# Benign thyroid nodules on cytology: Results of long-term follow up with Ultrasonography

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Directed by Professor Eun-Kyung Kim

The Master's Thesis
submitted to the Department of Medicine,
the Graduate School of Yonsei University
in partial fulfillment of the requirements for the degree
of Master of Medical Science

Soo-Yeon Kim

June 2013

This certifies that the Master's Thesis Soo-Yeon Kim is approved.

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June 2013

# ACKNOWLEDGEMENTS

I acknowledge my deep gratitude to Professor Eun-Kyung Kim, who is my thesis director, for supporting my efforts with total commitment and facilitating every step of the process. My appreciation for her guidance and encouragement is tremendous. I am also indebted to Professor Jin Young Kwak and Woong Youn Chung, for their help for pertinent advice to assure the superior quality of this paper. Additionally, I thank Hee Jung Moon and Kyung Hwa Han for their advice.

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ABSTRACT

# Benign thyroid nodules on cytology: Results of long-term Follow up with Ultrasonography

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**Background:** Repeated fine needle aspiration (FNA) is generally recommended for cytologically confirmed benign thyroid nodules demonstrating growth on follow-up ultrasonography (US). However, little is known about the natural history of cytologically confirmed benign thyroid nodules. This study investigated the natural history of FNA-confirmed benign thyroid nodules on US and to determine growth predictors for volume increases greater than 50%.

**Methods**: This retrospective observational cohort study enrolled 854 FNA-confirmed benign thyroid nodules from 819 patients with at least one more follow-up US since the initial US-guided FNA. Nodule volumes were measured at each US and the growth criteria was defined as an increase in volume of 50% or greater. Changes of nodule size were correlated with

demographic and US characteristics of each nodule. Incidence of malignancy was investigated.

**Results:** The majority of (79.7%) benign thyroid nodules did not change in size or decreased with the defined growth criteria during 47 months of mean follow up time (range: 7-101months). The estimated proportion with growth greater than 50% in volume was 8.1% at 4 years and 62.2% at 8 years. More than 4 years of follow up time, younger age and less than 25% of cystic component were independent growth predictors. Ten malignant nodules were detected, and eight out of them were stable in size during the follow up time but had suspicious US features.

**Conclusion:** FNA-confirmed benign thyroid nodules do grow slowly over the long-term follow up time of more than 4 years. More than 4 years of follow up time, younger age and less than 25% of cystic component were independent growth predictors for volume increases greater than 50%.

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Key words: Benign thyroid nodule, Fine-needle aspiration, Ultrasonography

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## I. INTRODUCTION

Fine needle aspiration (FNA) is known as the most accurate and cost-effective method for evaluating thyroid nodules[1]. When the nodule is diagnosed as benign on FNA, further immediate diagnostic examinations or treatments are not routinely needed[2]. However, the general recommendation is that all benign thyroid nodules should still be followed with serial ultrasonographic (US) examinations 6-18 months after initial FNA[2] because of inter-center variability in performance of FNA diagnosis and not negligible false-negative rate that has been reported to have values up to 11%[2-7]. Although nodule growth is not itself pathognomonic of malignancy, if there is evidence for nodule growth on a follow up US examination, repeated FNA is recommended[2]. Yet, there is no consensus on the definition of nodule growth requiring repeated FNA until now and little is known about the natural history of benign thyroid nodules on FNA[8-15]. 2009 revised ATA guideline[2] suggested that a 50% cutoff for nodule volume change appears to be an appropriate criteria for performing repeat FNA, refer to a study by Brauer et al.[16].

There have been many articles regarding the detected malignancy among FNA-confirmed benign thyroid nodules[2-7]. However, diagnostic performance of FNA has varied between different studies, and few articles have investigated both the nodule growth and detected malignancy during follow up among FNA-confirmed benign thyroid nodules[9,15].

The purpose of our study was to therefore determine the natural history of cytologically benign thyroid nodules and to determine growth predictors for volume increase ≥ 50% with the larger subjects over a long-term follow up period.

## II. Materials and Methods

### 1. Study population

This retrospective observational cohort study was approved by our institutional review board, and informed consent was not required. We retrospectively collected data for 1210 thyroid nodules in 1165 patients that were confirmed as benign on US-guided FNA from October 2002 to March 2004 at our hospital. There were no cases treated by US-guided percutaneous ethanol injection or thermal ablation with radiofrequency after performing FNA.

