



Radio-cytopathologic correlation of the thyroid nodule

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General Note

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ABSTRACT

Background: Ultrasonographic features of thyroid nodule are very helpful in predicting the risk of thyroid cancer. Fine-needle aspiration (FNA) is the primary diagnostic methodology used for thyroid nodule evaluation. Presence of ultrasonographic features suggestive of non-benign thyroid nodules may consider a way to decide which nodules should be sampled and subsequently, reduce the unnecessary biopsies. Of note up to one third of fine needle aspiration biopsies may be non-diagnostic, requiring open surgical biopsy for diagnosis. The current study aimed to correlate the ultrasonographic findings of thyroid nodule with malignancy. **Methods:** Retrospective cohort study was performed at King Salman Armed Forces Hospital to evaluate ultrasonographic findings in relation to cytology and histopathology. **Result:** Cytology results in relation to ultrasound findings show that malignancy was associated with larger nodule size, nodules containing intranodular blood supply as well as irregular nodular border. **Conclusion:** Radiological assessment of thyroid nodule by experienced radiologist in thyroid sonography is encouraged looking for high risk radiological findings suggestive of malignant thyroid nodule such as large, hypoechoic, irregular nodule.

Keywords: Thyroid nodule, Ultrasound, Malignant.

1. INTRODUCTION

Ultrasonographic features of thyroid nodule are very helpful in predicting the risk of thyroid cancer. Fine-needle aspiration (FNA) is the primary diagnostic methodology used for thyroid nodule evaluation (Smith-Bindman et al., 2012; Halakouei et al. 2019; El-Wafa et al. 2020; Raslan et al. 2020), first introduced over 50 years ago. Thyroid nodule FNA has proven to be of high value because nearly 70% of aspirates return benign (Ezzat et al., 1994).

Thyroid nodules are extremely common. Even among patients selected as controls in one study 56% had thyroid nodules greater than 5 mm, and nearly a third had multiple nodules (Harach et al., 1985).

In contrast to previous reports that have suggested the prevalence of cancer in thyroid nodules as high as 23%, we suspect a lower percentage of patients who had one or more thyroid nodules 5 mm or greater to harbor cancer (Davies et al., 2006; Howlader et al., 2011).

Thus, while thyroid nodules are common, the vast majority, 98.5%, are benign; highlighting the importance of being prudent in deciding which nodules should be sampled to reduce unnecessary biopsies (Aschebrook-Kilfoy et al., 2011).

Unnecessary tissue sampling is not only invasive and costly, but leads to repeated sampling and unnecessary open surgical procedures, as up to one third of fine needle aspiration biopsies may be non-diagnostic, requiring open surgical biopsy for diagnosis (Cooper et al., 2009).

2. MATERIALS AND METHODS

This is a retrospective cohort study conducted between May-2019 and Jun-2020 at King Salman Armed Forces Hospital. Ethical approval was taken from the Institutional Review Board of Institute of the armed forces hospital, North-western region, Saudi Arabia. FNA were taken from all patients referred to radiology department for thyroid ultrasonographic examination who were found to have thyroid nodules larger than 1 cm in size. Thyroid nodules were examined for nodule size, intra-nodular blood supplies were defined as vascularity within the nodule, nodules consistency was classified as solid when the entire nodule was solid without any cystic component, cystic when the entire nodule was cystic without any solid areas and partially cystic nodules were nodules that have more than 50% cystic areas with some solid areas.

Fine needle aspiration evaluated by hospital cytopathology department reported as benign (negative for malignant cell) or malignant. Patients who underwent total or subtotal thyroidectomies, a definitive pathological diagnosis is based on histopathological analysis of thyroid specimen.

All information was entered into SPSS v. 17. Frequencies with percentages of the categorical variables were presented in tables and graphs.

3. RESULTS

A total of 161 consecutive patients with thyroid nodule included in this study, age of the participants were ranged from 15 to 60 year. Out of the 161 participants, 140 (87%) were females and 21 (13) were males. Majority (122 samples, 75.8%) has multiple thyroid nodules measuring 1 centimeter or more, remaining 39 samples (24.2%) were less than 1 centimeter. Most of nodules 72(44.7%) has a partial cystic content followed by 63 nodules (39.1%) with pure solid contents, only 26 nodules (16.1%) has fully cystic contents (Table 1).

