

Pectoralis Major Myocutaneous Flap Failure in Cheek Reconstruction: A Case Report with Review of Controversial Considerations

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Abstract:

Background: Pectoralis Major Myocutaneous Flap (PMMCF) is a commonly used approach in reconstructive surgery for defects in the head and neck region, especially for closing cheek defects. Although flap failure is uncommon, it significantly impacts patient morbidity and diminishes quality of life, making investigation into its causes important.

Methods: A case of pectoralis major myocutaneous flap failure following cheek reconstruction is presented. A focused literature review was conducted through PubMed, Scopus, and ScienceDirect to identify studies reporting PMMCF complications, proposed etiologic mechanisms, and management considerations in head and neck reconstruction.

Results: The literature review identified multiple studies reporting pectoralis major myocutaneous flap complications in head and neck reconstruction, most commonly venous congestion and partial flap necrosis. Reported failure mechanisms were heterogeneous, with pedicle compression, tunneling-related tension, infection, and patient-related factors emerging as recurrent themes.

Conclusion: PMMCF has a multifactorial etiology. Close postoperative monitoring is essential to detect early complications and optimize outcomes. PMMCF is insufficient for stage 3 defects, worsened by poor vascularization and oxygenation.

Keywords: Pectoralis Major Myocutaneous Flap failure; Oral cancer reconstruction; Squamous cell carcinoma, Adjuvant therapy

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Introduction

The pectoralis major myocutaneous flap (PMMCF) remains a reliable reconstructive option for full-thickness cheek defects following radical excision of advanced oral squamous cell carcinoma (OSCC).^{1,2} It offers an easy harvest, a dependable

vascular supply, and sufficient tissue volume, making it especially useful in centers lacking microvascular expertise.³ However, flap-related complications still occur, and total flap failure adds significant morbidity, delays adjuvant therapy, and impacts

patient prognosis.⁴ Risk stratification models suggest that outcomes are worse in complex cases, particularly those with comorbid diabetes, chronic tobacco use, or previous chemoradiotherapy.⁴⁻⁶

Numerous studies have proposed contributing factors, including pedicle compression, perforator disruption, infection, lower margin of skin island, concurrent tracheotomy, diabetes mellitus, mandibular plate reconstruction, prior radiation, and perioperative blood transfusion.⁷ Nonetheless, the precise pathophysiology of PMMCF necrosis remains contentious, as clinical experiences vary and standardized predictors are lacking.^{7,8} This ambiguity continues to fuel debate in oncologic oral and maxillofacial

reconstructive circles and underscores the importance of documenting and analyzing flap failures in detail.^{4,9}

Case Description

A 51-year-old man presented with a progressively enlarging, painless swelling in the left cheek, which had increased in size in the last four and a half months. The mass was firm on palpation and had reached a size of approximately 6–8 cm at the time of evaluation. In the absence of conventional risk factors, his long-term occupational exposure to vehicular pollutants, UV radiation, and poor dietary patterns may represent significant contributors to oral carcinogenesis.^{10,11} The macroscopic appearance of the lesion is shown in Figure 1.



Figure 1. Macroscopic appearance of oral squamous cell carcinoma at left cheek region

On clinical examination, the lesion was fixed to the underlying left mandible region, a 9 x 8 cm mass presenting with irregular borders, involving both the buccal mucosa, mandible bone, and overlying skin. Palpable, firm lymph nodes were noted along the left cervical region. Contrast-enhanced computed tomography (CT) was performed and revealed a solid mass

originating from the left mandible extends anterolaterally into the left masseter, medially into the right medial pterygoid, erodes the mandibular ramus and corpus. Cervical ultrasonography showed Multiple inhomogeneous isoechoic lesions with well-defined, irregular margins and internal echoes at left neck region, as shown in Figure 2.

