Original Article

Analysis and prediction of contralateral central lymph node metastasis risk in unilateral papillary thyroid carcinoma with ipsilateral lateral cervical lymph node: a retrospective clinical study

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Background: Papillary thyroid carcinoma (PTC) often metastasizes to lymph nodes, increasing recurrence risk and reducing survival. This study identifies predictors for contralateral central lymph node metastasis (Cont-CLNM) in unilateral PTC patients with ipsilateral lateral cervical lymph node metastasis (Ipsi-LLNM).

Methods: We retrospectively analyzed data, preoperative ultrasound features, and thyroglobulin (Tg) levels in unilateral PTC patients with Ipsi-LLNM treated at the Thyroid Surgery Department of Nanjing Drum Tower Hospital from August 2017 to August 2024. Least absolute shrinkage and selection operator (LASSO) regression was used for variable selection, with independent *t*-tests and Chi-squared tests assessing differences. Logistic regression analyses identified risk factors for Cont-CLNM, and a nomogram was validated using 1,000 bootstrap resamples. Decision curve analysis (DCA) evaluated clinical impact.

Results: Of 105 PTC patients, 56 (53.3%) had Cont-CLNM. LASSO regression identified three predictors: male sex, lymph node metastasis posterior to the recurrent laryngeal nerve (LN-prRLN), and elevated Tg levels. Multivariate regression confirmed these variables' association with Cont-CLNM. Internal validation yielded an area under the curve of 0.771 [95% confidence interval (CI): 0.684–0.857]. A nomogram was developed and validated through DCA.

Conclusions: Our findings indicate that combining male gender, LN-prRLN, and Tg levels effectively predicts Cont-CLNM, providing a basis for risk assessment in unilateral PTC.

Keywords: Papillary thyroid carcinoma (PTC); ipsilateral lateral cervical lymph node metastasis (Ipsi-LLNM); contralateral central lymph node metastasis (Cont-CLNM); risk factors; predictive model

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Introduction

Papillary thyroid carcinoma (PTC) is the most common type of malignant thyroid tumor, accounting for approximately 85–90% of all thyroid cancers. PTC generally exhibits mild biological behavior and is associated with a favorable prognosis (1). However, it has a propensity for lymph node metastasis, with the central lymph nodes often recognized as the initial metastatic site (2). Studies indicate that in PTC patients, the metastasis rate to the ipsilateral lateral cervical lymph nodes (Ipsi-LLNs) ranges from 27% to 80%, to the ipsilateral central lymph nodes (Ipsi-CLNs) from 21% to 90%, and to the contralateral central lymph nodes (Cont-CLNs) from 16% to 24% (3,4). Lymph node metastasis is a known risk factor associated with higher recurrence rates and reduced survival in PTC patients, as well as an increased likelihood of reoperation and associated complications.

Currently, surgical resection remains the primary treatment modality for PTC. For patients with unilateral PTC suspected of ipsilateral cervical lymph node metastasis (Ipsi-CLNM), selective dissection of the lateral and central lymph nodes on the affected side is commonly recommended (1). However, for cases involving contralateral central lymph node metastasis (Cont-CLNM), the necessity of prophylactic Cont-CLNs dissection is debated. Some researchers argue that prophylactic Cont-CLNs dissection can elevate the risk of postoperative complications, such as hypoparathyroidism and recurrent laryngeal nerve (RLN) injury, which significantly impact patient quality of life. For instance, studies report that the incidence of hypocalcemia following bilateral central lymph node dissection (26.0%) is significantly higher than after unilateral dissection (9.6%) (5,6). On the other hand, some researchers suggest that removing potentially metastatic lymph nodes in the contralateral central region enhances surgical thoroughness, lowers the likelihood of reoperation, and provides valuable pathological evidence to aid in accurate postoperative staging and treatment planning (7).

This study aims to identify factors influencing Cont-CLNM in patients with unilateral PTC and ipsilateral lateral cervical lymph node metastasis (Ipsi-LLNM), develop a predictive model with bootstrap validation, and provide guidance for clinical surgical planning to improve patient prognosis. We present this article in accordance with the TRIPOD reporting checklist (available at https://gs.amegroups.com/article/view/10.21037/gs-24-473/rc).

