



1  
2

“ ”

405 725

2 0-3 5 0

, 7-10 , 4-6

가

가

: 725 654 (90.2%), 71 (9.8%)

0-3 589 10 (1.7%), 4-6

102 32 (31.4%), 7-10 34 29 (85.8%)

가  $p < 0.001$  가

40.8%, 99.2%, 85.3%, 94%, 93.5% 가

: “ ”

가

4-7%, 17-27%, 50%

(1). , 4-14% , 1 cm

(1, 2).

가 (1-5). 가 (1, 4-15),

가 ( 91.5-96%), 가

가

<sup>1</sup>

<sup>2</sup>

2004 9 24 2005 9 10 (7), 가

(strap muscle)  
 1, 0  
 (taller)  
 2, (non-taller) 0  
 (microcalcification)가  
 2, (nodular calcification) 가  
 1, (peripheral)  
 (egg-shell)가 가  
 0 mm  
 2002 2 2003 10  
 가 354, 46.8 가 51, 18 - 80  
 . 405 725 가 가  
 가 가 198 (27.3%), 527  
 (72.7%) 가 가 2  
 (sensitivity), (specificity), (positive predictive value), (negative predictive value), (accuracy) (diagnostic performance)  
 Milpitas, CA, U.S.A.) Disonic Master (Disonics, 10MHz, 21-gauge, 1-3 가 .  
 0.3 cm - 8.3 cm 1.95 cm 가 . 0 - 3 (low risk group), 4 - 6 (intermediate risk group), 7 - 10 (high risk group)  
 가 가 가  
 가 (internal content), (margin), (echogenecity), (shape), (calcification) 57가  
 0 2 가 가  
 2/3 1, 2/3 725 654 (90.2%), 71  
 (9.8%) goitrous nodule, hyperplastic nodule, inflammatory nodule, follicular nodule, papillary cancer (63 ), follicular cancer (1 ), medullary cancer (1 ), anaplastic cancer (4 ), poorly differentiated cancer (1 ), lymphoma (1 )  
 3 71  
 2, 1 가 2 atypical epithelial or atypical follicular lesion , 3  
 (macrolobulation) 0 (smooth) (strap muscle) 198 177 (89.4%), 21 (10.6%) 527  
 2, 477 (90.5%), 50 (9.5%)

가 . 가 44 , 가 47 , 가 34 (72.3%), 가 4 (9%), 가 33 (5.2%)가 가 2 , 241 가 482 가 4 (1.7%)가, 67 (13.9%) (microlobulation) 44 , 681 가 40 , 65 - 72% 31 (70.5%)가 , 40 가 72.3% 가 (5.9%)가 . 가 96% 64 , 636 , 59.2%, 96.6%, 25 , 42 65.6%, 93% 가 가 (65.6%), 29 (4.6%)가 가 가 44 - 48% taller shape 35 non - taller shape 690 , taller shape 23 (65.7%), non - taller shape 48 (7%)가 . 가 98.2% 가 가 32.4%

**Table 1.** Frequency of Benign and Malignant Thyroid Nodules According to Scoring System of Each of Five Sonographic Findings

USG findings	Score	Number of Nodules	
		Benign (Total No. = 654)	Malignant (Total No. = 71)
<b>Internal Content</b>			
cystic	0	2	0
mixed	1	237	4
solid	2	415	67
<b>Margin</b>			
smooth	0	641	40
microlobulated	2	13	31
<b>Echogenicity</b>			
anechoic/hyperechic	0	25	0
isoechoic/hypoechoic	1	607	29
markedly hypoechoic	2	22	42
<b>Shape</b>			
not taller	0	642	48
taller	2	12	23
<b>Calcification</b>			
no/peripheral	0	601	33
nodular	1	40	4
microcalcification	2	13	34

**Table 2.** Diagnostic Performances of Each of Five Sonographic Findings for Prediction of Malignant Thyroid Nodules

USG Finding	Sensitivity	Daignotic performances (%)			
		Specificity	Positive Predictive Value	Negative Predictive Value	Accuracy
Internal content	94.4	36.5	13.9	98.4	97.4
Margin	43.7	98	70.5	94.1	92.7
Echogenecity	59.2	96.6	65.6	95.6	93
Shape	32.4	98.2	65.7	92.8	91.7
Calcification	47.9	98	72.3	94.5	93.1

가 47 , 가 34 (72.3%), 가 4 (9%), 가 33 (5.2%)가 가 2 , 241 가 482 가 4 (1.7%)가, 67 (13.9%) (Table 2). 가 65 - 72% 가 72.3% 가 가 96% 59.2%, 96.6%, 65.6%, 93% 가 가 44 - 48% 98.2% 가 가 32.4% 0 - 3 589 , 4 - 6 102 , 7 - 10 34 (Table 3). 579 (98.3%), 10 (1.7%), 70 (68.6%), 32 (31.4%) ,

**Table 3.** Frequency of Benign and Malignant Thyroid Nodules According to Different Risk Groups Based on Scoring System of Sonographic Findings

Group	Total Score	Number of nodules	
		Benign (total No. = 654)	Malignant (total No. = 71)
Low risk group	0	2	0
	1	4	0
	2	237	0
	3	336	10
Intermediate risk group	4	41	11
	5	25	10
	6	4	11
High risk group	7	2	6
	8	3	17
	9	0	2
	10	0	4

**Table 4.** Comparisons of Diagnostic Performances of Sonography for Prediction of Malignant Thyroid Nodules between Various Groups of Subjects