Although all patients with benign cytology on US-guided FNA were advised to return for follow-up US examinations regardless of nodule characteristics in 6-12 months, 320 nodules in 310 patients did not return for follow-up US examinations during the follow-up period. Thirty six nodules were excluded from this study because of unavailable US images. Finally 854 nodules in 819 patients (median age, 49 years; range, 14-76) consisting of 764 women and 55 men were included in this study (Fig.1). The number of US examinations for each nodule on follow up time ranged from 2 to 8 times (mean: 2.6 times). Among the study population, repeat FNAs were performed at a mean of 1.6 times (range: 1-6 times) for 438 nodules. Among 77 nodules

in 76 patients that were operated on, 67 were benign (adenomatous hyperplasia (n=60), lymphocytic thyroiditis (n=1), and follicular adenoma (n=6)), and 10 were malignant. The reasons for performing surgery were as follows: malignant or suspicious cytology on the repeat FNA (n=10), suspicious US features (n=2), nodule growth (n=21), relatively large nodule size greater than 3cm in maximal diameter (n=13), associated nodules with operation of other nodules with malignant or suspicious cytologic results (n=15), patient request (n=14), associated nodules with parathyroidectomy due to parathyroid nodules (n=2).

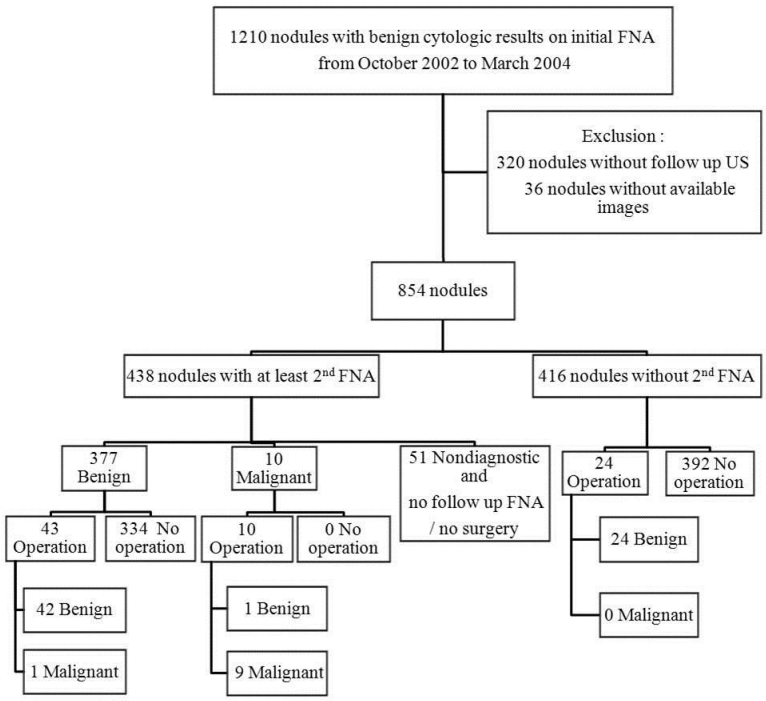



Figure 1. Diagram of the study group

2. Thyroid US and US-guided FNA

Thyroid US images were obtained by using a 7-to 15-, 8- to 15-, or

5- to 12- MHz linear array transducer. Thyroid US was performed by one of three radiologists with 9- 15 years of experience in thyroid imaging. After thyroid US examination, US-guided FNA was performed by the same radiologist. Initial FNAs were performed either for thyroid nodules with suspicious US features or for the largest nodules ≥ 1cm in maximal diameter if suspicious US features were not detected, or at the clinician's or patient's request despite being without suspicious US features or nodules < 1cm in maximal diameter. Suspicious US features were defined on the basis of our previously published criteria of marked hypoechogenicity, irregular or microlobulated margin, microcalcification, and taller-than-wide shape[17]. Repeated FNAs were performed during the follow up period because of nodule growth or suspicious US features, or at the clinician's or patient's request despite being without nodule growth or suspicious US features. FNA was directed to the remaining solid component after aspiration of cystic fluid in mixed cystic and solid nodules.

