www.jmscr.igmpublication.org
Impact Factor 5.84
Index Copernicus Value: 83.27
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v5i7.157

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Original Article

Comparison of Fine Needle Aspiration versus Non-Aspiration Cytology in Diagnosis of Non-Neoplastic Thyroid Lesions

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Abstract
Background: *Preoperative evaluation of thyroid disorder is mandatory for proper management of the patient so as to avoid unnecessary surgery. Fine needle aspiration cytology is the first line diagnostic test for evaluation of goitre and single most effective test for preoperative diagnosis of solitary thyroid nodule. Fine needle non-aspiration cytology avoids aspiration but permits cytologic diagnosis of the thyroid masses.*
Aim of the study: *To compare the results of Fine Needle Aspiration Cytology (FNAC) and Fine Needle Non Aspiration Cytology (FNNAC) in diagnosis of non-neoplastic thyroid lesions.*
Materials and Methods: *One-year observational study, conducted on 125 patients with non-neoplastic thyroid lesions in a tertiary care centre of north India. Patients were investigated with a thyroid function test and a needle biopsy. Both FNAC and FNNAC techniques were performed simultaneously at the same site by the same investigator Modified scoring system was employed to categorise each specimen.*
Results: *A total of 125 patients with non-neoplastic thyroid lesions were subjected to needle biopsies both aspirated and non-aspirated simultaneously. Females dominated the study with female to male ratio of 5.25:1. Colloid goiter was observed in 50.40% female and in7.20% male patients. Thyroiditis was observed in 30.40% female and in 3.20% male patients. Thyroglossal cyst was observed in 4.80% male and in 0.80% female patients, while colloid cyst was observed in 2.40% female and 0.80% male patients. Most of the non-neoplastic thyroid lesions (31.20%) were observed in the age group of 31-40 years. More lesions were observed as diagnostically adequate by FNAC, while diagnostically superior lesions were more in case of FNNAC*
Conclusion: *FNAC smears produced more adequate results, while. FNNAC was more diagnostically superior. Both the techniques were suitable for preoperative diagnosis of non-neoplastic thyroid lesions.*
Keywords: *Thyroid lesions, Non-neoplastic, Fine needle aspiration, Fine needle non-aspiration, Cytology.*

Introduction

After diabetes mellitus, the thyroid gland is the most common organ to cause endocrine disorders, having the spectrum of disease from simple goitre to malignancy or even systemic disease (Grave's Disease). The thyroid gland has the longest phylogenetic history among all endocrine organs, being present not only in all vertebrates but also in protochordates and ascidians. Main purpose of this gland is to produce and store thyroid hormones, which are involved in many basic fundamental processes such as body growth, differentiation and thermogenesis. The key element involved in regulating the process is TSH (thyrotropin-releasing hormone) secreted by hypothalamus [1].

The vast majority of nodules are non-neoplastic or benign neoplasms [2]. Benign nodules can be caused by adenomas, colloid nodules, cysts, infectious nodules, lymphocytic or granulomatous thyroiditis, hyperplastic nodules, and congenital anomalies [3].

Thyroid nodules warrant removal when they are large enough to be symptomatic, or if there is a concern for malignancy. The majority of nodules are asymptomatic, and with only 5 to 10% of nodules being malignant, the decision to operate is made on therapeutic or diagnostic grounds [4].

For thyroid lesions, fine needle aspiration cytology (FNAC) is first investigation of choice as the thyroid enlargement either diffuse or nodular can occur in any thyroid lesion like colloid goitre or thyroiditis or neoplasm. Moreover, the thyroid lesion has high cosmetic importance and surgery is difficult. Also the malignancy in thyroid is less common as compared to non-neoplastic lesion. Therefore, FNAC plays a crucial role in separating patients in to operative or non-operative groups [5].

Accurate diagnosis of various thyroid lesions by FNAC is based on the identification of predominant cell pattern, cell morphology and background details. FNAC is generally performed to exclude a thyroid neoplasm [6].

Fine needle non-aspiration cytology (FNNAC) or fine needle capillary sampling (FNCS) is a new technique originally developed in France by Brifford *et al.*[7] for breast and liver masses. It was first applied by Santos and Leiman [8] to obtain cytological specimens from thyroid nodules. This technique depends solely on capillary action of the fine needle, therefore is less painful, less traumatic and thus much more patient friendly. FNCS without aspiration is less commonly used but often easier to perform [9].

The present observational one-year study was carried out to evaluate cytological diagnosis of non-neoplastic thyroid lesions and to compare the results of FNAC and FNNAC to determine their efficacy.

