Role of Imprint Cytology in Diagnosis of Thyroid Lesions

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ABSTRACT

Background: Thyroid disorders are common in India. Rapid and accurate intraoperative diagnosis of thyroid lesions helps in deciding the plan of management and spares the patient the additional expenses and morbidity of a second surgery.

Aim: To assess the role of imprint cytology in the diagnosis of thyroid lesions in consecutive thyroidectomy specimens. A cross-sectional study was done at the Mahatma Gandhi Medical College and Research Institute, Puducherry. The study period was between November 2015 and July 2017 during which 60 consecutive thyroidectomy specimens were subjected to touch imprint cytology by the same pathologist who was blinded of the prior fine needle aspiration cytology reports, and the results of imprint cytology and fine needle aspiration cytology were compared with the final histopathological examination report. The data obtained were entered in MS Excel sheet and analyzed.

Results: A total of 60 consecutive thyroid specimens from the Departments of General Surgery and ENT were studied. Imprint cytology had a sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 61.5%, 97.9%, 88.8%, 90.1%, and 90%, respectively, which was found to be better compared to fine needle aspiration cytology.

Conclusion: Imprint cytology is a simple, cheap, and reliable intraoperative diagnostic technique for thyroid lesions. It has high specificity, positive predictive value, negative predictive value, and accuracy. The lack of uniform availability and expense remains a limiting factor for the frozen section. The diagnostic indices of imprint cytology were found to be comparable to that of frozen section in various other studies.

Keywords: Cytology, Imprint cytology, Thyroid.

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INTRODUCTION

Thyroid disorders are a common entity throughout the world including in India. Though fine needle aspiration cytology (FNAC) has been in use since the early 1950s, the diagnostic accuracy varies in different studies and there are certain diagnostic pitfalls associated, and the search has been on for a cytological method with better accuracy. Intraoperative diagnosis in the form of frozen section has been used in various centers but many centers lack the facility and expertise for frozen section which is also time-consuming and expensive. Imprint cytology offers a simpler and cheaper alternative. There are not many studies conducted regarding the accuracy of imprint cytology in thyroid lesions in India. Hence, this study was conducted with the aim of assessing the role of imprint cytology in diagnosing thyroid lesions keeping histopathological examination (HPE) as the gold standard.

AIMS AND OBJECTIVES

- Aim—to assess the role of imprint cytology in the diagnosis of thyroid lesions
- Objective—to compare imprint cytology and fine needle aspiration cytology with histopathological examination in the diagnosis of thyroid lesions

METHODOLOGY

This was a cross-sectional study, which was conducted at a tertiary care hospital over a period of one and a half years after the approval of the Institutional Medical Ethics Committee. Consecutive thyroidectomies cases were considered for the study. Sixty sequential patients undergoing thyroidectomy at the institution were included in the study. Fine needle aspiration cytology of the thyroid lesion was done. Fresh thyroidectomy specimens were

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taken from the operation theatre before fixation in formalin to the pathologist. Five to six imprint slides were made by gently pressing clean glass slides over the lesional areas of the submitted thyroid tissue. The slides were immediately submerged in 95% ethanol in a Koplin jar. The slides were then stained with rapid H&E staining method. The same pathologist who was blinded of the fine needle aspiration cytology report examined the slides of all the patients and reported the imprint cytology on the same day before the HPE report. The histopathological examination report was given by a different pathologist who was blinded of the fine needle aspiration cytology and imprint cytology reports. Imprint cytology report was then compared with fine needle aspiration cytology and histopathological examination reports (Figs 1 and 2).

RESULTS

Of the malignant lesions, papillary carcinoma accounted for the maximum number of lesions. Colloid goiter accounted for

Fig. 1: Papillary carcinoma high-power view imprint cytology

the highest number of benign lesions accounting for 43.3% of the cases. There were 4 cases of follicular variant of papillary carcinoma and one case of papillary carcinoma with metastasis. There was one case of medullary carcinoma of the thyroid (Table 1).

Role of Fine Needle Aspiration Cytology

The results of preoperative FNAC were compared with the final HPE diagnosis. This included both reports of FNAC done within the institute as well as the reports brought by the patients of FNAC done at outside centers (Table 2).

The sensitivity and specificity for FNAC were found to be 46.2% and 97.9% in this study. The positive predictive value was 85.7% and the negative predictive value was found to be 86.8%. The accuracy rate for FNAC was found to be 86.6%.

Role of Imprint

The results of imprint cytology were compared to the final HPE results. Of the 13 malignant lesions in the study, imprint cytology was able to accurately diagnose 8 of the lesions to be malignant accounting for 61.5%. Of the 47 benign cases, imprint cytology accurately diagnosed these to be benign in 46 cases (Table 3).

In this study, imprint cytology was found to have a sensitivity and specificity of 61.5% and 97.9%. The positive predictive value and negative predictive value were found to be 88.8% and 90.1%, respectively. The overall accuracy of imprint cytology was 90% (Table 4).