Two experienced radiologists retrospectively reviewed US features of each nodule on initial and follow up US examinations with consensus according to three criteria: (a) multiplicity; whether a patient has one or more than one nodule, (b) cystic component of the nodule; solid, <25%, 25% to 49%, 50% to 74%, or ≥75% cystic, and (c) echogenicity of the nodule: hypoechogenicity, isoechogenicity, or hyperechogenicity compared with the echogenicity of the underlying thyroid gland. The echogenicity in mixed echoic nodules was evaluated based on the internal solid components.

3. Data and Statistical analysis

Nodule volume was calculated using the formula for the rotational ellipsoid (length x width x depth x p/6)[16,18]. Change in nodule size over the interval time between initial and last US examination was assessed by using five criteria to facilitate comparison with previous studies: change in volume

of 1) 15% or more[8,9], 2) 30% or more[8,10,11], 3) 50% or more[16], change in maximal diameter 4) 3mm or more[9], 5) 50% or more[8,9].

We retrospectively reviewed electronic medical records in order to detect malignancy (false negative results of initial FNA) on follow up time. Demographic and US characteristics, and change in nodule size between initial and last US examination were analyzed for malignant nodules as well, and compared with benign nodules.

We used either the Chi-square test for categorical variables or the Student's t-test for continuous variables in order to test for differences of demographic and initial US data in patients with operation for comparison of the patients with benign or malignant nodules. Univariate and multivariate generalized linear mixed models were used to predict nodule growth defined as an increase in volume of 50% or more, while accounting for the correlation structure in the data where some patients had more than one thyroid nodule[19]. To consider the possibility of a change in volume due to the aspiration of the cystic component in mixed cystic and solid nodules during FNA, three sets of benign nodules categorized by the amount of cystic component (a) 844 nodules with variable cystic component from 0 to 100% (b) 719 nodules with <25% cystic component and (c) 504 completely solid nodules- were independently analyzed. As hyperechogenicity was found in only seven nodules, isoechogenicity and hyperechogenicity were integrated and compared with hypoechogenicity.

The estimated median time and estimated proportion with growth to achieve a volume increase of 50% or greater were analyzed by using life-table methods. The Log-rank test was used for comparison of growth rate between the two groups divided according to 25% of cystic component (<25% vs ≥25%). All analyses were performed with SAS version 9.1.3 (SAS Institute Inc., Cary, North Carolina, USA). P-values < 0.05 were considered statistically significant.

Results

Among 77 nodules in 76 patients with operation, 10 were malignant, and 67 were benign. Demographic and initial US characteristics of 77 nodules with operation are shown in Table 1. All malignant nodules were solid, and they had a higher proportion of single nodules and hypoechogenicity compared to the benign nodules (p-value: 0.013 and <0.001, respectively). Initial nodule size was significantly smaller in malignant than in benign nodules (p-value <0.001). Suspicious US features were more common in malignant than in benign nodules (p-value <0.001).The mean follow up time of the 844 benign nodules between initial and last US examination was 47±27months (range: 7-101months).

Table 1. Demographic and ultrasonographic characteristics of patients with operation

| Characteristics | Benign | Malignant | P-value |
|---|---|---|---|
| Patients (n) | 66 | 10 | |
| Age (mean ± SD) | 47.61±13.83 | 42.40±11.76 | 0.261 |
| Women (n(%)) | 65(97.0) | 10(100.0) | 0.583 |
| Nodules (n) | 67 | 10 | |
| Multiplicity (n(%)) | 47(71.2) | 3(30.0) | 0.013 |
| Nodule echogenicity (n(%)) | | | <0.001[a] |
| Hypoechoic | 12(17.9) | 7(70.0) | |
| Isoechoic | 54(80.6) | 3(30.0) | |
| Hyperechoic | 1(1.5) | 0(0.0) | |
| Nodule cystic component (n(%)) | | | 0.005[b] |
| Solid | 36(53.7) | 10(100.0) | |
| <25% cystic | 19(28.3) | 0(0.0) | |
| 25-50% cystic | 5(7.5) | 0(0.0) | |
| 50-75% cystic | 1(1.5) | 0(0.0) | |
| >75% cystic | 6(9.0) | 0(0.0) | |
| Suspicious US features (n(%)) | 2 (3.0) | 8(80.0) | <0.001 |

| | | | |
|---|---|---|---|
| Nodule size | | | |
| Maximal diameter (mean ± SD, mm) | 24.70±11.38 | 9.97±5.47 | <0.001 |
| Volume (mean ± SD, cm3) | 5.57±7.05 | 0.57±0.94 | <0.001 |
| Time between initial FNA and operation (mean ± SD, month) | 42.51±23.61 | 29.59±18.90 | 0.104 |

