

Incidental Detection of Thyroid Nodule on Carotid Color Doppler Ultrasound in Patients Presenting with Cerebrovascular Diseases

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ABSTRACT

Background: Thyroid nodules are often detected in clinical practice, during physical examination, or accidentally during different imaging techniques. Most of these nodules are characterized as benign, and thyroid cancer is identified in only a small subclass. Ultrasonography is considered an important tool in thyroid nodule evaluation. Therefore, the study aimed to determine the frequency of incidental detection of a nodule of thyroid on carotid color Doppler ultrasound in patients presenting with cerebrovascular diseases.

Methods: A cross-sectional descriptive study was carried out in the PNS Shifa hospital, Radiology department, from August 2017 to May 2018. Patients (n=110) underwent Color Doppler Ultrasound examinations with a scanner (Xario), furnished with a linear transducer operational at 10 MHz by the researcher. Incidental detection of thyroid nodule was labeled. Demographic detail including name, age, gender, and BMI was noted. Echogenicity and size of the thyroid gland was compared to that of encompassing glandular parenchyma. The data collected were analyzed and interpreted using SPSS version 20.

Results: The patient's mean age was 59.92 ± 11.03 years with the ratio being 1.2:1 between males and females respectively. Diabetes and hypertension were existent in 43(39.1%) and 54(49.1%) patients respectively. Family history of thyroid nodules was present in 31(28.2%) patients. Thyroid nodule was detected in 34(30.91%) patients. The Benign pattern of thyroid nodules on grayscale. However, the histologic pattern of a mildly differentiated follicular thyroid carcinoma was detected.

Conclusion: The frequency of incidental detection of thyroid nodule on carotid color Doppler ultrasound was 30.91% in patients presenting with cerebrovascular diseases.

Keywords: Carotid Color Doppler Ultrasound; Incidental Detection; Cerebrovascular; Thyroid Nodule.

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INTRODUCTION

Iodine is fundamental for the synthesis of thyroid hormones. Its deficiency leading to goiter occurs in 2.7% of the global population as of the 2010 report¹. In Pakistan, the prevalence of iodine deficiency is 63.6% following the WHO database². A thyroid nodule is a distinct lesion specific to the thyroid gland³. The occurrence of thyroid nodules is 4% to 7% on palpation alone and 18% to 67% on ultrasonography assessment. However, fewer than 7% of these nodules are malignant neoplasms^{4,5}.

Ultrasound imaging has developed as an imperative analytical tool in the evaluation of thyroid nodules. It is extremely sensitive for nodule detection, and the ultrasound attributes of the nodules can be employed to decide the requisite for additional exploration. Quite a few studies have studied the benign and malignant ultrasound imaging characteristics of thyroid nodules⁵. High-resolution ultrasonography with Doppler is a useful and reliable tool to segregate benign from malignant thyroid nodules⁶. Research has shown that the possibility of malignancy is higher in nodules with a completely central vascular pattern while nodules with a primarily perinodular pattern are more benign⁷.

The thyroid nodules are identified parenthetically during the physical evaluation and imaging of the neck for different purposes⁸. Thyroid incidentaloma is a term used to define coincidental thyroid nodules detection by medical imaging studies planned for other reasons. The stated prevalence of incidental thyroid nodule detection during Doppler ultrasound studies vary significantly depending upon the age of the patient, use of added iodine, and other less imperative factors^{9,10}. The prevalence of thyroid incidentaloma by other imaging techniques and its clinical importance has been stated by numerous prior studies. The increased use of different imaging modalities, such as ultrasound, computed tomography and magnetic resonance imaging have shown a steady increase in the prevalence of thyroid incidentaloma. In a contrast-enhanced MR angiography study, incidental thyroid nodules were detected in 4.6% of patients^{11,12}.

Cerebrovascular diseases are medical conditions that affect cerebral circulation. The most common presentation is an ischemic stroke and occasionally a hemorrhagic stroke. The color Doppler ultrasound is a widely recognized evaluation tool for the carotid artery and its branches. The thyroid gland is positioned in the neck in close vicinity to the carotid vessels¹³. Assessment of the thyroid gland during the carotid Doppler ultrasound imaging is a cost-effective, non-tedious method that may have diagnostic advantages¹⁴.

The rationale of the study is to determine the frequency of incidental detection of thyroid nodules on carotid

color Doppler ultrasound in patients presenting with cerebrovascular diseases. This help in attaining the local magnitude of this problem as well as in updating local guidelines for early detection and prevention of thyroid disease in the local population. The study aimed to determine the frequency of incidental detection of thyroid nodule on carotid color Doppler ultrasound in patients presenting with cerebrovascular diseases.

METHODS

A cross-sectional study was carried out after synopsis approval at the radiology department of PNS Shifa hospital. The sample size of 110 patients was calculated with a confidence level of 95%, 9.5% error margin, and taking an anticipated percentage of incidental thyroid nodule i.e., 51.1% in patients undergoing Color Doppler Ultrasound. The study approval was obtained by the institutional ethics review board and informed consent was taken from patients.

