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Original Article

Thyroid Cytology: Do Cytotechnician Make the Difference in Fine-needle Aspiration Cytology?

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Abstract

Introduction: Fine-needle aspiration (FNA) cytology is one the widely used investigation in thyroid lesions. Thyroid nodules are palpable in 5% of the population on thyroid examination and detectable in nearly 60% of those subjected to thyroid ultrasound. Timely and conclusive differentiation between benign and malignant categories is important for patient management.

Aim: The aim of the study was to evaluate role of cytotechnologist (CT) in preparing and screening thyroid cytology smears by The Bethesda System of reporting thyroid cytology and to assess the overall impact of CT in working of cytopathology laboratory.

Materials and Methods: A prospective study was carried from January 2017 to December 2017 (Group B). Results were compared retrospectively from January 2016 to December 2016 (Group A) where the laboratory worked without CT. In period B, CT was assigned duty of FNA smear preparation and screening in thyroid aspirates. Total 175 cases were reported in Group A and 187 cases in Group B.

Observations: As compared to Group A, during Group B, the maximum number of passes given, maximum number of slides prepared, non-diagnostic cases reported, complication rate, slide mixing, and technical error reduced from 6 to 4, 10 to 3, 10% to 3.7%, 2.8% to 0.5%, 2.2% to 0%, and 1.1% to 0%, respectively.

Conclusion: Trained CTs are capable of assessing the adequacy and reducing technical errors faced during preparation of thyroid aspirate smears. These all factors contribute to quick and efficient reporting by the cytopathologist and hence, helping in timely reporting of cases.

Key words: Cytotechnologist, Fine-needle aspiration, Thyroid, Cytopathologist

INTRODUCTION

Thyroid nodules are palpable in 5% of the population on thyroid examination and detectable in nearly 60% of those subjected to thyroid ultrasound.[1] Fine-needle aspiration (FNA) cytology is one the widely used investigation in thyroid lesions. Hence, FNA thyroid forms a bulk of cytology laboratory workload. Most of these lesions are benign; however, thyroid nodule may be first presentation in malignant cases.[1,2] Timely and conclusive differentiation between benign and malignant categories is important for patient management. There is an emerging need for an efficient cytotechnologist (CT) in preparing and screening FNA smears for timely reporting of thyroid lesions. The role of CT in screening and interpretation of gynecologic specimens has already been established.[3,4]

Performing thyroid FNA is a skilled procedure and many complications such as hematoma formation, excess bleeding, and anaphylactic reaction can be prevented if done under proper guidance. A skilled CT helps in reducing chances of complications as well as prepares and counsels

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patient well. All these factors help in reducing workload pressure and result in timely and efficient reporting. The aim of our study was to evaluate the role of CT in preparing and screening thyroid FNA smears by The Bethesda system for reporting thyroid cytology (TBSRTC)[5] and to assess the overall impact of CT in working of cytopathology laboratory.

MATERIALS AND METHODS

In the present prospective study, all FNAC results were registered in the period of 2 consecutive years, according to The Bethesda system. The results were distributed between two groups:

- Group A- January 2016–December 2016 without CT support
- Group B- January 2017–December 2017 with CT support

There were 187 cases during the period of January 2017–December 2017 (Group B) where CT was assigned duty of FNA smear preparation and screening in thyroid aspirates. The results were compared retrospectively with 175 thyroid FNA reporting from January 2016 to December 2016 (Group A) where the laboratory worked without CT.

Patient was counseled by CT regarding the procedure and its potential complications; helping in reducing patient's anxiety followed by thyroid nodules aspiration. For FNA minimum two passes were given using a 22-gauge needle, smears prepared were fixed in alcohol for Papanicolaou staining and air dried for May Grünwald Giemsa (MGG) staining as per standard protocol. FNA smears were initially screened by CT for the assessment of adequacy and interpretation of cytologic findings as per the guidelines of TBSRTC. Smears were then submitted to the reporting cytopathologist (CP) who then signed out the reports. Performance of CT was then assessed by comparing his findings with those of the reporting CP.

RESULTS

In Group A, total 175 cases were reported. Female:male ratio was 6.6:1. Maximum cases belonged to 21–30 years (31.4%) with mean age 35.05 years. Nodular presentation was most common (73%) [Table 1]. Maximum number of passes to obtain good yield was 6. Maximum number of slides prepared was 10 after repeated sampling in 14.3% (25/175) cases. Non- diagnostic cases were 18 cases (10%).

In Group B, total 187 cases were reported. Female: male ratio is 5.8:1. Maximum cases belonged to age group of 31–40 years (34.8%) with mean age 38.2 years. Nodular presentation was most common (66.3%) [Table 2]. Maximum number of passes given to yield adequate material was 4. Maximum number of slides prepared in each case was 3 and cellularity was checked by the CT using toluidine blue. Extra material was used to prepare liquid based cytology (LBC) slide and cell block. Non diagnostic cases were seven cases (3.7%).