[a]: p-value for comparison of hypoechogenicity versus iso and hyperechogenicity

[b]: p-value for comparison of solid nodule versus non-solid nodule

1. Nodule growth

Table 2 demonstrates nodule growth between initial and last US examination according to five defined growth criteria in benign and malignant nodules. In 844 benign nodules, using the growth criteria of a change in volume of 50% or more, 171 (20.3%) showed growth, 200 (23.7%) decreased or disappeared, and 473 (56.0%) remained unchanged. In 10 malignant nodules, only one (10.0%) grew more than 50% in volume, thus only one of 172 nodules ≥50% volume increase (0.58%) is expected to be malignant.

The estimated median time to achieve volume growth≥ 50% (or ≥15%) was 89.7 (79.7) months. Figure 2 demonstrates the estimated proportion of nodules to achieve volume growth ≥ 50% or ≥ 15% or greater in the 844 benign nodules. The estimated proportion to achieve volume growth ≥ 50% (or ≥ 15%) was 8.1% (17.9%) at 4 years, 13.6% (25.9%) at 5 years, and 62.2% (79.2%) at 8 years, thus 54.1 % of nodules achieved volume growth ≥ 50% from 4 to 8 years.

Table 2. Change in nodule size during interval time between initial and last US examination according to five growth criteria

| | Benign (n=844) | Malignant (n=10) |
|---|---|---|

| | All (n=844) | Nodules with <25% cystic (n=719) | Nodules with solid (n=504) | |
|---|---|---|---|---|
| Initial maximal diameter (mm) | 20.05± 9.93 | 18.88± 9.50 | 17.41± 9.19 | 9.97± 5.47 |
| Initial volume ($cm^3$) | 3.22± 5.38 | 2.69± 5.10 | 2.21± 5.13 | 0.57± 0.94 |
| Increase (n(%)) | | | | |
| Volume≥15% | 306 (36.3) | 277 (38.5) | 191 (37.9) | 3(30.0) |
| Volume≥30% | 243 (28.8) | 222 (30.9) | 149 (29.6) | 2(20.0) |
| Volume≥50% | 171 (20.3) | 157 (21.8) | 102 (20.2) | 1(10.0) |
| Maximal diameter≥3mm | 190 (22.5) | 168 (23.4) | 103 (20.4) | 1(10.0) |
| Maximal diameter≥50% | 38 (4.5) | 36 (5.01) | 22 (4.4) | 0(0.0) |
| Decrease (n(%)) | | | | |
| Volume≥15% | 356 (42.2) | 270 (37.6) | 184 (36.5) | 1(0.0) |
| Volume≥30% | 262 (31.0) | 184 (25.6) | 120 (23.8) | 0(0.0) |
| Volume≥50% | 184 (21.8) | 113 (15.7) | 62 (12.3) | 0(0.0) |
| Maximal diameter≥3mm | 228 (27.0) | 152 (21.1) | 94 (18.7) | 0(0.0) |
| Maximal diameter≥50% | 85 (10.1) | 34 (4.7) | 19 (3.8) | 0(0.0) |
| Complete disappearance (n(%)) | 16(1.9) | 11(1.5) | 7(1.4) | 0(0.0) |

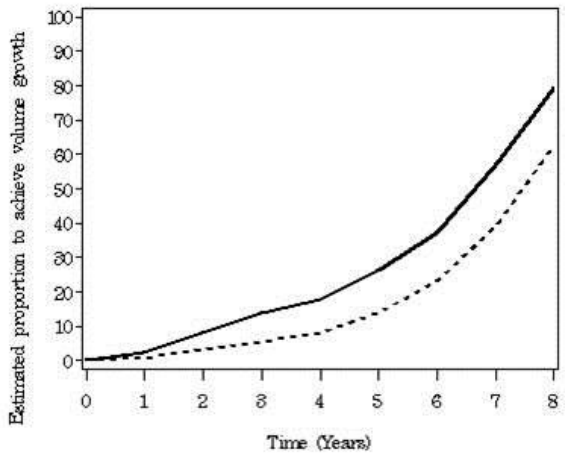



Figure 2. The estimated proportion of nodules to achieve volume growth ≥ 50% (dashed line) or ≥ 15% (continuous line) in the total 844 benign thyroid nodules

