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COMPARATIVE STUDY OF CYTOLOGICAL AND HISTOPATHOLOGICAL CORRELATION OF THYROID LESIONS IN A TERTIARY CARE CENTER

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Abstract

Background: Thyroid is superficially located gland, makes it easily approachable for examination. FNAC (Fine Needle Aspiration Cytology) is cost effective and OPD (Out Patient Department) based technique. Histopathological examination is gold standard. **Aim:** To compare the cytological and histopathological results of thyroid lesion in tertiary care center. **Settings and Design:** It is a cross-sectional analytical study conducted at department of pathology and ENT (otorhinolaryngology) at MGM medical college and hospital, Aurangabad. **Methods and Material:** 83 cases were included over a period of 1 year and 9 months. Patients presenting with thyroid lesions were included in the study while previously diagnosed cases were excluded from the study. FNAC was done on the patients and slides were reported according to Bethesda system of reporting thyroid cytopathology. Post-surgery specimen of the same patient received in the department of pathology, routine paraffin sectioned and hematoxylin and eosin stained (H & E stained) slides were reported. FNAC results were compared with histopathology results. **Statistical analysis:** The collected data entered in Microsoft excel and analyzed using SPSS version 24.0. Mean and SD(Standard deviation) will be calculated for quantitative variables and proportions will be calculated for categorical variables. Also, data represented in form of visual impression like bar-diagram, pie diagram etc. **Results:** Sensitivity of the FNAC for diagnosing malignant lesion was 50%. Specificity, PPV (Positive Predictive Value) and NPV (Negative Predictive Value) was 97%, 67% and 95% respectively. **Conclusion:** This study suggests preoperative diagnosis of FNAC is useful to plan the further management of the patient.

Key-words: Thyroid, FNAC, histopathology, cytology

Key Messages: Thyroid FNAC is very useful and handy technique to diagnose thyroid abnormality before planning surgical intervention.

Introduction

Thyroid gland is unique among endocrine glands which is easily accessible for direct examination. It is subjected to varying physiological and pathological disturbances such as

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developmental, inflammatory, hyperplastic, and neoplastic. Most common clinical presentation is thyroid nodule.[10] Thyroid nodules are common in India, with a prevalence of palpable nodules in the community of 12.2%.[7,8] Diagnosis of thyroid lesion is important as its incidence are rising in India, as per the data from the National Cancer Registry Program, one in 752 Indian males and 1 in 285 Indian females will develop thyroid cancers in their lifetimes. [7,9] To avoid direct surgical intervention and to get accurate diagnosis, diagnostic technique is required. The diagnosis of thyroid lesions using FNAC was first reported by Martin and Ellis in 1930.[10] Fine needle aspiration cytology is widely accepted as most accurate and cost-effective diagnostic technique. It is indicated in all palpable thyroid nodules and non-palpable lesions found suspicious on radiology.[1] It is cost-effective procedure that provide specific diagnosis rapidly with minimal complication. It plays important role in determination of treatment. Patients with suspected malignancy diagnosis can be subjected to surgery.[2] One of the major advantages is that FNAC can be performed as outpatient procedure. It is relied upon to distinguish benign from malignant thyroid nodule.[2] However, FNAC does have certain limitations. It may not yield optimal results for patients with lesions smaller than 1 cm, thyroiditis, and follicular neoplasms or in cases where malignancy cannot be definitively determined.[11] Other limitation of FNAC includes false negative and false positive results, sampling techniques and sampling inadequacy.[2] Histopathology is considered gold standard in diagnosing neck swellings.[3] But it is a more invasive and costly procedure, necessitating the removal of either the entire nodule or the affected portion of the thyroid gland. [11] Furthermore, histopathology is typically conducted post-surgery and tends to be more time-consuming than FNAC.[11]

Aim of the study to compare the cytological and histopathological results of thyroid lesion in tertiary care center.

Subjects and Methods

The present study was conducted in the department of pathology and ENT at MGM medical college and hospital, Aurangabad, after approval by the Institutional Ethics Committee. It was a cross-sectional analytical study including 83 cases over a period of 1 year and 9 months [September 2022 to June 2024]. All the patients with thyroid lesion coming to ENT OPD were included in the study while previously diagnosed cases were excluded from the study.

Methodology

1. FNAC samples of thyroid lesions collected.
2. The slides fixed in 95% alcohol for Papanicolaou stain.
3. All the surgically resected biopsies preserved in 10% formalin.
4. All the sections studied by routine paraffin sectioning and hematoxylin and eosin staining and special staining like mucicarmine and PAS done if required.
5. Histopathological typing of tumors done.
6. The FNAC results compared with histopathology results.

