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CASE REPORT

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A TWO-CASE REPORT AND BRIEF REVIEW

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

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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. The cases illustrate 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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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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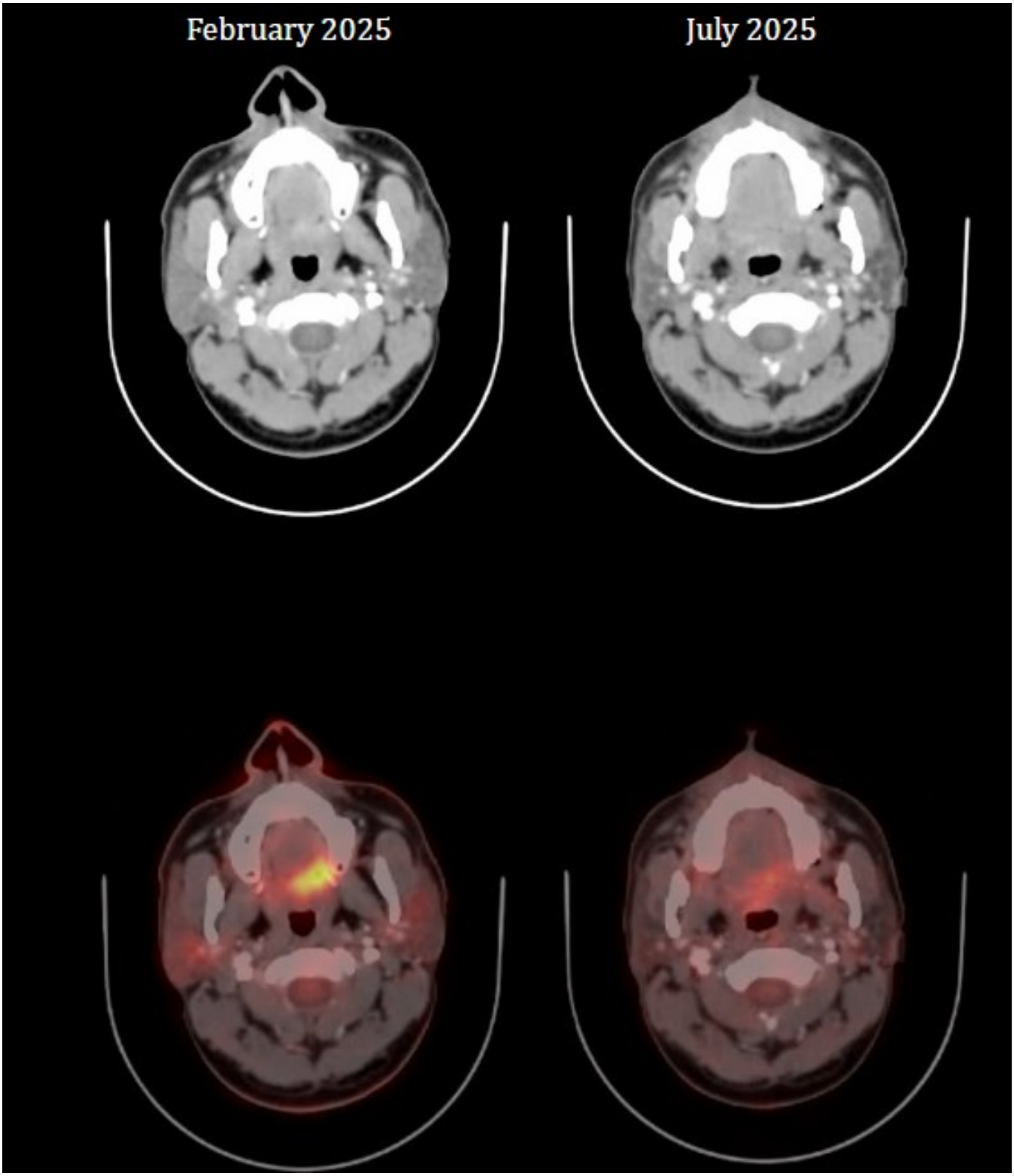

Figure 1.1 - Axial CT and fused PET/CT images. The left panel (February 2025) shows a lesion involving the left side of the palate. The right panel (July 2025) demonstrates mild, non-specific metabolic activity at the same site, likely representing post-treatment inflammatory changes.

