SJORANM
Swiss Journal of Radiology and Nuclear Medicine
SEPTEMBER 2026
VOL. 34 | NO. 1

CASE REPORT

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A TWO-CASE REPORT AND BRIEF REVIEW

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INDIA



OPEN ACCESS · PEER REVIEWED
WWW.SJORANM.COM
ISSUE DOI 10.59667/sjoranm.v34i1.12
SWITZERLAND
ISSN 2813-7221

Lessons from Missed Lesions in Head and Neck FDG PET/CT: A Two-Case Report and Brief Review

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Received: 11 April 2026 · Accepted: 22 September 2026 · Published: 23 September 2026

Swiss Journal of Radiology and Nuclear Medicine · www.sjoranm.com · SJORANM GmbH · Rosenweg 3 · CH-6340 Baar · Switzerland

Abstract

Head and neck FDG PET/CT interpretation is vulnerable to diagnostic error because of complex anatomy, physiological uptake, post-treatment change, and subtle perineural spread. We report two patients with head and neck squamous cell carcinoma in whom retrospectively visible lesions were not described on earlier FDG PET/CT examinations and were recognized after subsequent progression. Possible contributing factors include anchoring, premature diagnostic closure, satisfaction of search, and attentional capture near dominant or expected abnormalities. A systematic review of the retroantral fat, pterygopalatine fossa, pterygoid musculature, skull-base foramina, and relevant neural pathways may improve detection. Equivocal skull-base findings may prompt dedicated MRI for further characterization and staging assessment. These illustrative cases do not permit estimation of the frequency of missed lesions or the effect of earlier recognition on treatment outcome.

Keywords: FDG PET/CT; squamous cell carcinoma; cognitive bias; missed lesions

Introduction

In India, head and neck cancer is a major public health problem, both because of its high incidence and because it commonly affects relatively younger individuals. This is largely driven by widespread use of tobacco (often in smokeless forms) and areca nut, and it contributes substantially to cancer-related mortality, with squamous cell carcinoma representing the most prevalent histological type (1–3). In routine oncology practice, CT and PET/CT are frequently the only cross-sectional imaging studies performed prior to therapy initiation.

PET/CT, however, poses additional challenges because of the high rate of false-positive uptake in the head and neck region, including extraocular muscles, brain, tonsils, dental infections, vocal cords, thyroid gland, and post-radiotherapy settings due to osteoradionecrosis, muscle strain, and inflammatory changes (4). The head and neck region, particularly the skull base, is an area where lesions can be easily missed because of these factors, more so on FDG PET/CT, which is the most widely used PET tracer.

Here, we report two cases of patients on follow-up with FDG PET/CT at our institution in whom a lesion was detected on a later scan, but on retrospective review, a subtle abnormality was already present in the prior study and had been overlooked. We analyze the reasons for these misses and discuss strategies to reduce the likelihood of such errors in routine practice.

Case Report 1

A 35-year-old male with no significant past medical history, but with a history of oral tobacco use (local variety in rural Maharashtra, colloquially called mishri), presented in February 2025 with a 3 × 2 cm ulcerative lesion at the junction of the hard and soft palate, extending up to the midline. The left anterior tonsillar pillar was not involved. Punch biopsy revealed invasive keratinizing squamous cell carcinoma. Baseline FDG PET/CT revealed an FDG-avid, heterogeneously enhancing lesion involving the soft palate and the overlying mucosa of the hard palate on the left side, extending across the midline to involve the uvula. The lesion measured approximately 2.1 cm with SUVmax 10.2. Laterally, it closely abutted the left medial pterygoid plate and involved the descending pterygopalatine canal. The patient received definitive chemoradiation with curative intent, consisting of external beam radiotherapy to a dose of 70 Gy in 35 fractions, along with concurrent weekly cisplatin (40 mg/m²) for six cycles (completed in April 2025). Acute toxicities included grade II–III mucositis, grade II pharyngolaryngitis, and grade I skin reactions. Late toxicities included grade I xerostomia and grade I odynophagia. In July 2025, the patient presented with left eye deviation and diplopia for 7–8 days. No neck

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ISSN 2813-7221 · Swiss J. Radiol. Nucl. Med. (2026) 34(1):1-13 · DOI 10.59667/sjoranm.v34i1.14

nodes were palpable. Oral cavity examination showed slough at the primary site. Follow-up FDG PET/CT revealed a necrotic, FDG-avid soft tissue lesion in the left pterygopalatine fossa with extensions to nasal cavity including the middle turbinate and its posterior horizontal attachment, abutting the sphenoidal crest and vomer medially. Laterally, it showed extension into the left retroantral fat and abutted the infratemporal surface of the left maxillary bone. The lesion measured 3.2 cm in the longest diameter, with SUVmax 14.7. Superiorly, it showed intracranial invasion involving middle cranial fossa with possible dural involvement, where a 0.8 cm hyperenhancing, thickened focus demonstrated an SUVmax 9.9. The lesion closely abutted the left temporal lobe without significant perilesional edema. Linear FDG uptake was also noted in the left lateral pterygoid muscle, which was initially attributed to muscle edema (SUVmax 8.1). A follow-up MRI scan revealed a diffuse altered-signal intensity lesion involving the left cavernous sinus, left medial temporal extra-axial region, infratemporal region, pterygoid muscle, and pterygopalatine fossa. On post-contrast imaging, there was homogeneous enhancement, suggestive of invasive ascending perineural spread of the tumor.