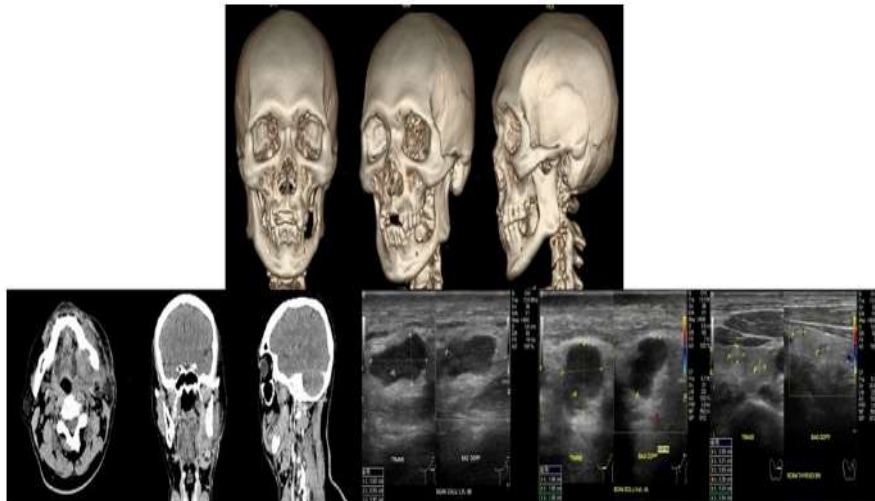


Figure 2. CT Imaging and Cervical Ultrasonography

Histopathologic evaluation of an incisional biopsy confirmed a well-differentiated squamous cell carcinoma of the buccal mucosa. The clinical stage was assigned as T4aN2bM0, indicating bone invasion and multiple ipsilateral lymph node metastases without confirmed distant spread.¹²

Radical surgery was performed, consisting of a segmental mandibulectomy, wide excision of the involved buccal mucosa and skin, and a modified radical neck dissection (levels I–V) (Figure 3). Due to the extensive full-thickness defect and the unavailability of microvascular reconstruction support, an

immediate reconstruction was done using a pedicled pectoralis major myocutaneous flap (PMMCF). The flap was raised using standard technique, preserving the thoracoacromial pedicle. A skin paddle measuring 10 × 9 cm was tunneled to the defect site and inset without undue tension. A bipaddle configuration was used, in which the epithelialized skin paddle provided intraoral lining while the external surface was used for cutaneous cheek coverage. Intraoperative assessment confirmed adequate perfusion, and the vascular pedicle remained intact.



Figure 3. Intra-operative

Duration of surgery: 120 min; estimation of blood loss: 350 ml; duration of hospital stay: E5 days. The patient received ceftriaxone 1g twice daily, metronidazole 5 mg thrice daily, ketorolac 30 mg twice daily, omeprazole 40 mg twice daily, methylprednisolone 125 mg thrice daily. Post-operative histopathology confirmed SCC proliferation. By postoperative day (POD) 2, early signs of compromised flap viability were observed, characterized by several areas exhibiting purplish discoloration (Figure 4). This condition progressed by POD 3, the flap began to exhibit progressive

swelling accompanied by purplish discoloration. On POD 4, the swelling worsened and the flap surface appeared tense and glossy, raising concerns for venous congestion. This condition progressed with notable blackening in the distal portions of the flap, strongly indicative of early superficial necrosis. In response to the progressive tissue deterioration, necrotomy debridement were performed on POD 10 to remove non-viable tissue and optimize the wound bed for subsequent healing. Following this intervention, the patient proceeded with the planned course of adjuvant radiotherapy



Figure 4. Post Operative

Despite salvage attempts through conservative measures such as IV heparin 5000 IU every 8 hours, supplemental oxygen, and meticulous wound care, but the necrosis continued to progress. Debridement performed on POD 10 resulted in an insufficient viable skin paddle to achieve definitive closure. Given the urgency to initiate adjuvant chemoradiation, secondary flap reconstruction was deferred, and the wound was managed conservatively. Adjuvant therapy commenced on POD 32, exceeding the generally recommended six-week window for timely oncologic intervention.