Highlight box

Key findings

- This study developed a model based on gender, lymph node metastasis posterior to the recurrent laryngeal nerve (LN-prRLN), and thyroglobulin (Tg) levels to predict the risk of contralateral central lymph node metastasis (Cont-CLNM) in patients with unilateral papillary thyroid carcinoma (PTC) with ipsilateral cervical lymph nodes. And was internally verified as an area under the curve of 0.771 (95% confidence interval: 0.684–0.857).

What is known and what is new?

- PTC frequently metastasizes to regional lymph nodes, primarily the ipsilateral central and lateral compartments. Cont-CLNM is less common but clinically significant.
- Risk factors for CLNM remain unclear, and predictive models are lacking, making surgical decisions challenging.

What is the implication, and what should change now?

- Risk factors such as LN-prRLN, male gender and increased serum Tg level can be used as predictive factors for the occurrence of lymph node metastasis in the contralateral central region, and preventive lymph node dissection can be performed in such patients to obtain better prognosis.

Methods

Study subjects

This retrospective study included 105 patients with unilateral PTC and Ipsi-CLNM, treated at the Thyroid Surgery Department of Nanjing Drum Tower Hospital, from August 2017 to August 2024. Patients were categorized based on the presence of Cont-CLNM into a metastasis group (n=56) and a non-metastasis group (n=49). This study received approval from the Ethics Committee of Nanjing Drum Tower Hospital (No. 2024-751-01), and patient data were kept strictly confidential during the collection process. Individual consent for this retrospective analysis was waived. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

Diagnostic methods

(I) Diagnosis of PTC: in accordance with the 2022 Thyroid Cancer Diagnosis and Treatment Guidelines, diagnosis was confirmed via intraoperative rapid frozen section and postoperative paraffin pathology.

(II) Diagnosis of lateral cervical lymph node metastasis: following the 2022 Thyroid Cancer Diagnosis and Treatment Guidelines, preoperative neck CT or fine-

needle aspiration of lymph nodes was performed, with confirmation obtained through postoperative paraffin pathology.

Inclusion criteria

(I) Age ≥18 years; (II) underwent initial total thyroidectomy with ipsilateral lateral cervical node dissection and bilateral central lymph node dissection at this hospital; (III) postoperative pathology confirmed unilateral PTC with metastasis to Ipsi-LLNs; (IV) complete clinical data available.

Exclusion criteria

(I) Postoperative pathology confirmed bilateral thyroid carcinoma; (II) presence of severe cardiovascular, hepatic, renal dysfunction, malignancy, hematologic disorders, or neurological/psychiatric conditions; (III) incomplete pathological data that cannot be supplemented; (IV) history of prior thyroid surgery, radiotherapy, chemotherapy, or immunotherapy.

Surgical method

After anesthesia was administered successfully, the patient was positioned supine, and routine disinfection and draping were completed. A 5–10 cm horizontal incision was made 2 cm above the suprasternal notch along the neck crease. The skin and superficial fascia were incised in layers, extending superiorly to the upper edge of the thyroid cartilage, inferiorly to the suprasternal fossa, and laterally to the sternocleidomastoid muscles. The anterior midline of the neck was incised to expose the thyroid capsule, and dissection was performed along the capsule. The thyroid lobes and isthmus were removed, and the tumor was carefully dissected to ensure complete excision of invaded tissue. The thyroid tissue was inspected thoroughly before being sent for pathological examination, with no apparent parathyroid tissue observed. Subsequently, the central lymph nodes on the affected side were dissected. The skin flap and anterior neck muscles were mobilized, exposing the RLN. Dissection extended inferiorly to the suprasternal fossa, with the removal of central lymphatic and adipose tissue from the tracheoesophageal groove and the tracheal surface. The lymphatic tissue was thoroughly inspected before submission for examination, with no parathyroid tissue identified. The Cont-CLNs were cleared using the same approach. During the dissection of lymph node metastasis posterior to the recurrent laryngeal nerve (LN-prRLN), carefully separate the surrounding tissues using scissors or an ultrasonic scalpel to expose the lymph node area. Initiate the dissection from the posterior aspect of the RLN, proceeding along its posterior trajectory. Employ bipolar electrocautery or an ultrasonic scalpel as necessary to minimize the risk of thermal injury. Once adequately mobilized, excise the lymph node group in its entirety. Finally, LLNs on the affected side were dissected. Dissection proceeded along the hyoid bone and infrahyoid muscles to expose the mandible, allowing clearance of submandibular lymph nodes. The sternocleidomastoid muscle was mobilized to expose the jugular vein, and lymph nodes surrounding the jugular vein were removed, extending from the mandible to the supraclavicular region. Suspicious lymph nodes were submitted for intraoperative examination, with careful preservation of structures such as the RLN, lymphatic ducts and the XI nerve.

