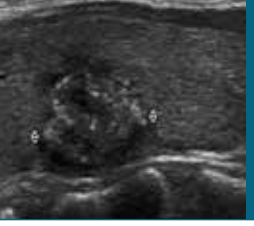

CASE STUDY

Papillary Thyroid Cancer: A Comprehensive Review

ABSTRACT

Papillary thyroid cancer (PTC) represents approximately 80% of all thyroid malignancies. This cancer primarily affects women and typically develops in adults between the ages of 30 and 50. Previous exposure to radiation during childhood stands out as a major risk factor. In most cases, PTC is discovered by chance as a thyroid nodule that causes no symptoms, though it can also manifest as a noticeable mass in the neck or enlarged lymph nodes. Less frequently, patients may experience dysphagia, dysphonia, and dyspnea when the tumour compresses nearby structures. This article examines the essential aspects of diagnosing, imaging, and treating this condition.

KEYWORDS: papillary thyroid cancer, thyroid malignancy, diagnosis, imaging, treatment

Introduction

Papillary thyroid cancer (PTC) is the most common type of thyroid malignancy, accounting for approximately 80% of all thyroid cancers. It typically affects individuals between 30-50 years of age and occurs more frequently in women. This review discusses the key aspects of diagnosis, imaging findings, treatment approaches, and prognosis.

Epidemiology and Risk Factors

- Age: Most common in adults 30-50 years
- Gender: Female predominance (3:1 ratio)
- Radiation exposure: Significant risk factor, especially childhood exposure
- Family history: Associated with familial syndromes like Familial Adenomatous Polyposis
- Genetic factors: BRAF V600E mutation present in approximately 45% of cases

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Clinical Presentation

PTC typically presents as:

- Asymptomatic thyroid nodule discovered incidentally
- Palpable neck mass
- Cervical lymphadenopathy
- Less commonly: dysphagia, dysphonia, or dyspnea due to local compression

Ultrasound Characteristics and ACR TI-RADS

Ultrasound is the primary imaging modality for thyroid nodule evaluation. The American College of Radiology Thyroid Imaging Reporting and Data System (ACR TI-RADS) provides a standardized approach for risk stratification.

Key Ultrasound Features of PTC:

1. Composition

– Solid or predominantly solid
– Hypoechoic compared to adjacent thyroid tissue

2. Suspicious Characteristics

– Microcalcifications (highly specific)
– Irregular margins
– Taller-than-wide shape
– Extra-thyroidal extension
– Suspicious lymph nodes

ACR TI-RADS Categories and Points:

The most characteristic ultrasound features of papillary thyroid cancer (PTC) include:

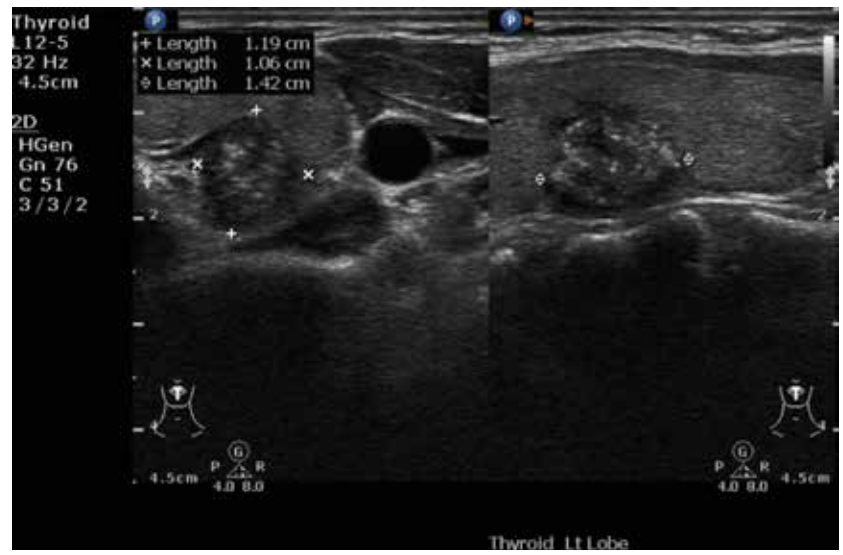

Figure 1: Ultrasound image of suspected papillary thyroid cancer, including multiple punctate mircrocalcifications, ACR TIRADS 5

