scapular flap failure and completion of neoadjuvant chemotherapy) was performed six months later using a left osteocutaneous fibular free flap. The peroneal artery and venae comitantes were anastomosed to the right facial artery and external jugular vein, respectively. The postoperative course was uncomplicated, and the patient was discharged on postoperative day 10 with a viable flap.

Two months after fibular reconstruction, surveillance CT imaging demonstrated focal calcification near the right masseter muscle. Although initially indeterminate, the finding prompted close follow-up given the patient's oncologic history. Over subsequent months, he developed progressive trismus, mastication pain, and right-sided facial fullness. Repeat imaging revealed a 7 cm ossified structure extending from the mandibular ramus to the reconstructed superior alveolar ridge along the vascular pedicle (Figure 2A). Given radiographic progression and concern for tumor recurrence, operative exploration was performed.

Through a transoral approach, the ossified pedicle was identified. The lateral aspect of the pedicle was completely calcified, whereas the peroneal vessels remained patent medially. The bony overgrowth adhered to both the reconstructed maxilla and mandibular ramus, forming a rigid connection that restricted jaw motion. The ossified segment was resected using a reciprocating saw, and adjacent bony prominences were contoured with

a drill to restore mobility. Postoperatively, the patient experienced marked improvement in trismus. Histopathology confirmed benign woven bone (Figure 1B) without evidence of osteosarcoma recurrence. Follow-up CT confirmed complete removal of the ossified segment (Figure 2B), and the fibular free flap remained viable.

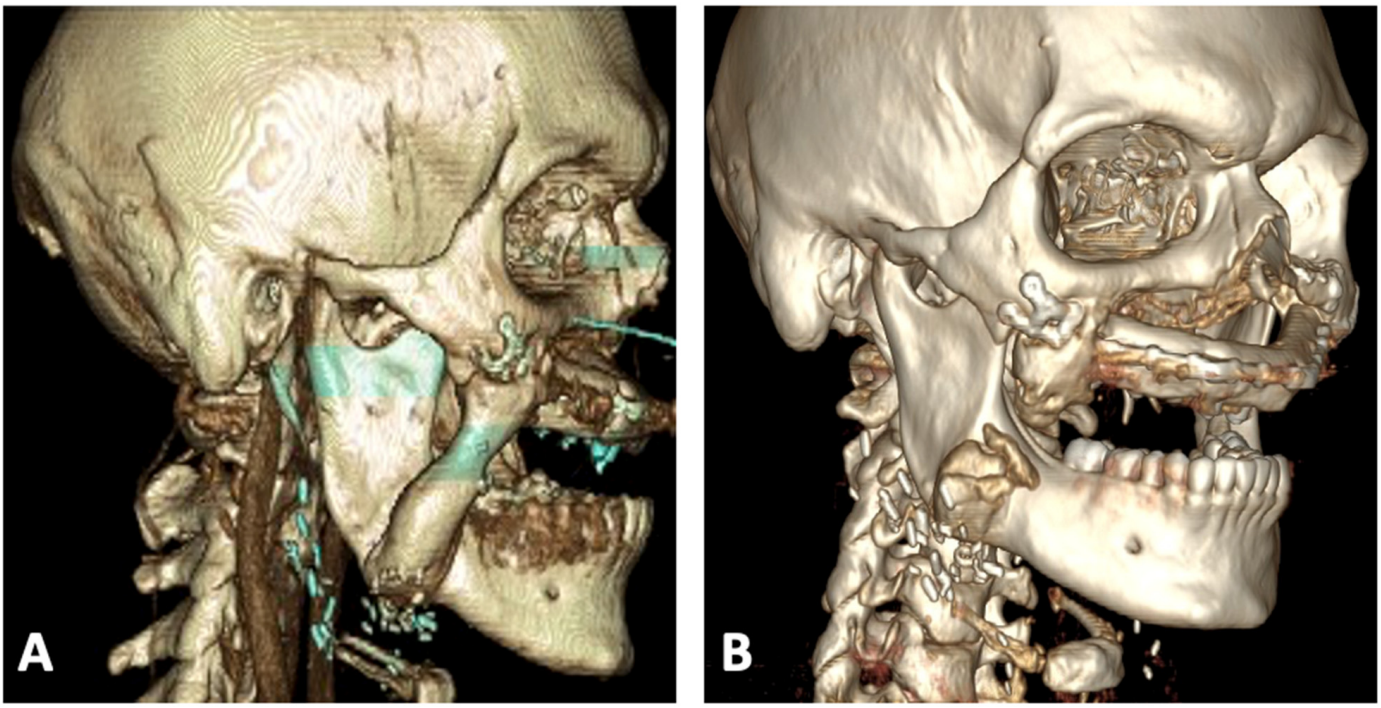


Figure 2. CT images with 3D reconstruction demonstrating: (**A**) preoperative bony ossification of the pedicle and (**B**) postoperative successful resection of the bony segment.