The sampling method was non-probability sampling at convenience. Inclusion criteria were patients between 40-80 years of age belonging to either gender with a diagnosis of cerebrovascular disease referred for Color Doppler Ultrasound. Patients with previously known thyroid disease, malignancy, or surgery (on medical record) were added to the exclusion criteria. A total of 110 patients referred to the Radiology Department of the hospital and satisfying the selection criterion were registered for the study. Demographic detail (name, age, gender, and BMI) was noted. The information was recorded and analyzed by version 20.0 of SPSS.

The patients underwent Color Doppler ultrasound examinations with an available scanner (Xario), fortified with a straight transducer operational at 10 MHz by the researchers. Echogenicity and size of the thyroid gland and any focal anomaly (echogenicity of nodule relative to neighboring strap muscles), existence or non-existence of echogenic foci, border depiction (irregular or lobulated), size and type of thyroid nodule i.e., solid (hyperechoic or hypoechoic), cystic (anechoic) or mixed (heterogeneous) as indicated by internal sonographic appearance comparative to that of encompassing glandular parenchyma was recorded. Incidental detection of thyroid nodule was labeled. All this information was recorded on a proforma.

RESULTS

According to the study results, the patient's mean age was 59.92 ± 11.03 years with the ratio being 1.2:1 between males and females respectively. Of the patients with DM were 43(39.1%) and hypertension was found in 54(49.1%) patients. The study exhibited that the patients with smoking status were 31(29.2%) and the patients without smoking habits were 79(71.8%) as shown in Table 1.

Table 1: Frequency of diabetes mellitus, hypertension, smoking and family history.

Variables	Female	Male	p-Value
Diabetes mellitus n=43	25	18	0.03
Hypertension n=54	22	32	0.07
Smoking n=31	0	31	0.02
Family History n=31	15	16	1.02

In this study, the history of thyroid nodules in the family was present in 31(28.2%) patients and 79(71.8%) of the patients had no history of thyroid nodules in the family. Thyroid nodule was present in 34(30.91%) patients. The single nodule was existent in 18(16.4%) patients and multiple nodules were

existent in 16(14.5%) patients. The solid type of nodule was noted in 13(11.8%) patients, cystic type in 10(9.1%) patients and mixed type in 11(10%) patients as shown in Table 2. The mean nodule size of the patients was 1.41±0.48 cm with minimum and maximum values of 0.5 and 2.0 cm respectively.

Table 2: Frequency distribution of number and type of nodules (n=34).

Number of Nodules	Single	Multiple	
	18(16.4%)	16(14.5%)	
Type of nodule	Solid	Cystic	Mixed
	13(38.2%)	10(29.4%)	11(32.4%)

The study results showed a statistically significant difference between gender and thyroid nodule status i.e., p-value=0.001 and a non-significant difference was found between the age and BMI with thyroid nodule status i.e. p-value >0.05 as

shown in Table 3. Within the context of ultrasound, the Benign pattern of thyroid nodules on grayscale is shown in Figure 1. However, the histologic pattern of a mildly differentiated follicular thyroid carcinoma (FTC) (250 X) is presented in Figure 2.

Table 3: Comparison of age, gender and Body mass index (BMI) with a thyroid nodule.

Comparative Variables		Thyroid Nodule		Total	p-Value
		Yes	No		
Age (years)	≤ 60	18	40	58	0.976
	> 60	16	36		
Gender	Male	34	26	60	0.001
	Female	0	50		
BMI	Normal	13	19	32	0.158
	Abnormal	21	57		

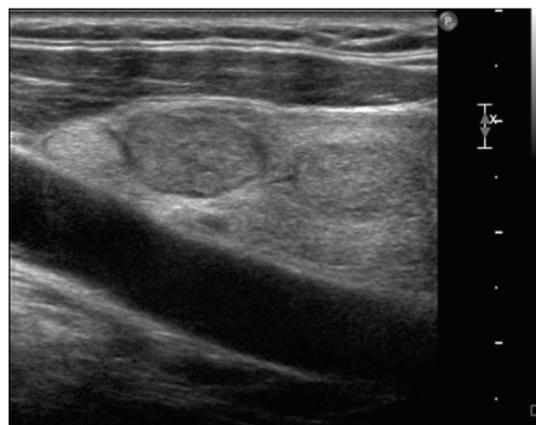


Figure 1: Benign pattern of thyroid nodules on grayscale ultrasound.