The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy calculated.

Statistical analysis

The collected data entered in Microsoft excel and analyzed using SPSS version 24.0. Mean and SD will be calculated for quantitative variables and proportions will be calculated for categorical variables. Also, data represented in form of visual impression like bar-diagram, pie diagram etc.

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Results

During the period from September 2022 to June 2023, 83 patients were examined for thyroid lesion. FNAC done on the patients and reported according to Bethesda category of thyroid cytopathology. Post- surgical excision specimens of the same patients were received in the department and slides were studied and reported.

Table 1 shows cases distribution according to the age. The cases were divided in six groups, maximum number of cases were seen in the age group 41 to 50 years (20 cases). It was followed by >60 years (17 cases), 51 to 60 years (16 cases), 18 to 30 years (14 cases), 31 to 40 years (14 cases) and ≤18 years (2 cases).

Table 1: Cases distribution according to age

No.	Age (Years)	Number of cases	Percentage %
1	≤ 18 years	2	2%
2	18 to 30 years	14	17%
3	31 to 40 years	14	17%
4	41 to 50 years	20	24%
5	51 to 60 years	16	19%
6	> 60 years	17	21%
Total		**83**	**100%**

Table 2 shows cases distribution according to gender. Male represents about 14% of cases (12 cases), while female represents remaining 86% of cases (71 cases).

Table 2: Cases distribution according to gender

No.	Gender	Number of cases	Percentage %
1	Male	12	14%
2	Female	71	86%
Total		**83**	**100%**

Table 3 shows distribution of cases according to Bethesda category of reporting cytopathology report. Majority of cases were reported as category II (70 cases, 84%). 7 cases (8%) were reported as category I, while 5 cases and 1 case were reported as category IV (6%) and category V (2%) respectively. Bethesda category IV, V and VI was considered as positive or malignant for analysis.

Table 3: Cases distribution according to Bethesda category

No.	Bethesda category	Number of cases	Percentage
1	Category I	7	8%
2	Category II	70	84%
3	Category III	0	0%
4	Category IV	5	6%
5	Category V	1	2%
6	Category VI	0	0%
	Total		**100%**

Table 4 shows distribution of cases according to cytological diagnosis. 77 cases (93%) were reported as benign thyroid lesions, while 6 cases (7%) were reported as malignant lesions.

Table 4: Cases distribution according to Cytological diagnosis

No.	Cytological diagnosis	Number of cases	Percentage
1	Benign	77	93%
2	Malignant	6	7%

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	Total		**100%**

Figure 1 shows Bethesda category II lesion on cytology, while **Figure 2** shows histopathology of same patient which was reported as colloid goiter.

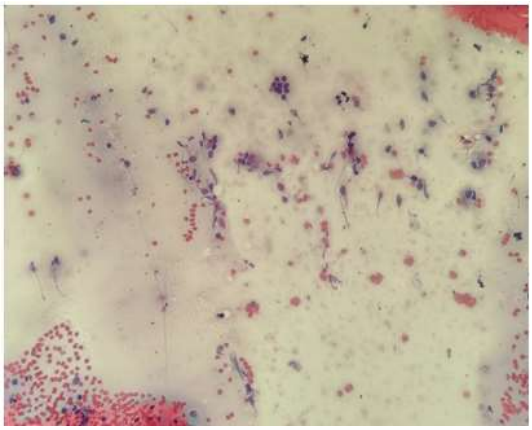

Figure 1 Colloid goiter with Hurthle cells, Bethesda category II (PAP Stain)

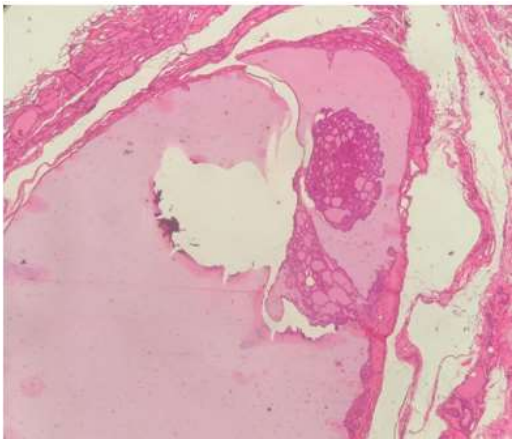

Figure 2 Colloid goiter (H&E stain)

Table 5 shows distribution of cases according to histopathological diagnosis. 10% of cases (8 cases) were reported as malignant lesion, while remaining 90% of cases (75 cases) were reported as benign thyroid lesion.

