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A Study of Fine Needle Aspiration Cytology of Thyroid Lesions and it's Correlation with Histopathological Diagnosis

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A B S T R A C T

Introduction:Thyroid swelling is a significant clinical problem in general population but majority of them are benign lesions. Fine Needle Aspiration Cytology (FNAC) is well established first line diagnostic test for evaluation of diffuse thyroid lesions. The main purpose of FNAC is to confirm benign lesions and thus reducing unnecessary surgery. ***Aims and Objectives:***To study various lesions of thyroid swelling by FNAC and correlation between the cytological and histopathological diagnosis.***Materials and Methods*:** A prospective study was conducted in Department of Pathology, Tertiary care center, Nashik from August 2020 to December 2022 to evaluate the diagnostic accuracy of FNAC in lesions of thyroid. The cyto-histological correlation was done in all the cases. ***Results:***Out of total 113 cases, 3 cases (2.65%) were diagnosed as non-diagnostic (Bethesda category I), 87 cases (76.98%) as Benign (Bethesda category II), 9 cases (7.96%) as Atypia of undetermined significance,13 cases (11.50%) as Follicular neoplasm (Bethesda category IV) and 1 case (0.88%) as Suspicious of neoplasm (Bethesda category V) on cytological examination. On histopathological study,97 cases (85.84%) were diagnosed as non-neoplastic and benign while 16 cases (14.16%) as malignant. The PPV, NPV, Sensitivity, Specificity of FNAC were 92.85%, 94.25%, 72.22% and 98.79% respectively. The diagnostic accuracy was 94.05%. **Conclusion:** Simplicity, diagnostic accuracy and most of all cost effectiveness have given FNA the status of the first line diagnostic test in preoperative evaluation of thyroid lesions. FNA has been shown in to be the safest and most accurate of diagnostic tools in thyroid lesions.

Keywords: FNAC, Thyroid nodule, Thyroidectomy.

INTRODUCTION

Thyroid swelling is a significant clinical problem in general population but majority of them are benign lesions. The main purpose of FNAC is to confirm benign lesions and thus reducing unnecessary surgery [1].

FNA has given the status of first line diagnostic test in preoperative evaluation of thyroid because of its simplicity, diagnostic accuracy and most of all cost effectiveness. FNA has been shown to be the safest and most accurate of diagnostic tools in thyroid lesions.

The accuracy of FNAC is lower in cases, where there is overlapping cytologic features like in cases where sample is obtained from hyperplastic nodule and follicular neoplasm. The accuracy can be increased if the needling and the interpretation are done by the pathologist. Ultrasound guided FNAC is useful in cases of the cystic and multinodular lesions that are harboring the malignancy [2].

However, with regard to detection of thyroid neoplasm, The Royal College of Pathologist suggest a varied range of values for its sensitivity, specificity and accuracy of FNAC. The limitations of thyroid FNAC are seen mostly in cases of suspicious, inadequate and indeterminate cytology [3].

Materials and Methods

Approval of institutional ethics committee was taken prior to the commencement of study. This was a prospective study of thyroid lesions carried out at Department of Pathology, Tertiary health Centre, Nashik from August 2020 to December 2022. The study was undertaken to study the cytology of the palpable thyroid lesions and compared them with histopathology to determine its diagnostic accuracy.

All the information regarding patients age, sex, routine investigations and ultrasonographic findings were recorded along with history of present illness with regards to signs, symptoms and duration.

All the patients were clinically examined in detail and a careful palpation of the thyroid was done to guide precisely the location for doing aspiration. Details of the procedure were explained to the patients and written consent was taken.

In case of large swelling, caution palpation of the thyroid swelling was done to know the exact site of aspiration. While ultrasound guided FNA was done in case of small swelling, which were difficult to palpate and lesions in close proximity to carotid artery.

Aspiration was done with full aseptic precautions using 22gauge needle with 10 ml syringe in supine or sitting position with extended neck so as to make the thyroid swelling appear prominent. Multiple smears were prepared and fixed immediately in fixative containing ether and ethyl alcohol or biofix spray. These smearsafterfixation were stained with Hematoxylin and Eosin (H & E) stain and Papanicolaou's (PAP) stain whenever required. Air dried smears also prepared and stained with Giemsa stain.