Observational indicators

Basic clinical characteristics

Collected data included age, gender, length of hospital stay, and medical history.

Ultrasound characteristics

Ultrasound examination was performed with the patient in a supine position and the neck extended to fully expose the area. After identifying the thyroid location, the left and right lobes and the isthmus were examined in sequence. Observed parameters included tumor size, location, number, internal echogenicity, blood flow signal, microcalcifications, and capsular invasion. Two ultrasound physicians, each with over 10 years of experience, independently assessed these findings. Discrepancies were resolved through consultation to reach a consensus.

Laboratory indicators

Upon hospital admission, patients fasted for 8–12 hours. Fasting venous blood samples were collected the following morning (about 6:00 am) and analyzed in the Clinical Laboratory Department of Nanjing Drum Tower Hospital for thyroglobulin (Tg) levels.

Pathological diagnosis

Postoperative pathological slides were reviewed by two pathologists, each with over 10 years of experience. The

assessment focused on metastasis rates in bilateral central lymph nodes and RLN lymph nodes. Discrepancies were resolved through consultation to reach a consensus.

Statistical analysis

Statistical analyses were conducted using R version 4.3.3 and SPSS version 26.0. For normally distributed data, values were expressed as $\bar{x}\pm s$ and compared using an independent sample *t*-test. Non-normally distributed data were reported as M (Q1, Q3) and analyzed with the Mann-Whitney *U* test. Categorical data were presented as cases (%) and assessed using the chi-square (χ^2) test. Least absolute shrinkage and selection operator (LASSO) regression was applied for dimensionality reduction to mitigate overfitting and multicollinearity, identifying factors associated with Cont-CLNM in Ipis-LLNM-PTC patients. A multivariate logistic regression model was then developed, and a nomogram was constructed for clinical prediction. Bootstrap resampling was employed to estimate the sampling distribution of statistics, calculate confidence intervals (CIs) and P values, and create a calibration curve. Model discrimination was evaluated by the area under the receiver operating characteristic (ROC) curve (AUC). Decision curve analysis (DCA) analysis was used to assess the model's clinical validity and utility. A P value <0.05 was considered statistically significant.

Results

Comparison of general, ultrasound, and laboratory assessment indicators between groups

Logistic regression was performed to analyze the clinical indicators of the study population. The dependent variable was Cont-CLNM (0 = no metastasis, 1 = metastasis), while the independent variables comprised the clinical indicators presented in *Table 1*. There were no statistically significant differences between the metastasis and non-metastasis groups regarding age, affected thyroid lobe, tumor signal, blood flow signal, microcalcifications, capsular invasion, or the presence of Hashimoto's thyroiditis. However, the metastasis group had a significantly higher proportion of males (P<0.05) and elevated Tg levels (P<0.001) compared with the non-metastasis group.

Comparison of pathological factors between groups

Logistic regression analysis was performed using the pathological characteristics of the enrolled patients as the independent variables, with the same dependent variable as described above. There were no statistically significant differences between the metastasis and non-metastasis groups regarding tumor number, Ipsi-CLNM, or contralateral thyroid lesions. Tumor multifocality specifically refers to the presence of two or more cancer foci within the same thyroid lobe, not the contralateral lobe. All included patients were confirmed to have PTC confined to a single lobe (either left or right). However, the metastasis group exhibited significantly larger tumor sizes (P<0.05) and greater involvement of the right LN-prRLN (P<0.001) compared to the non-metastasis group (*Table 2*).

LASSO regression for identifying factors influencing Cont-CLNM in Ipsi-LLNM-PTC patients

LASSO regression was applied to reduce the dimensionality of study variables, using 10-fold cross-validation to assess correlations between variables (*Figure 1*). Three predictors with non-zero coefficients were identified as influencing factors for Cont-CLNM in Ipsi-LLNM-PTC patients: gender, LN-prRLN, and Tg levels.

Logistic analysis of predictive factors for Cont-CLNM in Ipsi-LLNM-PTC patients

A multivariate logistic regression analysis was conducted using Cont-CLNM status in Ipsi-LLNM-PTC patients as the dependent variable, and the three predictive factors identified by LASSO regression as independent variables. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated (*Table 3*).