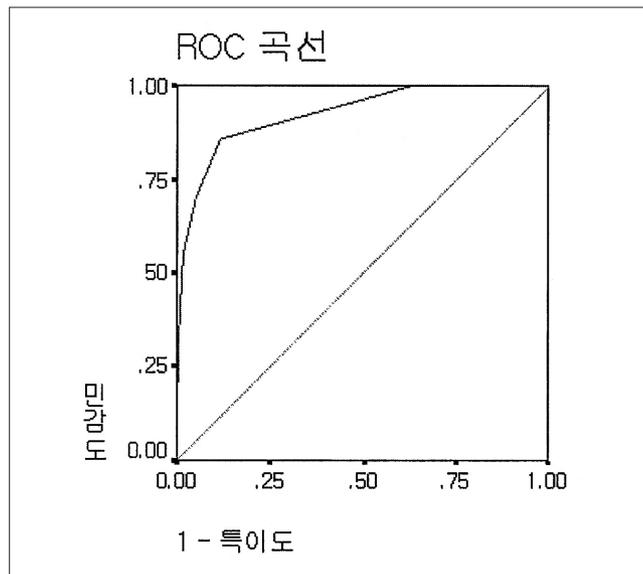
Group	No. of nodules		Diagnostic Performance (%)				
	Benign	Malignant	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Accuracy
LR	579	10	85.9	88.5	44.9	98.3	88.3
IR+HR	75	61					
LR+IR	649	42	40.8	99.2	85.3	94.0	93.5
HR	5	29					

LR = Low risk group; IR = Intermediate risk group; HR = High risk group

**Table 5.** ROC Curve Analysis Considered Sensitivity and Specificity According Total Score

Total Score	Sensitivity (%)	Specificity (%)	1-Specificity (%)
0	100	0.3	99.7
1	100	0.9	99.1
2	100	37.2	62.8
3	85.9	88.5	11.5
4	70.4	94.8	5.2
5	56.3	98.6	1.4
6	40.9	99.2	0.8
7	32.4	99.5	0.5
8	8.5	100	0
9	5.6	100	0
10	0	100	0

85.3%, 94%, 93.5% 가  
 (Table 4).  
 ROC , 3 0 3  
 4 10  
 85.9% 88.5% 가  
 가  
 (Table 5).



10 - 40% (6).  
 , 4 - 14%  
 2 - 4%가 (1 - 3).  
 9.8% ,  
 (incidentaloma)  
 가  
 가 ,  
 (4, 5).

5 (14.7%), 29 (85.8%) .  
 1.7%, 31.4%,  
 85.8% 가 ( $p < 0.001$ ).

가 , 가 (  
 91.5 - 96%),  
 가 , 가 가  
 가 .  
 가 ,  
 가 가  
 가

(1), 25.2%, 8, 4, 6  
 가 가 , 10.5%가 1 cm , ( )가 , 8  
 46% , 35% 가  
 (1, 4 - 15), (microlobulation),  
 (marked hypoechogenicity),  
 (taller shape) 가 ,  
 4 가  
 66%, 56%, 93.8%,  
 74.8% ,  
 Algorithm 가 (1, 11).  
 44.9%, 85.9%, 88.5%,  
 가 98.3%, 88.3% .  
 (7), 가  
 , 4  
 , 2/3  
 (1 ) 273 4 (1.7%)가 . 4  
 2 3 (1 ) ,  
 4 , (1 ) (2  
 ) (1 )  
 (2 ) 가  
 1.7%, 31.4%,  
 85.3% . 98%  
 , 32% 가  
 가 , 85%  
 가  
 71  
 16 , atypical  
 epithelial or atypical follicular lesion , 3

3  
 4 , 6  
 , 8  
 )가 , 8  
 가  
 atypical epithelial or atypical follicular lesion  
 가 ,  
 가  
 ROC 3 0 - 3 4 -  
 가 가 가  
 10

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## Differentiation of Benign and Malignant Thyroid Nodules: Sonographic Analysis and a New Scoring System<sup>1</sup>

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**Purpose:** To analyze the synthetically created sonographic features of thyroid nodules, we present here a new scoring system for the sonographic features that are suggestive of malignant thyroid nodules. We also evaluated the accuracy and clinical significance of this system.

**Materials and Methods:** In this study, we included 725 thyroid nodules of 405 patients that were pathologically proven by USG-guided percutaneous fine-needle aspiration biopsy (FNAB) or surgery. Two radiologists analyzed the sonographic features according to the internal content, margin, echogenicity, shape and calcification. We scored from 0 point to 2 point for each feature, and then we calculated the total scores and classified them as three groups according to the total score such as low risk (0 - 3), intermediate risk (4 - 6) or high risk (7 - 10). We demonstrated the difference of the frequency and the positive predictive value among the three groups by using the Chi-square test ( $p < 0.005$ ).

**Results:** For 725 nodules, 654 (90.2%) were benign and 71 (9.8%) were malignant. For 589 nodules classified as low risk, 10 (1.7%) were malignant. For 102 nodules classified as intermediate risk, 32 (31.4%) were malignant. For 34 nodules classified as high risk, 29 (85.8%) were malignant. There was a statistically significant difference in the frequency and positive predictive value of malignancy among the three groups ( $p < 0.001$ ).

**Conclusion:** There was a statistically significant difference in the frequency and positive predictive value of malignancy among the three groups for the new scoring system presented in this study to analyze the synthetically sonographic features of thyroid nodules. So, we think that sonography can be helpful for making the differentiation between benign and malignant nodules. When we find thyroid nodules on sonography, we can reduce the unnecessary FNAB and we can diagnose malignant nodules at an earlier stage.

**Index words :** Malignant thyroid nodule, sonography  
Fine-needle aspiration biopsy