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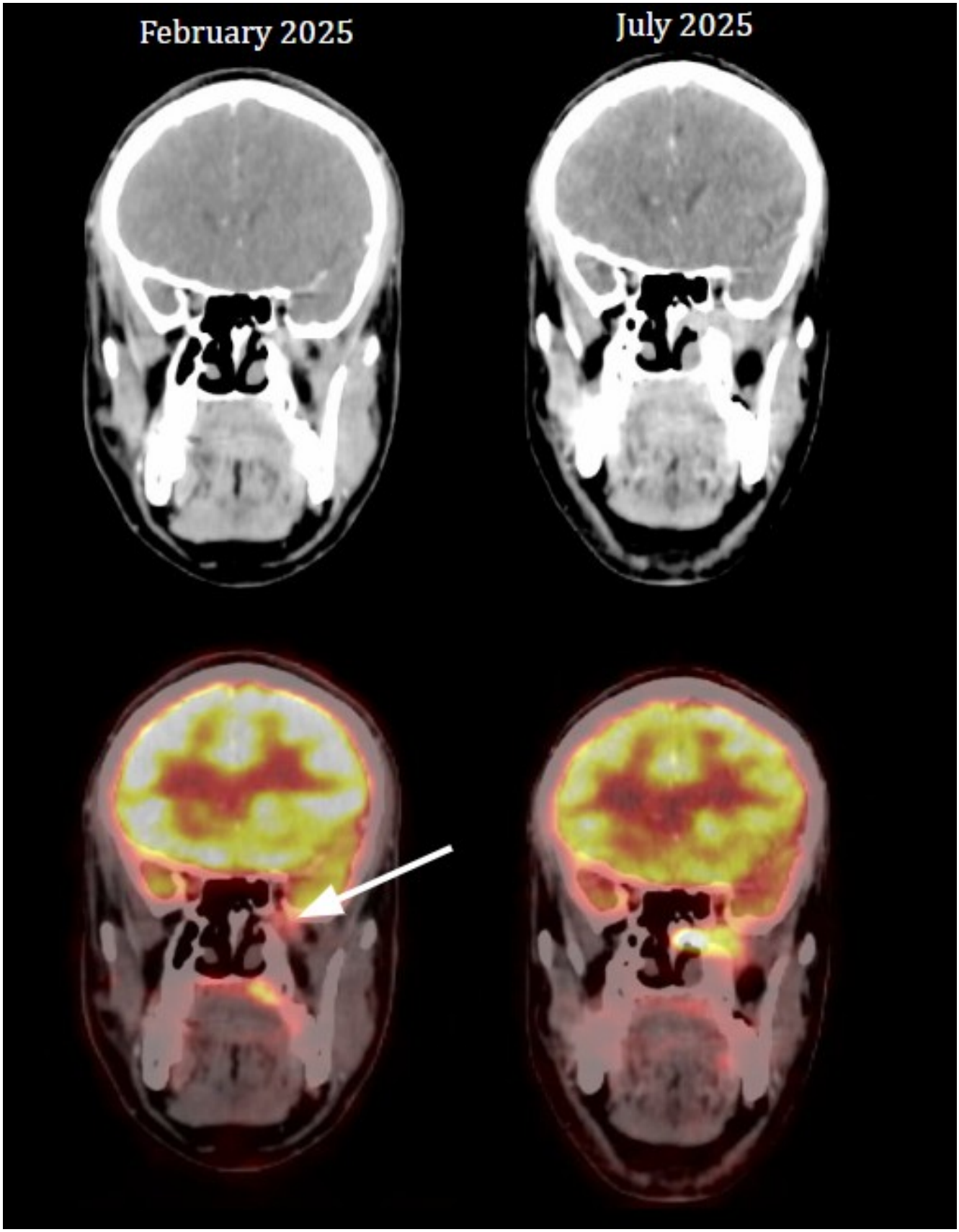

