



Human Papillomavirus-Positive Oropharyngeal Cancer: Clinical and Radiologic Characteristics

사람유두종바이러스 양성 입인두암:
임상적 및 영상의학적 특징

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The incidence of human papillomavirus (HPV)-positive oropharyngeal cancer (OPC) has been consistently increasing, now surpassing that of HPV-negative OPC. HPV-positive OPC exhibits distinct clinical characteristics and prognostic implications compared to HPV-negative OPC; occurs more frequently in younger, sexually active individuals; and generally demonstrates more favorable outcomes. Radiologic evaluation is crucial for tumor staging, predicting HPV status, and assessing or forecasting treatment response and patient outcomes. Recently, radiomics has enhanced tumor characterization. This review summarizes the key clinical features of HPV-positive OPC that radiologists should be familiar with and provides an overview of its radiologic characteristics, emphasizing the role of imaging in diagnosis, staging, treatment response assessment, and outcome prediction.

Index terms Human Papillomavirus; Oropharyngeal Cancer; Head and Neck Cancer

INTRODUCTION

Human papillomavirus (HPV) is a family of double-stranded DNA viruses that proliferate in the epithelial tissue of mucosal surfaces, particularly in the genital tract (specifically the uterine cervix) and the upper aerodigestive tract, affecting both males and females (1). More than 40 HPV subtypes are primarily transmitted through sexual contact and can lead to a wide range of benign and malignant neoplasms. Notably, among the high-risk subtypes associated with HPV-related malignancies, HPV-16 and HPV-18 are implicated in HPV-positive oropharyngeal cancer (OPC) and cervical cancer.

Received December 10, 2025

Revised January 5, 2026

Accepted January 11, 2026

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Since the recognition of HPV-positive OPC as a head and neck disease in 1983 (2), the incidence of HPV-positive cancers has steadily increased in South Korea, mirroring trends observed in other countries. Jun et al. (3) reported that 70% of OPC cases in a South Korean cohort were HPV-positive, with the incidence of HPV-positive OPC surpassing that of HPV-negative OPC since 2009. Moreover, although HPV-negative OPC has traditionally been associated with tobacco and alcohol use, HPV-positive OPC exhibits distinct clinical characteristics, affecting younger patients and demonstrating a more favorable treatment response and prognosis (4). Consequently, a separate staging system has been developed to address the unique behavior and improved prognosis of HPV-positive OPC compared with that of HPV-negative cancers.

Radiologic evaluation plays a crucial role in tumor staging, assessing treatment response, and conducting long-term surveillance of head and neck cancers. Numerous studies have explored the potential of imaging biomarkers to predict HPV status, tumor characteristics, and treatment outcomes using multiparametric techniques. Additionally, the ninth version of the Tumor, Node, Metastasis (TNM) staging system by the Union for International Cancer Control (UICC)/American Joint Committee on Cancer (AJCC) has recently been revised to include imaging-detected extranodal extension (iENE) in nodal staging, underscoring the significance of radiologic assessment in HPV-positive OPC.

In this review, we first delineate the clinical profile of HPV-positive OPC that radiologists should be familiar with and then provide an overview of the radiologic characteristics pertinent to diagnosis, tumor staging, and the assessment of treatment response and outcomes.

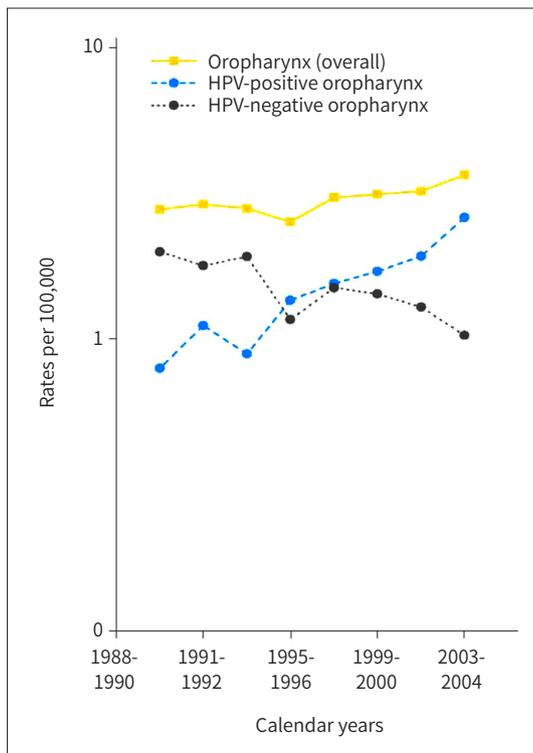


Fig. 1. Incidence rates for overall OPC, HPV-positive OPC, and HPV-negative OPC in the USA from 1988 to 2004 show an increase in HPV-positive OPC from 0.8 per 100,000 people from 1988 to 1990 to 2.6 per 100,000 people from 2003 to 2004, a decline in HPV-negative OPC from 2.0 per 100,000 people from 1988 to 1990 to 1.0 per 100,000 people from 2003 to 2004, and an overall increase in OPC from 2.8 per 100,000 people from 1988 to 1990 to 3.6 per 100,000 people from 2003 to 2004. Reprinted from Chaturvedi et al., *J Clin Oncol* 2011;29:4294-4301 (6). HPV = human papillomavirus, OPC = oropharyngeal cancer

