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A Comparative Study of Ultrasound (USG), Fine Needle Aspiration Cytology (FNAC) and Histopathological Examination (HPE) of Thyroid Swellings

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ABSTRACT

Diseases of the thyroid gland is a common clinical presentation in general population where the incidence being higher in endemic areas. The disorders of thyroid gland can be due to inflammatory and neoplastic causes. The primary aim of this study is to perform a comparative analysis of three diagnostic techniques Ultrasound (USG), Fine Needle Aspiration Cytology (FNAC) and Histopathological Examination (HPE) in the diagnosis of thyroid swellings (nodules). The present study was a Prospective observational study. This Study was conducted for 1 year. Total 100 patients were included in this study. In USG, 44 (88%) patients had Multinodular Goitre, 4 (8%) patients had Malignant and 2 (4%) patients had Indeterminant. In FNAC, 45 (90%) patients had Benign, 2 (4%) patients had Malignant and 3 (6%) patients had Indeterminant which was not statistically significant (p=0.6447). In conclusion, this comparative study of Ultrasound (USG), Fine Needle Aspiration Cytology (FNAC) and Histopathological Examination (HPE) of thyroid swellings highlights the complementary roles of each diagnostic method. While USG provides valuable imaging information regarding the size, location and characteristics of thyroid nodules, FNAC offers a reliable, minimally invasive technique for diagnosing malignancy and determining the cytological nature of the lesion.

INTRODUCTION

Thyroid gland disorders are prevalent in the general population, with endemic regions having a higher frequency[1]. Both inflammatory and neoplastic factors may contribute to thyroid gland diseases[2]. The doctor can assess thyroid swellings using a variety of invasive and non-invasive diagnostic techniques, such as ultrasound, thyroid nuclear scan and Fine Needle Aspiration Cytology (FNAC). Thus, histopathological examination (HPE), the last diagnostic test, becomes necessary. Thyroid gland disorders rank among the most prevalent endocrine and surgical issues seen in clinical practice[3]. Thyroid disorders have become more common in recent years as a result of goitrogens and dietary changes. Numerous conditions affect the thyroid gland, including nodular lesions, thyroiditis, cancer and generalized enlargement (goitre)[4]. Due to its superior ability to visualize the thyroid parenchyma, high-resolution ultrasound has emerged as the primary imaging modality for thyroid gland examination. In addition to guiding fine needle aspiration biopsies, it is extremely sensitive in identifying small nodules, calcification, septations and cysts[5]. A rapid, easy and affordable way to identify thyroid enlargement pathology is with FNAC. The most precise and straightforward information regarding the thyroid is given by FNAC. Approximately 50% fewer thyroidectomies are performed when FNAC is used[6], which doubles the surgical yield of cancer and lowers the patients' overall medical care costs by 25%[7]. When the gland is too tiny or fibrotic, FNAC may not work and a biopsy may be required. Additionally, FNAC may not be able to differentiate between follicular adenoma and follicular cancer, as histology is required to do so. Although USG and FNAC are widely used and reasonably priced diagnostic techniques, each has limitations and the solution to the issue is still a mystery[8]. Although FNAC and ultrasonography both have drawbacks, they should be regularly used to diagnose thyroid swelling disease since their benefits exceed their drawbacks. The objective is to assess the function of ultrasound (USG) in determining the extent of thyroid swellings.

MATERIALS AND METHODS

Study Area: Murshidabad Medical College and Hospital.

Study Design: Prospective observational study.

Study Period: 1 Year.

Inclusion Criteria:

- Patients of both genders, aged between 18 and 70 years, presenting with thyroid swellings or nodules will be included.
- Patients with clinically detectable thyroid nodules or goiter, with or without associated symptoms.
- Patients with thyroid nodules of varying sizes will be considered for inclusion in the study. Both benign and suspicious nodules will be included for comparison purposes.

Exclusion Criteria:

- Patients who have undergone prior thyroid surgery, as it may affect the interpretation of results from ultrasound, FNAC and HPE due to possible scarring or anatomical changes.
- Patients with diffuse thyroid enlargement without any distinct palpable or sonographically identifiable nodules will be excluded, as the study focuses on assessing thyroid nodules rather than generalized enlargement.

Sample Size: A total of 100 samples have been included in this study.