Development and validation of a predictive model for Cont-CLNM in Ipsi-LLNM-PTC patients

Development of the clinical predictive model

A clinical predictive nomogram (*Figure 2A*) was developed using three variables selected through logistic regression, with Cont-CLNM as the clinical outcome in patients with LLNM-PTC. This model was designated as the LASSO model.

In univariate analysis, tumor size showed a significant association with contralateral lymph node metastasis, indicating potential clinical relevance. Considering its potential application in clinical practice, tumor size was incorporated as an additional variable, leading to the

Table 1 Comparison of general information and relevant indicators of ultrasound evaluation and verification information between two groups

Items	Total (n=105)	Non-metastasis group (n=49)	Metastasis group (n=56)	P
Gender				0.048
Male	45 [43]	16 [33]	29 [52]	
Female	60 [57]	33 [67]	27 [48]	
Age (years)	38 [30–49]	37 [34–50]	38 [28–48]	0.48
Diseased glandular lobe				0.64
Left	52 [50]	26 [53]	26 [46]	
Right	53 [50]	23 [47]	30 [54]	
Blood flow signal				0.27
No	36 [34]	20 [41]	16 [29]	
Yes	69 [66]	29 [59]	40 [71]	
Microcalcification				>0.99
No	15 [14]	7 [14]	8 [14]	
Yes	90 [86]	42 [86]	48 [86]	
Extrathyroidal extension				0.71
No	22 [21]	9 [18]	13 [23]	
Yes	83 [79]	40 [82]	43 [77]	
Hashimoto's thyroid				0.13
No	77 [73]	32 [65]	45 [80]	
Yes	28 [27]	17 [35]	11 [20]	
Tg, ng/mL*				<0.001
≤73	84 [80]	47 [96]	37 [66]	
>73	21 [20]	2 [4]	19 [34]	

Data are presented as n [%] or median [Q1, Q3]. *, statistical analysis using SPSS 26.0 evaluated Tg levels as a predictor of Cont-CLNM. The maximum Youden index was 0.298, with a cut-off value of 73 ng/mL, yielding a sensitivity of 33.9% and specificity of 95.9%. Tg levels were classified into high and low groups based on this 73 ng/mL threshold. Cont-CLNM, contralateral central lymph node metastasis; Tg, thyroglobulin.

development of a second model, named the More model (*Figure 2B*).

In both nomograms, the length of each variable's line segment reflects its relative contribution to the clinical outcome. The total score, calculated as the sum of individual variable scores, corresponds to a probability scale that estimates the risk of Cont-CLNs metastasis in LLNM-PTC patients.

Validation of the clinical predictive model

DCA demonstrated that the LASSO model consistently provided a higher net benefit across all threshold ranges compared to the more model and both no-intervention and full-intervention strategies. This suggests that the LASSO model is more effective for predicting Cont-CLNs metastasis. Consequently, it was selected as the final clinical predictive model for this study (hereafter referred to as the predictive model) (*Figure 3*).

For internal validation, the LASSO model was assessed using bootstrap resampling with 1,000 iterations. The analysis yielded a calibrated AUC of 0.771 (95% CI: 0.684–0.857), indicating good predictive performance. The corresponding ROC and calibration curves were generated (*Figure 4*).

Table 2 Comparison of pathology information between two groups

Items	Total (n=105)	Non-metastasis group (n=49)	Metastasis group (n=56)	P
Tumor number				0.56
Single	82 [78]	40 [82]	42 [75]	
Multifocal	23 [22]	9 [18]	14 [25]	
Ipsilateral central lymph nodes				0.47
Non-metastasis	8 [8]	5 [10]	3 [5]	
Metastasis	97 [92]	44 [90]	53 [95]	
LN-prRLN				<0.001
No	61 [58]	38 [78]	23 [41]	
Yes	44 [42]	11 [22]	33 [59]	
Contralateral thyroid gland				0.12
Normal tissue	74 [70]	31 [63]	43 [77]	
Nodular goiter	23 [22]	15 [31]	8 [14]	
Benign tumor	8 [8]	3 [6]	5 [9]	
Maximum tumor diameter (cm)	1.5 (1–2.3)	1.2 (0.9–1.8)	1.8 (1.2–2.52)	0.02

Data are presented as n [%] or median (Q1, Q3). LN-prRLN, lymph node metastasis posterior to the recurrent laryngeal nerve.