Cytological diagnosis was done on the basis of adequacy, cellular arrangement, cellular and nuclear morphology and background material. The Bethesda System of Reporting Thyroid Cytology were used to categorized the thyroid lesions. It classifies the lesions into 6 categories – 1) Nondiagnostic 2) Benign 3) Atypia of undetermined significance 4) Follicular neoplasm/Suspicious for a Follicular Neoplasm 5) Suspicious of malignancy 6) Malignant.

On FNA diagnosis, the cases were followed up and histopathological study was done on postoperative specimen received from the Department of Surgery or ENT.

Histopathological diagnosis was done on the basis of thyroid architecture, cellular arrangement, cellular and nuclear morphology and capsular integrity.

Cytological diagnosis was correlated with histopathological diagnosis. The diagnostic accuracy, sensitivity and specificity, positive predictive value (PPV) and negative predictive value (NPV) of FNAC in diagnosing thyroid malignancy were calculated.

Inclusion Criteria

- Age between 12 years to 80 years.
- All patients presenting with clinical evidence of thyroid disease and swelling.

Exclusion Criteria

- Patient who is not ready to give consent and who fails to give proper history.
- Patient unfit for surgery.
- Patient having bleeding tendency.
- Small solitary lesions in very close proximity to carotid artery.

OBSERVATION AND RESULTS

113 cases of Fine Needle Aspiration Cytology from the thyroid had a post-surgical follow-up.12 cases of non-diagnostic (Bethesda category I) and atypia of undetermined significance (Bethesda category III) were removed from the calculation. As these diagnostic classifications do not necessarily imply a benign, nonneoplastic or malignant nature and there is need for repeated aspiration. So, the analysis is done for 101 cases.

In this study the youngest age patient was of 15 years and oldest 80 years with maximum frequency in between 31 to 40 years. There was female predominance with a Female to Male ratio of 5.27: 1.

Out of these 113 cases from cytology studies 3 cases (2.65%)were reported Non – diagnostic/unsatisfactory (Bethesda category I), 3 cases (2.65%) reported Colloid cyst (Bethesda category II), 68 cases (60.18 %) reported as Colloid goitre (Bethesda category II), 13 cases (11.50%) reported Lymphocytic thyroiditis (Bethesda category II), 2

cases (1.77%) reported Hashimoto's thyroiditis (Bethesda category II), 1 case (0.88%) had Thyroglossal cyst (Bethesda category II), 9 cases (7.96%) reported Atypia of undetermined significance (Bethesda category III), 13 cases (11.50%) had Follicular neoplasm (Bethesda category IV) & 1 (0.88%) case had suspicious of malignancy suggestive of Papillary carcinoma (Bethesda category V).

The histopathology diagnosis of 4 cases (3.54%) reported a Colloid cyst, 66 cases (58.40%) of Colloid goiter (Figure 1), 9 cases (7.96%) had Follicular adenoma (Figure 2), 7 cases had (6.20%) had Follicular carcinoma (Figure 3), 2 cases reported (1.78 %) had a follicular variant of papillary carcinoma, 3 cases (2.65%) had Hashimoto's thyroiditis, 12 (10.62%) cases reported Lymphocytic thyroiditis, 7 (6.20%) had Papillary carcinoma &1 case (0.88%) reported with Hurthle cell adenoma and 1 case (0.88%) of Thyroglossal cyst.

In nodular lesion of thyroid, we diagnosed one case (0.88%) of Schwannoma of thyroid which is extremely rare site.

Among 3 cases (2.65%) categorized as non-diagnostic on cytology, 1 case each was diagnosed as Colloid cyst, Follicular adenoma and Schwannoma respectively.

Out of 9 cases (7.96%) of Atypia of undetermined significance, 2 cases were diagnosed as colloid goitre, 4 cases as follicular adenoma, and 1 case each of follicular variant of papillary carcinoma, follicular carcinoma and papillary carcinoma.

Histopathological study revealed 97 cases (85.84%) as non-neoplastic and benign lesions while 16 cases (14.16%) as neoplastic malignant lesions.

