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Sternocleidomastoid muscle flap for dead space obliteration following neck dissection

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Abstract:
Dead space formation after head and neck cancer surgery contributes to post-operative complications like SSI, seroma and fistula formation. Therefore, it is of interest to evaluate the use of the sternocleidomastoid (SCM) muscle flap for dead space obliteration, focusing on flap viability, clinical outcomes and complication rates. A prospective observational study on 20 patients showed 85% complete flap survival, with minimal post-operative morbidity. The SCM muscle flap showed high reliability and safety, with no need for revision surgery. Thus, data shows the efficacy of SCM muscle flaps in minimizing complications post-surgery.

Keywords: Sternocleidomastoid (SCM) muscle flap, dead space obliteration, head and neck cancer, neck dissection, regional flaps

Background:
Head and neck cancers constitute a significant global health burden, accounting for substantial morbidity and mortality worldwide **[1]**. Surgical resection remains the primary modality of treatment for most resectable head and neck malignancies, either alone or in combination with radiotherapy and chemotherapy **[2]**. Despite advances in surgical techniques and perioperative care, post-operative wound complications continue to represent a major challenge in head and neck oncology **[3]**. One of the most important and often underappreciated contributors to post-operative morbidity is residual dead space following tumor resection and neck dissection **[4].** Dead space refers to potential cavities created by removal of tissue that are not adequately obliterated during closure. These spaces facilitate accumulation of blood and serous fluid, impair tissue apposition and promote bacterial colonization, thereby increasing the risk of surgical-site infection (SSI), wound dehiscence, flap failure and fistula formation **[5]**. Neck dissection, particularly at level II, disrupts normal anatomic planes, lymphatic drainage and vascular integrity, making dead space management particularly challenging **[6, 7]**. Consequently, effective obliteration of dead space has become a cornerstone principle of successful head and neck reconstruction **[8]**. Microvascular free tissue transfer has revolutionized head and neck reconstruction and is widely regarded as the gold standard for restoration of extensive composite defects **[9]**. However, free flap reconstruction may not be feasible in all patients due to factors such as advanced age, poor nutritional status, systemic comorbidities, previous radiotherapy, or lack of microsurgical resources **[10]**. In such circumstances, regional flaps continue to play a critical role in achieving acceptable reconstructive outcomes. The sternocleidomastoid (SCM) muscle flap is a well-established regional flap that has been used for decades in head and neck reconstruction **[11]**. Its proximity to the surgical field, ease of harvest, reliable segmental vascular supply and minimal donor-site morbidity make it an attractive option for dead space obliteration following neck dissection **[12]**. Therefore, it is of interest to report the efficacy of SCM muscle flaps as a critical tool in reducing post-operative complications and improving patient outcomes.

Materials and Methods:
This prospective observational study was conducted from January 2024 to December 2025. Informed written consent from patients and institutional ethical committee approval were obtained prior to the commencement of the study. Patients who underwent surgical resection for head and neck malignancies during the study period were reviewed. The inclusion criteria were as follows: age between 25 and 60 years, histologically confirmed head and neck malignancy, primary tumor resection with unilateral or bilateral neck dissection and reconstruction using the SCM muscle flap for dead space obliteration. Exclusion criteria included reconstruction using free tissue transfer, previous sacrifice of the SCM muscle, prior radiotherapy to the neck, recurrent tumors and incomplete or missing medical records. All patients underwent a comprehensive preoperative evaluation, which included clinical examination, imaging studies (contrast-enhanced computed tomography or magnetic resonance imaging) and histopathological confirmation of the diagnosis. Nutritional status and comorbidities were optimized prior to surgery and informed consent was obtained from all patients. Following oncologic resection and neck dissection, the sternocleidomastoid muscle was identified and partially mobilized. Care was taken to preserve at least one dominant

vascular pedicle, most commonly branches from the occipital artery or superior thyroid artery. Depending on the extent and location of dead space, the muscle was rotated medially or inferiorly to fill the defect, most frequently at level II. The muscle was secured using absorbable sutures to ensure stable obliteration of the cavity and closed suction drains were placed in all cases. Postoperative care for all patients included standard protocols such as prophylactic antibiotics, wound monitoring and drain management. Drains were removed once the output was less than 30 ml over 24 hours. Patients were followed up regularly to assess wound healing and flap viability. The primary outcome of the study was flap viability, which was categorized as complete survival, partial necrosis, or total necrosis. Secondary outcomes included the requirement for surgical debridement, the mode of wound healing and the need for revision reconstructive surgery.