Table 1: Final diagnosis of thyroid lesions based on histopathology examination

S. no.	Diagnosis	Number of cases	Percentage
1	Chronic lymphocytic thyroiditis	6	10
2	Colloid goitre	26	43.3
3	Hashimotos thyroiditis	9	15
4	Follicular adenoma	7	11.7
5	Medullary carcinoma	1	0.02
6	Papillary carcinoma	11	18.3
	Total	60	100

Fig. 2: Follicular neoplasm high-power view imprint cytology

DISCUSSION

Imprint cytology has been used in the accurate diagnosis of various lesions since as early as in 1927 including lesions of the thyroid, breast, lymph nodes, and prostate. In diagnosing thyroid lesions, imprint cytology finds an important place as accurate diagnosis is paramount especially in malignancies as the plan of management entirely rests on it. There are lots of instances where the fine needle aspiration cytology fails to give a conclusive diagnosis and also false diagnosis which forces the surgeon not to proceed with a total thyroidectomy in unsuspected malignancies with the patient having to suffer the morbidity of a subsequent second surgery. Imprint cytology is a quick and cost-effective diagnostic tool especially in centers which lack facilities of a frozen section. Even in centers with facilities for frozen section studies have shown that in certain lesions which are malignant like papillary carcinoma, imprint cytology is superior in depicting nuclear features which are important in their accurate diagnosis.

Diagnostic Indices of FNAC

The sensitivity and overall accuracy of FNAC at 46.2% and 86.6% is found to be lesser compared to other studies. However, the specificity, positive predictive value, and negative predictive values are comparable (Table 5).

Diagnostic Indices of Imprint Cytology

In the current study, the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were 61.5%, 97.9%, 88.8%, 90.1%, and 90%, respectively. There have not been many studies conducted in India regarding imprint cytology. In one of the largest studies on imprint cytology conducted in India at the Department of Pathology at the Regional Cancer Centre, Trivandrum, by Anila and Krishna, which included 84 patients, the sensitivity, specificity, positive predictive value, and negative predictive value were 75%, 100%, 100%, and 98.7%, respectively.⁶ The sensitivity was found to be lower in our study compared to other studies but the other diagnostic indices have been found to be comparable and better compared to FNAC. The sensitivity of imprint cytology was found to be 61.5% in our study compared to 80% in the study conducted by Ahmadinejad et al., 75% in the study conducted by Anila and Krishna, and 83.3% in the study conducted by Taneri et al.^{4,6,8} The nuclear features were much clearer in imprint cytology. In studies such as those by Rupp and Ehya,⁹ the particular

Table 2: Comparison between preoperative FNAC report and postoperative histopathology examination of study participants

<i>Malignant status</i>		<i>Postoperative HPE</i>		<i>Total n (%)</i>
		<i>Malignant n (%)</i>	<i>Benign n (%)</i>	
Preop FNAC	Malignant	6 (46.2)	1 (2.1)	7 (11.7)
	Benign	7 (53.8)	46 (97.9)	53 (88.3)
Total		13 (100)	47 (100)	60 (100)

Table 3: Comparison between intraoperative imprint cytology result and postoperative histopathology examination of study participants

<i>Malignant status</i>		<i>Postoperative HPE</i>		<i>Total n (%)</i>
		<i>Malignant n (%)</i>	<i>Benign n (%)</i>	
Imprint cytology	Malignant	8 (61.5)	1 (2.1)	9 (15)
	Benign	5 (38.5)	46 (97.9)	51 (85)
Total		13 (100)	47 (100)	60 (100)

Table 4: Diagnostic indices of preoperative FNAC and imprint cytology to diagnose malignant lesions of thyroid

<i>S. no.</i>	<i>Indices of screening test</i>	<i>FNAC</i>	<i>Imprint cytology</i>
1	Sensitivity	46.2	61.5
2	Specificity	97.9	97.9
3	Positive predictive value	85.7	88.8
4	Negative predictive value	86.8	90.1
5	False benign rate	53.8	38.4
6	False malignant rate	2.1	2.1
7	Accuracy	86.6	90

Table 5: Comparison of diagnostic indices of FNAC with other studies

	<i>Present study</i>	<i>Hajmanoochehri and Rabiee¹</i>	<i>Ozdemir et al.²</i>	<i>Bagga and Mahajan³</i>	<i>Ahmadinejad et al.⁴</i>	<i>Jyothi et al.⁵</i>
Sensitivity	46.2	95.2	78.5	66	62.5	66.7
Specificity	97.9	68.4	97	100	100	98.9
Positive predictive value	85.7	83.3	72.6	–	100	88.9
Negative predictive value	86.8	89.6	97.8	–	95.3	96
Accuracy	86.6	85.1	95.3	96.2	–	95.4

importance of nuclear grooving in identifying papillary carcinoma as well as the advantage of using imprint cytology in assessing this feature has been well emphasized. In the current study, intraoperative imprint cytology also provided the pathologist with an opportunity to assess the gross features of the thyroid specimen which were not possible with FNAC and proved to be quite valuable. One of the drawbacks of imprint cytology found in our study has been the difficulty in accurately diagnosing follicular variants of papillary carcinoma. Imprint has been accurately used to diagnose medullary carcinoma; however, the statistical significance is questionable since there is only one case of medullary carcinoma in the present study (Table 6).

