



ROLE OF PODOPLANIN AS A BIOMARKER IN DIAGNOSIS AND PREDICTION OF METASTASIS IN PAPILLARY THYROID CARCINOMA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Papillary thyroid carcinoma (PTC) is the most common malignant tumor of the thyroid gland and frequently spreads through lymphatic channels. Identification of reliable biomarkers that assist in diagnosis and prediction of metastatic potential is essential for appropriate management. **Objective:** To evaluate the role of podoplanin expression as an immunohistochemical biomarker in the diagnosis of papillary thyroid carcinoma and its association with metastatic potential. **Methods:** A cross-sectional study was conducted in the Department of Pathology at a tertiary care hospital in Telangana. Histopathologically confirmed cases of papillary thyroid carcinoma were included. Immunohistochemical staining for podoplanin (D2-40) was performed on formalin-fixed paraffin-embedded tissue sections. Podoplanin expression was assessed based on staining intensity and percentage of positive tumor cells. **Results:** Podoplanin expression was observed in a significant proportion of papillary thyroid carcinoma cases. Increased expression was associated with higher tumor aggressiveness and lymphatic invasion. Tumor cells demonstrated membranous and cytoplasmic staining patterns, particularly at the invasive front. The findings suggest a correlation between podoplanin expression and metastatic potential. **Conclusion:** Podoplanin is a useful immunohistochemical biomarker in papillary thyroid carcinoma. Its expression may assist in differentiating PTC from non-papillary thyroid lesions and may serve as a predictor of lymphatic invasion and metastasis.

KEYWORDS : Papillary Thyroid Carcinoma, Podoplanin, Immunohistochemistry, Lymphatic Invasion, Biomarker

INTRODUCTION

Papillary thyroid carcinoma accounts for nearly 80–85% of all thyroid malignancies. Although the prognosis is generally favorable, a subset of tumors demonstrates aggressive behavior with lymphatic invasion and regional lymph node metastasis. Identification of reliable biomarkers that can assist in diagnosis and prediction of metastatic potential is therefore essential.

Podoplanin is a mucin-type transmembrane glycoprotein expressed in lymphatic endothelial cells and has been widely used as a marker of lymphatic vessels. Recent studies have demonstrated aberrant expression of podoplanin in various malignancies, including papillary thyroid carcinoma. Its role in tumor invasion, epithelial–mesenchymal transition, and lymphatic dissemination makes it an attractive biomarker for assessing tumor aggressiveness.

This study aims to evaluate the expression of podoplanin in papillary thyroid carcinoma and determine its potential role in diagnosis and prediction of metastasis.

MATERIALS AND METHODS

Study Design: Cross-sectional study.

Study Setting: Department of Pathology, at tertiary care hospital in Telangana.

Study Material: Histopathologically confirmed cases of papillary thyroid carcinoma received in the department during the study period.

Methodology: Formalin-fixed paraffin-embedded tissue blocks were selected and sections were stained with hematoxylin and eosin for routine histopathological evaluation. Immunohistochemical staining for podoplanin (D2-40) was performed.

Evaluation of Staining: Podoplanin expression was assessed semi-quantitatively based on staining intensity (weak, moderate, strong) and percentage of positive tumor cells. An immunoreactive scoring system was applied to categorize expression levels.

Statistical Analysis: Data were analyzed using statistical software and associations between clinicopathological parameters and podoplanin expression were evaluated.

OBSERVATION AND RESULTS

The study included multiple cases of papillary thyroid carcinoma with varying demographic and clinicopathological characteristics. Females constituted the majority of cases, consistent with the known female predominance of thyroid malignancies.

Podoplanin expression was observed in tumor cells in a significant number of cases. The staining pattern was predominantly membranous with occasional cytoplasmic positivity. Higher expression levels were noted in tumors demonstrating lymphatic invasion and nodal metastasis.

Statistical analysis showed an association between podoplanin expression and aggressive tumor features, suggesting its role in tumor progression and metastatic potential.