CLINICAL PROFILE

EPIDEMIOLOGY AND RISK FACTORS

The epidemiology of head and neck cancer has undergone a significant transformation, characterized by a decline in smoking-related cancers and a concomitant rise in HPV-associated cancers (Fig. 1) (5, 6). This rise in the incidence of HPV-positive OPC has rendered it the most prevalent HPV-associated cancer in the United States (7). Similarly, data from the Korea Central Cancer Registry indicate a steady rise in the incidence of OPC since 1999 (8). Furthermore, Jun et al. (3) reported that since 2009, HPV-positive OPC cases have outnumbered HPV-negative cases. As of 2018, it is estimated that South Korea experiences approximately 735 new HPV-positive OPC cases and 176 associated deaths annually, resulting in an incidence and mortality rate of 1.4 and 0.34 per 100,000, respectively (9).

Furthermore, although HPV-negative OPC predominantly affects older individuals with a history of heavy tobacco or alcohol consumption, HPV-positive OPC is typically observed in younger, nonsmoking patients, leading to a lower average age of tumor onset. Over 90% of oral HPV infections are sexually transmitted. Factors such as an early age at first sexual contact; a high number of lifetime oral, vaginal, or anal sexual partners; and concurrent genital HPV infections significantly increase the risk (7). Additionally, the combined influence of tobacco use and HPV infection may further exacerbate the development of HPV-positive OPC (7).

PATHOGENESIS

HPV is implicated in approximately 70% of OPC cases, with HPV-16 being the most common subtype associated with this malignancy (9). Persistent HPV infection in the immature basal cells of the tonsillar crypt squamous epithelium of the tongue base and lingual/palatine tonsils enables viral DNA integration into host chromosomes. This process activates E6 and E7 oncoproteins, which inactivate the critical tumor suppressor proteins p53 and Rb, thereby playing a pivotal role in the pathogenesis of HPV-associated cancers (10, 11). The resulting dysregulation of DNA replication and mitosis contributes to the malignant transformation of intraepithelial lesions.

CLINICAL MANIFESTATION AND DIAGNOSIS

Early-stage HPV-positive OPC is frequently asymptomatic, and the emergence of symptoms typically signals advanced disease. Consequently, diagnosis is often postponed until the disease has progressed to a later stage. The initial symptoms can vary based on HPV status: HPV-positive OPC commonly presents with a neck mass (51%) due to nodal metastasis, while HPV-negative OPC more frequently manifests as a sore throat (53%) and dysphagia (41%) related to the primary tumor site (12). A summary of the clinical manifestations for patients with HPV-positive and HPV-negative OPC is presented in Table 1.

Diagnosis primarily relies on patient history, physical examination, endoscopy, and imaging studies. Pathological confirmation is achieved through incisional biopsy of suspicious mucosal lesions in the oropharynx, and HPV testing is essential for diagnosing HPV-positive OPC. The most frequently employed method for detecting the p16 protein, a surrogate marker for HPV infection, is p16 immunohistochemistry, as it is the most cost-effective approach. Additionally,

Table 1. Clinical Manifestations of HPV-Positive and HPV-Negative OPC

	HPV-Positive OPC	HPV-Negative OPC
Demographics	Younger patients Higher socioeconomic status	Older patients Lower socioeconomic status
Risk factors	Young age at first sexual contact, high number of sexual partners	Tobacco and alcohol exposure
HPV association	HPV-16, HPV-18	Not associated
Common symptoms	Neck mass	Sore throat, dysphagia
Prognosis	Favorable	Poor

HPV = human papillomavirus, OPC = oropharyngeal cancer

HPV-specific testing, such as polymerase chain reaction, can complement p16 testing. Recently, the detection of circulating tumor DNA—small DNA fragments shed from tumor tissues into the bloodstream, referred to as liquid biopsy—has emerged as a promising tool for early diagnosis, monitoring treatment response, and conducting post-treatment surveillance (13).

TREATMENT AND PROGNOSIS

The primary treatment modalities for HPV-positive OPC include surgery, radiotherapy (RT), and concurrent chemoradiotherapy (CCRT). According to the National Comprehensive Cancer Network (NCCN) guidelines (14), early-stage disease (T1-2, N0) is managed with surgery (resection of the primary tumor along with selective neck dissection) or definitive RT. In cases of T1-2 tumors with lymph node metastasis, definitive CCRT or induction chemotherapy may be considered. Furthermore, definitive CCRT is generally preferred for advanced-stage disease (T4 or N3). Treatment decisions may vary based on several factors, including potential complications, available hospital resources, and patient preferences. Therefore, the optimal management strategy is typically determined within a multidisciplinary framework.