Primary Suspicious Features:

1. Microcalcifications

- Appear as tiny, punctate bright echogenic foci (usually < 1mm)
- No posterior acoustic shadowing
- Represent psammoma bodies histologically
- One of the most specific features for PTC

2. Shape

- Taller-than-wide orientation (measured in transverse plane)
- Growth across normal tissue planes
- Reflects the tumor's tendency to grow perpendicular to the skin surface

3. Echogenicity

- Markedly hypoechoic compared to thyroid parenchyma
- Often similar in appearance to adjacent strap muscles
- May show internal heterogeneity

4. Margins
- Irregular or microlobulated borders
- Ill-defined or spiculated edges
- Non-smooth, non-encapsu lated appearance
- Possible infiltrative borders

5. Composition
- Solid or predominantly solid
- Minimal to no cystic compo nents in classic PTC
- Some variants may show more cystic change

Additional Features:

1. Vascularity
- Intranodular blood flow on color Doppler
- Chaotic, disorganized vessel pattern
- May show peripheral and central vascularity

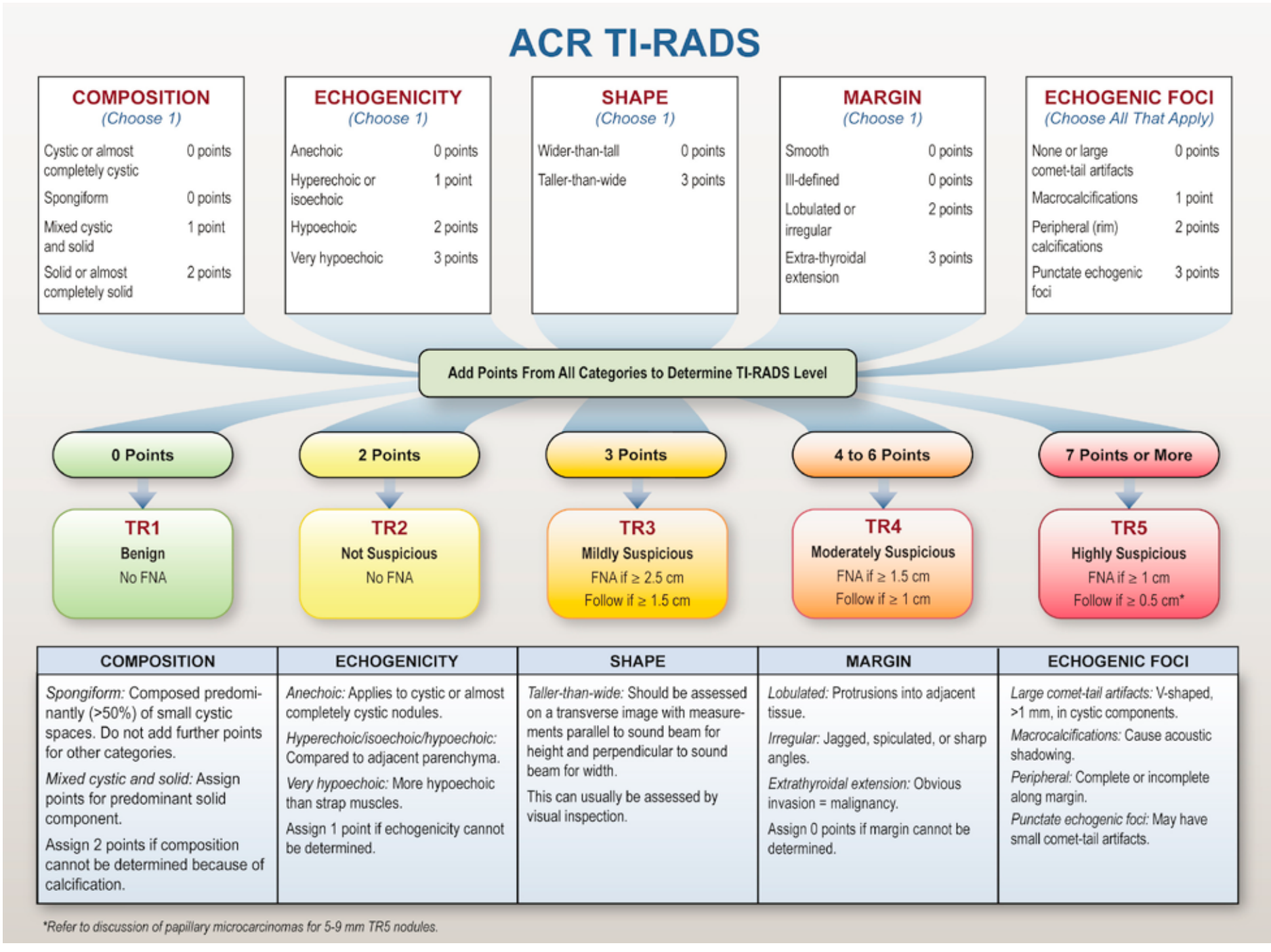

Figure 2: Chart showing five categories on the basis of the ACR Thyroid Imaging, Reporting and Data System (TI-RADS) lexicon, TR levels, and criteria for fine-needle aspiration or follow-up ultrasound. From https://www.jacr.org/article/s1546-1440%2817%2930186-2/fulltext
Tessler FN et al. ACR Thyroid Imaging, Reporting and Data System (TI-RADS): White Paper of the ACR TI-RADS Committee. JACR. Volume 14, Issue 5, p587-595May 2017.

2. Extra-thyroidal Extension (ETE)

- Disruption of thyroid capsule
- Invasion into adjacent structures
- Loss of clear tissue planes

3. Associated Lymph Node Features

- Round shape instead of oval
- Loss of fatty hilum
- Microcalcifications
- Cystic change
- Peripheral vascularity

4. Elastography Findings (if available)

- Increased stiffness