On reviewing the literature, it was also found that the overall accuracy of imprint cytology in our study was similar to those of frozen section in several studies of thyroid lesions proving that imprint cytology could prove to be an invaluable alternative for intraoperative diagnosis of thyroid lesions in centers with the lack of frozen section.

CONCLUSION

Based on our study, we have come to the following conclusions. Colloid goitre was the most common benign lesion and papillary carcinoma was the most common malignancy accounting for 43.3 and 18.3% of the study population. Imprint cytology had a sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 61.5%, 97.9%, 88.8%, 90.1%, and 90%, respectively, which was found to be better compared to FNAC. The diagnostic accuracy of imprint cytology in the present study was found to be similar to that of frozen section in various other studies proving imprint cytology could be a valuable alternative to frozen section (Table 7).

LIMITATIONS

The diagnostic accuracy of imprint cytology was compared with that of frozen section in other studies. Including frozen section in the current study would have produced a better comparison. Also there has been only a single case of medullary carcinoma

Table 6: Comparison of diagnostic indices of imprint cytology with other studies

	<i>Present study</i>	<i>Anila and Krishna⁶</i>	<i>Ahmadinejad et al.⁴</i>	<i>Chehrei et al.⁷</i>	<i>Taneri et al.⁸</i>
Sensitivity	61.5	75	80	78.6	83.3
Specificity	97.9	100	100	95	97.7
Positive predictive value	88.8	100	100	84.6	83.3
Negative predictive value	90.1	98.7	96.7	92.9	97.7
Accuracy	90	–		92.4	96

Table 7: Comparison of imprint cytology with frozen section

	<i>Imprint cytology present study</i>	<i>Frozen section (FS) Trosman et al.¹⁰</i>	<i>FS Prades et al.¹¹</i>	<i>FS Cetin et al.¹²</i>
Sensitivity	61.5	81	56	72.9
Specificity	97.9	95	99	100
Positive predictive value	88.8	98	–	–
Negative predictive value	90.1	66	–	–
Accuracy	90	85	89	94

in our study. So the diagnostic accuracy of imprint cytology in medullary carcinoma needs to be evaluated further.

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REFERENCES

- Hajmanoochehri F, Rabiee E. FNAC accuracy in diagnosis of thyroid neoplasms considering all diagnostic categories of the Bethesda reporting system: A single-institute experience. *J Cytol* 2015 Dec;32(4):238–243. DOI: 10.4103/0970-9371.171234.
- Ozdemir D, Bestepe N, et al. Comparison of thyroid fine needle aspiration biopsy results before and after implementation of Bethesda classification. *Cytopathology* 2017 Oct;28(5):400–406. DOI: 10.1111/cyt.12437.
- Bagga PK, Mahajan NC. Fine needle aspiration cytology of thyroid swellings: how useful and accurate is it? *Indian J Cancer* 2010 Dec;47(4):437–442. DOI: 10.4103/0019-509X.73564.
- Ahmadinejad M, Aliepour A, et al. Fine-Needle Aspiration, Touch Imprint, and Crush Preparation Cytology for Diagnosing Thyroid Malignancies in Thyroid Nodules. *Indian J Surg* 2015 Dec;77(Suppl 2): 480–483. DOI: 10.1007/s12262-013-0882-8.
- Lngegowda JB, Muddegowda PH, et al. Application of pattern analysis in fine needle aspiration of solitary nodule of thyroid. *J Cytol* 2010 Jan;27(1):1–7. DOI: 10.4103/0970-9371.66688.
- Anila KR, Krishna G. Role of imprint cytology in intra operative diagnosis of thyroid lesions. *Gulf J Oncolog* 2014 Jul;1(16): 73–78.
- Chehrei A, Ahmadinejad M, et al. Touch imprint and crash preparation intra operative cytology vs frozen section in thyroid nodule. *J Res Med Sci* 2012 May;17(5):475–480.
- Taneri F, Poyraz A, et al. Using imprint and frozen sections in determining the surgical strategies for thyroid pathologies. *Endocr Regul* 2001 Jun;35(2):71–74.
- Rupp M, Ehya H. Nuclear grooves in the aspiration cytology of papillary carcinoma of the thyroid. *Acta Cytol* 1989 Feb;33(1): 21–26.
- Trosman SJ, Bhargavan R, et al. The contemporary utility of intraoperative frozen sections in thyroid surgery. *Am J Otolaryngol* 2017 Oct;38(5):614–617. DOI: 10.1016/j.amjoto.2017.07.003.
- Prades J-M, Querat C, et al. Thyroid nodule surgery: predictive diagnostic value of fine-needle aspiration cytology and frozen section. *Eur Ann Otorhinolaryngol Head Neck Dis* 2013 Sep;130(4): 195–199. DOI: 10.1016/j.anorl.2012.12.005.
- Cetin B, Aslan S, et al. Frozen section in thyroid surgery: Is it a necessity? *Can J Surg* 2004 Feb;47(1):29–33.