Out of 161 thyroid sonography more than half 87 (54%) shown intranodular blood supply, near to one third 46 nodules (28.6%) contain intranodular calcification and border irregularity was noted in 75 samples (46.6%), were majority 86 (53.4%) has regular borders. Echogenicity assessment of thyroid nodules reveal than a hypo echoic nodule were the predominant finding as 79 nodules (49.1%) were hypo echoic, 60 nodules (37.3%) were iso echoic and the remaining 22 nodules (13.7%) were hyper echoic (Table 2).

Regarding fine needle aspiration cytology finding, out of 161 thyroid samples 127 (79%) were benign, 18 nodules (11%) were malignant. Colloid thyroid nodules were seen in 56 (35%) samples followed by 48 (29.8%) follicular nodules. Benign fine needle aspiration cytology were in 130 females participants (80.7%), in 14 out of 21 males participants (66.7%), 11 participants aged between 15-30 years, 66 participants aged between 31-45 years, 35 participants aged between 46-60 year and in 14 participants aged more than 60 year. Malignant fine needle aspiration cytology were found in 12 females participants (8.6%), in 6 out of 21 males participants (28.6%), 2 participants aged between 15-30 years , 10 participants aged between 31-45 years, 1 participants aged between 46-60 year and in 5 participants aged more than 60 year (Figure 1,2; Table 3).

AS shown in tables 4-5, benign fine needle aspiration cytology reported in 98 samples measured 1 centimeter or more (5 samples(19.2%) were malignant). Presents of intranodular blood supply reported in 67(77%) benign samples and in 13 malignant samples (14.8%). Presence of intranodular calcification reported in 31 benign and 8 malignant samples. Presence of rim of calcification reported in 34 benign and 8 malignant samples. Border irregularity reported in 59(78.7%) benign and 9(12%) malignant samples. Taller nodules were reported in 13 (72.2%) benign and 2(11.1%) malignant samples.

Table 1: Study population characteristics.

	Frequency	Percent
Male	21	13%
Female	140	87%
Total	161	100%
Nodule		
Single	26	16.1%
Multiple	135	83.9%
Total	161	100%
Size of Nodule (Cm)		
>1	122	75.8%
<1	39	24.2%
Total	161	100%
Cystic Contents		
FULL	26	16.1%
Partial	72	44.7%
Solid	63	39.1%
Total	161	100%

Table 2: Thyroid nodule characteristics.

Intranodular Blood Supply		
Yes	87	54%
No	74	46%
Total	161	100%
Intranodular Calcification		
Yes	46	28.6%
No	115	71.4%

Total	161	100%
Rim of Calcification		
Partial	48	29.8%
No	113	70.2%
Total	161	100%
Border of nodule		
Regular	86	53.4%
Irregular	75	46.6%
Total	161	100%
Nodule T>W		
Yes	18	11.2%
No	143	88.8%
Total	161	100%
Echogenicity of the nodule		
Iso echoic	60	37.3%
Hypo echoic	79	49.1%
Hyper echoic	22	13.7%
Total	161	100%

FNA Cytology

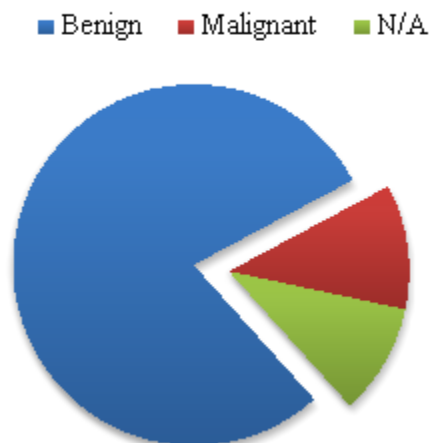


Figure-1: FNA Cytology of patients

Table-3: Demographic characteristic of the population in relation to cytopathology.