Table 5: Cases distribution according to Histopathological diagnosis

No.	**Histopathological diagnosis**	**Number of cases**	**Percentage**
1	Benign	75	90%
2	Malignant	8	10%
	Total		**100%**

Figure 3 shows Bethesda category IV lesion while Figure 4 shows histopathology of same patient which was reported as follicular adenoma.

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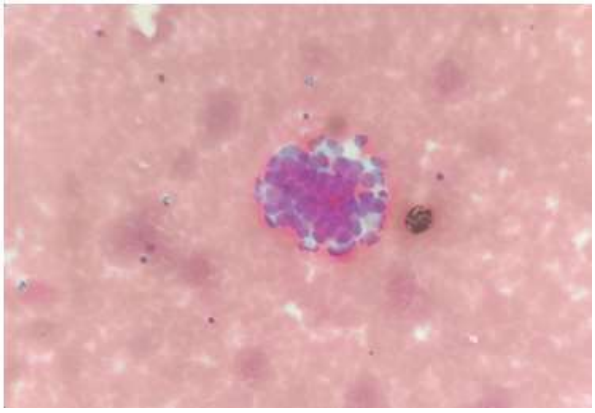

Figure 3 Follicular neoplasm, Bethesda category IV (PAP stain)

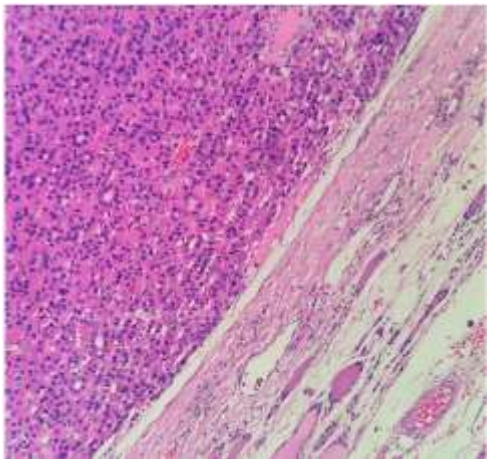

Figure 4 Follicular adenoma (H&E stain)

In **Table 6,** benign thyroid cases were distributed according to their histopathological diagnosis. Maximum number of cases (20 cases, 28%) were reported as Multinodular goiter. 9 cases (12%) of each colloid goiter, colloid goiter with adenomatous hyperplasia and follicular adenoma were reported.

Table 6: Cases distribution according to Benign histopathological diagnosis

No.	Histopathological diagnosis	Number of cases	Percentage
1	Adenomatous goiter	4	5%
2	Adenomatous goiter with hashimoto's thyroiditis	1	1%
3	Colloid goiter	9	12%
4	Colloid goiter with adenomatous hyperplasia	9	12%
5	Colloid goiter with cystic degeneration	2	3%
6	Colloid goiter with granulomatous thyroiditis	1	1%
7	Colloid goiter with hashimoto's thyroiditis	4	5%
8	Follicular adenoma	9	12%
9	Follicular adenoma with	1	1%

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	granulomatous thyroiditis		
10	Follicular adenoma with hashimoto's thyroiditis	4	5%
11	Hashimoto's thyroiditis	5	8%
12	Multinodular goiter	20	28%
13	Multinodular goiter with adenomatous hyperplasia	4	5%
14	Multinodular goiter with hashimoto's thyroiditis	1	1%
15	Thyroglossal cyst with multinodular goiter	1	1%
	Total	**75**	**100%**

Table 7 shows distribution of cases according to malignancy diagnosed in the histopathology. 3 cases (35%) were reported as follicular variant of papillary carcinoma, while one case (13%) of each medullary carcinoma of thyroid, follicular carcinoma encapsulated angioinvasive, well differentiated tumour of uncertain malignant potential, follicular tumor of uncertain malignant potential, non-invasive follicular thyroid neoplasm with papillary like nuclear features were reported.

Table 7: Cases distribution according to Malignant histopathological diagnosis

No.	Histopathological diagnosis	Number of cases	Percentage
1	Medullary carcinoma of thyroid	1	13%
2	Follicular carcinoma, Encapsulated angioinvasive	1	13%
3	Follicular variant of papillary carcinoma of thyroid	3	35%
4	Well differentiated tumour of uncertain malignant potential	1	13%
5	Follicular tumor of uncertain malignant potential	1	13%
6	Non-invasive follicular thyroid neoplasm with papillary like nuclear features	1	13%
	Total	**8**	**100%**

Table 8 shows both cytological and histopathological diagnosis. 88% of cases were diagnosed correctly benign by cytology, were confirmed by histopathology diagnoses. While 5% of cases diagnosed benign in cytology, later turned out as malignant lesion.