HPV-positive OPC is well-documented to have more favorable outcomes than HPV-negative OPC. Ang et al. (15) reported a three-year overall survival rate of 82.4% for HPV-positive OPC, compared to 57.1% for HPV-negative OPC. According to the UICC/AJCC eighth edition TNM staging system for HPV-positive OPC, the five-year overall survival rates are 79.1%, 78.2%, 54.6%, and 21.3% for stages I, II, III, and IV, respectively (16). Within three years following definitive treatment, locoregional recurrence occurred in 13.6% of patients with HPV-positive OPC, while distant metastasis was observed in 8.7% of these patients (15).

Given the superior outcomes associated with HPV-positive OPC, treatment deintensification strategies have been proposed to mitigate the side effects of chemotherapy and/or RT in affected patients (17). However, to date, treatment deintensification has not yielded outcomes satisfactory enough to replace standard treatment. Furthermore, a recent meta-analysis indicated that deintensification poses a risk of suboptimal treatment, potentially leading to decreased overall survival and progression-free survival, as well as locoregional and distant control (18).

RADIOLOGIC CHARACTERISTICS

IMAGING EVALUATION AND TUMOR STAGING

Multimodal imaging techniques, including CT, MRI, and ¹⁸F-fluoro-2-deoxyglucose (FDG)

PET/CT, are crucial for initial diagnosis, tumor staging, and ongoing follow-up.

CT is widely utilized for assessing anatomical structures, primary tumors, and cervical lymph nodes. However, MRI is often favored due to its superior soft tissue contrast, which allows for detailed anatomical visualization and precise delineation of tumor extent. A standard MRI protocol should comprise sagittal T1-weighted images, axial and coronal fat-saturated T2-weighted or short T1 inversion recovery (STIR) images, axial T1-weighted images, and axial post-contrast T1-weighted images with fat saturation (19, 20). In addition, three-dimensional post-contrast T1-weighted gradient-recalled echo sequences can be instrumental in detecting small mucosal lesions or early post-treatment recurrences (19, 21, 22).

Furthermore, advanced MRI techniques such as diffusion-weighted imaging (DWI) and dynamic contrast-enhanced (DCE) MRI may offer enhanced insights for HPV-positive OPC. High apparent diffusion coefficient (ADC) values observed on DWI, attributed to low cellularity, high stromal content, and micronecrosis, are linked to poor clinical outcomes (23). Additionally, the evaluation of pharmacokinetic parameters through DCE-MRI can enhance tumor characterization by providing further information regarding the tumor microenvironment (24).

FDG PET/CT delivers metabolic information and is primarily employed for initial staging to assess locoregional spread and distant metastasis. The most frequent sites of distant metastasis include the lungs, followed by the distant lymph nodes, bone, and liver (25). Given that the oropharynx is the most common primary site in patients with cervical nodal metastasis of unknown origin (26), PET/CT should be conducted if the primary tumor remains unidentified (14).

In accordance with the UICC/AJCC ninth version of the TNM staging system, the T category is determined by tumor size and the presence of advanced local invasion, while the M category pertains to the presence of distant metastasis. The clinical T category definitions are as follows (27):

- T0: No evidence of primary tumor, but p16-positive (HPV-associated) cervical nodal metastasis present.
- T1: Tumor measures 2 cm or less in the greatest dimension.
- T2: Tumor measures more than 2 cm but not more than 4 cm in the greatest dimension.
- T3: Tumor measures more than 4 cm in the greatest dimension or extends to the lingual surface of the epiglottis.
- T4: Tumor invades the larynx, deep or extrinsic tongue muscle, medial or lateral pterygoid muscle, hard palate, mandible, pterygoid plates, nasopharynx, or skull base, and encases the carotid artery.

A significant update in the recent UICC/AJCC ninth version of the TNM staging system for HPV-positive OPC is the inclusion of ENE within the N category. ENE is defined as tumor extension beyond the lymph node capsule into the perinodal soft tissue (28), indicating a more aggressive phenotype (29). Several studies have demonstrated that iENE is associated with decreased overall survival (30-32) and increased distant metastasis (33) in patients with HPV-positive OPC. Consequently, to enhance nodal risk stratification, cases with iENE positivity in HPV-positive OPC are now reclassified one stratum higher (iENE-positive N1 to N2; iENE-positive N2 to N3). A comparison of the N classification between the eighth edition and ninth version of the TNM staging systems for HPV-positive OPC is presented in Table 2.

Radiologic assessment of iENE in head and neck cancer has been an ongoing endeavor.