Figure 1.2 - Coronal CT and fused PET/CT images. The right panel (July 2025) clearly demonstrates a hypermetabolic lesion in the left nasal cavity involving the middle turbinate and its posterior horizontal attachment, abutting the sphenoidal crest and vomer medially. Laterally, the lesion extends into 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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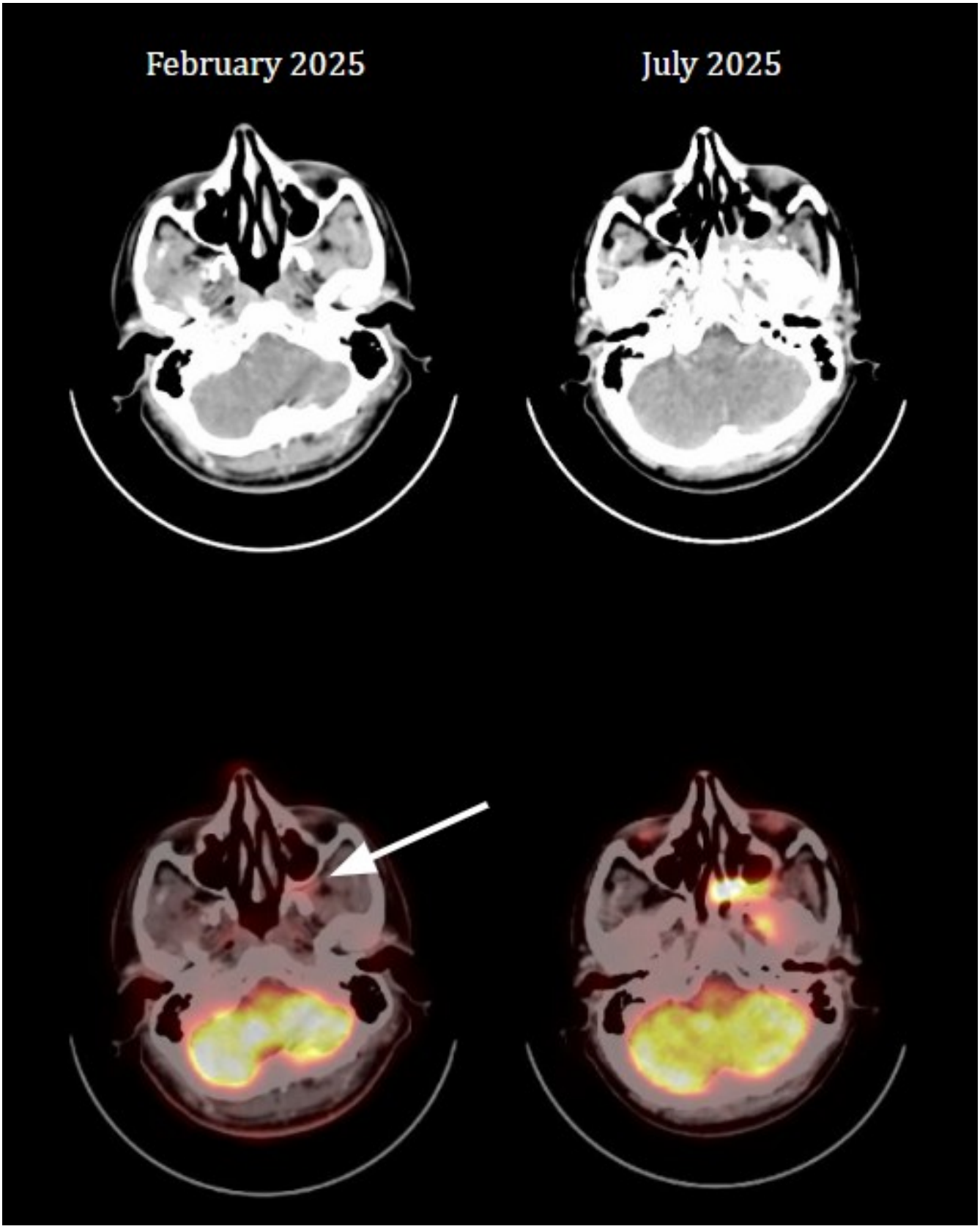

Figure 1.3 - Axial CT and fused PET/CT images corresponding to Figure 1.2 reveal a subtle lesion with abnormal mild FDG uptake in the left pterygopalatine fossa, which was initially missed due to its inconspicuous appearance (arrow).