Table 1: Overall distribution of cases on cytology and histopathological study

Cytological diagnosis	Histological diagnosis											
	Colloid goitre	Colloid cyst	Hashimoto's thyroiditis	Lymphocytic thyroiditis	Thyroglossal cyst	Follicular adenoma	Hurthle cell adenoma	Follicular carcinoma	Follicular variant of papillary carcinoma	Papillary carcinoma	Schwannoma	Total
Non-diagnostic	-	1	-	-	-	-	-	-	1	-	1	3
Colloid goitre	59	-	-	4	-	3	-	2	-	-	-	68
Colloid cyst	-	3	-	-	-	-	-	-	-	-	-	3
Hashimoto's thyroiditis	1	-	1	-	-	-	-	-	-	-	-	2
Lymphocytic thyroiditis	3	-	2	8	-	-	-	-	-	-	-	13
Thyroglossal cyst	-	-	-	-	1	-	-	-	-	-	-	1
Follicular lesions of undetermined significance	2	-	-	-	-	4	-	1	1	1	-	9
Follicular neoplasm	1	-	-	-	-	2	1	4	-	5	-	13
Suspicious of malignan	-	-	-	-	-	-	-	-	-	1	-	1

cy features suggestive of papillary carcinoma												
Total	**66**	**4**	**3**	**12**	**1**	**9**	**1**	**7**	**2**	**7**	**1**	**113**

Histopathology confirmed the cytological diagnosis in 85 cases (84.16%) while 16 cases (15.84%) were non correlating with cytological diagnosis.

Table 2: Correlation between the FNAC and histopathology diagnosis

Diagnosis on FNAC	**No. of cytological diagnosis**	**Correlation with the result of histopathology**		**Histological findings in case of false cyto-diagnosis**	**No. of cases**
		Correct cytological diagnosis	**False cytological diagnosis**		
Colloid cyst	3	3	-	-	-
Colloid goitre	68	59	9	Lymphocytic thyroiditis	4
				Follicular adenoma	3
				Follicular carcinoma	2
Lymphocytic thyroiditis	13	8	5	Colloid goitre	3
				Hashimoto's thyroiditis	2
Hashimoto's thyroiditis	2	1	1	Colloid goitre	1
Thyroglossal cyst	1	1	-	-	-
Follicular neoplasm	13	12	1	Colloid goitre	1
Suspicious of malignancy suggestive ofpapillary carcinoma	1	1	-	-	-

Histopathology confirmed the cytological diagnosis in 85 cases (84.16 %) while 16 cases (15.84%) were non correlating with cytological diagnosis.

Table 3: Sensitivity, Specificity and Accuracy of FNAC in detecting malignancy

		HPE		**Total**
		Neoplastic	**Non neoplastic**	
FNAC	**Neoplastic**	13 TP	1 FP	14
	Non neoplastic	5 FN	82 TN	87
Total		**18**	**83**	**101**

The sensitivity of the study is 72.22%, specificity 98.79%, PPV 92.85%, NPV 94.25% and diagnostic accuracy of 94.05%.

Table 4: Comparison of results of present study with the previous studies

Series	**Sensitivity (%)**	**Specificity (%)**	**Accuracy (%)**	**PPV (%)**	**NPV (%)**
Bagga PK *et al*., [12]	66	100	96.2	100	96
Roy PK *et al*., [10]	81.48	95.29	91.16	84.61	94.18
Sengupta A *et al*., [13]	90	100	98.88	100	98.75
Gupta M *et al*., [14]	80	86.6	84	80	86.6
Kessler A *et al*., [15]	79	98.5	87	98.7	76.6
Machala E *et al*., [16]	60.28	98.05	89.46	90.1	89.35
Singh P *et al*., [8]	83.3	100	95.71	100	96.7
Afroze N *et al*., [9]	61.9	99.3	94.5	92.8	94.7
Deschuytere L *et al*., [17]	91.67	40.68	62.62	56.79	92.31
Harsoulis P *et al*., [7]	89.4	95.4	94.2	92.5	88.3
Present study	**72.22**	**98.79**	**94.05**	**92.85**	**94.25**

Figure 1: Colloid goitre gross morphology showing coarsely nodular gland with areas of fibrosis and cystic changes