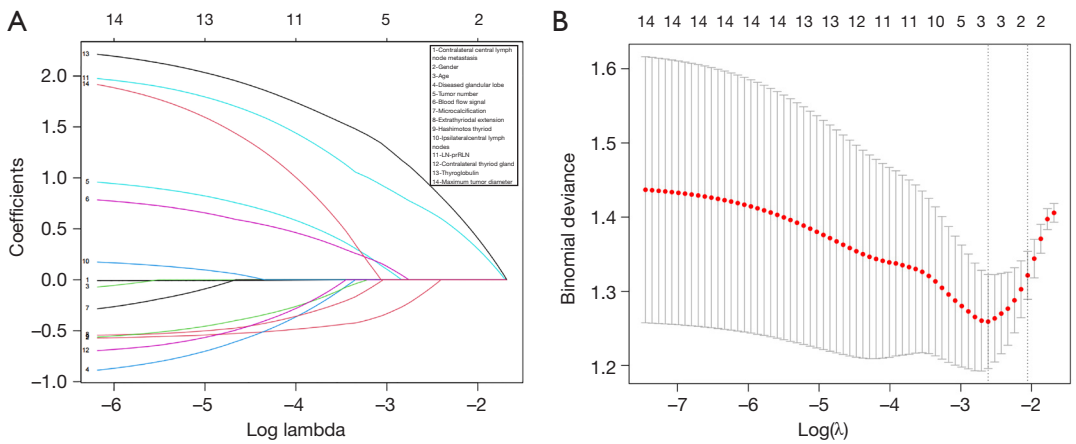

Figure 1 LASSO regression screening for factors affecting the occurrence of Cont-CLNM in Ipsi-LLMN-PTC. (A) LASSO coefficient path for study variables; (B) selection of optimal λ via 10-fold cross-validation. (B) Three predictor variables with non-zero coefficients were identified as the key factors influencing contralateral central lymph node metastasis in LLNM-PTC patients. These variables resulted in the smallest error and the best model fit. The predictor factors identified from the left figure, corresponding to the intersection with the lambda =3 line, include gender, lymph node metastasis of the recurrent laryngeal nerve, and thyroglobulin levels. Cont-CLNM, contralateral central lymph node metastasis; Ipsi-LLMN-PTC, papillary thyroid carcinoma patients with ipsilateral lateral cervical lymph node metastasis; LASSO, least absolute shrinkage and selection operator; LLNM-PTC, papillary thyroid carcinoma patients with lateral cervical lymph node metastasis; LN-prRLN, lymph node metastasis posterior to the recurrent laryngeal nerve.

Table 3 LLNM-PTC patients' prediction factors for contralateral central compartment lymph node metastasis: logistic analysis

Items	Total (n=105), n [%]	P	β	OR (95% CI)
Gender		0.050	0.900	2.459 (1.012–6.182)
Male	45 [43]			
Female	60 [57]			
LN-prRLN		0.005	1.312	3.715 (1.501–9.632)
No	61 [58]			
Yes	44 [42]			
Thyroid report (Tg), ng/mL		0.005	2.279	9.769 (2.401–66.743)
≤73	84 [80]			
>73	21 [20]			
Intercept		<0.001	–3.393	0.034 (0.004–0.154)

CI, confidence interval; LLNM-PTC, papillary thyroid carcinoma patients with lateral cervical lymph node metastasis; LN-prRLN, lymph node metastasis posterior to the recurrent laryngeal nerve; OR, odds ratio; Tg, thyroglobulin.

Discussion

PTC is one of the most common malignant tumors and is generally associated with a favorable prognosis. However, it is prone to metastasis to the lateral and central cervical lymph nodes, which increases the risk of reoperation (8,9). Li *et al.* developed a recurrence risk factor and prediction model for PTC based on a single-center sample of 955 cases, offering clinicians a practical tool for accurately predicting recurrence risk (10). Similarly, Zhu *et al.* created and validated a clinical prediction model for extensive lymph node metastasis in PTC, facilitating the early identification of high-risk patients with high-volume central lymph node metastasis (hv-CLNM) and supporting more effective risk stratification and management (11). This study targets patients with unilateral PTC and ipsilateral lateral lymph node metastasis, focusing on central lymph node metastasis as a key area of interest. Using statistical methods, we evaluated risk factors and constructed a clinical prediction model to assess the risk of Cont-CLNM in Ipsi-LLNM-PTC patients. Unlike prior studies focused mainly on general lymph node metastasis in PTC, this research establishes a predictive model specifically aiding surgical decision-making in lymph node-metastatic PTC, with the goal of improving patient outcomes. Our aim is to develop a corresponding risk assessment tool to address existing gaps in clinical research, provide a foundation for early identification of Cont-CLNM, and ultimately improve patient prognosis and quality of life.