On retrospective review of baseline PET/CT, a subtle thickening was identified in the pterygopalatine fossa extending to the left infratemporal fossa involving the retroantral fat, measuring up to 1.7 cm in length and 0.4 cm in thickness on axial sections, with SUVmax 4.5.

Therapeutic Implication:

Earlier recognition of the subtle abnormality on the initial PET/CT could have prompted dedicated MRI, multidisciplinary reassessment of disease extent, and reconsideration of treatment planning. The effect on the selected radiation volumes or clinical outcome cannot be determined from this case.

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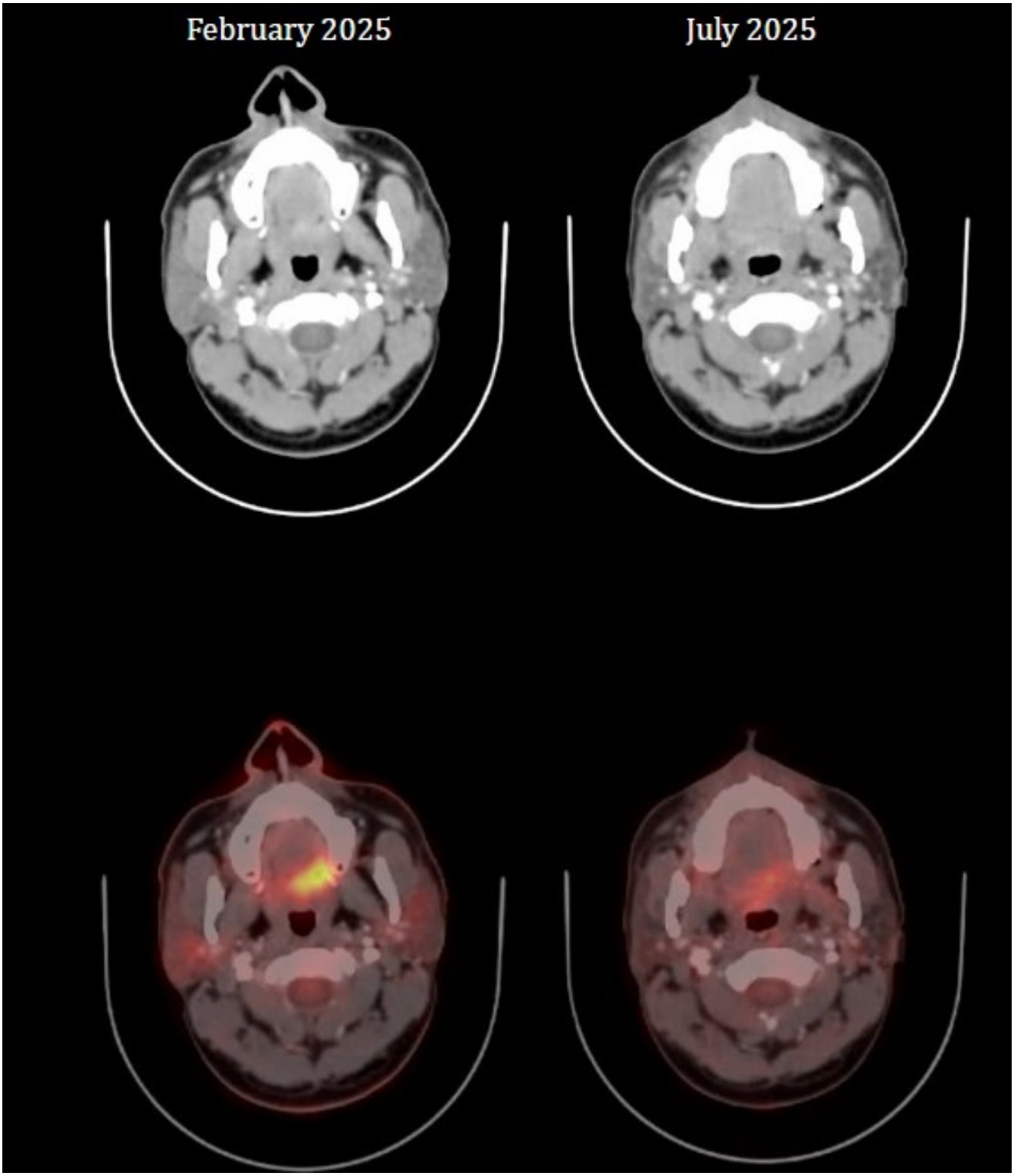


Figure 1.1 - Axial CT and fused PET/CT images. The left panel (February 2025) shows a lesion involving the left side of the palate. The right panel (July 2025) demonstrates mild, non-specific metabolic activity at the same site, likely representing post-treatment inflammatory changes.