FNAC	Gender		Age			
	Male	Female	15-30	31-45	46-60	>60
Benign	14(66.7%)	113(80.7%)	11(78.6%)	66(79.5%)	35(83.3%)	14(66.7%)
Malignant	6(28.6%)	12(8.6%)	2(14.3%)	10(12%)	1(2.4%)	5(23.8%)
Not available (N/A)	1(4.8%)	15(10.7%)	1(7.1%)	7(8.4%)	6(14.3%)	2(9.5%)
Total	21	140	14	83	42	21
p-value*	0.022**		0.265			

*: Chi-Square Test, **: Significant (p-value<0.05)

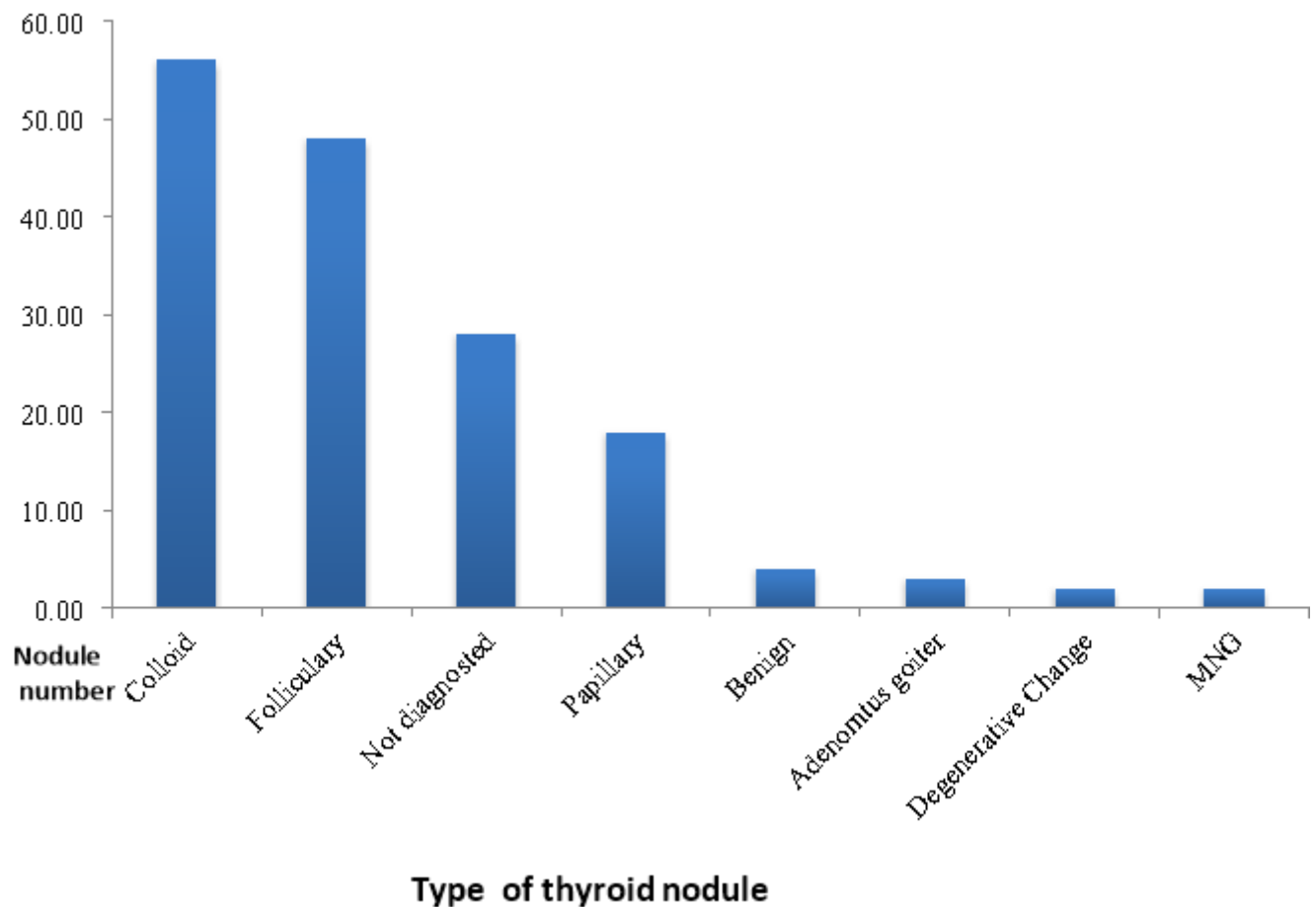


Figure-2: Type of Thyroid Nodule

Table-4: Ultrasonographic characteristics of benign and malignant thyroid nodules.