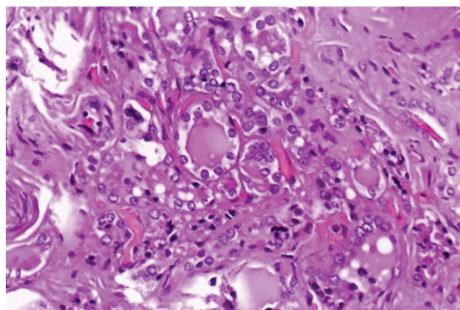


Figure 2: Histologic pattern of a mildly differentiated follicular thyroid carcinoma (FTC) (250 X).

DISCUSSION

This present cross-sectional descriptive study was done at PNS Shifa hospital, Karachi in the Department of Radiology, to determine the frequency of coincidental detection of thyroid nodule on color Doppler ultrasound of carotid in patients presenting with cerebrovascular. The thyroid nodule is a common entity. An endocrinologist frequently evaluates these nodules because they may epitomize malignancy. The nodules are usually detected on physical examination or incidentally when imaging techniques are executed for other purposes. Ultrasonography is considered the optimal investigation for thyroid nodules. It is a non-invasive technique that can detect small non-palpable nodules, their consistency, the presence of multiple nodules, lateral or central lymphadenopathy of the neck, and offers precise dimensions of nodule diameter for monitoring¹⁵. It also has a prime role in the effective treatment of thyroid nodules.

In our study, the frequency of thyroid nodules was 34(30.91%). The frequency of thyroid nodules was significantly greater in female patients as compared to male patients ($p=0.001$). Different studies have reported the coincidental detection of thyroid nodules during Doppler ultrasound and their prevalence varies significantly depending upon the age of the patient, use of iodine supplementation, and other less imperative factors^{9, 10}.

An ultrasound examination study involving 300 patients without clinical presentation of thyroid disease, showed small, echogenic nodules in 17% of male and 20% of female patients with an average of 19%¹⁶. In another study conducted in Iran at least, a single thyroid nodule was identified in 161 (51%) subjects, who were referred for Doppler ultrasound imaging for cervical vessel evaluation.¹⁷ Bartolotta et al. in their screening of 704 elderly patients with high-resolution ultrasound and real-time spatial compound imaging reported 58.5% and 41.5% thyroid nodules in women and men respectively with the highest prevalence in the 7th decade¹⁸.

Rad et al. in their study on 209 patients presented that 63 (21.8%) had abnormal thyroid and incidental thyroid nodules were present in 57 (19.6%) patients; mostly female and elderly. A total of 15 patients underwent fine needle aspiration biopsy (FNAB) and three had significant findings suggestive

of neoplasm¹⁹. The present study showed a statistically significant difference between gender and thyroid nodule status with $p=0.001$. Thirty-four out of 60 males (56.66%) had thyroid nodule while thyroid nodule was not detected in any female. However, in our study, no significant difference was detected between age and thyroid nodule status.

In the present study single and multiple nodules were detected in 16.4% and 14.5% of patients respectively. A total of 9.1% of patients had the cystic type of lesion while solid and mixed lesions were detected in 11.8% and 10% of patients respectively. In a study conducted by Steele et al. patients undergoing carotid Doppler Ultrasound, thyroid abnormalities were identified in 9.4% of patients. Nodules were both unilateral and bilateral²⁰. However, the consistency of the lesions was different from our study and was as follows: cystic (47%), solid (43%), and mixed (10%). After biopsy 9 patients were found to have thyroid neoplasm.

In a local study, the frequency of incidental detection of thyroid nodules was 21% in patients who underwent ultrasound examination of their thyroid and were asymptomatic for thyroid disease. Thyroid nodule was present in 16% of males and 25% of females. Among them, 55% had a single thyroid nodule while multiple nodules were present in 45% of patients²¹. Another study of Carotid Doppler ultrasound on asymptomatic patients documented thyroid nodules in 9.4% of patients. It reported 5(62.07%) and 3 (37.93%) female and male patients respectively²². However, in the current study thyroid nodule was detected in male patients and 53% had single and 47% had multiple nodules.

CONCLUSION

The frequency of incidental thyroid nodule detection was 30.91% on carotid color doppler ultrasound in patients presenting with cerebrovascular disease. The study observed the frequency of thyroid nodules to be high in patients with cerebrovascular disease. There may be higher chances of thyroid problems in ill patients if more sample size was obtained. We recommend the patients for screening for thyroid nodules because this will assist in improving the current practices and will also update the local guidelines for early detection and prevention of thyroid disease in the Pakistani population.

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CONFLICT OF INTEREST

The authors declared no conflict of interest.

ETHICS APPROVAL

The study approval was obtained by the institutional ethics review board.

PATIENT CONSENT

Informed consent was taken from the patients.

AUTHOR'S CONTRIBUTION

MS contributed to the analysis and interpretation of data, drafted the manuscript, and finalized the paper to be published. TJ and S assisted in the concept and study design, analysis and interpretation of data and drafting of the manuscript. SSU, A, FN and MAM helped in the critical revision and drafting of the manuscript. All authors agreed to be accountable for all aspects of the work.

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