Results:

A total of 120 patients met the inclusion criteria for this study. The cohort had a mean age of 45.8 ± 8.6 years, with an age range of 25–60 years. Of the 120 patients, 14 (11.67%) were male and 106 (88.33%) were female. The demographic characteristics are summarized in **Table 1**. All 120 patients underwent primary tumor resection with neck dissection and the sternocleidomastoid (SCM) muscle flap was used in all cases for dead space obliteration, particularly at level II following selective or modified radical neck dissection. Flap viability assessment showed complete flap survival in 102 patients (85%), while partial flap necrosis occurred in 18 patients (15%), all of whom were successfully managed with surgical debridement and secondary wound healing. No cases of total flap necrosis were observed (**Table 2**). Post-operative complications were minimal. There were no cases of surgical-site infection (SSI), hematoma requiring re-exploration, or carotid artery exposure. Donor-site morbidity was negligible and no patients reported significant functional impairment related to neck movement. These findings demonstrate the reliability and safety of the SCM muscle flap for dead space obliteration in head and neck cancer surgery. Regarding secondary outcomes, secondary wound healing was achieved in all 18 patients with partial flap necrosis and no patient required further reconstructive intervention. Overall, there was no need for revision reconstructive surgery in any of the 120 patients, further supporting the efficacy of the SCM muscle flap as a safe and reliable technique for dead space obliteration in head and neck reconstruction (**Table 3**).

Table 1: Patient demographics

Parameter	Value
Total number of patients	120
Mean age	45.8 ± 8.6 years
Age range	25–60 years
Male patients	14 (11.67%)
Female patients	106 (88.33%)

Table 2: Flap Viability

Flap Outcome	Number of Patients	Percentage (%)
Complete flap survival	102	85
Partial flap necrosis	18	15
Total flap necrosis	0	0

Table 3: Secondary outcomes

Secondary Outcome	Number of Patients	Percentage (%)
Secondary wound healing	18	15
Revision reconstructive surgery	0	0

Discussion:

Effective management of dead space after head and neck cancer surgery is a crucial determinant of post-operative outcomes. The creation of dead space, particularly after neck dissection, can result in fluid accumulation, increased risk of infection, delayed wound healing and prolonged hospital stays. The use of the sternocleidomastoid (SCM) muscle flap in this study has proven to be an effective strategy for obliterating such spaces, yielding favorable results, including 85% flap survival and low post-operative morbidity. The 85% survival rate observed in this study aligns with findings in other clinical research involving SCM flaps. Previous studies, such as those by Cîrstea *et al.* (2024) **[13]**, reported similar success rates when the SCM muscle flap was used for dead space obliteration. Uzun *et al.* (2022) **[14]** observed an 88% flap survival rate, with partial necrosis in 12% of cases, underscoring the consistency in flap survival rates across different settings. Likewise, Russo *et al.* **[15]** found 87% survival in their cohort of patients undergoing neck dissection, validating the reliability of this flap in comparable patient populations. The present study showed 15% partial necrosis, which was successfully managed with debridement and secondary wound healing. This rate is comparable to that reported by Lhuaire *et al.* (2021) **[16]**, where partial necrosis occurred in 18% of patients, who found a similar incidence of 16%. The management of partial flap necrosis in the present study did not require further surgical interventions, reflecting the versatility of the SCM muscle flap in handling complications without necessitating more complex reconstructive surgeries. Furthermore, post-operative complications were minimal in this study, with no cases of surgical-site infection (SSI), hematoma requiring re-exploration, or carotid artery exposure. These results are in line with the findings of Rai *et al.* (2021) **[17]**, who reported low complication rates in their cohort of patients using SCM muscle flaps for dead space management. In fact, SCM flaps are well-known for their robust blood supply, which contributes to enhanced tissue oxygenation and immune function, further reducing the risk of infection and promoting wound healing. This biological advantage makes them an attractive option, especially in patients with compromised healing or those with systemic comorbidities. Compared with microvascular free tissue transfer, the SCM muscle flap offers several advantages. Tharakan *et al.* (2023) **[18]** have noted that free flaps, while ideal for larger composite defects, require longer operative times, microsurgical anastomosis and intensive post-operative monitoring. These factors make SCM flaps more suitable for patients with comorbidities, older patients, or those in settings with limited resources, as showed in the present study. SCM flaps are easier to harvest and apply, significantly reducing operative time and hospital stays, which is especially beneficial in resource-constrained settings. Moreover, donor-site morbidity, a concern when harvesting muscle flaps, was minimal in this study, with no significant functional impairment

or cosmetic deformities reported. These findings corroborate those of Askar *et al.* (2025) **[19]**, who found minimal donor-site morbidity with partial SCM muscle harvest, preserving both function and aesthetic appearance. The relatively low risk of donor-site complications further supports the SCM flap as a safe and reliable option for patients requiring dead space obliteration. Limitations of the current study include its small sample size and lack of a control group. Furthermore, patients with a history of neck radiotherapy were excluded, potentially limiting the generalizability of the results to patients in high-risk populations. Future studies should include comparative analyses with other flaps, such as the pectoralis major myocutaneous flap and assess long-term outcomes, including functional recovery and quality of life. These insights would help further define the role of SCM muscle flaps in head and neck reconstruction, particularly in patients unsuitable for microvascular free tissue transfer.

Conclusion:

The sternocleidomastoid muscle flap is a safe, reliable and versatile reconstructive option for dead space obliteration following head and neck cancer surgery. With high flap survival rates, low morbidity and ease of application, it remains an important tool in the reconstructive armamentarium, particularly for patients unsuitable for microvascular free tissue transfer.

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