The multidisciplinary team deciding on the treatment options included oral &

maxillofacial surgeons, oncologists, radiotherapists, radiologists. The decision was made to treat the patient with the surgical approach with postoperative radiotherapy (PORT). Considering the patient's age, general history, the size and progression of the tumor, the prognosis was poor. Written informed consent was obtained from the patient for the use of clinical data and publication of this case report.

Literature Review

A focused literature review was performed using PubMed, Scopus, ScienceDirect, and MEDLINE to identify relevant studies discussing complications, failure mechanisms,

and risk factors associated with pectoralis major myocutaneous flap reconstruction in head and neck surgery. Keywords included “pectoralis major myocutaneous flap,” “flap failure,” “venous congestion,” and “cheek reconstruction.” Relevant references from selected articles were also screened to ensure comprehensive contextual discussion.

The reviewed literature demonstrates that PMMCF failure is multifactorial, with commonly reported contributing factors including vascular compromise, mechanical tension, infection, and patient-related comorbidities. These findings provide clinical context for interpreting the present case and for understanding the variability in reported outcomes Vascular and Technical Factor in PMMCF Failure

The viability of the pectoralis major muscle

flap is highly dependent on adequate vascular supply through its pedicle, primarily the thoracoacromial vessels.¹³ However, pedicled flaps are prone to mechanical complications such as *kinking* of the vascular pedicle during mobilization and inset, which can significantly compromise blood flow (Figure 5).^{14,15} Pedicle *kinking* leads to partial or complete obstruction of arterial inflow and venous outflow, resulting in tissue ischemia and venous congestion that predispose the flap to necrosis, particularly in the distal regions furthest from the vascular origin.¹⁴⁻¹⁶ Additional factors such as excessive tension, compression, or vasospasm may exacerbate this vascular insufficiency. Careful intraoperative handling to avoid pedicle torsion and tension, along with vigilant monitoring of flap perfusion, is critical to prevent necrosis.¹⁷

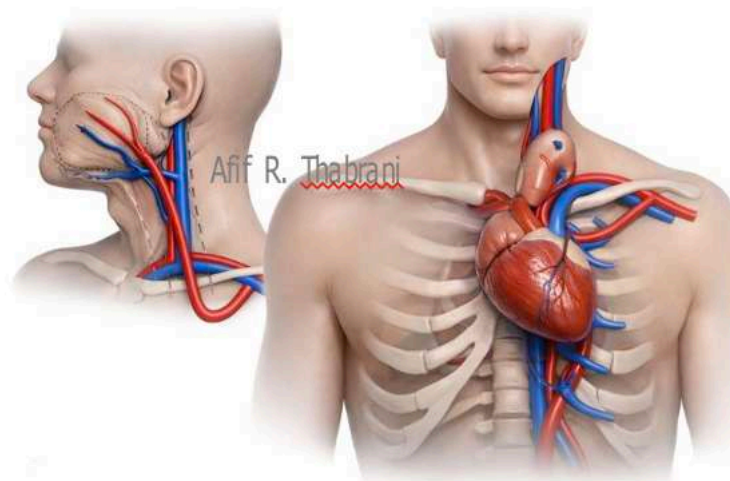


Figure 5. Illustration demonstrating venous drainage pathway of the PMMCF

The clinical manifestations of arterial and venous kinking in pedicled flaps differ notably in their onset and progression. Arterial kinking typically results in an acute ischemic event characterized by rapid onset greyness, coolness, and loss of capillary refill, reflecting immediate cessation of oxygenated blood inflow.^{18,19} In contrast, venous kinking often presents more insidiously, with progressive venous congestion, flap edema, cyanosis, and eventual tissue hypoxia due to impaired outflow, which may take several hours to manifest

clinically.^{18,19} PMMCF failure is frequently attributed to venous kinking caused by mechanical compression within the cervical supraclavicular tunnel.^{6,15,18,19} The bulky nature of the PMMCF pedicle, when transposed through the narrow supraclavicular space, predisposes the venous pedicle to compression and subsequent kinking, leading to venous outflow obstruction.^{15,18,19} This venous congestion can progress to flap edema, increased interstitial pressure, and ultimately partial or complete flap necrosis if not promptly recognized