A total of 105 patients were enrolled in the study following strict inclusion and exclusion criteria. Clinical data were collected and analyzed using statistical software. The highest Youden index for Tg was 0.298, with a cutoff value of 73 ng/mL, yielding a specificity of 95.9%. Based on this threshold, patients were classified into high and low Tg level groups. LASSO regression was applied for dimensionality reduction, identifying three key predictive factors. These factors were subsequently analyzed using multivariate logistic regression, all of which demonstrated statistical significance (P<0.05). A validated nomogram effectively visualizes disease risk probability, demonstrating substantial clinical applicability. The More model was developed by incorporating tumor size as a predictive factor. DCA was conducted to compare the two nomograms, showing that the LASSO model consistently provided higher net benefits across all threshold probabilities, establishing it as the final model. Internal validation via the Bootstrap method resulted in a calibration AUC of 0.771 (95% CI: 0.684–0.857).

This study presents the following findings: (I) tumor size: larger thyroid tumors are more likely to develop Cont-CLNM, in agreement with previous studies (12-14). Larger tumor volumes generally indicate increased invasiveness, as they contain a higher number of tumor cells capable of entering the lymphatic system, thereby raising the risk of metastasis to Cont-CLNs. (II) Gender: variations in hormone levels between males and females may influence the progression of PTC (15). Normal estrogen expression