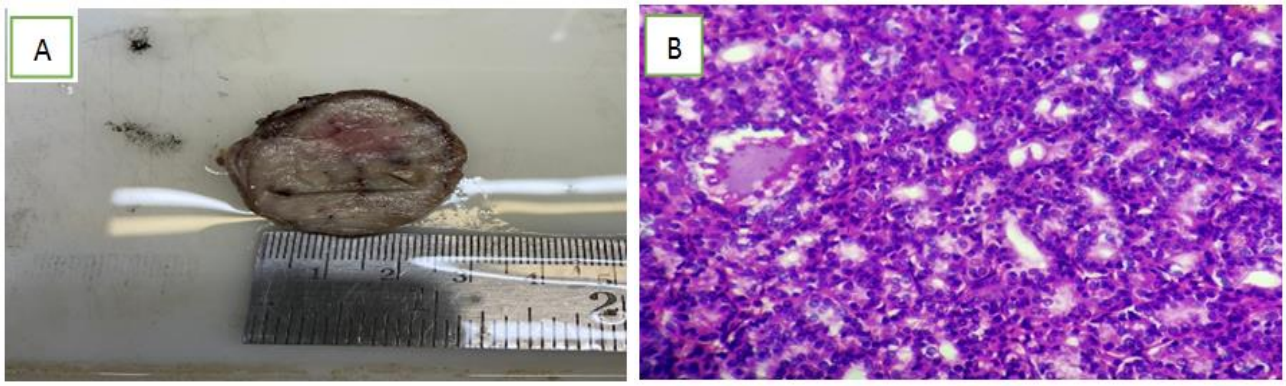

Figure 2: Follicular adenoma: A) Gross – Encapsulated solid mass with focal areas of hemorrhage; B) Microscopy - H & E sections showing intact fibrous capsule with follicles (HP 40x)

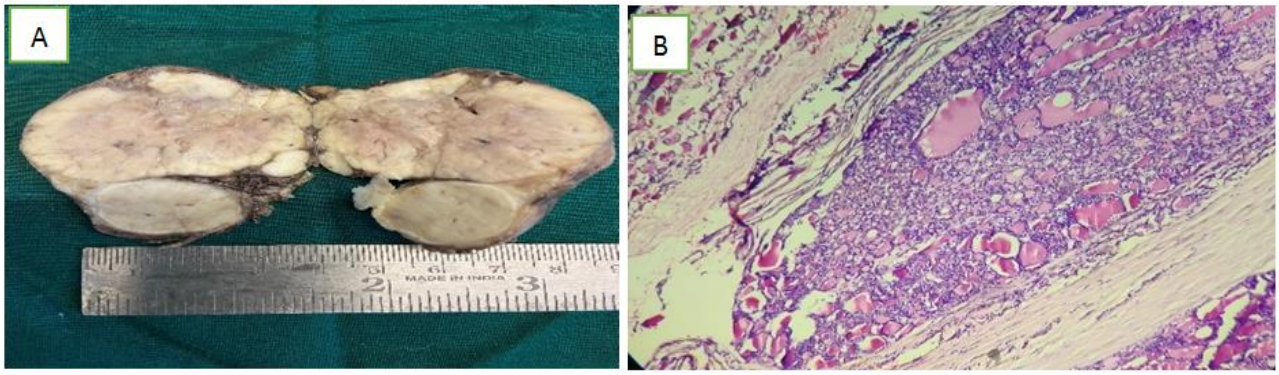

Figure 3: Follicular carcinoma, A) Gross – Light tan appearance of solid mass with complete replacement of lobe of thyroid; B) Microscopy - Capsular and vascular invasion of tumor with follicles (H & E, LP10x)