- Higher shear wave velocities
- Strain ratio typically > 4

Patterns in Specific Variants:

1. Cystic PTC

- Can show predominantly cystic appearance
- Eccentric solid component
- Thick, irregular walls
- Intracystic solid projections

2. Multifocal PTC

- Multiple suspicious nodules
- Similar ultrasound characteristics in satellite nodules
- May be bilateral

Keep in mind that while these features are highly suggestive of PTC, no single ultrasound feature is pathognomonic, and the final diagnosis requires fine needle aspiration cytology or surgical pathology.

The presence of multiple suspicious features increases the likelihood of malignancy.

Diagnosis

1. Fine Needle Aspiration (FNA)

– Gold standard for diagnosis
– Guided by ultrasound for accuracy
– Bethesda System for reporting cytopathology

2. Molecular Testing

– BRAF V600E mutation
– RET/PTC rearrangements
– Other molecular markers as indicated

Treatment

Surgical Management

1. Thyroidectomy

– Total thyroidectomy for tumors >4cm or with extra-thyroidal extension
– Lobectomy may be considered for small, unifocal tumors
– Central neck dissection when indicated

2. Radioactive Iodine (RAI) Therapy

Indicated for:

- Larger tumors
- Extra-thyroidal extension
- Lymph node involvement
- Distant metastases

SUMMARY OF KEY POINTS

Papillary thyroid cancer is the most prevalent thyroid malignancy, comprising 80% of all thyroid cancer cases and predominantly affecting women between 30-50 years old.

A history of childhood radiation exposure is identified as a significant risk factor for developing this cancer.

Most cases are discovered as asymptomatic thyroid nodules found incidentally, though some patients present with visible neck masses or enlarged lymph nodes.

While less common, patients may experience compression symptoms including difficulty swallowing, voice changes, or breathing problems.

