

The crucial balance in surgical margins for head and neck oncology

Introduction

Achieving clear surgical margins is essential in head and neck cancer surgery, directly influencing local control, survival, and quality of life. The challenge lies in balancing oncologic safety with functional preservation, particularly in speech and swallowing. Surgeons must remove tumours with sufficient margins while minimising unnecessary tissue loss.

Historically, positive margins – tumour cells at or near the resection edge – significantly increase recurrence risk. Margin classifications as “positive”, “close,” or “clear” guide clinical decisions, but recent evidence underscores the need for site-specific definitions. A ≥ 5 mm margin is standard for oral cavity tumours, though narrower thresholds suffice for certain procedures, especially with intraoperative frozen section analysis (FSA) and advanced imaging technologies like narrow-band imaging and fluorescence-guided surgery.

Assessing surgical margins remains complex due to the intricate anatomy of the head and neck. While FSA is widely used, limitations such as sampling errors and time constraints persist. Optical coherence tomography and hyperspectral imaging are emerging as valuable tools for real-time margin assessment. Furthermore, understanding microscopic tumour spread is crucial, as subclinical extensions influence surgical planning, especially in compartmental surgery for advanced tongue tumours.

Neoadjuvant therapies, including chemotherapy and immunotherapy, are reshaping treatment paradigms by downstaging tumours, potentially allowing for less extensive resections. However, fibrosis and inflammation from these treatments can obscure tumour boundaries, complicating margin assessment. Adjuvant therapies, such as (chemo)radiotherapy, play a key role in cases with close or positive margins but cannot fully compensate for inadequate surgical resection, reinforcing the importance of achieving an initial R0 resection.

Technological advancements, particularly artificial intelligence (AI) and molecular diagnostics, are revolutionising surgical precision. AI-driven analysis of imaging data enhances intraoperative decision-making, while biomarkers like TP53 mutations and EGFR overexpression may help define “molecular margins”, improving patient-specific surgical strategies.

Beyond oncologic control, surgical margins profoundly impact quality of life. Wider resections reduce recurrence risk but can impair critical functions. Advances in reconstructive techniques and a multidisciplinary approach allow for treatment de-intensification in select cases, balancing survival with functional outcomes.

Surgical margin management remains at the crossroads of precision oncology and patient-centred care. As research progresses, integrating innovative tools and personalised strategies will be key to refining surgical approaches, ensuring both oncologic success and optimal post-therapeutic quality of life. This report aims to clarify ongoing debates and reinforce best practices in margin management for head and neck oncology.



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