Table 2. Update on the N Category of the Clinical TNM Staging System for Human Papillomavirus-Positive OPC

	UICC/AJCC Eighth Edition TNM Staging System	UICC/AJCC Ninth Version TNM Staging System
N0	No regional lymph node metastasis	No regional lymph node metastasis
N1	One or more ipsilateral lymph nodes, none larger than 6 cm	Metastasis in ipsilateral lymph node(s), all 6 cm or less in greatest dimension, without unequivocal imaging-detected and/or clinical extranodal extension
N2	Contralateral or bilateral lymph nodes, none larger than 6 cm	Metastasis in ipsilateral lymph node(s), all 6 cm or less in greatest dimension, with unequivocal imaging-detected and/or clinical extranodal extension or Contralateral or bilateral metastasis in lymph node(s), all 6 cm or less in greatest dimension without unequivocal imaging-detected and/or clinical extranodal extension
N3	Lymph node(s) larger than 6 cm	Metastasis in lymph node(s) greater than 6 cm in greatest dimension or Contralateral or bilateral metastasis in lymph node(s) with unequivocal imaging-detected and/or clinical extranodal extension

AJCC = American Joint Committee on Cancer, OPC = oropharyngeal cancer, TNM = Tumor, Node, Metastasis, UICC = Union for International Cancer Control

However, the lack of standardized iENE assessments has resulted in considerable variability among studies, with poor inter-reader agreement (34-36). A recent meta-analysis revealed low diagnostic accuracy, with a pooled sensitivity of 65% and a specificity of 74% for HPV-positive OPC (37). To standardize iENE assessment, an expert consensus was established by the Head and Neck Cancer International Group (38), and the Asian-Oceanian Society of Neuroradiology and Head and Neck Radiology (AOSNHNR) in collaboration with the American Society of Head and Neck Radiology (ASHNR) and the European Society of Head and Neck Radiology (ESHNR) has recently clarified the iENE guidelines (39). They underscored the importance of employing unequivocal radiologic criteria when grading iENE. The proposed four-tier grading system is as follows:

- Grade 0: Negative.
- Grade 1: Invasion into perinodal fat, exhibiting an irregular or indistinct capsule with projections or spikes into perinodal fat.
- Grade 2: Coalescent nodes with 1) a loss of intervening fat planes between nodes, 2) a loss of convexity at the point of contact in at least one node, and 3) a loss of an acute angle between nodes at any point of contact.
- Grade 3: Invasion of surrounding organs, demonstrating unequivocal muscle invasion, encasement of major arteries encompassing at least 270° of circumference, complete obliteration or tumor thrombus within the vein, or definitive invasion of the nerve, skin, or major salivary glands.