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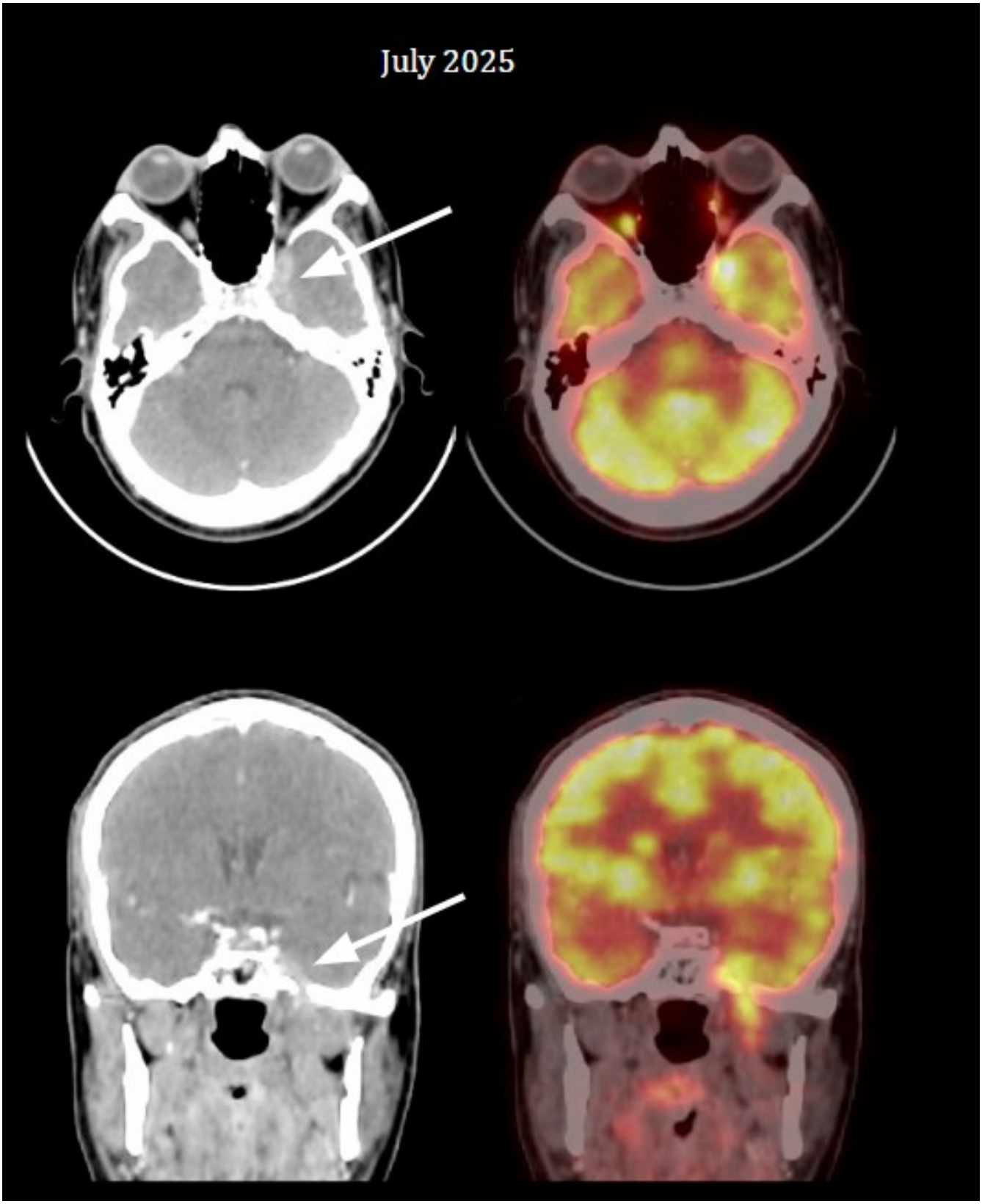