Table 8: Cases distribution according to Cytology and histopathology

No.			Histopathological diagnosis		Total Number of cases (%)
			Benign Number of cases (%)	Malignant Number of cases (%)	
1	**Cytological diagnosis**	Benign Number of cases (%)	73 (88%)	4 (5%)	**77 (93%)**
2		Malignant	2 (2%)	4 (5%)	**6 (7%)**

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		Number of cases (%)			
Total Number of cases (%)			**75 (90%)**	**8 (10%)**	**83 (100%)**
FNAC Sensitivity- 50%, Specificity- 97%, Positive predictive value- 67%, Negative predictive value- 95%					

Overall sensitivity, specificity, positive predictive value, and negative predictive value of FNAC for malignant lesions were found as 50%, 97%, 67% and 95% respectively.

Discussion

In the present study, age groups were divided into the six categories namely, ≤18 years; 18 to 30 years; 31 to 40 years; 41 to 50 years; 51 to 60 years and >60 years. Age group ranging from 18 years to 77 years with mean age is 47 years. In the present study, Maximum number of cases are seen in the age group 41 to 50 years (20 cases). While in age group >60 years total 17 cases were noted. It is followed by 51 to 60 years (16 cases), 18 to 30 years (14 cases), 31 to 40 years (14 cases) and ≤18 years (2 cases).

In similar study by **Arif M *et al.*** [34] shows majority of patients (55%) belongs to 21 to 40 years of age. While 37%, 7% and 1% of cases were recorded from the age group 41 to 60 years, 61 to 80 years, and 0 to 20 years respectively. Other study **Nagare MR *et al.*** [32] shows maximum incidence of thyroid lesions in the 31 to 40 years age group in which there were 33 cases (29.72%). This was followed by the 21 to 30 years of age group and 41 to 50 years of age group with an incidence of 27.02% (30 cases) and 24.32% (27 cases). **Anand V. *et al.*** [10] included the age ranging from 10 years to 81 years with a mean age of 43.24 years. Summary of age wise distribution in different study are showed in **Table 9**.

Table 9: Age range in various studies

No.	Study	Age range (Mean age)
1	Anand V. *et al.* [10]	10 to 81 years (43.24 years)
2	Osseis, M. *et al.* [30]	13 to 91 years (49.02 years)
3	Nagare MR *et al.* [32]	10 to 75 years (39 years)
4	Nandedkar *et al.* [5]	2 to 87 years (37.6 years)
5	Rashmi Kunder *et al.* [31]	19 to 85 years (38.72 years)
6	**Present study**	**18 to 77 years (47 years)**

In the present study, females were more than male. 71 cases out of 83 are of females (86%) while remaining 12 cases were males (14%). **Table 10** shows gender wise distribution in various other studies.

Table 10: Gender wise distribution in various studies

No.	Study	Male (Number of cases, %)	Female (Number of cases, %)
1	Arif M. *et al.* [34]	18 cases, 12%	132 cases, 88%
2	Anand V. *et al.* [10]	35 cases, 16%	178 cases, 84%
3	Nagare MR *et al.* [32]	24 cases, 22%	87 cases, 78%
4	Rashmi Kunder *et al.* [31]	19 cases, 15%	106 cases, 85%
5	Osseis, M. *et al.* [30]	85 cases, 25%	259 cases, 75%
6	**Present study**	**12 cases, 14%**	**71 cases, 86%**

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Table 10 suggests female cases were higher than male cases, in other studies as well as in the present study.

In the present study, TIRADS score of all 83 cases were also recorded. 67 cases were reported as TIRADS category II which contribute the 81% of the total cases. It is followed by category I, IV and V representing 8 (10%), 5 (6%) and 3 (3%) cases respectively. However, no case was reported as TIRADS category III and VI. **Dy JG *et al.* [33]** shows 5% of cases from TIRADS category III, 91% of cases from TIRADS IV and 4% cases from TIRADS category V.

In the present study, cytological diagnosis was given according to Bethesda categories. Maximum cases were reported as Bethesda category II (70 cases, 84%). 7 cases (8%) were reported as category I, 5 cases (6%) were reported as category IV and 1 case (2%) was reported as category V. No case was reported as category III or category VI. **Anand V. *et al.* [10]** also reported Bethesda category. They reported 5% of cases as Bethesda category I, 89% of cases as category II, 2% of cases as category III, IV and V each. 3% cases were also reported as category VI. **Osseis, M. *et al.* [30]** shows 3% of cases from Bethesda category I, 22% from category II and III each, 20% from category IV, 31% from category V and 2% from category VI.