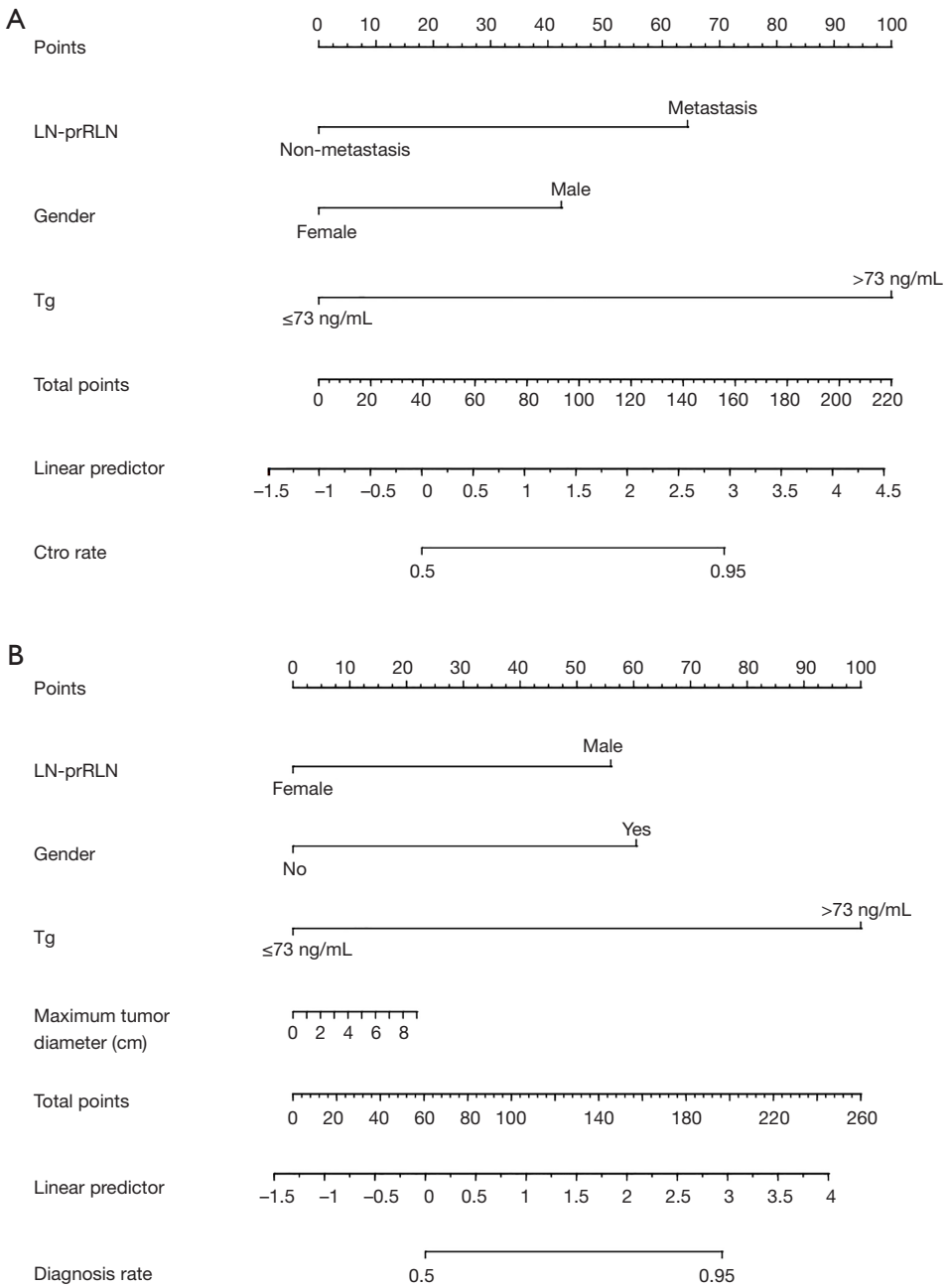

Figure 2 Nomogram of clinical prediction model for factors affecting the occurrence of Cont-CLNM in Ipsi-LLMN-PTC. (A) A nomogram developed using three predictive variables selected through LASSO. (B) Expanding on this model by incorporating tumor size as an additional predictive factor. The length of each variable's line segment reflects its relative contribution to the clinical outcome. The total score, calculated as the sum of individual variable scores, corresponds to a probability scale that estimates the risk of Cont-CLNs metastasis in LLNM-PTC patients. Cont-CLNs, contralateral central lymph nodes; Ipsi-LLMN-PTC, papillary thyroid carcinoma patients with ipsilateral lateral cervical lymph node metastasis; LASSO, least absolute shrinkage and selection operator; LLNM-PTC, papillary thyroid carcinoma patients with lateral cervical lymph node metastasis; LN-prRLN, lymph node metastasis posterior to the recurrent laryngeal nerve; Tg, thyroglobulin.

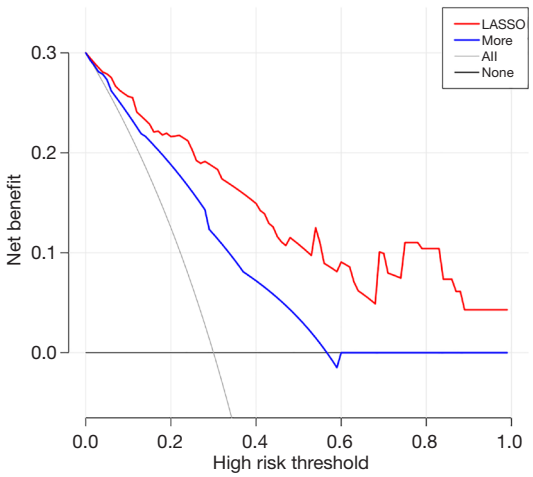

Figure 3 Decision curve analysis of clinical prediction model for Cont-CLNM in Ipsi-LLMN-PTC. The red line (LASSO) represents the model established using the three predictor variables selected through LASSO screening. The blue line (More) represents the model built upon these three variables with the addition of tumor size as a predictor. The LASSO model consistently demonstrated significantly higher net benefits across all threshold ranges compared to the More model and no or full intervention. All, full intervention; Cont-CLNM, contralateral central lymph node metastasis; Ipsi-LLMN-PTC, papillary thyroid carcinoma patients with ipsilateral lateral cervical lymph node metastasis; LASSO, least absolute shrinkage and selection operator; More, the More model; None, no intervention.