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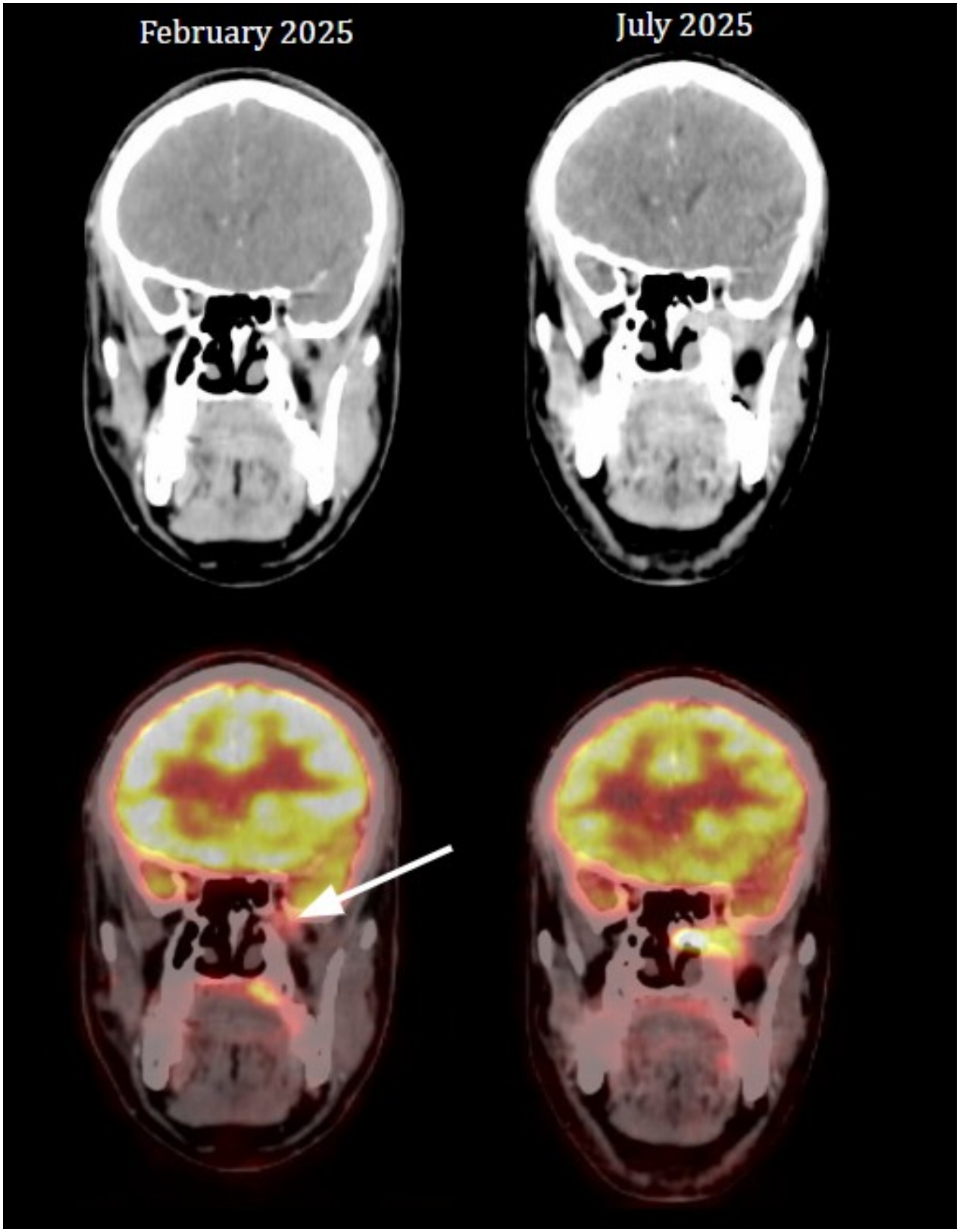


Figure 1.2 - Coronal CT and fused PET/CT images. The right panel (July 2025) clearly demonstrates a hypermetabolic lesion in the left nasal cavity involving the middle turbinate and its posterior horizontal attachment, abutting the sphenoidal crest and vomer medially. Laterally, the lesion extends into the left pterygopalatine fossa. The left panel (February 2025) shows a subtle, FDG-avid thickening in the same site (arrow) that was initially overlooked.

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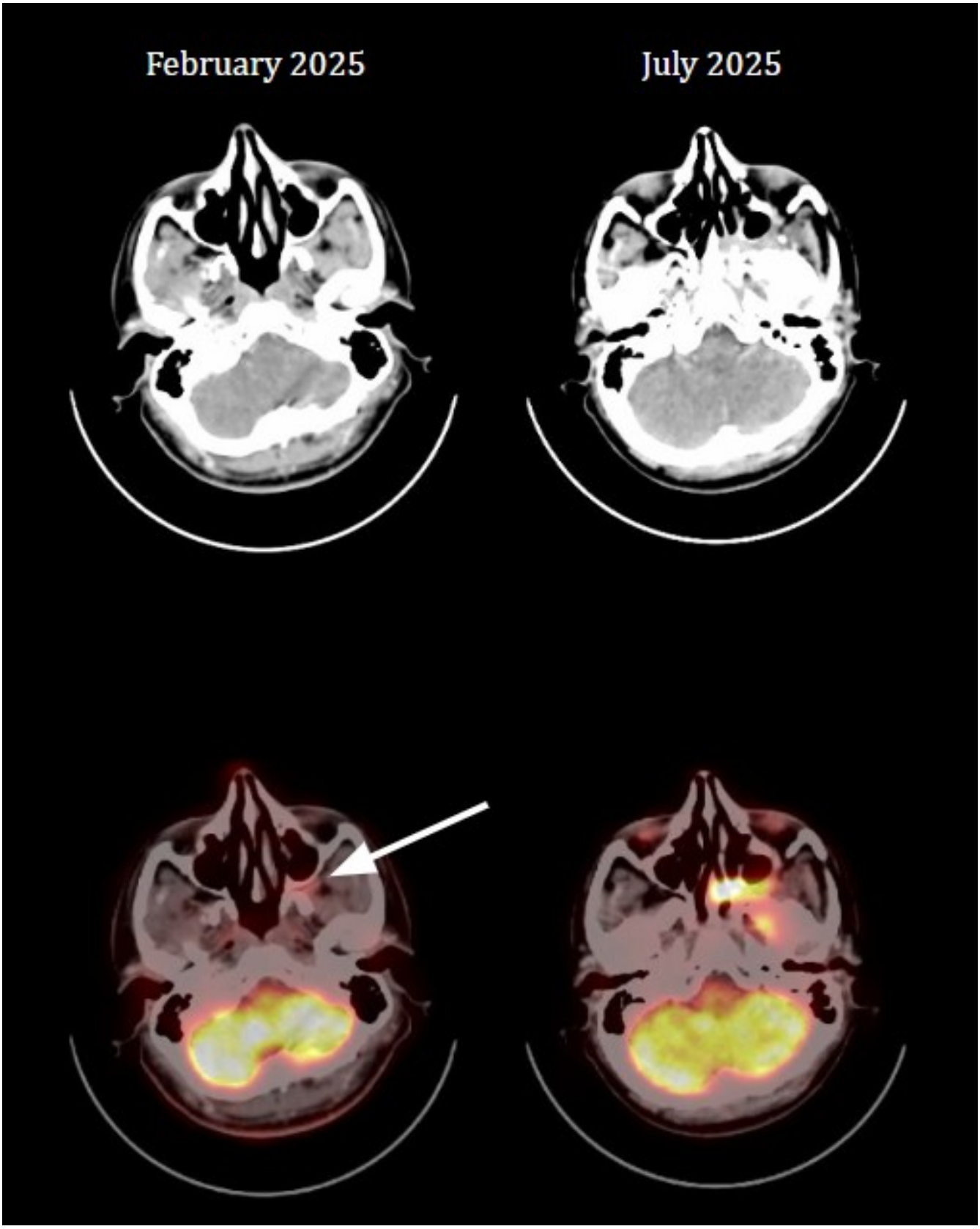