Table 3 shows categorization of thyroid lesions as per TBSRTC in our laboratory by CP in 175 cases and by CT and CP in 187 cases. There was 100% concordance in diagnosing unsatisfactory and malignant cases. Concordance in benign, atypia of undetermined significance or follicular lesion of undetermined significance (AUS/FLUS), follicular neoplasm or suspicious for a follicular neoplasm (FN/SFN) and suspicious for malignancy (SM) category was 94.4%, 83.3%, 85.7%, and 85.7%, respectively. There was increase in diagnoses of AUS/FLUS (DC III), FN/SFN (DC IV), and SM (DC V) lesions from 4.5% to 6.5%, 6.8% to 11.3%, and 5.7% to 7.5%, respectively.

Table 4 shows detailed distribution of cases reported by CT as compared to CP. Sensitivity, specificity, positive predictive value and negative predictive value of CT as compared to CP for benign lesions was 95.9%, 87.72%, 94.4%, and 90.9%, respectively. Sensitivity, specificity, positive predictive value, and negative predictive value of

Table 1: Patients characteristics and FNA details in Group A (without CT support)

Age range	Gender		Lesion			FNA aspirate		
	Male	Female	Single nodule	Multiple nodules	Diffuse swelling	Blood mixed	Colloid	Blood mixed colloid
0–10	0	0	0	0	0	0	0	0
11–20	04	23	12	8	7	20	5	2
21–30	06	49	23	21	11	34	5	16
31–40	03	47	29	9	12	30	0	20
41–50	03	15	12	4	2	14	1	3
51–60	04	15	5	4	10	15	1	3
61–70	02	02	1	0	3	4	0	0
71–80	01	01	0	0	2	2	0	0
Total	23	152	82	46	47	119	12	44

CT: Cytotechnologist

Table 2: Patients characteristics and FNA details in Group B (with CT support)

Age range	Gender		Lesion			FNA aspirate		
	Male	Female	Single nodule	Multiple nodules	Diffuse swelling	Blood mixed	Colloid	Blood mixed colloid
0–10	0	0	0	0	0	0	0	0
11–20	04	16	13	4	3	12	4	4
21–30	06	55	24	18	19	39	4	18
31–40	06	59	27	10	28	53	0	12
41–50	05	13	12	4	2	15	1	2
51–60	03	09	6	0	6	7	1	4
61–70	02	04	4	0	2	5	0	1
71–80	02	03	2	0	3	5	0	0
Total	28	159	88	36	63	136	10	41

CT: Cytotechnologist

Table 3: Comparison of the Bethesda reporting of thyroid FNAC smears in Group A and Group B

Diagnostic category	Group A	Group B
I Non-diagnostic	18	7
II Benign	119	125
III AUS/FLUS	8	10
IV FN/SFN	12	18
V SM	10	12
VI Malignant	8	15
Total	175	187

CT: Cytotechnologist, AUS/FLUS: Atypia of undetermined significance or follicular lesion of undetermined significance, FN/SFN: Follicular neoplasm or suspicious for a follicular neoplasm, SM: Suspicious for malignancy

CT as compared to CP for malignant lesions were 87.8%, 95.9%, 90%, and 94%, respectively.

Table 5 shows areas where improvement was seen in laboratory with skilled CT. Since the CT counseled each patient before performing FNAC, there was reduced rate of anxiety related complications. There was reduction in non-diagnostic cases from 10% to 3.7%. A better yield was obtained with less number of passes and extra material was used for making LBC slides and cell block wherever possible. Prior screening by CT reduced the turn over time in reporting cases as CT use to mark areas of suspicious cells, thus easing the workload of CP. Also double screening of cases helped in efficient and timely reporting. Smear quality improved with prompt smearing and good staining. Special stains such as Congo red and periodic acid Schiff (PAS) showed improved quality. There were fewer clots in the slides prepared.

DISCUSSION

In 1952, Soderstrom first introduced FNA of the thyroid gland and since then it is widely used in many institutions.[6] The thyroid gland is most commonly sampled by FNA because FNA can make a real difference to patient management.[7] Thus thyroid FNA smears constitute huge bulk in pathology laboratories and with an increasing workload in cytopathology laboratory, there is an emerging need for involvement of CT in preparing good quality smears and initial screening.

Despite its widespread use, the FNA procedure many times yield material that is inadequate or suboptimal for rendering a diagnosis. A shortage of cellularity is a common factor contributing to the inability to make a definitively malignant or benign diagnosis. For this reason, adequacy evaluation is an essential component of cytologic evaluation of thyroid FNA smears and is included as a component of TBSRTC.[4,8,9] Many studies are available regarding strategies to improve thyroid FNA yield, involving gross examination of the direct smear[10-12] increase in the number of passes and slides,[13] standardization of techniques for noncytologist specimen handling[14] and microscopic on-site evaluation of adequacy (OSEA) of a direct smear.[15] Of all these methods, best results are obtained by OSEA of the smears prepared.[15] Studies conducted by Olson *et al*., Redman *et al*. and O Malley *et al*. concluded that there is no significant difference in OSEA by CT or by CP.[16-18] OSEA by CT has been studied in various organ FNA sites and significant results are seen in FNA of pancreas[19-21] and in other multiple body sites.[22]

In Group A, where there was no CT in our laboratory, staining and smear preparation was carried out by laboratory technician. There were four cases of slide mixing and repeat FNA was done in them. Post-procedure complications such as hematoma formation and irritation of trachea were seen in five cases as patient was not stable during the procedure. OSEA of direct smears was not done in any case resulting in increased number of repeat aspirations (48 cases) and increased passes given to the patient.

