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Research Article

Evaluation of Thyroid Nodules: Comparison between Radiological and Cytopathological Diagnosis

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Abstract

Background: Thyroid cancer is the most common cancer in Bangladesh's at 19th century, with an estimated annual incidence of 1.5 per 100,000 people [1]. Initial diagnosis and treatment is essential for optimal outcomes, but cytopathological diagnosis is not always feasible or accurate. Radiological diagnosis can help to identify patients at high risk of having malignant thyroid nodules, which can be prioritized for further evaluation and treatment.

Objective: To evaluate the association between radiological and cytopathological diagnosis in thyroid nodules.

Methods: This study was conducted at a tertiary-level hospital in Dhaka, Bangladesh, for one year and three months period. A total of 62 patients with thyroid nodules were included in the study. All patients underwent X-radiation (X-ray), computed tomography (CT) scan, magnetic resonance imaging (MRI), and ultrasound sonography (USG-guided) tests fine needle aspiration cytology (FNAC) for diagnosis of thyroid nodules. The radiological and cytopathological diagnoses were also recorded. The association between radiological and cytopathological diagnosis was done by using Pearson's chi-square test. A p-value of <0.05 was measured statistically significant.

Result: The study evaluated the association between radiological and cytopathological diagnosis of thyroid nodules. A significant association was found between the two variables (p-value< 0.05). The most common radiological diagnosis in patients was benign cysts (71.4%), while the most common radiological diagnosis was nodular goiter with lymphatic thyroiditis (42.9%).

Conclusion: The study found a significant association between radiological and cytopathological diagnosis in the evaluation of thyroid nodules. These findings suggest that radiological findings can be helpful in guiding the decision to perform FNAC and in predicting the likelihood of malignancy.

Keywords: Cytopathological; Thyroid Nodules; Radiological; Lymphatic Thyroiditis; Malignant; Benign Cysts

Introduction

Fine-needle aspiration (FNA) cytology using the Bethesda System is a global standard for thyroid lesion diagnosis. Category III Atypia of Undetermined Significance/Follicular Lesion of Undetermined Significance (AUS/FLUS) is the most diverse, often requiring repeat FNA for diagnosis. Resection is considered for AUS/FLUS nodules with clinical or radiological suspicion [2]. Solitary thyroid nodules are common clinical findings encountered by otorhinolaryngologists and physicians. The optimal diagnostic strategy for euthyroid patients with solitary thyroid nodules remains a topic of debate [3]. Modern imaging improves spinal Tuberculosis (TB) diagnosis—whole-spine imaging for multi-site involvement. Biopsy confirms, especially in human immunodeficiency virus (HIV) cases, that multiple tests are needed to avoid misdiagnosis [4]. After colon reflection, the blue dome cyst was dissected and aspirated using laparoscopic guidance, and the aspirate was sent for cytological analysis [5]. In non-pandemic regions of South Asian countries, the predicted contribution is 44% of the global burden, with annual rates of -52,500 (India), -20,000 (Indonesia), and -16,900 (Bangladesh) cases [6]. Dental X-rays are radiation-regulated, and CT scans emit higher doses. Occasional use is low-risk, but continuous screening or treatment increases radiation exposure [7]. Brain MRI reveals high signal changes in the putamen, lentiform nucleus, thalamus, and brainstem. White matter lesions with mass effect are rare [8]. From 2010 to 2020, 124 patients (69 women, 55 men, aged 22-92) with salivary gland lesions had surgery. Of these, 68 had prior FNA. FNA diagnoses were categorized using the Milan System and correlated with surgical findings to determine malignancy risk Range of motion (ROM) [9]. High-risk (oncogenic) Human papillomavirus (HPV) Deoxyribonucleic acid (DNA) testing could be used to effectively triage postmenopausal women with unequivocal cytology results [10]. A rare condition, arises when posterior reversible encephalopathy syndrome (PRES) impacts the spinal cord. While PRES is recognized, only a handful of PRES-SCI cases are documented in the literature [11]. In 67% of cases, changes in Kirsten rat sarcoma viral oncogene homolog (KRAS) mutant allele frequency correlated with radiological evaluation of disease status [12]. Lymph node TB: confirmed by biopsy or FNAC. Abdominal/pleural TB: diagnosed from ascitic/pleural fluid. Central nervous system (CNS) TB: diagnosed via A cerebrospinal fluid (CSF) analysis. In inconclusive cases or when samples were unavailable, contrast-enhanced CT scans were used for diagnosis [13]. Pancreatic cancer cases were identified based on histology, cytology, or a combination of clinical findings, tumor marker levels, and progressive radiological changes [14]. The sensitivity and specificity of a test are typically traded off against one another. Most suitable screening tests, such as cervical cytology, have a compassion of 50-70% and a specificity of 90-95% [15]. Thirty-one thyroid cancer specimens had A triglycerides (Tg) levels, and five medullary cancer specimens had calcitonin levels. Among 36 lymph nodes, 13 tested negative (3 by surgery, ten by follow-up). Surgery confirmed malignancy in 23 nodes. Cytopathology showed 91% sensitivity and 100% specificity [16]. We measured the American College of Rheumatology Criteria (ACR) thyroid nodule scoring structures in triaging 480 nodules for FNA. The ACR recommended FNA for 46.5% and the What is the normal range for Thyroid Imaging Reporting and Data System (TIRADS)?