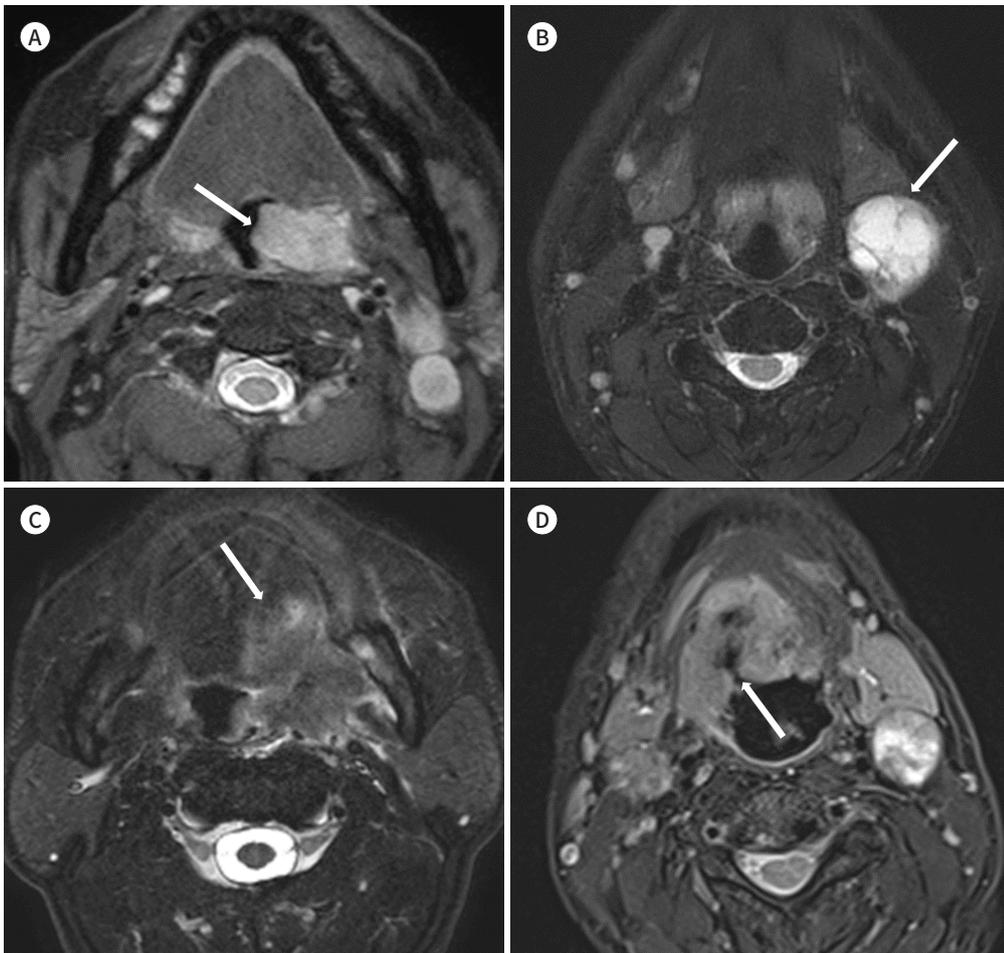
DIFFERENTIATION BETWEEN HPV-POSITIVE AND HPV-NEGATIVE OPC

Given the distinct clinical profiles of HPV-positive and HPV-negative OPC, numerous studies have sought to identify imaging features that can differentiate between them. Several researchers have examined primary tumor characteristics utilizing conventional MRI. Cantrell et al. (40) compared CT images of paired HPV-positive and HPV-negative OPC matched for T stage, tumor subsite, and smoking status, reporting that HPV-positive OPC exhibited more en-

hancing, exophytic, and well-defined morphology, less adjacent muscle invasion, and a greater prevalence of cystic nodal metastasis. Similarly, Chan et al. (41) noted comparable features on CT and MRI, with HPV-positive OPC displaying more exophytic, well-defined, and smaller tumors, alongside a predominance of cystic nodal metastasis. Chen et al. (42) also reported that HPV-positive OPC is less likely to demonstrate necrosis and ulceration within the primary tumor (Fig. 2).

Advanced MRI techniques have further contributed to the differentiation between HPV-positive and HPV-negative OPC. Several studies have indicated that the mean and minimum ADC values of HPV-positive OPC are significantly lower than those of HPV-negative OPC. Nakahira et al. (43) identified a mean ADC cutoff of $1.027 \times 10^{-3} \text{ mm}^2/\text{s}$ (43-45). Moreover, histogram analyses of ADC values have indicated that HPV-positive OPC exhibits higher kurtosis and skewness compared to HPV-negative OPC (46), suggesting that histologically, densely packed tumor cells with minimal stromal components and necrosis in HPV-positive OPC correspond to lower ADC values with a leptokurtic distribution. A recent study demonstrated

Fig. 2. Characteristic radiologic features of HPV-positive and HPV-negative OPC are shown on axial T2-weighted MRI images, with HPV-positive OPC demonstrating a well-defined and exophytic primary tumor (arrow in A) and a cystic lymph node (arrow in B), and HPV-negative OPC demonstrating ill-defined borders (arrow in C) and ulceration (arrow in D) in primary tumors. HPV = human papillomavirus, OPC = oropharyngeal cancer



that a reduced field-of-view DWI can enhance the differences in diffusion parameters between HPV-positive and HPV-negative OPC (47).

DCE-MRI has also been employed to differentiate HPV status. Choi et al. (48) reported that the permeability of HPV-positive OPC is greater than that of HPV-negative OPC, characterized by a higher volume transfer constant (K^{trans}) and flux rate constant (k_{ep}) (Fig. 3); however, other studies did not find perfusion parameters to be distinctly discriminatory (49-51).

ASSESSMENT OF TREATMENT RESPONSE AND OUTCOMES

In clinical practice, tumor response to therapy is evaluated using the Response Evaluation Criteria in Solid Tumors (RECIST) (52), which depend on lesion detection and linear measurements obtained through CT and conventional MRI. Patient outcomes are effectively stratified by the UICC/AJCC TNM staging system, wherein the size and extent of the primary tumor are traditionally regarded as prognostic factors in HPV-positive OPC, as indicated by the T category of TNM staging.

The prediction of tumor response utilizing advanced MRI techniques has also been explored. Numerous studies have investigated the potential of diffusion parameters to predict treatment response and prognosis. Most MRI studies have reported that HPV-positive OPC demonstrates significantly lower ADC values compared to HPV-negative OPC. Notably, in contrast to other types of head and neck cancers, lower pretreatment ADC values are associated with a more favorable treatment response in patients with OPC (Fig. 4) (43-45, 53-56). The increased cellularity observed in HPV-positive OPC may be attributed to the presence of basaloid or non-keratinizing tumor cells characterized by inconspicuous cytoplasm and a high mitotic rate resulting from the inactivation of the p53 and Rb pathways (57). However, high cellularity may also signify a greater number of therapeutically responsive cells amenable to chemoradiotherapy, resulting in a favorable treatment outcome. While the primary tumor is typically the focus of assessment, Noij et al. (58) demonstrated that a lower ADC measured in the largest lymph node is a significant predictor of improved disease-free survival in patients with OPC. In contrast, Ravanelli et al. (46) and Chawla et al. (59) reported no association between diffusion parameters and outcomes on pretreatment MRI in HPV-positive OPC.