appears to exert a protective effect, potentially slowing cancer progression (16,17). Certain genetic variations, which may be more prevalent in males, could also play a role in thyroid cancer progression and lymph node metastasis; however, the exact mechanisms remain to be clarified (18). (III) LN-prRLN: lymph nodes located posterior to the RLN are situated in deep and narrow anatomical space, complicating both preoperative detection and assessment of metastasis. This unique anatomical positioning makes early diagnosis and treatment of metastasis challenging. Thyroid cancer lymphatic drainage commonly first involves the paratracheal lymph nodes, with potential subsequent spread to posterior RLN lymph nodes, making these nodes particularly susceptible to metastasis. Research by Chen *et al.* on micropapillary carcinoma metastasis posterior to the RLN supports this conclusion (19). (IV) Tg levels: Tg, primarily synthesized and secreted by thyroid follicular epithelial cells, is the most abundantly expressed protein in the thyroid. This study indicates that patients with high preoperative Tg levels are at increased risk for Cont-CLNM. Normally, Tg is stored within thyroid follicles and appears at low levels in the serum. However, as cancer cells invade and disrupt thyroid structure, follicular epithelial cells become activated, synthesizing and releasing significant amounts of Tg into the bloodstream, resulting in elevated serum Tg levels. Tg expression is also observed in positive lymph nodes in distant metastases. These findings align

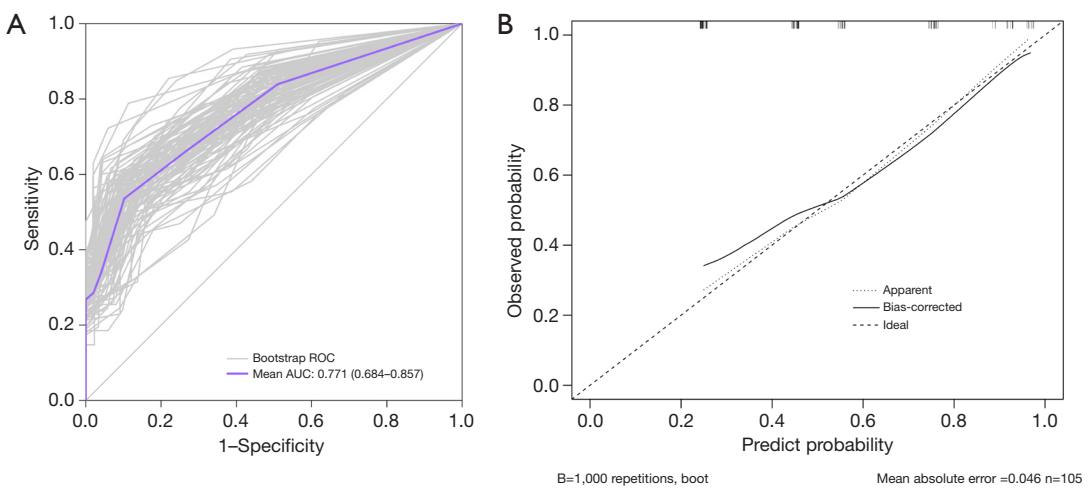

Figure 4 Clinical prediction model for the risk of Cont-CLNM in Ipsi-LLMN-PTC: results of bootstrap internal sampling validation. (A) ROC curves from 1,000 internal bootstrap resamples. The model's calibration AUC is 0.771, with a 95% confidence interval of 0.684–0.857, indicating good fit. (B) Bootstrap calibration curve. AUC, area under the curve; Cont-CLNM, contralateral central lymph node metastasis; Ipsi-LLMN-PTC, papillary thyroid carcinoma patients with ipsilateral lateral cervical lymph node metastasis; ROC, receiver operating characteristic.

with results from studies by Ren and Min *et al.* (7,20).

There are certain limitations in this study. The sample size is relatively small, and the analysis is based on data from a single center. Future research should aim to expand the sample size and include multicenter studies to enhance the generalizability and robustness of the findings.

Conclusions

In summary, this study investigates risk factors for Cont-CLNM in Unilateral PTC patients with lateral lymph node metastasis and develops a clinical prediction model to assess these risks. The findings suggest that patients with risk factors such as LN-prRLN, male gender, and elevated serum Tg levels may benefit from prophylactic Cont-CLN dissection.

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Footnote

Reporting Checklist: The authors have completed the TRIPOD reporting checklist. Available at https://gs.amegroups.com/article/view/10.21037/gs-24-473/rc

Data Sharing Statement: Available at https://gs.amegroups.com/article/view/10.21037/gs-24-473/dss

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://gs.amegroups.com/article/view/10.21037/gs-24-473/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study received approval from the Ethics Committee of Nanjing Drum Tower Hospital (ethics approval No. 2024-751-01), and patient data were kept strictly confidential during the collection process. Individual consent for this retrospective analysis was waived. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

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