2. Growth predictor ≥50%

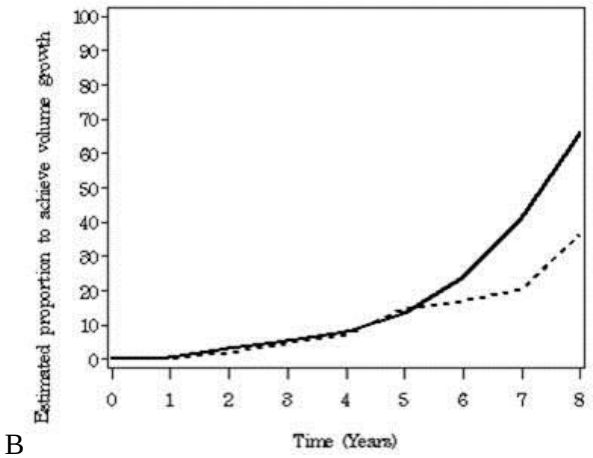
In the final multivariable model, younger age and more than 4 years of follow up time compared to less than 2 years of follow up time were independent growth predictors in all groups (Table 3). Male sex, multiplicity and nodule echogenicity did not predict growth in all groups. More than 25% of cystic component predicted a lower rate of growth compared to less than 25% of cystic component in the 844 nodules.

Among the 844 benign nodules, the estimated proportion to achieve volume growth of 50% or greater was 8.2 % at 4 years, and 65.7% at 8 years in nodules with <25% of cystic component, which was significantly different compared with nodules with ≥25% of cystic component (Figure 3, p-value: 0.032).

Table 3. Single-variable predictors and final multivariable model to predict nodule growth with growth criteria of volume increase ≥ 50%

| Variable | All (n=844) | | Nodules with <25% cystic (n=719) | | Nodules with solid (n=504) | |
|---|---|---|---|---|---|---|
| | Odds ratio (95% CI) | P-value | Odds ratio (95% CI) | P-value | Odds ratio (95% CI) | P-value |
| Single-variable predictors | | | | | | |
| Age | 0.981 (0.967-0.995) | 0.006 | 0.974 (0.958-0.990) | 0.002 | 0.964 (0.944-0.985) | 0.003 |
| Male | 1.440 (0.756-2.744) | 0.259 | 1.862 (0.920-3.770) | 0.082 | 1.922 (0.737-5.009) | 0.166 |
| Follow up (years) | | | | | | |
| 2-4 vs <2 | 1.620 (0.867-3.025) | 0.126 | 1.555 (0.793-3.050) | 0.190 | 2.516 (0.958-6.613) | 0.060 |

| | | | | | | |
|---|---|---|---|---|---|---|
| ≥4 vs <2 | 3.993 (2.402-6.637) | <0.001 | 4.118 (2.400-7.064) | <0.001 | 7.043 (3.134-15.801) | <0.001 |
| Multiplicity vs Single | 0.807 (0.560-1.163) | 0.241 | 0.694 (0.471-1.024) | 0.065 | 0.739 (0.445-1.227) | 0.220 |
| Hypoechogenicity vs Iso and Hyperechogenicity | 0.861 (0.568-1.305) | 0.469 | 0.782 (0.509-1.203) | 0.252 | 0.871 (0.512-1.481) | 0.584 |
| Cystic component (%) | | | | | | |
| ≥ 25 vs <25 | 0.452 (0.246-0.831) | 0.012 | | | | |
| > 0 and <25 vs solid | | | 0.738 (0.496-1.098) | 0.128 | | |
| Final multivariable model | | | | | | |
| Age | 0.979 (0.965-0.994) | 0.006 | 0.976 (0.961-0.992) | 0.003 | 0.968 (0.949-0.987) | 0.001 |
| Follow up time (years) | | | | | | |
| 2-4 vs <2 | 1.648 (0.898-3.026) | 0.107 | 1.546 (0.807-2.960) | 0.189 | 2.521 (1.051-6.050) | 0.058 |
| ≥4 vs <2 | 3.991 (2.446-6.511) | <0.001 | 4.090 (2.444-6.842) | <0.001 | 7.040 (3.393-14.609) | <0.001 |
| Cystic component (%) | | | | | | |
| ≥ 25 vs <25 | 0.456 (0.251-0.826) | 0.010 | | | | |




B

Figure 3. The estimated proportion of nodules to achieve volume growth ≥ 50% in nodules with <25% of cystic component (continuous line) and in nodules with ≥25% of cystic component (dashed line) (p-value: 0.032)

3. False negative results

There were 10 malignancies (8 papillary carcinoma, 1 follicular variant of papillary carcinoma, and 1 minimally invasive follicular carcinoma).