Table 1 Histopathological Diagnosis of Papillary Thyroid Carcinoma

HPE Diagnosis	Frequency (n)	Percentage (%)
PTC	4	8
PTC with Adjacent Hashimoto's	8	16
PTC – Classic Subtype	8	16
PTC – Conventional	10	20
PTC – Encapsulated Variant	6	12
PTC – FVPTC	11	22
PTC – Multicentric	3	6
Total	50	100

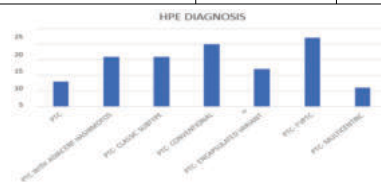


Figure 1

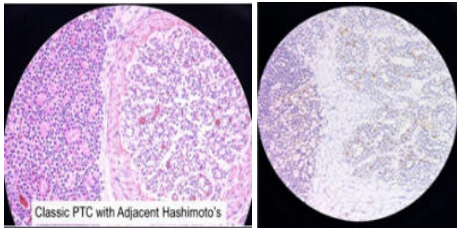


Figure 2 Podoplanin Expression in PTC with Adjacent Hashimoto

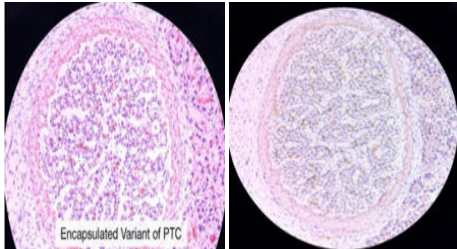


Fig3 Podoplanin in Encapsulated PTC

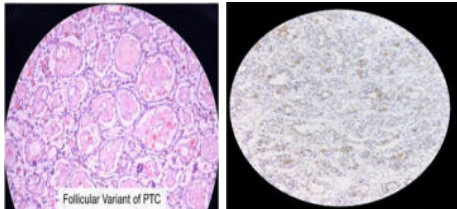


Fig4 Podoplanin Expression in Follicular Variant of PTC

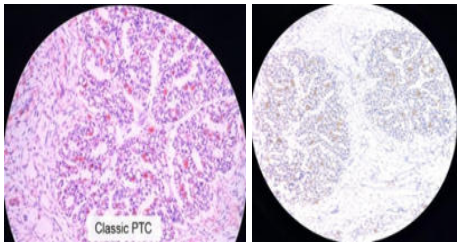


Fig 5 Podoplanin Expression in Classic PTC

Table 2 Distribution of Cases According to Podoplanin Intensity

PDPN Intensity	Frequency (n)	Percentage (%)
0	34	68
5	8	16
10	8	16
Total	50	100

Table 3 Distribution of Cases According to Podoplanin Score

PDPN Score	Frequency (n)	Percentage (%)
0	34	68
1	16	32
Total	50	100

Table 4 Association Between Final Histopathological Diagnosis and Podoplanin Expression

Final Diagnosis	Negative n (%)	Weak Positive n (%)	Total n (%)
PTC	2 (4.00%)	2 (4.00%)	4 (8.00%)
PTC with Adjacent Hashimoto's	6 (12.00%)	2 (4.00%)	8 (16.00%)
PTC – Classic Subtype	7 (14.00%)	1 (2.00%)	8 (16.00%)
PTC – Conventional	4 (8.00%)	6 (12.00%)	10 (20.00%)
PTC – Encapsulated Variant	4 (8.00%)	2 (4.00%)	6 (12.00%)
PTC – FVPTC	9 (18.00%)	2 (4.00%)	11 (22.00%)
PTC – Multicentric	2 (4.00%)	1 (2.00%)	3 (6.00%)
Total	34 (68.00%)	16 (32.00%)	50 (100%)

Chi-square p-value = 0.3447

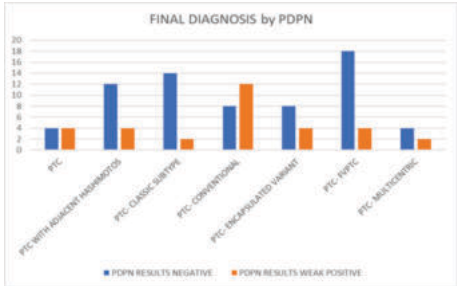


Figure 6: Final Diagnosis by Podoplanin

DISCUSSION

Papillary thyroid carcinoma is known for its propensity to spread through lymphatic channels. Podoplanin plays an important role in lymphangiogenesis and tumor cell migration. Increased expression of podoplanin in tumor cells has been associated with lymphatic invasion and lymph node metastasis in several malignancies.

The findings of the present study are consistent with previous reports demonstrating increased podoplanin expression in papillary thyroid carcinoma compared with benign thyroid lesions. The membranous staining pattern observed in tumor cells further supports its involvement in tumor cell motility and invasion.

Podoplanin immunostaining can therefore serve as a valuable adjunct to routine histopathology, particularly in challenging cases where morphological features overlap with benign or non-papillary thyroid lesions.

CONCLUSION

Podoplanin is a promising immunohistochemical biomarker in papillary thyroid carcinoma. Its expression in tumor cells correlates with lymphatic invasion and metastatic potential. Incorporation of podoplanin staining in routine pathological evaluation may improve diagnostic accuracy and assist in identifying tumors with aggressive biological behavior

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