Figure 1.3 - Axial CT and fused PET/CT images corresponding to Figure 1.2 reveal a subtle lesion with abnormal mild FDG uptake in the left pterygopalatine fossa, which was initially missed due to its inconspicuous appearance (arrow).

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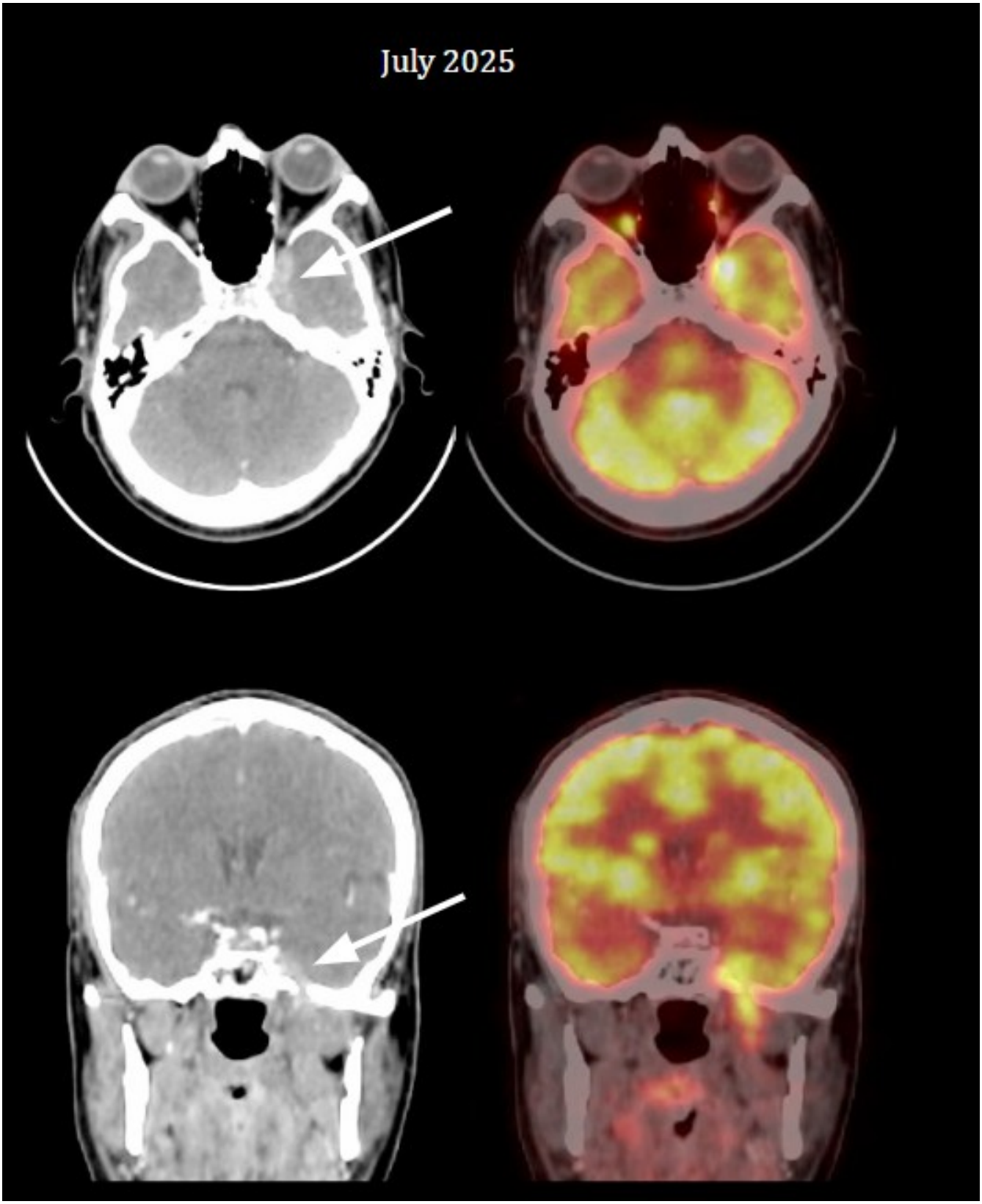