3. Discussion

Vascular pedicle ossification following fibula free flap reconstruction is a recognized but likely underreported phenomenon. Reported incidence varies widely, with higher detection rates in series performing routine postoperative imaging rather than imaging only symptomatic patients (Table 1) [3–6,11–14]. This variability suggests that asymptomatic ossification may be more common than clinically appreciated.

Table 1. The incidence of fibular free flap pedicle ossification reported in the literature varies significantly depending on the imaging protocol.

Study	Incidence	No. of Patients
Autelitano et al., 2008 [4]	4%	4/100
Myon et al., 2012 [3]	9.4%	14/149
Tarsitano et al., 2013 [6]	17%	7/41
Karagozoglu et al., 2013 [11]	27%	20/74
Baserga et al., 2018 [14]	4.4%	3/68
Kim et al., 2019 [12]	6.8%	6/88
Wood et al., 2020 [13]	21%	21/100

The pathophysiology likely relates to the osteogenic potential of retained periosteum along the vascular pedicle. Periosteal tissue contains progenitor cells capable of osteoblastic differentiation, particularly when stimulated by bone morphogenetic proteins and local

inflammatory mediators [8,9,15–17]. Experimental and clinical studies have demonstrated heterotopic bone formation when periosteum remains attached to the pedicle. Conversely, meticulous periosteal stripping during flap harvest has been associated with lower ossification rates, although this technique may increase operative complexity and theoretically risk pedicle injury [12,18–20]. Tarsitano et al. reported no ossification when the periosteum was dissected from the pedicle compared with a 17% incidence in controls [6].

Mechanical stress also appears to contribute. Mechanotransduction and micromotion-induced callus formation suggest that repetitive functional forces may stimulate osteogenesis in susceptible periosteal tissue [10]. This may explain the higher frequency of ossification in maxillary reconstruction, where the pedicle traverses the buccal space near active masticatory musculature [21–23]. Myon et al. reported on 149 patients who underwent fibula free flap surgery, 10 of whom underwent maxillary reconstruction and 139 underwent mandibular reconstruction. The overall rate of vascular pedicle ossification was 9.4%; however, the rate was much higher in maxillary reconstructions (50%) compared to 6.4% of mandibular reconstructions [3].

Recipient vessel selection and pedicle orientation may further influence ossification. In this case, anastomosis to the facial artery resulted in a pedicle trajectory through the buccal space near the masseter and medial pterygoid muscles, likely subjecting the periosteum to repetitive mechanical stress. Minimizing excess pedicle length, avoiding direct contact between retained periosteum and native bone, and routing the pedicle away from high-motion regions may reduce the risk of clinically significant ossification.

Most cases are asymptomatic and incidentally detected. When symptoms occur, they typically include mass effect, trismus, mastication pain, or, rarely, ankylosis. In oncologic patients, new calcification along the pedicle may raise concern for tumor recurrence, particularly in osteogenic malignancies. Correlation with clinical findings and histopathologic confirmation is therefore essential.

For symptomatic patients, surgical excision is both diagnostic and therapeutic. Prior reports and our experience demonstrate that pedicle resection does not compromise flap viability, and recurrence after excision appears uncommon. Awareness of this complication is especially important in maxillary reconstruction, where functional impairment may be significant.

4. Conclusions

Pedicle ossification following fibular free flap reconstruction is an underrecognized complication with variable incidence. Retained periosteum and mechanical stress contribute to its pathogenesis. Symptomatic cases presenting with trismus, pain, or mass effect should undergo surgical excision. Recognition of this entity is particularly important in maxillary reconstruction to avoid misdiagnosis of tumor recurrence.

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Abbreviations

The following abbreviations are used in this manuscript:

FFF	Fibula free flap
CT	Computed tomography

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