and managed.¹⁹

Postoperative management of patients undergoing pectoralis major myocutaneous flap reconstruction must include careful attention to patient positioning to preserve flap viability.²⁰ Sleeping with excessive cervical extension or elevated pillows may place undue tension on the pedicle, resulting in decreased arterial inflow and tissue hypoxia.²⁰ Conversely, prolonged neck flexion can cause pedicle kinking or compression, leading to venous outflow obstruction and flap congestion.²⁰ Both scenarios increase the risk of ischemic injury and potential flap necrosis.²⁰ Therefore, comprehensive postoperative education is essential to instruct patients on maintaining a neutral head and neck position to minimize pedicle tension and kinking.^{16,21}

Overall, PMMCF has been reported to achieve a high success rate, with flap survival ranging from 90–96% and partial or total necrosis reported in approximately 2–10% of cases.^{5,7,8} This provides a benchmark against which the present case of flap compromise can be contextualized. Several clinical studies have reported outcomes of PMMCF and explored potential risk factors contributing to flap failure. These data provide a broader clinical context to interpret the present case, particularly regarding the multifactorial nature of PMMCF necrosis. A summary of selected recent studies is presented in Table 1.^{4–9}

Oncologic and Defect-Related Factors Affecting Flap Outcomes

A recent scoping review by Cirstea AI *et al.* reported that reconstructive outcomes in advanced head and neck tumors are strongly influenced by patient-related factors, tumor characteristics, and perioperative management, underscoring the importance of individualized reconstructive planning, particularly when interpreting flap failure cases.²² This evidence highlights that while PMMCF remains a reliable flap, its complications are not negligible. Risk factors such as systemic comorbidities (e.g., diabetes), perioperative factors (e.g., blood transfusion, infection), and technical elements

(e.g., pedicle compression, skin island design) all play significant roles in determining outcome. The present case shares similarities with previously reported risk associations, particularly in relation to advanced tumor stage and defect size.^{4–9}

Assessing surgical margins intraoperatively plays a crucial role in ensuring full resection of oral and maxillofacial malignancies.^{23,24} Although frozen sections are commonly utilized for rapid intraoperative diagnosis, their effectiveness tends to decrease in OSCC cases with bone involvement.^{23,25} The mineral density of cortical bone presents significant technical barriers to cryostat slicing, which can lead to artifacts or unreadable sections.^{23,26} In such scenarios, touch imprint cytology may serve as a more practical alternative, especially in cases involving bone or adipose tissue.^{23,26–28} This diagnostic limitation underscores the crucial importance of timely postoperative adjuvant radiotherapy, which functions as a compensatory oncologic safeguard in scenarios where intraoperative pathological margin assessment is unavailable.²⁰ Adjuvant radiotherapy plays a pivotal role in mitigating the risk of local recurrence, particularly when the precise extent of tumor infiltration into adjacent bones structures cannot be definitively delineated intraoperatively due to the inability to perform frozen section analysis.^{29,30}

In surgical resections of advanced buccal squamous cell carcinoma, the vascularity at the peripheral margin of the excised cheek mass is often suboptimal.^{31,32} This reduced perfusion may compromise flap integration and delay wound healing, especially in cases involving extensive soft tissue or osseous resection.^{18,33,34} Hypovascular conditions at the surgical margin may also limit the accuracy of intraoperative margin assessment, thereby increasing the risk of residual disease and contributing to a higher incidence of flap failure.³⁵

Qaisi *et al.* reported several cases of OSCC stage III and above that tended to experience flap failure due to tissue dehiscence at the distal end of the PMMCF skin paddle.⁶

This complication was managed successfully with local wound care and primary closure within four weeks, as previously discussed. Importantly, patients were still able to begin adjuvant therapy on schedule. The dehiscence may have been attributed to the extensive defect size in T3/T4 tumors and/or inadequate vascular margins following tumor excision.⁶ Advanced tumor stage is associated with an increased defect size, thereby elevating the risk of tension on the pectoralis major flap due to the limited dimensions of the cervical tunneling pathway.