Figure 1.4 - Axial and coronal CT and fused PET/CT images (July 2025) showing extension of the lesion into the left infratemporal fossa, with superior extension into the middle cranial fossa (arrow). The lesion abuts the left temporal lobe without associated perilesional edema, best appreciated on the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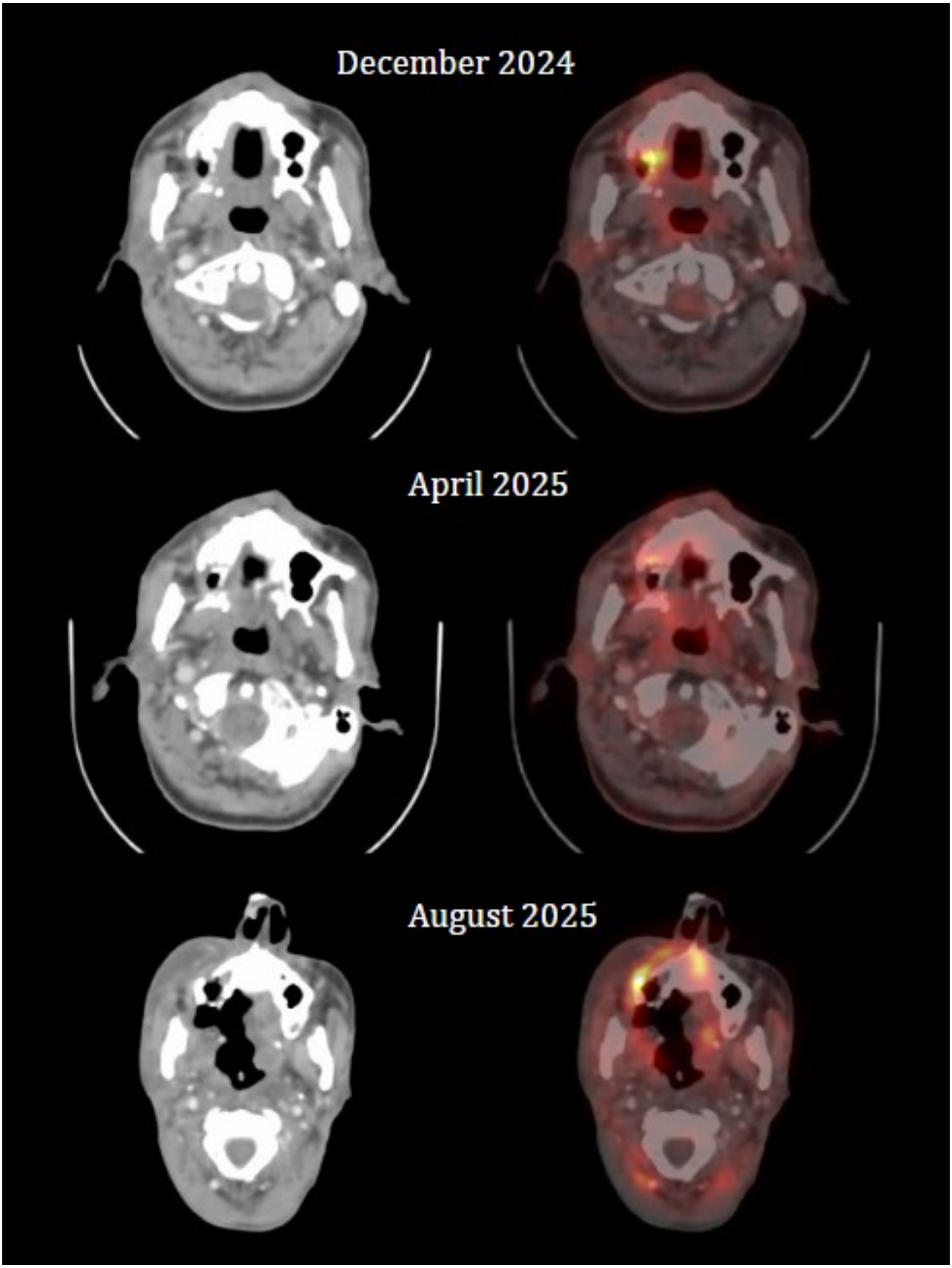