Post-therapy alterations in diffusion parameters may serve as the most reliable indicators of tumor response and outcomes. An increase in ADC percentage correlates with a favorable tumor response and reduced locoregional recurrence in head and neck cancers. Complete responders exhibited significantly greater increases in ADC of the primary tumor within one week compared to partial responders (60) and within two to four weeks compared to the recurrence group following chemoradiotherapy (61). Additionally, a lower percentage change in ADC has been associated with higher rates of locoregional failure (62, 63). Furthermore, intravoxel incoherent motion (IVIM) diffusion parameters have shown significant ADC increases during treatment in complete responders with HPV-positive OPC (64, 65).

Tumors exhibiting higher vascularity are considered more responsive to chemoradiotherapy, attributed to enhanced delivery of chemotherapeutic agents and increased radiosensitivity (23). Among the perfusion parameters derived from DCE-MRI, K^{trans} has shown potential associations with treatment response and outcomes, with higher pretreatment K^{trans} values in primary tumors (66, 67) correlating with longer locoregional recurrence-free survival, dis-

Fig. 3. MRI images, DCE-MRI parameter maps, and histograms of K^{trans} values according to HPV status show an enhancing tumor in the right tonsillar fossa on axial T2 (A) and contrast-enhanced fat-suppressed T1 weighted MRI; corresponding color-coded DCE-MRI-derived K^{trans} (C) and v_e maps (D); and higher relative frequency at higher K^{trans} values in the HPV-positive oropharyngeal cancer group on relative frequency (E) and cumulative relative frequency (F) histograms. Reprinted from Choi et al., *AJR Am J Roentgenol* 2016;206:408-413 (48). DCE = dynamic contrast-enhanced, HPV = human papillomavirus, K^{trans} = volume transfer constant, v_e = extravascular extracellular volume fraction