TIRADS category ranges from TIRADS 1 to TIRADS 5. TIRADS 1 corresponds to normal thyroid gland, TIRADS 2: benign nodules, TIRADS 3: probably benign nodules, TIRADS 4: with ultrasound features suspicious of malignancy, TIRADS 5: nodules highly suggestive of malignancy. Aug 2, 2017 TIRADS for 51.9% of nodules [17]. Various ultrasound-based risk stratification systems (RSSs) help distinguish benign from malignant thyroid nodules and guide FNA biopsies. The top five globally recognized RSSs include ACR TI-RADS, American Thyroid Association (ATA) guidelines, American Association of Clinical Endocrinologists (AACE/ACE) guidelines, Aviation Medical Examiners (AME) guidelines, EU TI-RADS, and Korean Thyroid Imaging Reporting and Data System (K-TI-RADS) [18]. Cytology risk depends on nodule US patterns. Management should consider combined FNA cytology and US pattern malignancy risk [19]. Twelve studies, 18,750 thyroid nodules. Final malignant diagnosis via histology, benign via cytology. American College of Radiology (ACR)-TIRADS had a higher diagnostic odds ratio than ATA or K-TIRADS (P=.002), with DOR ranging from 2.2 to 4.9 [20]. All nodules were pathologically labeled as malignant or benign. Ultrasound features examined: size, location, composition, echogenicity, shape, margins, calcifications, and extrathyroidal extension [21].

Material and Methods

This study was conducted at the Department of Radiology and Imaging in Sheikh Hasina National Institute of Burn and Plastic Surgery, a tertiary-level hospital in Dhaka, Bangladesh, for one year and three months, commencing in June 2022 and concluding in August 2023. A total of 62 patients with thyroid nodules were included in the study. Patients were eligible for inclusion if they

were over the age of 18 years and had a thyroid nodule detected on ultrasound. Patients were excluded from the study if they had a history of thyroid cancer or other thyroid surgery. All patients underwent X-ray, CT scan, MRI, and USG-guided FNAC for diagnosis of thyroid nodules. The radiological and cytopathological diagnoses were recorded. Data was analyzed using the SPSS 26 version. The association between radiological and cytopathological diagnosis was assessed using Pearson's chi-squared test. A p-value of <0.05 was measured statistically significant.

Result

The study evaluated the association between radiological and cytopathological diagnosis in the evaluation of thyroid nodules. The study population consisted of 62 respondents, of which 75.8% were female and 24.2% were male. The majority of the respondents (41.9%) were in the age group ≥ 50 years, followed by 33.9% and 24.2% in the age groups 31-50 years and 8-30 years, respectively.

All of the respondents had undergone an X-ray, CT scan, MRI, and USG-guided FNAC to diagnose the disease. The most common radiological diagnoses were benign cysts (35.5%), followed by thyroid nodules (24.2%), multinodular thyroid goiter (22.6%), and lymphadenopathy (17.7%). (Table 4).

The most common cytopathological diagnoses were nodular goiter with lymphatic thyroiditis (27.4%), nodular goiter with degenerative change (22.6%), Bethesda category-I (19.4%), nodular goiter with cystic change (16.1%), and Bethesda category-II (14.5%). (Figure 2).

There was a significant association between radiological and cytopathological diagnosis (p-value=0.05). The most common radiological diagnosis in patients with benign cytopathological diagnosis was benign cysts (71.4%), while the most common radiological diagnosis in patients with malignant cytopathological diagnosis was nodular goiter with lymphatic thyroiditis (42.9%).

Gender	Frequency	Percent
Male	15	24.2
Female	47	75.8
Total	62	100.0

Table 1: Dissemination of the respondents by gender (n = 62).

Table 1 the majority of respondents (75.8%) were female, while 24.2% were male.

Age category in years	Frequency	Percent
8-30 yrs	15	24.2
31-50 yrs	21	33.9
≥50 yrs	26	41.9
Total	62	100.0
Mean ± SD	43.48±16.956	

Table 2: Distribution of the respondents by age category (n = 62).

Table 2 shows that 41.9% of the respondents were in the age group ≥ 50 years, and 33.9% and 24.2% were 31-50 years and 8-30 years, respectively.

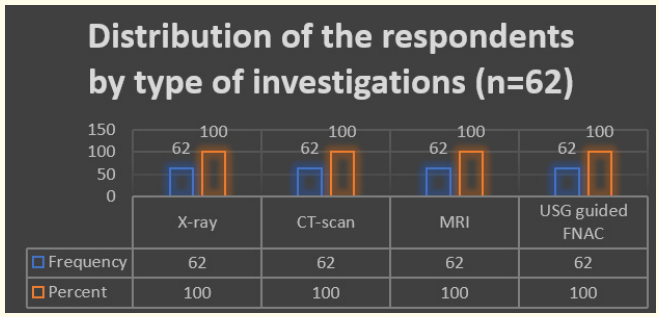

Figure 1: Distribution of the respondents by type of investigations (n = 62).

