

DEVELOPMENT AND VALIDATION OF A LOGISTIC PREDICTION MODEL FOR PAPILLARY THYROID CARCINOMA BASED ON CLINICAL AND ULTRASOUND PARAMETERS

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Background. Early identification of papillary thyroid carcinoma (PTC) remains one of the major challenges in endocrine oncology. Although thyroid ultrasonography and fine-needle aspiration biopsy are widely used, the diagnostic accuracy of individual methods may be limited, particularly in patients with coexisting autoimmune thyroiditis or indeterminate sonographic findings. Multivariable prediction models integrating clinical and imaging characteristics may improve individualized risk assessment and facilitate clinical decision-making.

Objective. To develop and evaluate a logistic regression model for predicting the probability of papillary thyroid carcinoma using clinical and ultrasonographic variables.

Materials and Methods. A comparative observational study included 90 patients with thyroid diseases treated between 2023 and 2025. The study population consisted of 30 patients with histologically confirmed papillary thyroid carcinoma, 30 patients with autoimmune thyroiditis, and 30 patients with nodular euthyroid goiter.

All participants underwent clinical examination, thyroid ultrasonography with TI-RADS classification, shear wave elastography, laboratory assessment of thyroid function, and determination of thyroid autoantibodies. Logistic regression analysis was applied to identify independent predictors of papillary thyroid carcinoma. Model discrimination was assessed using receiver operating characteristic (ROC) analysis, whereas calibration was evaluated with the Hosmer–Lemeshow goodness-of-fit test.

Results. Multivariable logistic regression identified patient age and TI-RADS category as independent predictors of papillary thyroid carcinoma.

The developed prediction model demonstrated excellent diagnostic performance, achieving an area under the receiver operating characteristic curve (AUC) of 0.972 (95% CI: 0.938–1.000), with a sensitivity of 93.1% and a specificity of 96.7%. Model calibration was satisfactory, as confirmed by the Hosmer–Lemeshow goodness-of-fit test ($p = 0.888$). The optimal probability threshold determined by the Youden index was 32.2%, providing the highest combined sensitivity and specificity.

These findings indicate that combining routinely available clinical and ultrasonographic parameters allows highly accurate prediction of papillary thyroid carcinoma before surgical treatment.

Conclusions

The proposed logistic prediction model demonstrated excellent discrimination and calibration for identifying papillary thyroid carcinoma. Incorporating patient age and TI-RADS classification into a multivariable model may improve preoperative risk stratification and support clinical decision-making in patients with thyroid nodules.