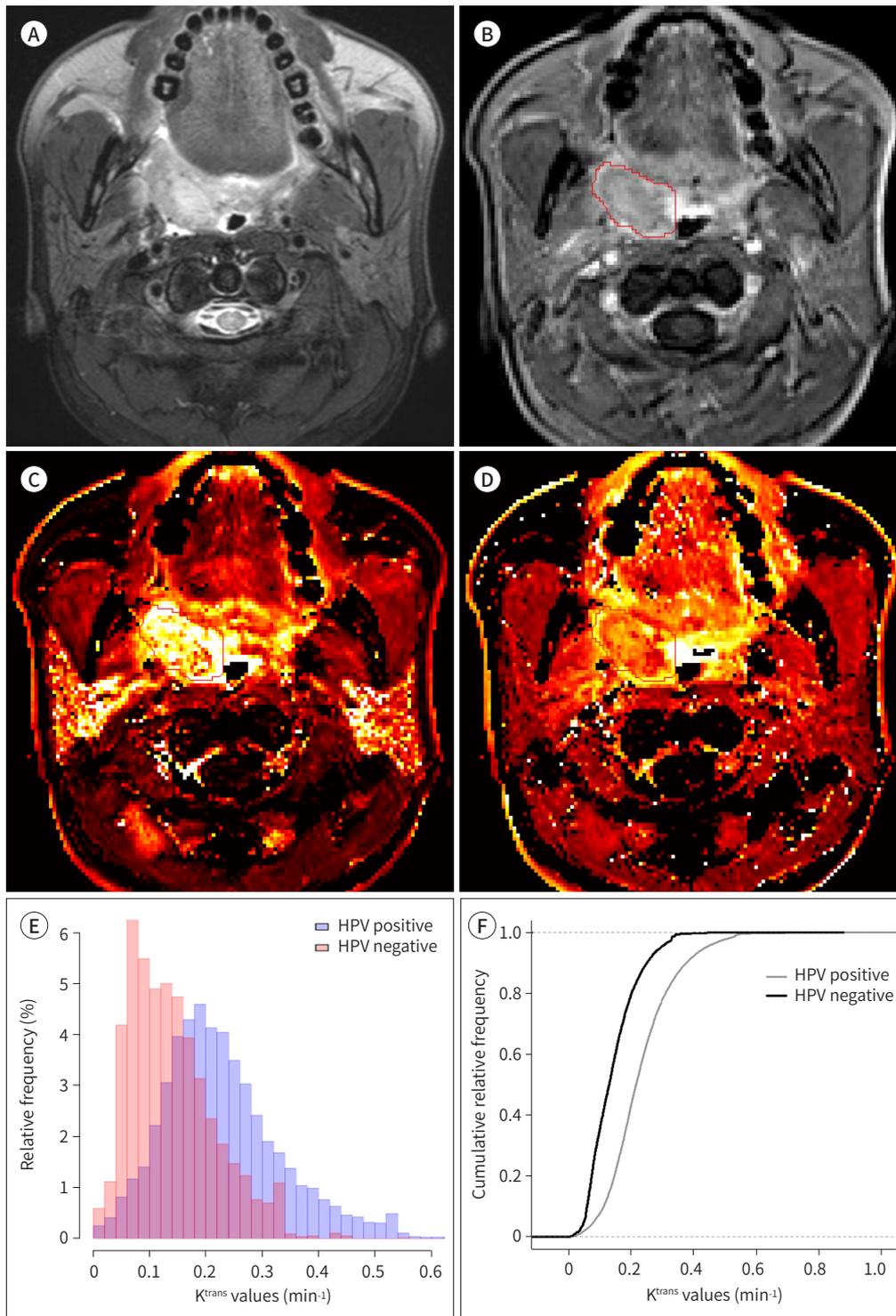
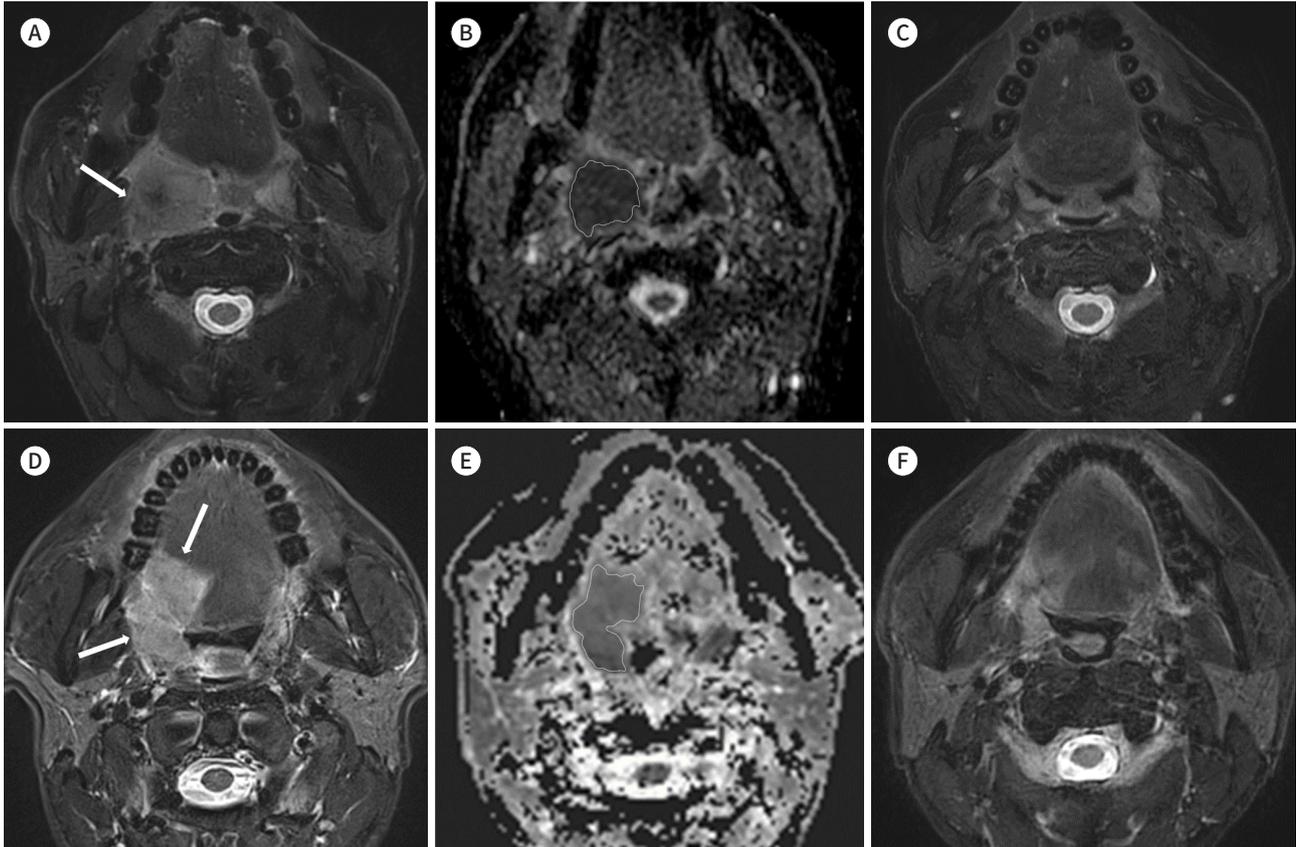


Fig. 4. Treatment response comparison of a 71-year-old male with HPV-positive OPC, in which axial T2-weighted MRI (A) demonstrates a primary tumor in the right tonsillar fossa (arrow) with a gross tumor volume of 15.35 cm³, an ADC value calculated using region-of-interest on the ADC map (B) of $0.707 \times 10^{-3} \text{ mm}^2/\text{s}$, and follow-up MRI (C) showing complete tumor shrinkage 2 months after chemoradiotherapy is compared to that of a 59-year-old male with HPV-negative OPC, in which axial T2-weighted MRI (D) demonstrates a primary tumor in the right tonsillar fossa and base of tongue (arrows) with a gross tumor volume of 12.94 cm³, an ADC value of $0.942 \times 10^{-3} \text{ mm}^2/\text{s}$ (E), which is higher than that of the HPV-positive OPC case, and follow-up MRI (F) showing a partial tumor size decrease 2 months after chemoradiotherapy. ADC = apparent diffusion coefficient, HPV = human papillomavirus, OPC = oropharyngeal cancer



ease-free survival, or overall survival (68-70).