Figure 1.4 - Axial and coronal CT and fused PET/CT images (July 2025) showing extension of the lesion into the left infratemporal fossa, with superior extension into the middle cranial fossa (arrow). The lesion abuts the left temporal lobe without associated perilesional edema, best appreciated on the left-hand contrast enhanced CT images.

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Case Report 2

A 44-year-old male with a history of gutka use presented with squamous cell carcinoma of the right lateral tongue border (T3N0, depth of invasion 15 mm, with perineural and lymphovascular invasion). He underwent anterior glossectomy, bilateral neck dissection, radial forearm free flap reconstruction, and adjuvant radiotherapy (60 Gy in 30 fractions) in 2020. Surveillance FDG PET/CT in October 2022 was negative. In August 2024, FDG PET/CT demonstrated an FDG-avid lesion in the right tonsillar fossa, consistent with recurrence; biopsy confirmed moderately differentiated squamous cell carcinoma. He received re-irradiation (66 Gy in 33 fractions) followed by oral metronomic chemotherapy (OMCT).

PET/CT in December 2024 showed a hypermetabolic lesion in the right tonsillar fossa with bony erosion, suggestive of residual disease. Clinical examination revealed a sloughy and edematous lesion in the right hard palate reaching the midline, although the posterior extent could not be assessed because of trismus. A punch biopsy showed benign palatal tissue with ulceration. Because the sample may have been superficial and a deeper biopsy was difficult to obtain, recurrent disease could not be excluded. In view of the persistent clinical suspicion, OMCT was continued.

PET/CT was repeated in April 2025 and was reported as showing a complete metabolic response. As a result, OMCT was discontinued. However, PET/CT in August 2025 revealed two FDG-avid lesions: ill-defined thickening at the right lateral remnant tongue operative site (1.7 × 0.8 cm, SUVmax 8.7), and a destructive necrotic lesion in the right maxillary sinus and nasal cavity (SUVmax 15.7, 5.5 cm) with erosion of the maxillary walls, hard palate, and inferior orbital wall, oroantral fistula formation, and invasion of the pterygoid muscles, infratemporal fossa, and retroantral fat, consistent with locoregional recurrence. Retrospective review of the April 2025 scan identified a missed FDG-avid lesion in the right upper gingivobuccal sulcus with maxillary extension (SUVmax 5.6). The patient was subsequently advised to start combination systemic therapy with pembrolizumab, cisplatin, and 5-fluorouracil.

Therapeutic Implication: If the lesion had been reported on the FDG PET/CT scan in April 2025, it could have prompted further diagnostic evaluation and reconsideration or modification of treatment planning.

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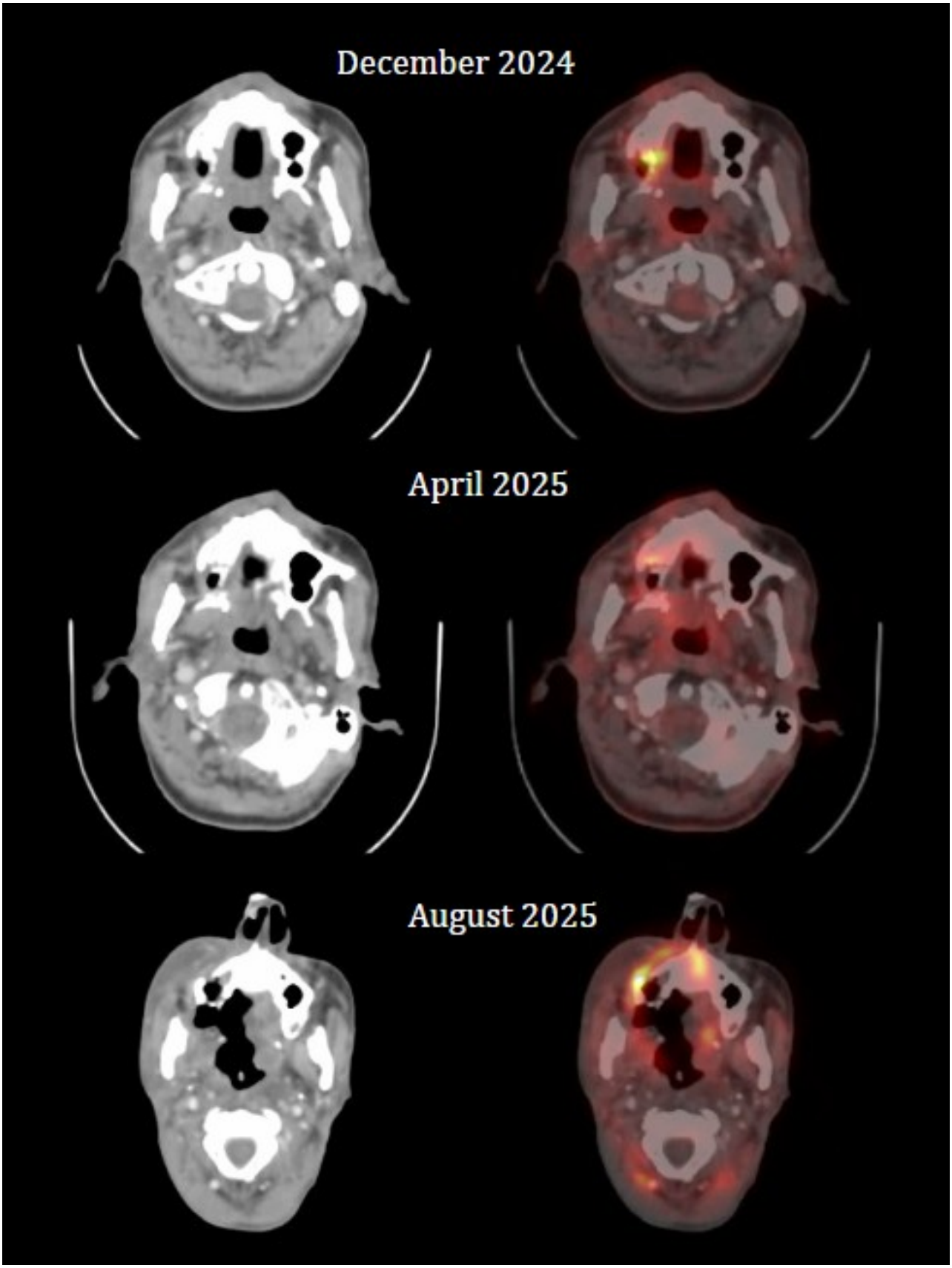


