A PREDICTION MODEL FOR THYROID TISSUE BREAKAGE DURING SPECIMENS EXTRACTION FOLLOWING TRANSORAL ENDOSCOPIC THYROIDECTOMY VESTIBULAR APPROACH

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INTRODUCTION

Due to concerns over the optimal thyroid nodule characteristics for the Transoral Endoscopic Thyroidectomy Vestibular Approach (TOETVA) without tissue damage, we aim to develop a preoperative scoring system to identify high-risk patients for specimen breakage during thyroid tissue extraction via TOETVA.

METHODS AND PROCEDURES

A retrospective medical record review was conducted at Police General Hospital, Bangkok, Thailand, between January 2018 and October 2022. Patients who underwent TOETVA were recruited, and their demographics, nodule characteristics, operative procedures, and outcomes were collected. 25.8% of patients received a total TOETVA (112/434). Therefore, this study counted each thyroid lobe as an individual sample. 70 and 30% of the samples were randomly assigned to the training and testing datasets. Stepwise logistic regression with patient clustering was performed. The coefficients from the optimal model were used to create the scoring system. Area under the curve (AUC) was calculated to evaluate the model's performance using 1,000 bootstrap resamplings. The probabilities of thyroid nodule breakage were computed for each score range using the entire dataset. All statistical analyses were calculated using STATA 17 (College Station, TX: StataCorp LLC).

Table 1 Patients' Baseline Characteristics (N = 434)

Variables	N (%)
Demographic	
Female	417 (96.1)
Mean Age, year (SD)	41.0 (12.0)
Procedure	
Lobectomy TOETVA	320 (73.8)
Total TOETVA	112 (25.8)
Completion TOETVA	1 (0.2)
Isthmectomy TOETVA	1 (0.2)
Number of Thyroid Samples (N=521)[1]	
Nodule Characteristic	
Solid	289 (55.5)
Solid-Cystic	163 (31.3)
Cystic	69 (13.2)
Number of Thyroid Nodules	
1 Nodule	335 (64.3)
2 Nodules	83 (15.9)
3 Nodules	69 (13.3)
Multiple Nodules	34 (6.5)
Mean Total Nodule Size, cm (SD)	3.7 (1.7)
Mean Largest Nodule Size, cm (SD)	3.1 (1.4)
Cytological Result (Bethesda)	
I	63 (12.1)
II	310 (59.5)
III	57 (10.9)
IV	43 (8.3)
V	10 (1.9)
VI	13 (2.5)
FNA was not done	25 (4.8)

[1]87 patients had two thyroid samples.

Table 2 Outcomes (N = 521)

Variables	N (%)
Thyroid Capsule Rupture	335 (64.3)
Affect to pathological assessment	
- Could not interpret capsular involvement	17 (3.3)
- Could not interpret tumor margin	11 (2.1)

RESULTS

434 patients with 521 lobectomies were included in the analysis; 335 (64.3%) thyroid capsule were ruptured during specimen extraction, leading to 28 (5.4%) uninterpretable pathologic results (Table 1, 2). The training and testing datasets consisted of 362 and 179 samples, respectively. The AUC in the testing cohort was 0.74 (95%CI: 0.66-0.83) (Figure 2). Table 3 describes the scoring system estimated from the optimal equation. The probabilities of thyroid breakage for each scoring range (Score: 0-7, 8-12, 13-17, and 18-23) were 20, 41, 68, and 88%, respectively.

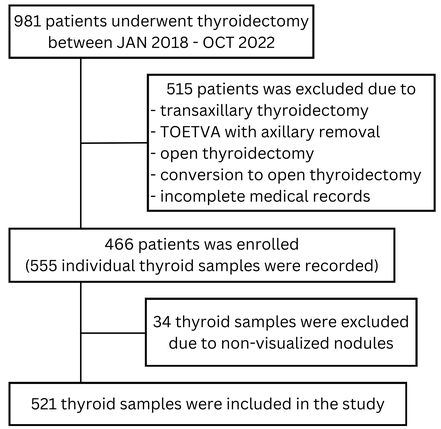


Figure 1 Patient Recruiting Flow Chart

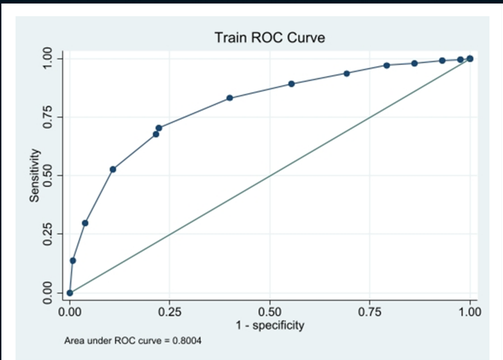
Table 3 Adjusted Odd Ratio and Predictive Model Scores for Thyroid Capsule Rupture

Predictive Variables	Adjusted Odd Ratio	95% Confidence interval		P Value	Predictive Model Scores[a]
		Lower	Upper		
Number of thyroid nodules					
- Multiple	Reference				0
- Single	1.64	0.92	2.92	0.09	2
Largest nodule's characteristic					
- Cyst	Reference				0
- Cystic-solid	1.78	0.8	3.92	0.16	2
- Solid	5.73	2.55	12.87	<0.001	7
Total thyroid nodule size					
- Less than 2 cm	Reference				0
- 2 to 2.99 cm	2.97	1.28	6.94	0.01	4
- 3 to 3.99 cm	8.55	3.63	20.14	<0.001	9
- 4 cm and larger	32.31	12.96	80.55	<0.001	14

[a]Prediction model scores were calculated by dividing each regression coefficient by the lowest coefficient number, rounding the number to the nearest 0.5 decimal level, and multiplying by 2 to create the integers.

CONCLUSION(S)

Our preoperative scoring system using common clinical features could help surgeons identify high-risk individuals with thyroid nodule breakage during specimen extraction from TOETVA.



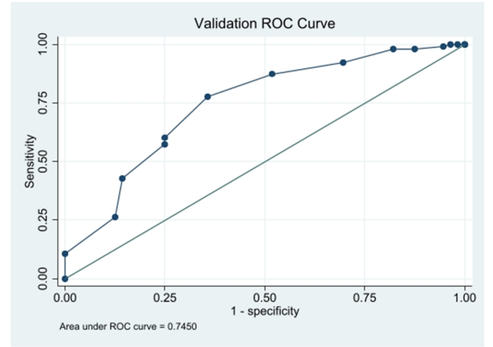


Figure 2 ROC curve of training and testing dataset