Eight papillary carcinomas did not change in size during 22 months ofmean follow up time. However, all of them showed suspicious US features at initial US examination, and revealed suspicious cytology on repeated FNAs. Minimally invasive follicular carcinoma was stable in size during 18 months with benign US features but it was operated on because of a cytological diagnosis of follicular neoplasm on repeat FNA. Only one out of 10 malignant nodules grew greater than 50% in volume during 39 months of follow up. Although both initial and repeated FNAs misdiagnosed it as adenomatous hyperplasia, it was finally confirmed as a follicular variant of papillary carcinoma by means of surgery.

IV. Discussion

Thyroid nodule growth is not itself pathognomonic of malignancy, but it is generally accepted as an indication for repeated FNA[2]. However, supporting data for this indication is limited. A few retrospective studies on the natural history of benign thyroid nodules[8-15,20] and several randomized trials on the efficacy of L-thyroxine suppression therapy for nodular thyroid disease[21,22] provide conflicting results about the growth of benign thyroid nodules. Several studies have found that a majority of benign thyroid nodules decreased or unchanged in size over time[12,13,15,22]. In contrast, other studies have found that they often increased in size, albeit slowly[8-11,14,20,21]. Furthermore, there is no consensus on the definition of thyroid nodule growth[2]. The growth criteria used to define nodule growth were inconsistent among the different studies, and most of them were not established based on the inter-observer variability for size measurement derived from their own data. A prospective blinded trial by Brauer et al.[16] suggested that the inter-observer variation for the ultrasound determination of thyroid nodule volumes was approximately 50%, concluding that future investigators should not interpret changes in nodule volume <50% as significant. Based on their study, the growth criterion of volume change ≥50% was established in this current study.

In the present study with follow up time ranging from over 1 month to 101 months, approximately 20-22% of FNA-confirmed benign thyroid nodules increased greater than 50% in volume, and the estimated proportion of nodules with growth greater than 50% in volume after 5 years was 13.60%. We found that benign thyroid nodules grew more from 4 to 8 years, than from 0 to 4 years demonstrating the estimated proportion to achieve volume increase ≥50% was 8.1% from 0 to 4 years, and 54.1 % from 4 to 8 years. More than 4 years of follow up time was an independent growth predictor compared to less than 2 years of follow up time. However, a follow up time from 2 to 4 years was not a growth predictor compared to less than 2 years of

follow up time. Therefore, our results prove that a majority of benign thyroid nodules do not grow significantly until 4 years, but they grow slowly over a long-term follow up time of more than 4 years.

The incidence of malignancy in the current study was 1.17% (10 of 854 nodules). 0.58% out of FNA-confirmed benign thyroid nodules was predicted as malignancy using the growth criteria of a change greater than 50% in volume. Eight of 10 malignant nodules were detected not by growth but by suspicious US features, which reinforces the conclusion of the study by Kwak et al.[23] that showed that repeated FNAs should be performed for thyroid nodules with suspicious US features, even if initial FNA results are benign and there is no growth during follow up.

The present study demonstrated that benign thyroid nodules were less likely to grow in older patients, contrary to previous studies reporting that age does not predict the growth of benign thyroid nodules[8-10]. It might be related with the lower TSH concentration in the healthy old population than in the young population[24] and/or lower estrogen levels associated with post-menopause in older women. TSH is generally believed to be a trophic factor for the thyroid[25], and estrogen increased the growth of a differentiated follicular cell regardless of the presence of TSH[26]. However, this is merely an assumption because we were not able to collect the old clinical data including serum TSH, history of levothyroxine suppression therapy, post-menopausal status, and estrogen. Future study to investigate the relationship between those clinical data and the growth of benign thyroid nodules is needed to prove this assumption.

Alexander et al.[9] demonstrated that benign thyroid nodules with >50% of cystic component were less likely to grow compared to those with <50% of cystic component. Our results also show that benign thyroid nodules with ≥ 25% of the cystic component are less likely to grow than those with < 25% of the cystic component. These results can be explained by the fact that cystic

nodules may decrease in size by simple aspiration[27].