In the present study, there was improvement in adequacy rate by 6.3%. The main aim of obtaining adequate samples is to reduce rate of repeat procedures. Apart from improvement in adequacy rate, there was improvement in smearing with fewer blood clots and

Table 4: Comparison of distribution of thyroid lesions between cytotechnologist and cytopathologist in Group B

Thyroid cytological lesions interpreted by cytotechnologist	Thyroid cytological lesions interpreted by cytopathologist					
	I Non Diagnostic (7)	II Benign (118)	III AUS/FLUS (12)	IV FN/SFN (21)	V SM (14)	VI Malignant (15)
I Non-diagnostic (7)	07	-	-	-	-	-
II Benign (125)	-	115	8	-	02	-
III AUS/FLUS (10)	-	02	4	04	-	-
IV FN/SFN (18)	-	01	-	15	02	-
V SM (12)	-	-	-	02	10	-
VI Malignant (15)	-	-	-	-	-	15

AUS/FLUSL: Atypia of undetermined significance or follicular lesion of undetermined significance, FN/SFN: Follicular neoplasm or suspicious for a follicular neoplasm, SM: Suspicious for malignancy

Table 5: Factors influenced with working of cytotechnologist in laboratory

Factors	Period A	Period B
Maximum number of passes	6	4
Maximum number of slides prepared	10	3
OSEA	0	153 (81.8%)
Non diagnostic cases	10%	3.7%
Complication rate	2.8%	0.5%
Slide mixing	2.2%	0%
Technical error	1.1%	0%
Number of repeat aspirations	48 (27.4%)	23 (12.3%)
Turnaround time	48–72 h	24–48 h
LBC prepared	0	59 (31.6%)
Cell block prepared	0	63 (33.7%)

OSEA: On site evaluation of adequacy, LBC: Liquid based cytology

minimal overlapping. Also there was availability of material for LBC and cell block. Overall reduction in non-diagnostic lesions was contributed by more promptness in smear preparation resulting in clot free smears, better smear technique, macroscopic recognition of inadequate samples, and better communication between CT and the person who performed FNAC. As the slides were screened by CT, marking of suspicious cells helped in easy and quick reporting. In present study, concordance in DC I and DC VI cases was 100%. In a study conducted by Wotruba *et al*., there was 98.8% concordance and 1.2% disconcordance between CT and CP.[23] Many studies highlight the evolving role of CT which was initially confined mainly to the technical aspect but now also includes screening and interpretation of gynecologic, and non-gynecologic/ FNAC specimens.[16,17,23]

Amongst the discordant cases, maximum discrepancy was seen in DC II, that is, benign category. Out of 125 cases reported by CT, 115 were correctly identified. Eight cases were put in DC III (AUS/FLUS) because there was varying proportion of colloid with microfollicles that were insufficient in number for a diagnosis of follicular neoplasm, so categorized as DC III. Next discrepancy was seen in DC III where four cases were diagnosed as DC IV (FN/SFN) because of presence of crowding and overlapping of microfollicles with mild atypia which were considered part of hyperplastic nodule by CT. Two cases showing follicular pattern and few papillary sheets with distinct intranuclear inclusions were reported as FN/SFN by CT but DC V (SM) suspicious for papillary neoplasm by CP.

There was reduction in number of passes given in obtaining good yield from 6 to 4. According to study by Schmidt *et al*., increased number of passes increases the yield of FNA material.[24] The effect of multiple passes has been investigated by many studies.[25-30] But it also increases the chances of complications; and so benefits of increased passes should be balanced with the amount of adverse effects. FNA performed by a skilled person ensures good yield with minimum passes.

Our study had few limitations like it was a single center study, so the data of this study may not precisely reflect the general population; correlation with clinical, biochemical, and radiology findings was not available for many cases and only one CT and CP participated in this study. Hence, more studies in this direction should be undertaken to overcome these limitations.

CONCLUSION

Thyroid FNA smear reporting forms an important and bulk workload in cytology laboratories. A helping hand in form of a skilled CT is a boon in working of cytopathology laboratories as it eases the work of CP by screening and preparing good quality FNA slides. Also pre-procedure counseling and proper communication with the patient reduces the chances of complications post procedure. A CT should be integrated in the cytology team to reduce the number of non-diagnostic results and consequently the number of patients that need to repeat the FNAC. Overall, a trained CT contributes in improved efficiency of cytology laboratory.

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