Figure 2.1 - Axial CT and fused PET/CT images. The uppermost panel (December 2024) shows a lesion in the right tonsillar region with bony erosion along the right hard palate and maxillary alveolar process. The middle panel (April 2025) was reported as metabolically inactive. The lower panel (August 2025)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

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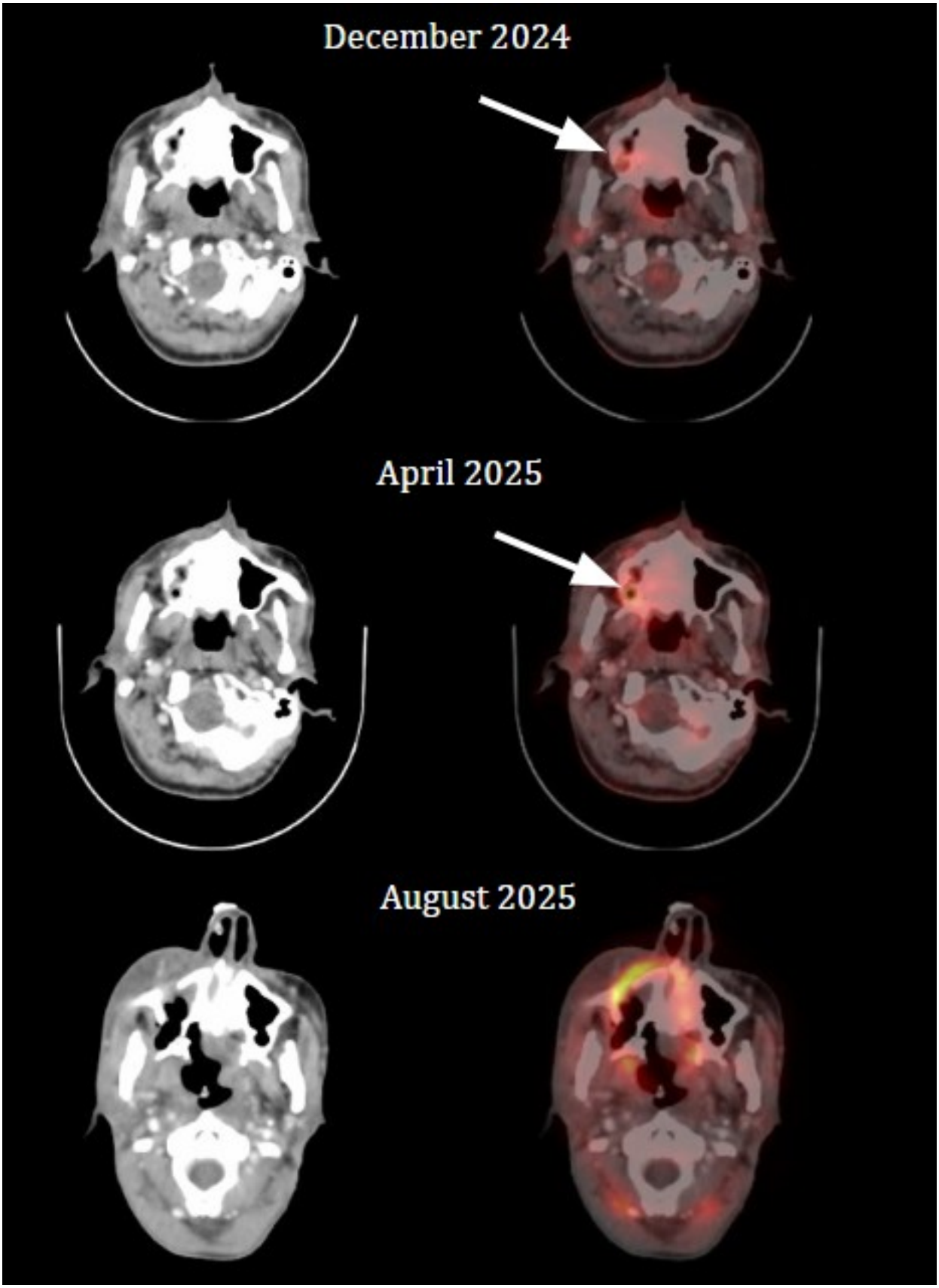

Figure 2.2 - Axial CT and fused PET/CT images corresponding to Figure 2.1. Subtle focal FDG uptake (arrow) is seen along the inferior wall of the right maxillary sinus, appearing indeterminate in December 2024 and reported as negative in April 2025. Clear progression is seen in August 2025.