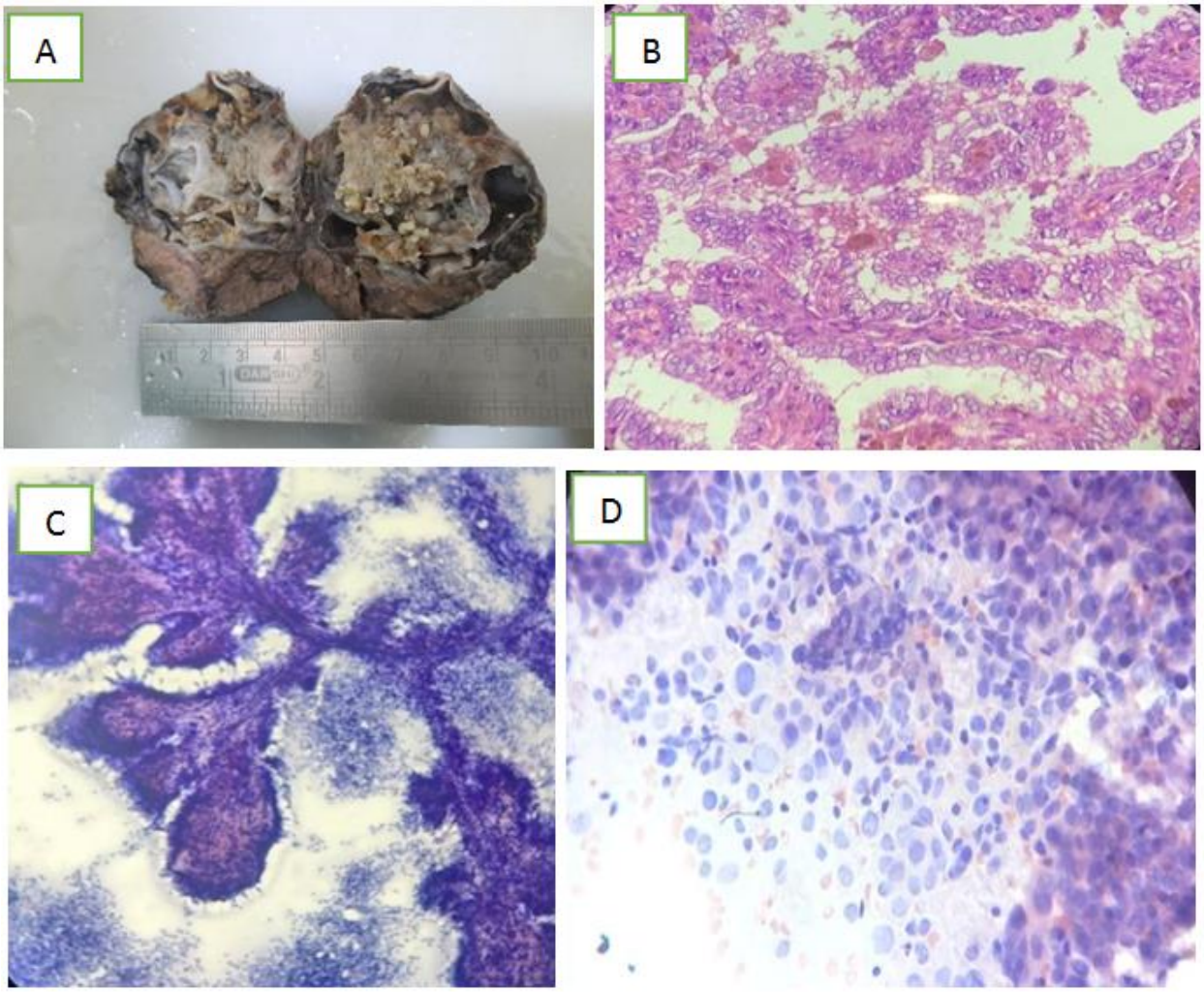

Figure 4: Papillary carcinoma: A) Gross – Discernible papillary structures with well formed papillae; B) Histopathology - Well formed papillae lined by Orphan Annie eye nuclei (H &E,HP 40x); C & D) FNAC - papillary cluster of cells and intranuclearpseudoinclusion and groove (MGG, B – LP 10x and C- HP40x)

DISCUSSION

FNAC has the single best predictive value of any test available currently and maximum benefit can be gained by using FNA as the initial diagnostic procedure in the management of thyroid lesions [4]. When FNAC report is positive, it leads to early diagnosis and aids in the treatment of thyroid lesions [2].

In the study conducted by Chandanwale S *et al.*, [4] and Moosa FA *et al.*, [5], malignant lesions were 4% and 7.9% out of which 2.6% and 6.8% were papillary carcinoma respectively. In the study conducted by Patel P *et al.*, [6], 94.16% lesions were diagnosed as benign, 2.5% as inflammatory and 2.5% as follicular neoplasm on cytology.