FNAC	Size (Cm)		Intranodular Blood Supply		Intranodular Calcification		Rim of Calcification		Border of nodule	
	>1	<1	Yes	No	Yes	No	Partial	No	Regular	Irregular
Benign	98(80.3%)	29(74.4%)	67(77%)	60(81.1%)	31(67.4%)	96(83.5%)	34(70.8%)	93(82.3%)	68(79.1%)	59(78.7%)
Malignant	15(12.3%)	3(7.7%)	13(14.9%)	5(6.8%)	8(17.4%)	10(8.7%)	8(16.7%)	10(8.8%)	9(10.5%)	9(12%)
Not available	9(7.4%)	7(17.9%)	7(8%)	9(12.2%)	7(15.2%)	9(7.8%)	6(12.5%)	10(8.8%)	9(10.5%)	7(9.3%)
Total	122	39	87	74	46	115	48	113	86	75
p-value	0.134		0.206		0.078		0.240		0.934	

*: Chi-Square Test, **: Significant (p-value<0.05)

Table-5: Ultrasonographic characteristics of benign and malignant thyroid nodules.

FNAC	Nodule (T>W)		Echogenicity of the nodule		
	Yes	No	Iso echoic	Hypo echoic	Hyper echoic
Benign	13(72.2%)	114(79.7%)	50(83.3%)	61(77.2%)	16(72.7%)
Malignant	2(11.1%)	16(11.2%)	5(8.3%)	8(10.1%)	5(22.7%)
Not available	3(16.7%)	13(91.%)	5(8.3%)	10(12.7%)	1(4.5%)
Total	18	143	60	79	22
p-value	0.595		0.512		

4. DISCUSSION

Thyroid nodules are common finding in the general population, and its prevalence is increasing now a day with prevalence ranging from 19% to 67%, notable increases in prevalence were associated with age (Cooper et al., 2009; Dean et al., 2008).

Risk of malignancy associated with specific ultrasonographic finding with deferent sensitivity and specificity such as micro calcifications, hypo echogenicity, intranodular blood supply and margin irregularity, for example intranodular vascularity has up to 74% , 80% sensitivity and specificity, respectively (Frates et al., 2005; Rago et al., 2008).

Isolated ultrasonographic finding do not provide clear evidence to confirm presence of malignancy. However, micro calcifications (sensitivity, 44.2%; specificity, 90.8%) and taller than wide shape (sensitivity, 40.0%; specificity, 91.4%) features had high specificity for malignancy as shown in Moon et al and Salmaslioglu et al., found that the presence of micro calcifications had a sensitivity of 89.3% for malignancy (Moon et al., 2008; Salmaslioglu et al., 2008).

In our study malignant result of fine needle aspiration was more in male gender with single thyroid nodule, aged more than 60 years, compared with female, multiple nodules. Regarding cytology result in relation to ultrasound finding show that malignancy was associated with larger nodule size (1 or more centimeter), nodules containing intranodular blood supply (14.9% were malignant comparing to 6.8%) as well as irregular nodular border. Most of hypo echoic nodules turn to be malignant.

The association between thyroid nodule size and malignancy consider a controversial area, in our study larger nodules were associated with higher risk of malignancy, increase nodules vascularity consider a predictor for malignancy, in our study more malignant nodule were diagnosed in nodules with increased vascularity, which is consistent with the finding reported in Cappelli et al., (2007) and Arpana et al., (2018) studies.

Our finding reveal that hypo echoic nodules were associated with malignant cytology which is consider as independent predictors of malignant nodules (Moon et al., 2011). However, other study reports that insignificant association between nodules echogenicity and nodules histopathology (Iannuccilli et al., 2004).

5. CONCLUSION

Tissue sampling is invasive, costly and leads to repeated sampling. Radiological assessment of thyroid nodule by experience radiologist in thyroid sonography measuring nodule size, presence of intra nodular calcification or blood supply, rim of calcification and evaluates border irregularity before obtaining invasive biopsy.

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Author Contributions

A. Zahrani, Y. Alawi, A. Khan, R. Khan and O. Mukhtar: Developed the theoretical formalism, performed the analytic calculations and performed the numerical simulations.

I. Ajwah, F. Alatawi, M. Albalawi, H. Alharbi and A. Alghamdi: contribute in data collection sheet design, data collection, writing background section.

R. Alzahrani, H. Alharbi, R. Asiri, A. Alanazi, W. Alqulayti: Date collection, writing the main manuscript.

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Conflict of interest

Authors declare no conflict of interest

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical approval

The study was approved by medical ethical committee of King Salman Armed Forces Hospital (ethical approval code: R&REC2019-198)

Data and materials availability

All data associated with this study are present in the paper.

Peer-review

External peer-review was done through double-blind method.

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