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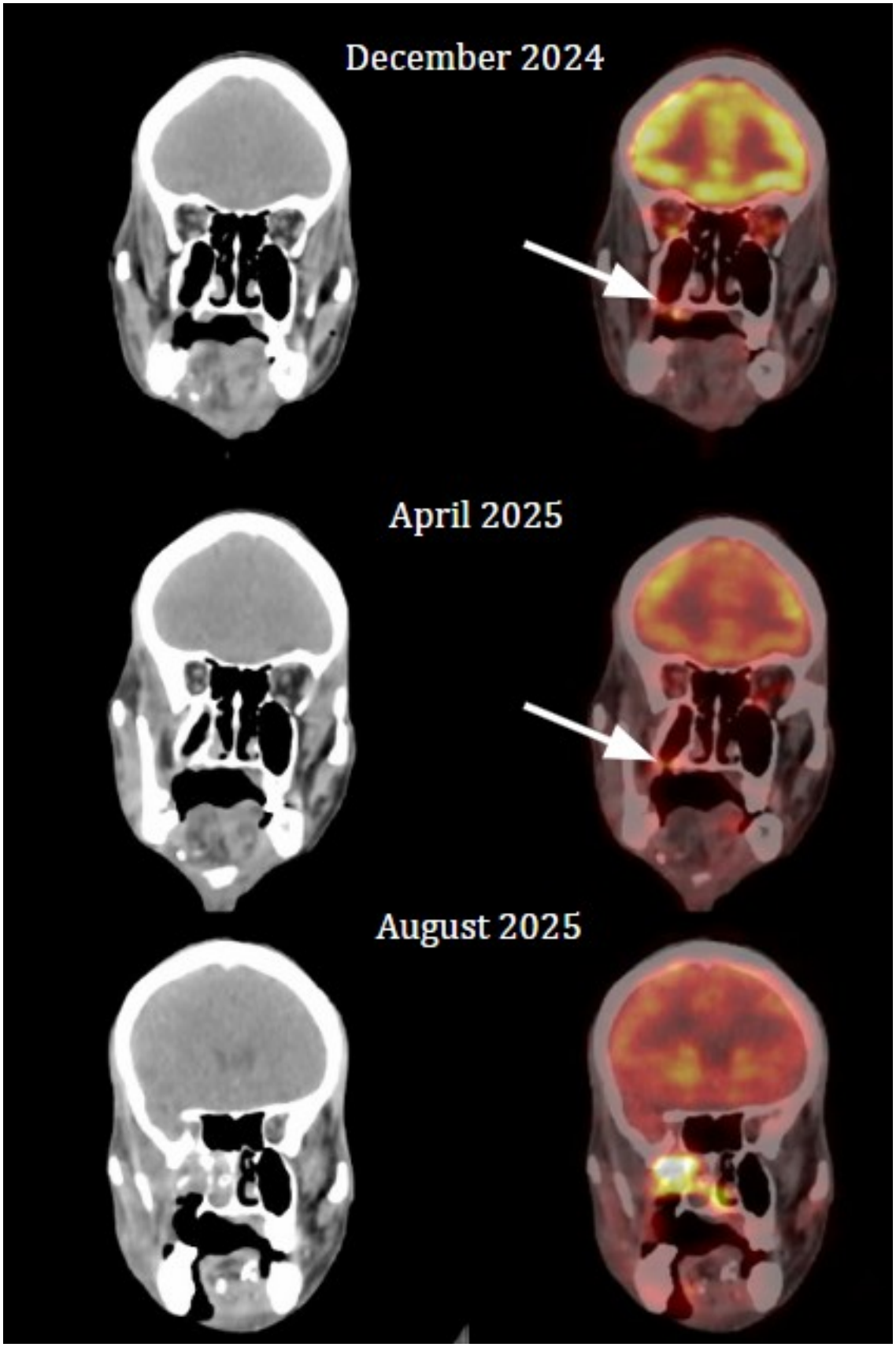

Figure 2.3 - Coronal CT and fused PET/CT images, demonstrating the same subtle focal uptake along the floor of the right maxillary sinus on earlier scans, and the later destructive mass lesion seen in August 2025.