In present study, 63.71% cases were diagnosed as benign, 13.27% as inflammatory, 11.5% as follicular neoplasm and 0.88% as suspicious of malignancy on cytology.

The overall diagnostic accuracy ranged from 62.62 % to 98.88%, sensitivity ranged from 61.9 to 91.67% and specificity ranged from 40.68% to 100% in various series. In present study, sensitivity was 72.22%, specificity 98.79% and diagnostic accuracy was 94.05% which was comparable to study done by Harsoulis P *et al.*, [7], Singh P *et al.*, and Afroze N *et al.*, [8, 9].

The positive predictive in various series ranged from 56.79 % to 100% and negative predictive value from 76.6% to 98.75%. In present study positive predictive value was 92.85% and negative predictive value was 94.25% which was comparable to study done by Roy PK *et al.*, [10].

False negative cytology results in a delay in treatment and hence adversely affects the outcome in patients with thyroid carcinoma.

Poor cellularity of the aspirated samples in cystic lesions and suboptimal preparations is often misinterpreted as benign lesions. Sampling errors were responsible for the under diagnosis of papillary neoplasm. An accurate diagnosis could not be rendered because of sampling of areas of cystic changes rather than cellular areas. Aspiration from multiple sites and from solid areas may be useful in preventing sampling errors. USG-guided FNAC in cystic thyroid nodule results in better sample acquisition leading to low rate of non-diagnostic smears and high overall accuracy.

Multiple passes should be performed in various parts of a large nodule or in different nodules to reduce the false negative rate due to specimen problem. Cytopathologist should strengthen their criteria for identification of adenomatous hyperplasia, thyroiditis and cystic lesions to avoid false positive diagnosis due to interpretation errors [11].

Whenever the small or multiple diffuse swellings are present, the USG guided FNAC to be performed. Also, it is important to correlate the clinical findings with that of the cytological and histological findings along with the imaging to yield a better diagnosis.

Poor smearing technique and issues involving specimen transportation to the laboratory have led to increasing use of liquid-based processing (LBP) at some centers. While LBP has the advantage of enabling ancillary tests such as immunostains and molecular techniques, specific tumor categorization was found to be less frequent as compared to conventional smears [2].

Adenomatoid hyperplastic nodule shows follicular epithelial cells arranged in honeycomb pattern with the small nuclei showing focal nuclear atypia is mistaken for follicular neoplasm (Bethesda category IV).

Sometimes thyroiditis is commonly mistaken as papillary carcinoma specially in cellular stage. Hashimoto's thyroiditis with oncocytic change may lead to some nuclear atypia.

Squamous metaplasia of thyroid follicular epithelial cells may be misinterpreted as suspicious of malignancy.

Cystic nodules in malignant cyst are mis-interpreted as colloid cyst. Co-existence and cytomorphological overlap of benign and malignant lesions can result in interpretation error in false negative cases.

Majority of the false negative cases shows colloid background and scant cellularity with dispersed cohesive follicular cells favoring non neoplastic adenomatous nodule.

CONCLUSION

Simplicity, diagnostic accuracy and most of all cost effectiveness have given FNA the status of the first line diagnostic test in preoperative evaluation of thyroid lesions. FNAC is rapid, cost effective, minimally invasive procedure which has overall good sensitivity and specificity. It is used routinely for the diagnosis of the thyroid nodules which gives better accuracy and avoidsunnecessary surgeries in case of benign lesion. However, expertise as well as pathologist skills are required for proper aspiration, identification, and diagnosis interpretation.

Ethical approval and consent to participate

Ethical clearance was obtained from the Institutional Ethics Committee of Dr.VasantraoPawar Medical College, Nashik, Maharashtra, IEC-47/2020-21. Written informed consent was obtained from the subjects before enrolling in the study. Confidentiality of patient information was maintained.