Edrogan et al. showed that hypoechogenicity was the only significant growth predictor[8]. However in the current study, hypoechogenicity was not a grow predictor, and there was a trend that hypoechoic nodules were less likely to grow than iso and hyperechoic nodules without statistical significance. Possible assumption to explain why nodules with hypoechogenicity grow less can be explained with fibrosis. Nodule echogenicity is related with fibrosis and the more fibrosis nodules have, the more echogenicitiy decreases[28]. TGF-β1 is known to be involved in the development of fibrosis in a variety of organs including thyroid[29,30]. Also, it is a potent inhibitor of growth in human thyroid follicular cells[31]. From this point of view, we speculated that hypoechoic nodules with fibrosis might express TGF- β1 more, thus they might grow less than iso and hyperechoic nodules. Additional studies are needed to investigate the relationship between echogenicity and growth of benign thyroid nodules.

We acknowledge several limitations in this study. First, patient selection bias might have occurred because patients who returned for follow up US examinations were not chosen randomly. Second, as pointed out above, we could not collect and analyze the clinical data because most of previous data were not available at the present time. Although several previous studies have demonstrated that initial serum TSH and a history of levothyroxine therapy do not predict the growth of benign thyroid nodules[8-10], we cannot exclude the possibility that they might have a significant association with nodule growth. Third, only 67 nodules (7.8%) out of 854 cytologically benign nodules underwent surgery. Therefore, the possibility of additional false-negative results on initial FNA cannot be completely excluded for nodules without operation.

## V. Conclusion

In conclusion, the majority of the cytologically benign thyroid nodules do not grow greater than 50% in volume during 4 years of follow up time. However, they do grow slowly over a long-term follow up time of more than 4 years. More than 4 years of follow up time, younger age and less than 25% of cystic component were shown to be significant growth predictors.

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ABSTRACT(IN KOREAN)

# 미세침흡인세포검사에서 양성으로 진단된 갑상선 결절의 경과: 장기 초음파 추적 결과

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배경: 미세침흡인세포검사에서 양성으로 진단된 갑상선결절의 추적 초음파 검사에서 결절의 크기가 증가하는 경우 반복 미세침흡인세포검사가 일반적으로 권고된다. 그러나 미세침흡인세포검사에서 양성 결과를 보인 갑상선결절의 자연사에 대해서는 거의 밝혀지지 않았다. 본 연구의 목적은 미세침흡인세포검사에서 양성으로 진단된 갑상선결절의 부피가 50% 이상 증가하는 것을 예측하는 인자를 추적 초음파 검사를 통해서 알아보는 데에 있다.

방법: 본 연구는 후향적 코호트 연구로 처음 미세침흡인세포검사에서 양성 결과를 보이고 이후 적어도 한번 이상의 추적 초음파 검사를 시행한 819명에서 854개의 결절을 대상으로 하였다. 결절의 부피는 매 추적 초음파 검사

시에 측정 하였고 결절의 성장 기준은 부피가 50% 이상 커지는 것으로 정의하였다. 결절의 성장과 각 결절의 인구통계학적인 특성과 초음파 특성과의 상관관계를 분석하였다. 악성 결절의 빈도도 조사하였다.
결과: 대부분의 (79.7%) 양성 갑상선 결절은 평균 47개월의 추적 관찰 기간 (범위: 7-101 개월) 동안 크기가 변하지 않거나 감소하였다. 부피가 50% 이상 증가하는 것으로 추정되는 결절의 비율은 추적 관찰 기간 4년 째 8.1% 이고 8년 째 62.2% 였다. 4년 이상의 추적 관찰 기간과 젊은 나이, 그리고 25% 미만의 낭성 성분이 독립적인 성장 예측 인자였다. 열 개의 악성 결절이 발견되었고, 그 중 여덟 개의 결절이 추적 관찰 기간 중에 크기가 변하지 않았지만 초음파상 악성 의심 결절 이었다.
결론: 미세침흡인세포검사에서 양성으로 진단된 갑상선결절은 4년 이상의 장기간 추적 관찰 기간 동안 천천히 자란다. 4년 이상의 추적 관찰 기간과 젊은 나이, 그리고 25% 미만의 낭성 성분이 부피가 50% 이상 커지는 데에 대한 독립적인 성장 예측 인자 였다.

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핵심되는 말 : 양성 갑상선결절, 미세침흡인세포검사, 초음파