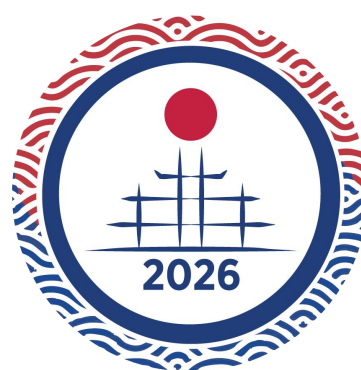




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INTRODUCTION

Neoadjuvant immunotherapy and chemotherapy (NICT) is the standard treatment regimen for resectable non-small cell lung cancer (NSCLC). This study aims to establish a deep learning model based on interactive automated 3D segmentation to predict NICT efficacy and identify patients likely to benefit from postoperative adjuvant immunotherapy.

METHODS

This study collected NSCLC patients who underwent NICT and surgery at three centers. A proven high-precision and strong generalization 3D segmentation architecture with a flexible interaction mode (VISTA3D) is applied in this study for CT images to achieve automatic tumor identification in NSCLC patients via automated segmentation combined with segmentation point prompts. Multiplex immunofluorescence was performed to compare the tumor immune microenvironment between low-risk and high-risk patients stratified by the model. Based on this model, patients likely to benefit from postoperative adjuvant immunotherapy are identified.

DISCUSSION AND CONCLUSION

- The deep learning model developed in this study, based on automated segmentation combined with point prompts, can replace manually segmented prediction models to assist clinicians in effectively predicting pathological complete response in NSCLC patients undergoing NICT prior to surgical treatment. Furthermore, patients identified as high-risk by the model can significantly benefit from postoperative adjuvant immunotherapy.

RESULTS

The 3D Vision-Transformer model based on manual segmentation achieved an area under the curve (AUC) of 0.85 on the internal test set of development cohort A and 0.82 on external validation cohort C. When applied to segmentations generated by the VISTA3D segmentation model, this model attained AUC values of 0.83 and 0.81 for cohort A and cohort C, respectively, with a Dice similarity coefficient reaching  $0.83 \pm 0.15$ . Patients identified as high-risk by the model demonstrated significantly improved disease-free survival and overall survival with adjuvant immunotherapy (HR: 0.55, P=0.002; HR: 0.51, P=0.002). Multiplex immunofluorescence validation demonstrated that low-risk patients had an immune-active microenvironment characterized by increased CD8+, CD68+ and PD-L1+ cells and decreased CD163+ cells compared to high-risk patients.