In the present study, 77 cases (93%) were reported as benign lesions on cytology. However, 4 lesions (5%) out of 77 cases were turned out to be malignant lesion in the histopathological examination. 6 cases (7%) were reported as malignant lesions in the cytology, out of them 2 cases (2%) were turned out as benign in the post-surgery histopathological examination. 75 cases (90%) were diagnosed as benign lesion on the histopathology result, while remaining 8 cases (10%) were diagnosed as malignant lesion on the same.

Rashmi Kunder *et al.* [31] shows 18 cases (14%) were diagnosed as malignant lesion on the histopathology, while 107 cases (86%) were diagnosed as benign lesion on the histopathology. **Osseis, M. *et al.* [30]** shows 133 cases (39%) were diagnosed as malignant lesion on the histopathology, while 211 cases (61%) were diagnosed as benign lesion on the histopathology.

In the present study, benign lesion as per histopathology results further subtyped according to their diagnosis. Out of them, maximum number of cases (20 cases, 28%) were reported as Multinodular goiter. Other diagnosis includes, hashimoto's thyroiditis, colloid goiter, colloid goiter with adenomatous hyperplasia, follicular adenoma with hashimoto's thyroiditis, adenomatous goiter, multinodular goiter with adenomatous hyperplasia, follicular adenoma, colloid goiter with hashimoto's thyroiditis, colloid goiter with cystic degeneration, follicular adenoma with granulomatous thyroiditis, thyroglossal cyst with multinodular goiter and adenomatous hyperplasia with hashimoto's thyroiditis.

In the present study, six types of malignant lesions were reported in the histopathology. Out of them 3 cases (35%) were reported as follicular variant of papillary carcinoma, while one case (13%) of each medullary carcinoma of thyroid, follicular carcinoma encapsulated angioinvasive, well differentiated tumour of uncertain malignant potential, follicular tumor of uncertain malignant potential, non-invasive follicular thyroid neoplasm with papillary like nuclear features were also reported. **Nagare MR *et al.* [32]** shows 2 cases (20%) of each follicular carcinoma, papillary carcinoma and undifferentiated (anaplastic carcinoma), 1 case (10%) of medullary carcinoma, and 3 cases (30%) of follicular adenoma on histopathology results.

In the present study, overall sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of FNAC to diagnose malignancy was found as 50%, 97%, 67% and 95% respectively. It correlates with different previous studies. **(Table 11)**

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Table 11: Sensitivity, specificity, PPV and NPV of different studies

No.	Study	Sample size	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
1	Nagare MR *et al.* [32]	111	88	100	100	98.21
2	Nandedkar *et al.* [5]	606	85.7	98.6	-	-
3	Sangalli G *et al.* [6]	5287	93.4	74.9	98.6	-
4	Rashmi Kunder *et al.* [31]	125	72.2	99.06	92.86	95.49
5	Osseis, M. *et al.* [30]	344	89.31	48.44	78	68.89
6	Asha C *et al.* [3]	90	64.3	97.4	81.8	93.7
7.	**Present study**	**83**	**50**	**97**	**67**	**95**

Gupta M *et al.* [35] did study on 75 patients. sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of FNAC for malignancy was found as 80%, 86.6%, 80% and 86.6% respectively. The incidence of papillary thyroid carcinoma was 80% in the study. However, in the present study, there was no case reported as papillary thyroid carcinoma.

Pandey, Pinki *et al.* [36] shows sensitivity of FNAC to diagnose malignant lesion was 57.14% with specificity, PPV and NPV were 90%, 70.58% and 83.33% respectively. However, cytohistological comparison available in only 112 patients out of 447 patients.

One of the primary investigations in evaluating thyroid nodule is FNAC. However, there are some limitations such as inadequate sampling in non-palpable nodules, misinterpretation as malignancy, false positive and false negative rates. According to **Arif M. *et al.* [34]** common cause of false positive results could be, many cellular goiters can be mistaken for neoplasm and cause of false negative could be, follicular adenoma can be mistaken for adenomatous goiter.

Overall, FNAC helps to filter out cases which can be successfully treated by conservative methods and thus reduce unnecessary thyroid surgery. Thus, the overall management of thyroid nodules improves by a reduction in the number of operations for benign lesions without a decrease in the number of surgeries for malignant lesions. [34]

Histopathology is still a gold standard to diagnose the thyroid lesion [37], but other advantages of FNAC gives surgeon a clue to diagnose the lesion.

Conclusion

In conclusion, this study suggests that pre-operative diagnosis of FNAC has more value to plan further management.

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