Figure 2.1 - Axial CT and fused PET/CT images. The uppermost panel (December 2024) shows a lesion in the right tonsillar region with bony erosion along the right hard palate and maxillary alveolar process. The middle panel (April 2025) was reported as metabolically inactive. The lower panel (August 2025) demonstrates a destructive necrotic lesion centered in the right maxillary alveolar process, consistent with marked disease progression.

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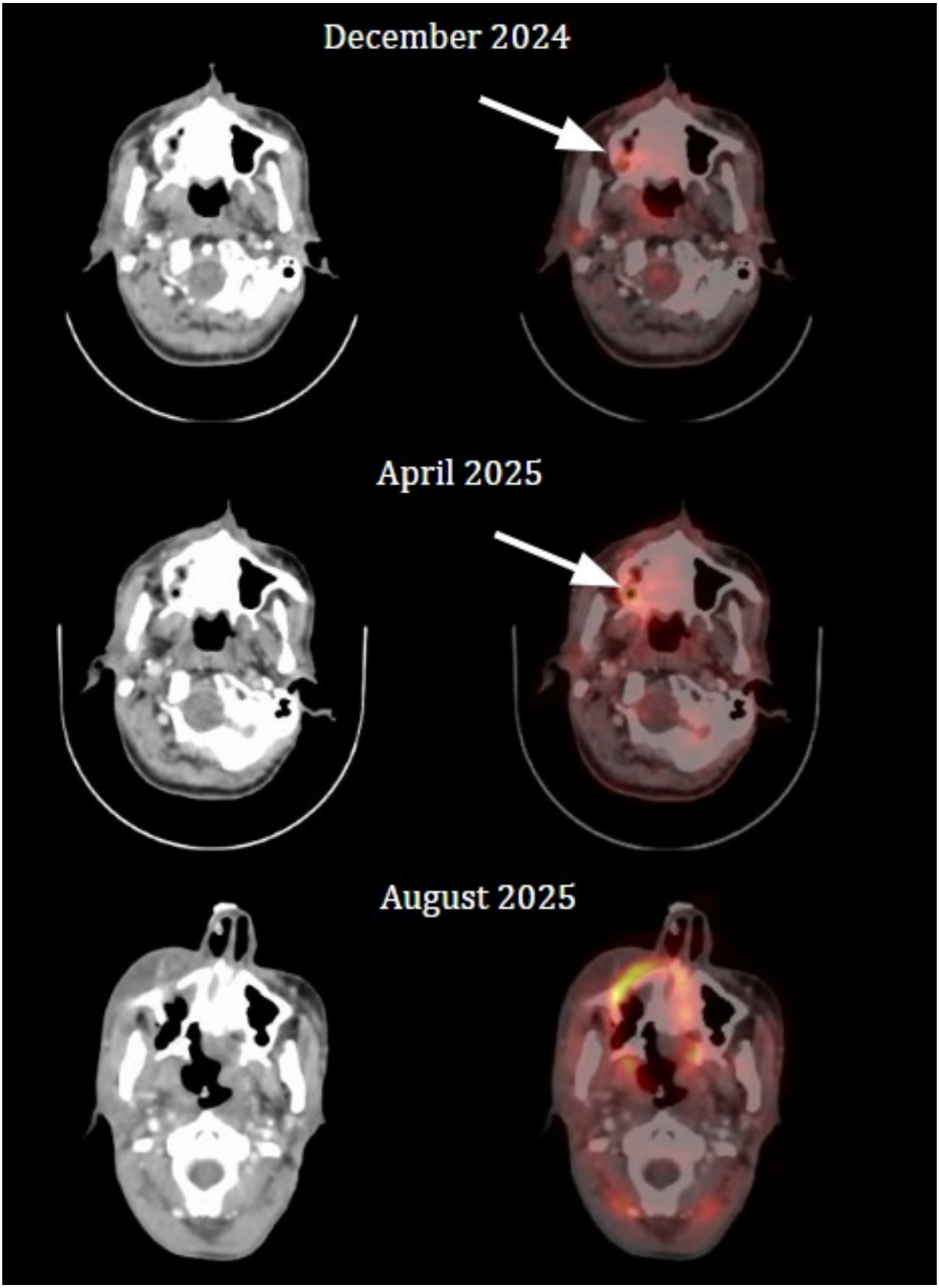


Figure 2.2 - Axial CT and fused PET/CT images corresponding to Figure 2.1. Subtle focal FDG uptake (arrow) is seen along the inferior wall of the right maxillary sinus, appearing indeterminate in December 2024 and reported as negative in April 2025. Clear progression is seen in August 2025.