Figure 1 reveals that 100% of the respondents had done an X-ray, CT scan, MRI, and USG-guided FNAC to diagnose the disease.

Radiological diagnosis	Frequency	Percent
Benign cyst	22	35.5
Multinodular Thyroid goiter	14	22.6
Lymphadenopathy	11	17.7
Thyroid nodule	15	24.2
Total	62	100.0

Table 3: Distribution of the respondents by radiological diagnosis (n = 62).

Table 3 respondents diagnosed as follows - benign cyst (35.5%), thyroid nodule (24.2%), multinodular thyroid goiter (22.6%), and lymphadenopathy (17.7%)

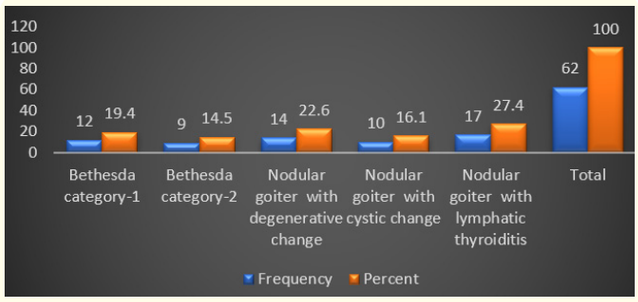

Figure 2: Distribution of the respondents by cytopathological diagnosis (n = 62).

Figure 2 nodular goiter with lymphatic thyroiditis (27.4%), nodular goiter with degenerative change (22.6%), Bethesda Category-I (19.4%), nodular goiter with cystic change (16.1%), Bethesda Category-II (14.5%).

Discussion

The present study evaluated the association between radiological and cytopathological diagnosis in evaluating thyroid nodules. The study found a significant association between the two, with the most common radiological diagnosis in patients with benign cytopathological diagnosis being benign cysts (71.4%). In comparison, the most common radiological diagnosis in patients with malignant cytopathological diagnosis was nodular goiter with lymphatic thyroiditis (42.9%). These results are reliable with previous studies, which have also found a strong correlation between radiological and cytopathological diagnosis in thyroid nodules [17-19].

Radiological	Cytopathological Dx					*p*-value
	Bethesda category 1	Bethesda category 2	Nodular goiter with degenerative change	Nodular goiter with cystic change	Nodular goiter with lymphatic thyroiditis	
Benign cyst, benign thyroid nodule,	12	9	1	0	0	.000*
Multinodular Thyroid goiter	0	0	13	1	0	
Lymphadenopathy	0	0	0	9	2	
Thyroid nodule	0	0	0	0	15	
Fisher's Exact Test	111.542					

Table 4: Association between radiological and cytopathological diagnosis of the respondents (n = 62).

Nineteen cells (95.0%) have an expected count of less than 5. *Significant; *p*-value is .05 at 95% CI.

The findings of this study have several clinical implications. First, they suggest that radiological findings can be used to help guide the decision of whether or not to perform fine-needle aspiration cytology (FNA) in patients with thyroid nodules. For example, patients with nodules that have radiological features that are highly suggestive of malignancy (e.g., irregular margins, microcalcifications) may be more likely to benefit from FNA than patients with nodules that have radiological features that are more suggestive of benignancy (e.g., smooth margins, cystic change) [20,21].

Second, the findings of this study suggest that radiological imaging can be used to help interpret the results of FNA. For example, if a patient has an FNA that is Bethesda category III (atypia of undetermined significance/follicular lesion of undetermined significance), the radiological findings can be used to help assess the risk of malignancy. For example, patients with nodules that have radiological features that are highly suggestive of malignancy (e.g., irregular margins, microcalcifications) may be more likely to have a malignant FNA result than patients with nodules that have radiological features that are more suggestive of benignancy (e.g., smooth margins, cystic change).

Overall, the findings of this study suggest that radiological imaging plays an important character in evaluating thyroid nodules. By understanding the association between radiological and cytopathological diagnosis, clinicians can use radiological imaging to help guide the decision of whether or not to perform FNA and to help interpret the results of FNA.

Limitations

- The study was conducted at a single center, which limits its generalizability to other populations.
- The sample size was relatively small (n = 62).
- The study was retrospective, meaning it is more prone to bias than a prospective study.
- The study did not control for other factors influencing the association between radiological and cytopathological diagnosis, such as patient age, gender, and medical history.

Conclusions

This study assessed the link between radiological and cytopathological diagnoses of thyroid nodules. It found a significant association. Benign cysts were common in patients with benign cytopathological diagnoses (71.4%), while nodular goiter with lymphatic thyroiditis was prevalent in those with malignant cyto-

pathological diagnoses (42.9%). These results imply that radiological imaging can aid in deciding whether to perform FNA in thyroid nodule patients and help interpret FNA results.

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