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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 are systematic errors in judgment arising from the use of heuristics, which are mental shortcuts used to simplify complex decisions (8,9). They are largely unconscious and broadly divided into two types: perceptual, in which an abnormality is present but not identified; and interpretive, in which an abnormality is identified but its significance or meaning is not correctly deduced (9). It is worth mentioning here that, according to the dual-process theory of cognition described by Daniel Kahneman and Amos Tversky, decision-making involves two systems: a fast, intuitive pattern-recognition process (“type 1” thinking) and a slower, analytical reasoning process (“type 2” thinking) (8). In their narrative review of cognitive and systemic factors in diagnostic errors, Lee et al. noted that most clinical work relies on “type 1” thinking, which enables faster decision-making but is more prone to errors, with serious implications for diagnostic accuracy and patient safety (10).

These cases prompt a fundamental question, “Why do we miss lesions other than the main and prominent one?” In head and neck FDG PET/CT, subtle additional lesions may be hidden near the dominant primary lesion or masked by expected post-treatment findings. Another possible contributing factor may be the clinical history that comes to the radiologist alongside images. In the first case, the referral history specifically noted a lesion in the hard palate, and accordingly, the reporting radiologist described that lesion while missing a subtle abnormality in the retroantral fat and pterygopalatine fossa. When the interpreter anchors to the provided clinical information and identifies a lesion that adequately accounts for the presenting symptoms, a sense of premature diagnostic closure may set in, and other subtle findings in the proximity may feel less compelling. This is a localized form of satisfaction of search – once a significant abnormality is found, a mental disengagement follows, and the rigor of the search pattern may diminish for the remainder of the study (10,11,12). In the case of FDG PET, the lesion with the greatest metabolic activity may capture one’s attention, and smaller lesions may be less conspicuous and more easily missed, a phenomenon sometimes referred to as perceptual/attentional tunneling or local attentional bias (4,13).

Considerations in Remote Reporting:

The limited availability of on-site specialists, especially in rural and semi-urban regions with a high head and neck cancer burden, has made teleradiology essential for timely service delivery. Nevertheless, teleradiology can introduce additional challenges, such as limited opportunities to obtain supplementary imaging views (e.g., puffed-cheek or tongue-out views), which may lead to perceptual difficulties. Significant misregistration between PET and CT images may also necessitate repeat scans, thereby increasing dependence on acquisition quality and technologist workflow (14). These considerations are particularly pertinent to the interpretation of complex head and neck PET/CT studies, although perceptual errors occur in both remote and on-site reporting environments.

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Proposed Measures to Reduce Misses:

Structured search patterns integrated into reporting templates can help ensure that no lesions are overlooked (9). We recommend a dedicated review of the skull base pathways, with particular attention to the retroantral fat and the pterygopalatine fossa, as obliteration or asymmetry in these regions may be an early clue to deep-tissue involvement and perineural spread. Dedicated MRI may be considered when subtle or equivocal abnormalities are detected on CT, especially for midface lesions. Table 1 summarizes key structures to assess and is intended to support a systematic approach for early-career radiologists.

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 factors that may contribute to missed lesions on head and neck FDG PET/CT. A systematic review of the retroantral fat, pterygopalatine fossa, pterygoid musculature, and skull base foramina may improve detection of subtle additional lesions in the presence of a dominant primary. Identification of a hypermetabolic primary should not end the search for satellite or perineural disease along adjacent pathways. Equivocal skull-base findings on PET/CT may prompt consideration of dedicated MRI for further characterization and staging assessment. Awareness of these potential errors may help early-career radiologists apply a more systematic search pattern.

Declarations

Competing interests: The authors declare no competing interests.

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Data availability: Not applicable. No datasets were generated or analyzed for this case report.

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.

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Consent for publication and ethical compliance: Written informed consent for publication was obtained from the patient, and patient anonymity was preserved. The clinical work and preparation of this case report were conducted in accordance with the Declaration of Helsinki and all applicable local and international ethical standards.

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