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Performance of Radiomics in Predicting HPV Status of Oropharyngeal Cancer

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INTRODUCTION

Oropharyngeal carcinoma has been on the rise despite overall decreases in tobacco use. This rise is due, in large part, to the increase in human papilloma virus (HPV). [1,2] Therefore, determining the HPV status of oropharyngeal carcinoma is a key element in the management and prognostication of patients. Currently, testing for HPV status uses p16 immunohistochemistry, which requires an invasive procedure to obtain a tissue sample.[3,4] As such, there is benefit in considering non-invasive options and new methods of distinguishing HPV status in this patient population have become an area of increased research interest.

One such possible method in determining HPV status is radiomics, a branch of artificial intelligence that uses high-throughput extraction of quantitative imaging features to develop predictive models.[5,6] The primary advantage of using a radiomics framework over more traditional methods of determining HPV status is that it offers a non-invasive approach.

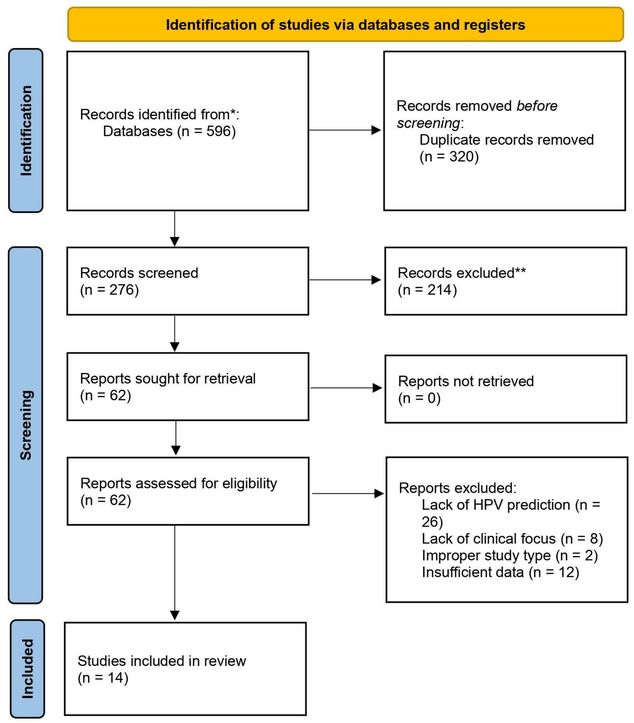
Currently, several studies have been published which examine the radiomic features of oropharyngeal cancer patients that are associated with HPV status and the ability to predict HPV status based on these features.[7] However, these studies contain a large deal of heterogeneity, both in the methodology and in the results of these studies. As such, it is difficult for clinicians to interpret the results of these individual studies and their relevance to clinical practice in the prediction of HPV status of oropharyngeal cancers. Therefore, we performed a systematic review and meta-analysis with the intention of assessing the diagnostic accuracy and predictive value of radiomics in predicting HPV status of patients with oropharyngeal carcinoma

METHODS

This review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A comprehensive literature search of PubMed, OVID, Cochrane, Web of Science, and Scopus from inception until June 7, 2022 was performed to identify eligible studies.

Strict inclusion and exclusion criteria were applied to the identified studies. Data collection was performed by two independent reviewers with disagreements resolved by consensus. Following full-text review and data collection, a meta-analysis was performed on studies with sufficient data regarding model performance.

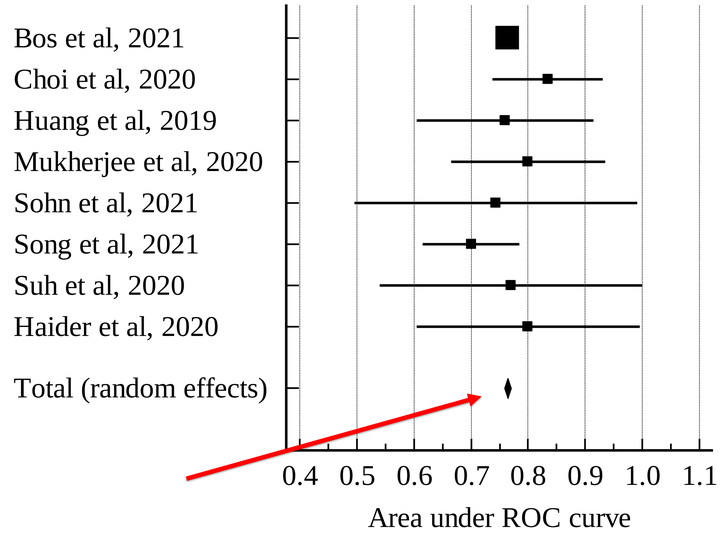
Fourteen articles were chosen, with a total of 15 radiomics models.



RESULTS

Of the included studies, 12 models reported sensitivity, with a mean of 0.778 (standard deviation (SD) 0.073). Similarly, 12 models reported specificity, with a mean of 0.751 (SD 0.111). The area under the ROC curve (AUC) was reported by all 15 models, with a mean of 0.814 (SD 0.081). Finally, accuracy was reported by 8 models, with a mean of 0.768 (SD of 0.044). Meta-analysis was performed on 8 studies which reported AUCs with confidence intervals, returning a pooled AUC of 0.764 [95% CI 0.758 to 0.770]. The radiomics quality score (RQS) was applied to each included study as a measure of quality. RQS ranged from -1 to 22, with a mean of 13.4 and an intraclass coefficient (ICC) of 0.874.

	Sensitivity	Specificity	Accuracy	AUC
Mean	0.778	0.751	0.768	0.814
SD	0.073	0.111	0.044	0.081



CONCLUSIONS

Radiomics modeling may serve as a diagnostic indicator for HPV status in oropharyngeal cancer patients. However, the methodological quality of such studies in the literature remains a limitation for further clinical implementation.

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