Limitations

This case report has several limitations. Objective intraoperative and postoperative perfusion assessment modalities, such as indocyanine green angiography or quantitative Doppler flowmetry, were not utilized; therefore, evaluation of flap vascular dynamics relied primarily on clinical observation. While this reflects real-world practice in many surgical settings, it may limit detailed mechanistic interpretation of the vascular compromise observed.

In addition, as this is a single-case observation, the findings cannot be generalized to all reconstructive scenarios or patient populations. Nevertheless, the clinical course and identified risk factors remain meaningful, as they are consistent with patterns reported in previous studies describing similar mechanisms of flap compromise, as summarized in Table 1, 4–9

Finally, certain advanced diagnostic adjuncts that could further characterize microcirculatory status were not performed, which may restrict comprehensive physiologic correlation. Despite these constraints, the case provides practical clinical insight into flap monitoring, early recognition of vascular compromise, and decision-making considerations in complex oncologic reconstruction.

Conclusion

Failure of the Pectoralis Major Myocutaneous Flap (PMMCF) is multifactorial and involves a complex interaction of patient-related, oncologic, and technical factors.

Although the flap is widely regarded as a reliable reconstructive option, compromised vascularity, excessive tension, infection, systemic comorbidities, and large composite defects may predispose to flap necrosis. Once vascular compromise develops after flap inset, therapeutic options are often limited and salvage success is unpredictable. Therefore, the most clinically meaningful strategy lies in careful preoperative risk assessment, appropriate flap selection for advanced-stage defects, meticulous intraoperative handling of the pedicle, and vigilant early postoperative monitoring. In extensive defects, particularly in stage III malignancies, reconstructive alternatives should be considered when feasible, as the structural and perfusion limitations of PMMCF may increase the risk of failure. Moreover, systematic collection of cases with flap complications is warranted to enable future statistical analyses, which could help identify reliable predictive factors and guide evidence-based reconstructive planning in complex head and neck surgery.

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Ethics Statement

This case report was conducted in accordance with the principles of the Declaration of Helsinki. According to institutional policy, formal ethical approval was not required for the publication of a single anonymized case report. Written informed consent was obtained from the patient for the publication of clinical details and accompanying images

Disclosure

The authors declare no conflict of interest in this work.

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Table 1: Summary of recent studies reporting PMMCF outcomes and flap failure risk factors⁴⁻⁹

Number	Author	Year	Sample size	Site	Flap Failure Rate	Reported Risk Factors	Definition of failure	Partial vs total flap failure	Salvage method	Adjuvant therapy timing
1	Ord ⁵	1996	50	Oral Cavity	4%	Diabetes, smoking	inadequate tunnel width, a muscle flap wrapped around a rib graft	3 with total 5 with partial	-Fibrin glue -Skin grafting -Necrotomy Debridement	None reported
2	Anehosur et al ⁴	2020	150	Head & neck	6%	Trachesotomy, Infection	surgical technique to patient-specific conditions	12 with partial	-Regular dressings -Wound care -Monitoring for healing	Two to three weeks post-operatively
3	Wang et al ⁷	2015	478	Oral Cavity	38.3%	Prior radiation, Diabetes	vascular integrity	183 with partial	-Wound care	None reported
4	Soni et al ⁸	2022	1022 (Meta analysis)	Head & neck	2-10%	Pedicle compression	Defect size insufficient	19 with total 74 with partial	None reported	None reported
5	Panda et al ⁹	2023	196	Mandible / Cheek	17.6%	Concurrent mandibular plate, diabetes	larger surface areas especially when the skin paddle extends beyond the angiosome territory of the acromiothoracic artery	3 with total 23 with partial	-Necrotomy debridement -Free flap	None reported
6	Qaisi et al ⁶	2019	3	Buccal Mucosa	Flap partial loss	Stage III/IV tumor, large defect size	Delayed healing at distal end of PMMCF	1 with partial	-Wound care	None reported