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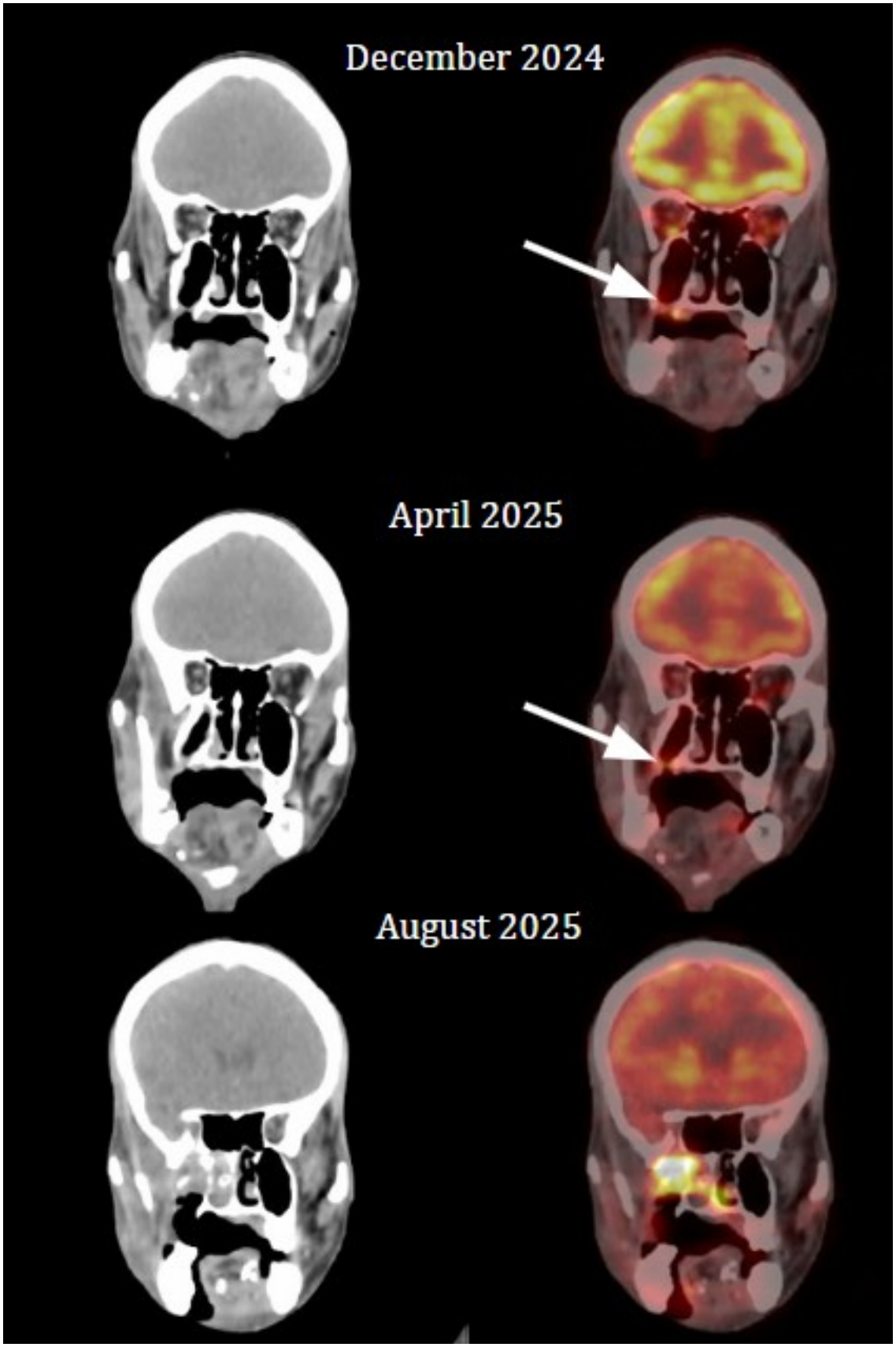


Figure 2.3 - Coronal CT and fused PET/CT images, demonstrating the same subtle focal uptake along the floor of the right maxillary sinus on earlier scans, and the later destructive mass lesion seen in August 2025.

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Discussion

These two cases illustrate real-world instances of missed lesions in head and neck squamous cell carcinoma. We believe that even isolated occurrences warrant a careful analysis of the underlying factors, especially in light of increasing utilization of PET/CT in India, with the aim of minimizing their recurrence.