Conflict of Interest: None

REFERENCES

1. Rathod, G. B., Rai, P., &Rai, S. (2015). A prospective study of ultrasonographic and FNAC correlation of thyroid pathology. *IAIM*, *2*(11), 46-51.
2. Gita, J., &Orell, S. R. (2012). Thyroid. In: Orell, S. R., Sterrett, G. F., editors. Fine Needle Aspiration Cytology. 5th ed. Philadelphia: Churchill Livingstone; 118-55.
3. Gunaratne, S. A., Wijesinghe, H. K. S. N., Wijesinghe, C. J., Dissanayake, S. K. E., &Godakandage, M. H. P. (2016). Comparison of Fine Needle Aspiration Cytology (FNAC) and thyroid ultrasonography in the diagnosis of thyroid nodules. *Journal of Diagnostic Pathology*, *10*(2).
4. Chandanwale, S., Singh, N., Kumar, H., Pradhan, P., Gore, C., &Rajpal, M. (2012). Clinicopatholological correlation of thyroid nodules. *Int J Pharm Biomed Sci*, *3*(3), 97-102.

5. Moosa, F. A., Khan, F. W., Sultan, N., &Rao, M. H. (2010). Up to what extent FNAC is accurate in detecting malignancy in solitary thyroid nodule. *A comparison with post-operative histopathology findings. Med Chann*, *16*, 280-283.
6. Patel, P., & Patel, D. To study the impotence of the correlation between fine needle aspiration cytology (FNAC) and histopathological diagnosis of thyroid lesion.
7. Harsoulis, P., Leontsinit, M., Economout, A., Gerasimidis, T., &Smbarounis, C. (1986). Fine needle aspiration biopsy cytology in the diagnosis of thyroid cancer: comparative study of 213 operated patients. *Journal of British Surgery*, *73*(6), 461-464.
8. Singh, P., Gupta, N., Dass, A., Handa, U., &Singhal, S. (2021). Correlation of fine needle aspiration cytology with histopathology in patients undergoing thyroid surgery. *Polish Journal of Otolaryngology*, *75*(4), 33-39.
9. Afroze, N., Kayani, N., &Hasan, S. H. (2002). Role of fine needle aspiration cytology in the diagnosis of palpable thyroid lesions. *Indian Journal of Pathology and Microbiology*, *45*(3), 241-246.
10. Roy, P. K., Bandyopadhyay, S., Dubey, A. B., &Sengupta, A. (2019). A comparative study on aspiration cytology and histopathology in diagnosis of thyroid nodule and its correlation. *Indian Journal of Otolaryngology and Head & Neck Surgery*, *71*(1), 997-1001.
11. Zhu, Y., Song, Y., Xu, G., Fan, Z., &Ren, W. (2020). Causes of misdiagnoses by thyroid fine-needle aspiration cytology (FNAC): our experience and a systematic review. *Diagnostic pathology*, *15*(1), 1-8.
12. Bagga, P. K., &Mahajan, N. C. (2010). Fine needle aspiration cytology of thyroid swellings: How useful and accurate is it?. *Indian Journal of cancer*, *47*(4), 437-442.
13. Sengupta, A., Pal, R., Kar, S., Zaman, F. A., Sengupta, S., & Pal, S. (2011). Fine needle aspiration cytology as the primary diagnostic tool in thyroid enlargement. *Journal of natural science, biology, and medicine*, *2*(1), 113.
14. Gupta, M., Gupta, S., & Gupta, V. B. (2010). Correlation of fine needle aspiration cytology with histopathology in the diagnosis of solitary thyroid nodule. *Journal of thyroid research*, *2010*(1), 379051.
15. Kessler, A., Gavriel, H., Zahav, S., Vaiman, M., Shlamkovitch, N., Segal, S., &Eviatar, E. (2005). Accuracy and consistency of fine-needle aspiration biopsy in the diagnosis and management of solitary thyroid nodules. *Isr Med Assoc J*, *7*(6), 371-373.
16. Machała, E., Sopiński, J., Iavorska, I., &Kołomecki, K. (2018). Correlation of fine needle aspiration cytology of thyroid gland with histopathological results. *Polish Journal of Surgery*, *90*(6), 13-19.
17. Deschuytere, L., Cools, G., De Schepper, S., & Van Bruaene, N. (2021). Cytology versus histopathology in thyroid nodules: a retrospective study. *B-ENT*, *17*(2), 92-97.