Early Detection of Osteoradionecrosis in NPC: The Role of Computed Tomography in Routine Surveillance

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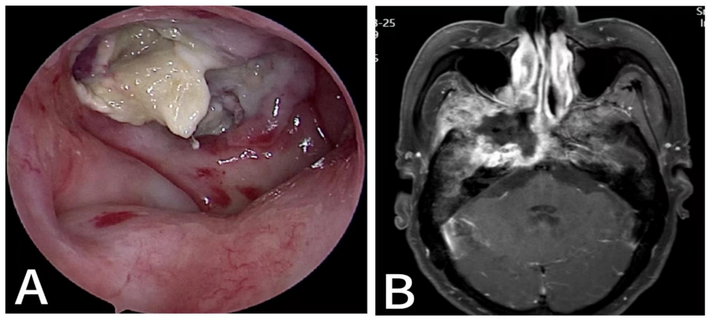
Introduction

Nasopharyngeal carcinoma (NPC) is a malignancy of the nasopharyngeal epithelium, often associated with Epstein-Barr Virus (EBV). Radiotherapy (RT) is a cornerstone of NPC treatment due to the tumor's high radiosensitivity, but it carries long-term risks. Osteoradionecrosis (ORN) is a rare but serious late complication of RT, typically diagnosed years post-treatment. ORN is marked by bony necrosis due to radiation-induced vascular damage and can lead to pain, cranial nerve deficits, or infections. Early detection is critical, but diagnosis is often delayed, especially with standard imaging (MRI/PET). CT scans may detect early osseous changes missed by routine imaging, offering potential for earlier intervention. The objective of this study is to determine whether CT imaging leads to a shorter time to diagnosis (TTD) for ORN compared to routine surveillance modalities (MRI/PET) in NPC patients.



Methods

This was a retrospective chart review of patients with confirmed history of NPC treated with radiotherapy who were subsequently diagnosed with ORN between 2001–2024 at a single academic institution. Patients were included if they had sufficient imaging and clinical documentation. Data collected included demographics (age, gender, comorbidities), radiation treatment details (dose, date), imaging data (modality, timing, findings), presence of symptoms or clinical concern for recurrence, and the management strategy (surgical, hyperbaric therapy, observation). The primary outcome of the study was the time to diagnosis, which was defined as the days from first imaging evidence of ORN to clinical diagnosis. Secondary outcomes included time from radiotherapy completion to ORN diagnosis as well as imaging frequency and the time interval between scans.

Results

Eighteen patients (72.2%, mean age = 58.03) were included in this study. The mean time from radiotherapy completion to ORN diagnosis was 5.5 years. Confirmation of ORN was determined by surgical debridement or imaging. ORN was first detected by CT in 50% of patients.

Figure 1. Percentage of patients who had ORN confirmed by debridement vs imaging.

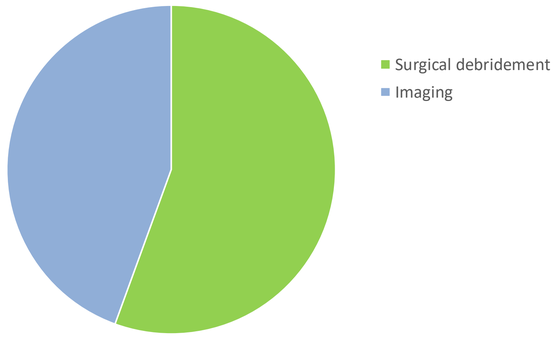
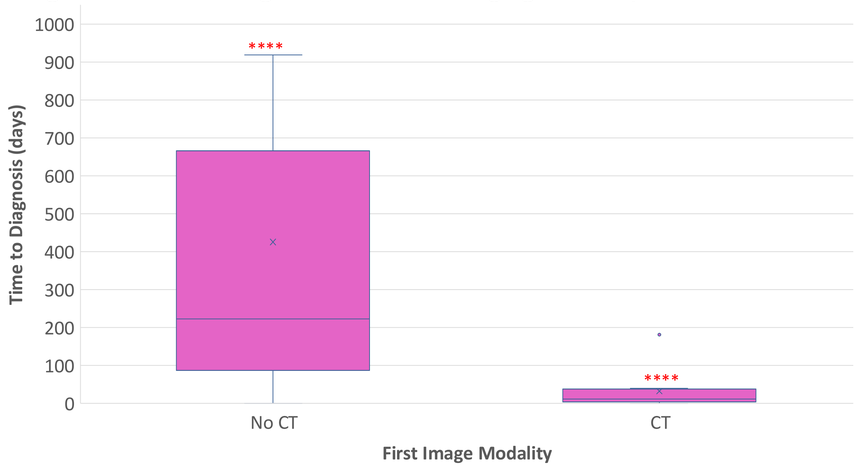


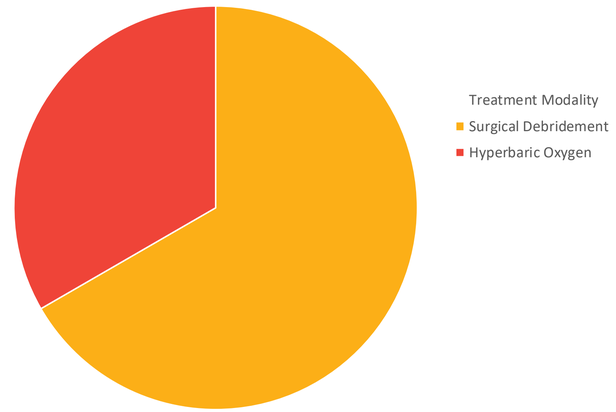
Figure 2. Time to diagnosis based on imaging modality.



A shorter TTD was observed in patients who obtained a CT compared to routine imaging (425.11 vs 32.00 days, p = 0.01), with fewer days between images (22.11 vs 232.20 days, p = 0.019). $P < 0.05$ indicates statistical significance.

Patients with CT scans after initial imaging had a shorter TTD than those who only underwent routine surveillance, though this was not significant (135.82 days vs 375.29 days, p = 0.221). CT detected ORN earlier than MRI (p = 0.036) though not earlier than PET (p = 0.498). TTD was unaffected by the presence of symptoms or lesion location (p = 0.14, p = 0.13).

Figure 3. Summarization of management of ORN for cohort.



Most patients (61.1%) subsequently underwent surgical debridement while 33.3% underwent hyperbaric therapy.

Discussion

CT identified ORN significantly earlier than MRI, leading to shorter TTD and potentially improved outcomes. This supports CT as a valuable adjunct in post-radiotherapy surveillance for NPC patients. Neither symptoms nor anatomical lesion location reliably predicted earlier diagnosis. Earlier ORN detection can reduce morbidity and allow for less invasive management.

Conclusions

CT scans significantly reduce diagnostic delays in ORN compared to standard MRI/PET imaging. Integrating CT into routine follow-up protocols for NPC survivors may improve outcomes by enabling earlier intervention. Future prospective studies are needed to determine optimal surveillance strategies.

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