Challenges in Head and Neck Lesion Detection:

The anatomical complexity of the head and neck region, combined with the inherent biological characteristics of head and neck squamous cell carcinoma (HNSCC), makes this area challenging for radiologists. Subtle lesions may precede symptom onset, and while FDG-PET/CT offers the advantage of identifying lesions by metabolic activity in addition to morphological features (such as nerve thickening), sites of physiological and artefactual tracer uptake are frequent, and the resultant background activity causes visual interference (4). To detect lesions accurately, it is crucial to understand the pathways by which tumors spread, especially in anatomically difficult-to-access areas, such as the pterygopalatine fossa and the skull base. In these regions, obtaining tissue samples is often not possible, so further evaluation using MRI may be necessary (5,6). Diagnosticians should also be familiar with the characteristic FDG PET/CT patterns of perineural spread and skull base involvement, as pattern recognition depends on prior awareness (7).

Cognitive Factors in Image Interpretation:

Cognitive biases may influence judgment when heuristics simplify complex decisions (8,9). Diagnostic errors can be described as perceptual, when an abnormality is not identified, or interpretive, when its significance is not correctly recognized; these are categories of error rather than a complete classification of cognitive biases (9,10). Dual-process models distinguish relatively fast, intuitive pattern recognition (type 1) from slower, analytical reasoning (type 2). Both processes may contribute to image interpretation. Lee et al. discuss the efficiency of type 1 processes and their vulnerability to error, supporting awareness of biases and metacognitive strategies rather than elimination of useful cognitive shortcuts (10).

In head and neck FDG PET/CT, subtle additional lesions may be obscured by a dominant primary lesion, physiological uptake, or expected post-treatment findings (4). The referral history in Case 1 emphasized a palatal lesion; anchoring to that information and premature closure are possible explanations for the additional finding not being reported. Satisfaction of search describes failure to detect an additional abnormality after identifying an initial lesion (10-12). A conspicuous focus may also draw attention away from less apparent abnormalities. These mechanisms are plausible considerations, but the original readers' reasoning and search behavior were not measured. Retrospective recognition alone cannot establish the cause of an individual miss or distinguish cognitive, acquisition, communication, and other system factors (9,10,13).

Considerations in Remote Reporting:

Teleradiology may support access to specialist interpretation, while requiring adequate clinical information, image quality, and communication with the acquisition team (14). Dedicated head and neck acquisitions or positioning maneuvers may aid assessment, and PET/CT misregistration can complicate interpretation (4). These acquisition and workflow considerations apply to both remote and on-site reporting. Neither case establishes that remote reporting caused the missed finding or that its error rate differs from on-site interpretation.

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Proposed Measures to Reduce Misses:

Structured search patterns integrated into reporting templates may support a systematic search and reduce the risk of overlooking additional findings (9,10). A dedicated review of skull-base pathways, particularly retroantral fat and the pterygopalatine fossa, may reveal asymmetry or obliteration associated with deep-tissue involvement or perineural spread. Dedicated MRI may be considered for subtle or equivocal findings (5,6). Table 1 supports a systematic approach; its effectiveness has not been evaluated in these two cases.

Table 1. Key anatomical regions and pathways to assess

Region / Pathway	Key Structures to Assess
Trigeminal nerve (V): central segment	Meckel's cave, lateral wall of the cavernous sinus, foramina of skull base (rotundum/ovale)
Maxillary nerve (V2) pathway	Foramen rotundum, pterygopalatine fossa, inferior orbital fissure, infraorbital canal & foramen, greater palatine canal
Mandibular nerve (V3) pathway	Foramen ovale, masticator space, mandibular foramen, mandibular canal, mental foramen
Pterygopalatine region (key region)	Pterygopalatine fossa, pterygomaxillary fissure, retroantral fat
Facial nerve (VII)	Internal acoustic meatus, facial canal (labyrinthine, tympanic, and mastoid segments), geniculate ganglion, stylomastoid foramen, parotid space
Lower cranial nerves (IX–XI)	Jugular foramen, carotid space
Hypoglossal nerve (XII)	Hypoglossal canal, occipital condyle/condylar fossa
Parasellar / skull base interface	Parasellar region, cavernous sinus

Conclusion

These two cases illustrate retrospectively visible findings that were not reported on earlier head and neck FDG PET/CT examinations. A systematic review of retroantral fat, the pterygopalatine fossa, pterygoid musculature, and skull-base foramina may support detection of subtle additional lesions. Identification of a dominant primary should not end the search for adjacent disease. Equivocal skull-base findings may warrant dedicated MRI for further characterization and staging assessment.

Limitations

This report presents two selected cases with unblinded retrospective review and is vulnerable to hindsight bias. There was no systematic case ascertainment, controlled assessment of the original readers, or evaluation of a search checklist. Specific cognitive causes, the frequency of missed lesions, and any treatment or outcome benefit from earlier recognition cannot be established. Complete acquisition parameters and subsequent outcomes were not reported; perineural spread in Case 1 was suggested by imaging rather than histologically verified.

Declarations

Competing interests: The authors declare no competing interests.
Funding: No funding was received for this work.
Data availability: The clinical information and images supporting these case descriptions are presented in the article. No separate public patient-level dataset is provided.
Author contributions: All authors contributed to the conception, preparation, and critical revision of this case report. All authors read and approved the final manuscript and agree to be accountable for the work.
Peer review: This article underwent anonymous review. Reviewer identities are not disclosed.
AI use: No artificial intelligence tools were used in preparing the article or its graphics.

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Consent for publication and ethical compliance: Written informed consent for publication of clinical information and images was obtained from both patients. Identifying information has been omitted from the published material. The authors report that the clinical work was conducted in accordance with the Declaration of Helsinki and applicable ethical standards.

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