Meanwhile, although DWI and DCE-MRI have demonstrated potential utility in evaluating HPV-positive OPC, their application in clinical practice should remain supplementary due to limited inter-reader agreement and heterogeneous diagnostic performance across studies. When integrating DWI or DCE-MRI findings into radiologic reports, qualitative descriptions (e.g., low or high values) may be more appropriate than strict cutoff values, and these findings should be interpreted holistically, considering both conventional imaging features and clinical context.

RADIOMICS APPLICATIONS

Radiomics is an image analysis methodology that extracts extensive high-dimensional quantitative data from medical images. It is increasingly applied in oncological imaging research and focuses on tumor classification, outcome prediction, treatment response assessment, and integrative analyses linking imaging features to genomics. Extracted radiomic features quantify morphological characteristics, first-order statistical properties, and spatial

relationships between voxels (texture features) (71). Consequently, radiomics models have demonstrated substantial performance in distinguishing HPV-positive from HPV-negative OPC (72-78); a recent systematic review and meta-analysis reported pooled sensitivity and specificity values of 0.78 and 0.76, respectively (79), with area under the curve values ranging from 0.71 to 0.95 (80). Radiomics models have also exhibited feasibility in predicting overall survival, with enhanced performance when clinical parameters were incorporated (78, 81, 82). Despite the novel insights radiomics offers in the assessment of HPV-positive OPC, challenges related to generalizability and reproducibility persist. Therefore, standardization of image processing and radiomics feature definitions is essential (71, 83).

CONCLUSION

Recent findings underscore the pivotal role of HPV infection in the development of OPC, presenting a clinical profile distinct from traditional smoking- or alcohol-related head and neck cancers. HPV-positive OPC typically manifests in younger, sexually active individuals and is associated with improved treatment responses and prognoses compared to HPV-negative OPC. Radiologic evaluation is crucial for the diagnosis, tumor staging, treatment response assessment, and long-term surveillance of HPV-positive OPC, as well as other solid tumors. HPV-positive OPC generally presents as a small, well-defined, exophytic tumor with cystic nodal metastasis. The recently updated UICC/AJCC ninth version of the TNM staging system has incorporated iENE into the N category, emphasizing the importance of rigorous radiologic assessment of ENE. Advanced MRI techniques, such as DWI and DCE-MRI, may provide additional value in predicting HPV status, treatment response, and patient outcomes. Radiologists should be well-acquainted with the characteristic clinical and radiologic features of HPV-positive OPC and the implications of recent staging updates.

Supplementary Materials

Korean translation of this article is available with the Online-only Data Supplement at <http://doi.org/10.3348/jksr.2025.0127>.

Author Contributions

Writing—original draft, all authors; and writing—review & editing, all authors.

Conflicts of Interest

Jinna Kim has been a Section Editor of the Journal of the Korean Society of Radiology since 2022; however, she was not involved in the peer review, evaluation, or decision process of this article. The other author declares no conflicts of interest.

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Funding

This study was supported by faculty research grant 6-2025-0070 from Yonsei University College of Medicine.

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사람유두종바이러스 양성 입인두암: 임상적 및 영상의학적 특징

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사람유두종바이러스(human papillomavirus; 이하 HPV) 양성 입인두암(oropharyngeal cancer)의 발생률은 지속적으로 증가하고 있으며, 현재는 HPV 음성 입인두암의 발병률을 넘어선 상태이다. HPV 양성 입인두암은 HPV 음성 입인두암과 비교하여 명확히 구별되는 임상적 특징과 예후를 보이는데, 더 젊고 성적으로 활동적인 연령층에서 흔히 발생하고 치료 반응 및 예후가 더 우수하다. 영상평가는 종양 병기 설정, HPV 상태 예측, 치료 반응과 환자 예후 평가 및 예측에 필수적이다. 최근에는 의료영상정보체학(radiomics)이 종양 특성 평가에 추가적인 정보를 제공하고 있다. 본 중설에서는 영상의학과 의사가 알아야 할 HPV 양성 입인두암의 핵심 임상적 특징을 정리하고, 진단, 병기 설정, 치료 반응 평가 및 예후 예측에서 영상의 역할을 중심으로 HPV 양성 입인두암의 영상의학적 특성을 개괄하고자 한다.

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