Post-treatment Management

1. Thyroid Hormone Suppression

- Maintains TSH at appropriate levels
- Prevents recurrence

2. Surveillance

- Regular neck ultrasound
- Thyroglobulin monitoring
- Whole-body scanning when indicated

Prognosis

PTC generally has an excellent prognosis with proper treatment:

- 5-year survival rate: >98% for localized disease
- 10-year survival rate: >95% for

Factors affecting prognosis:

- Age at diagnosis
- Tumor size
- Extra-thyroidal extension
- Lymph node involvement
- Distant metastases
- Molecular profile (BRAF mutation status)

CLINICAL PEARLS

Always obtain a detailed radiation exposure history in patients presenting with thyroid nodules, as this significantly impacts risk assessment.

Don't dismiss asymptomatic thyroid nodules—they could be the first sign of PTC and warrant proper evaluation.

When examining a patient with a thyroid nodule, be sure to thoroughly assess cervical lymph nodes, as PTC commonly spreads to regional lymph nodes even in early stages.

References

1. Haugen BR, et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid. 2016;26(1):1-133.
2. Tessler FN, et al. ACR Thyroid Imaging, Reporting and Data System (TI-RADS): White Paper of the ACR TI-RADS Committee. J Am Coll Radiol. 2017;14(5):587-595.
3. Cabanillas ME, et al. Thyroid Cancer. Lancet. 2016;388(10061):2783-2795.
4. Cooper DS, et al. Revised American Thyroid Association Management Guidelines for Patients with Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid. 2009;19(11):1167-1214.
5. Sipos JA, Mazzaferri EL. Thyroid Cancer Epidemiology and Prognostic Variables. Clin Oncol. 2010;22(6):395-404.

Key References for Ultrasound Features of Papillary Thyroid Cancer

1. Moon WJ, Baek JH, Jung SL, et al. Ultrasonography and the ultrasound-based management of thyroid nodules: consensus statement and recommendations. Korean J Radiol. 2011;12(1):1-14.
2. Remonti LR, Kramer CK, Leitão CB, Pinto LC, Gross JL. Thyroid ultrasound features and risk of carcinoma: a systematic review and meta-analysis of observational studies. Thyroid. 2015;25(5):538-550.
3. Na DG, Baek JH, Sung JY, et al. Thyroid Imaging Reporting and Data System Risk Stratification of Thyroid Nodules: Categorization Based on Solidity and Echogenicity. Thyroid. 2016;26(4):562-572.
4. Shin JH, Baek JH, Chung J, et al. Ultrasonography Diagnosis and Imaging-Based Management of Thyroid Nodules: Revised Korean Society of Thyroid Radiology Consensus Statement and Recommendations. Korean J Radiol. 2016;17(3):370-395.
5. Middleton WD, Teefey SA, Reading CC, et al. Multiinstitutional Analysis of Thyroid Nodule Risk Stratification Using the American College of Radiology Thyroid Imaging Reporting and Data System. AJR Am J Roentgenol. 2017;208(6):1331-1341.
6. Zhang F, Oluwo O, Castillo FB, et al. Thyroid Nodule Location on Ultrasonography as a Predictor of Malignancy. Endocr Pract. 2019;25(2):131-137.
7. Hoang JK, Lee WK, Lee M, Johnson D, Farrell S. US Features of thyroid malignancy: pearls and pitfalls. Radiographics. 2007;27(3):847-860.
8. Brito JP, Gionfriddo MR, Al Nofal A, et al. The accuracy of thyroid nodule ultrasound to predict thyroid cancer: systematic review and meta-analysis. J Clin Endocrinol Metab. 2014;99(4):1253-1263.
9. Tessler FN, Middleton WD, Grant EG, et al. ACR Thyroid Imaging, Reporting and Data System (TI-RADS): White Paper of the ACR TI-RADS Committee. J Am Coll Radiol. 2017;14(5):587-595.
10. Frates MC, Benson CB, Charboneau JW, et al. Management of thyroid nodules detected at US: Society of Radiologists in Ultrasound consensus conference statement. Radiology. 2005;237(3):794-800.