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0., SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests, which compare the means of independent or unpaired samples, were used to assess differences between groups. Paired t-tests, which account for the correlation between paired observations, offer greater power than unpaired tests. Chi-square tests (χ^2 tests) were employed to evaluate hypotheses where the sampling distribution of the test statistic follows a chi-squared distribution under the null hypothesis., Pearson's chi-squared test is often referred to simply as the chi-squared test. For comparisons of unpaired proportions, either the chi-square test or Fisher's exact test was used, depending on the context. To perform t-tests, the relevant formulae for test statistics, which either exactly follow or closely approximate a t-distribution under the null hypothesis, were applied, with specific degrees of freedom indicated for each test. P-values were determined from Student's t-distribution tables. A $p \leq 0.05$ was considered statistically significant, leading to the rejection of the null hypothesis in favour of the alternative hypothesis.

RESULTS AND DISCUSSIONS

In our study, 15(15%) patients were 10-20 years of age, 30(30%) patients were 21-30 years of age, 25 (25.0%) patients were 31-40 years of age, 10(10%) patients were 41-50 years of age and 20(20%) patients were 51-60 years of age. The value of z is 2.7915. The value

Table 1: Age Distribution

Age Group	Number of Patients	Percentage
10-20	15	15
21-30	30	30
31-40	25	25
41-50	10	10
51-60	20	20
Total	100	100

Table 2: Comparison of FNAC and HPE of Thyroid Swellings

Thyroid Swellings	FNAC	HPE
Multinodular Goitre	40 (80%)	30 (60%)
Hashimoto's Thyroiditis	3 (6%)	17 (34%)
Follicular Adenoma	5 (10%)	2 (4%)
Papillary Carcinoma	2 (4%)	1 (2%)
Total	50 (100%)	50 (100%)

Table 3: Relationship of USG and FNAC Findings

	USG (%)	FNAC (%)
Benign	44 (88%)	45 (90%)
Malignant	4 (8%)	2 (4%)
Indeterminant	2 (4%)	3 (6%)
Total	50 (100%)	50 (100%)

of p is .00528. The result is significant at p<.05. In FNAC, 40(80%) patients had Multinodular Goitre, 3 (6%) patients had Hashimoto's Thyroiditis, 5 (10%) patients had Follicular Adenoma and 2 (4%) patients had Papillary Carcinoma. In HPE, 30 (60%) patients had Multinodular Goitre, 17 (34%) patients had Hashimoto's Thyroiditis, 2 (4%) patients had Follicular Adenoma and 1 (2%) patients had Papillary Carcinoma. Association of Thyroid Swellings with Group was statistically significant (p=0.0049). In USG, 44 (88%) patients had Multinodular Goitre, 4 (8%) patients had Malignant and 2 (4%) patients had Indeterminant. In FNAC, 45 (90%) patients had Benign, 2 (4%) patients had Malignant and 3 (6%) patients had Indeterminant which was not statistically significant (p=0.6447). In our study, out of 100 patients most of the patients were 21-30 years old [30 (30.0%)] but this was statistically significant (p=.00528) which is correlated with the other studies[9]. In contrast to the HPE Group [30(60%)], we found that a greater proportion of patients in the FNAC Group [40(80%)] developed multifodular goitre. However, p=0.0049 indicated that this was statistically significant. Most cancers had symptoms that lasted less than six months, which is similar to the findings of the Jain *et al.* study[10]. Only one example (1.33%) had a hard consistency, whilst 34% had a firm consistency and the majority (66.66%) had a soft consistency. This finding is consistent with that of Vyas *et al.,* who also noted that the majority of swellings (58%) had a soft consistency[11]. We found that, higher number of patients had Benign in FNAC Group [45(90%)] compared to USG Group [44(88%)] but this was not statistically significant (p=0.6447). Histopathology revealed that 57 of the 58 benign swellings on FNAC were benign, while one was found to be malignant. Rathod[12] observed a similar finding. Ultrasound (USG) of thyroid gland is a simple cost effective noninvasive diagnostic tool for evaluation of thyroid swellings. USG can differentiate solid from cystic lesion and can identify cysts as small as 2mm. It is performed using a 12 MHz transducer that is optimal for high resolution imaging. Color flow Doppler is useful in assessing vascularity. USG is safe inexpensive procedure with quick result and an excellent patient compliance.

CONCLUSION

In conclusion, the complementing functions of each diagnostic technique are highlighted in this comparison of thyroid swellings using ultrasound (USG), fine needle aspiration cytology (FNAC) and histopathological examination (HPE). FNAC is a dependable, less invasive method for identifying the cytological nature of the lesion and diagnosing malignancy, while USG delivers useful imaging information about the size, location, and characteristics of thyroid nodules. HPE is still the gold standard for conclusive diagnosis since it provides comprehensive tissue architecture and verifies whether a patient is malignant or benign after surgery.

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