Materials and Methods

This observational one-year study was conducted on 125 patients diagnosed with non-neoplastic thyroid lesions in the Government Medical College Hospital, Jammu. All these cases were referred to the Department of Pathology by various clinical departments including outpatient and indoor patients of Government Medical College and Associated Hospitals, as well as patients referred from other hospitals. Both FNAC and FNNAC biopsies were conducted on all the patients. Study was conducted after obtaining necessary approval from the Institutional Ethics Committee. Exclusion criteria included cases of palpable neoplastic thyroid lesions, non-palpable thyroid lesions requiring image guided FNA, and patients not willing to participate in the study.

Detailed clinical examination was conducted and it was ensured to note any doubtful sites on the thyroid gland. All the patients were investigated with a thyroid function test. An informed written consent was obtained from the patients or their attendants. Both FNAC and FNNAC techniques were performed simultaneously at the same site by the same investigator. An average of 4 slides was obtained by both the techniques.

Method

Fine Needle Aspiration Cytology

1. With the patient in comfortable position, swelling was grasped with two fingers of one hand and prepared by applying an antiseptic solution.
2. The aspiration was performed with a fine needle of 21-23 gauge attached to 20 ml disposable syringe and fitted to Cameco pistol.
3. After the needle was well advanced in the swelling, adequate negative pressure wias exerted varying with the density of the specimen to be aspirated.
4. With the suction held steady, the needle was moved back and forth within the lump using short quick strokes and released the pistol of the syringe before removing the needle.
5. Needle was withdrawn gently and immediate pressure was applied to the puncture site with a sterile gauze pad.
6. Syringe was filled with air after removing the needle and sample was expressed onto the slides after reattaching the needle.
7. Some of the smears were fixed in alcohol and some air-dried.

Fine Needle Non-Aspiration Cytology

Non-aspiration needle sampling was obtained by inserting the needle held between thumb and forefinger of the one hand into the swelling and moving the needle rapidly in and out within the mass as with conventional fine needle aspiration method but without attachment to a syringe or a holder.

Upon withdrawal of the needle, a syringe filled with air was then attached to the needle to enable expression of needle contents onto the glass slide. Some of the smears were fixed in alcohol and some air-dried.

Specimen quality analysis

The slides were classified according to point scoring system (0 to 2 points) of Mair *et al.* [10]. The specimens were classified as background blood or clot, amount of cellular material (1 point), degree of cellular degeneration, degree of cellular trauma, and retention of appropriate architecture.

On the basis of these criteria, a cumulative score between 0 to 10 points was allocated to each fine needle specimen which was then categorized according to one of the three categories

- Unsuitable for cytodiagnosis 0 – 2 total points
- Diagnostically adequate 3 – 6 total points
- Diagnostically superior 7 – 10 total points

a) **Unsuitable specimens:** Consist mainly of red blood cells or absent cellularity making them inadequate for cytodiagnosis.

b) **Diagnostically adequate:** Possible to render an opinion on nature of lesion sampled but the cellular material present can be sub-optimal due to poor cellularity, sample dilution, degenerative changes, or specimen entrapment in blood clots.

c) **Diagnostically superior:** Cell aggregates are prominent, well preserved, and unobscured by background blood and cellular morphology is well displayed.

The qualitative data was compared using chi-square test. For comparison of means, unpaired 't'-test was performed. A p-value less than 0.05 was considered as level of significance.

Results

This observational study was conducted for a period of one year on 125 patients of non-neoplastic thyroid lesions referred to the Department of Pathology, Government Medical College, a tertiary care centre of north India. All the patients were subjected to needle biopsies using both FNAC and FNNAC techniques.

Colloid goiter was observed in 63 (50.40%) female and in 9 (7.20%) male patients. Thyroiditis was observed in 38 (30.40%) female and in 4 (3.20%) male patients. Thyroglossal cyst was observed in 6 (4.80%) male and in 1 (0.80%) female patients, while colloid cyst was observed in 3 (2.40%) female and 1 (0.80%) male patients (Table 1).

Table 1: Gender wise frequency of non-neoplastic lesions

Non-neoplastic lesions		Male		Female		Total	
		No.	%	No.	%	No.	%
Colloid goiter		9	7.20	63	50.40	72	57.60
Colloid cyst		1	0.80	3	2.40	4	3.20
Thyroiditis	Lymphocytic thyroiditis	4	3.20	36	28.80	40	32.00
	Subacute thyroiditis	0	0.00	2	1.60	2	1.60
Thyroglossal cyst		6	4.80	1	0.80	7	5.60
Total		20	16.00	105	84.00	125	100.00

Most of the non-neoplastic thyroid lesions 39 (31.20%) were observed in the age group of 31-40 years, comprising 20 (16%) colloid goiters, 17 (13.60%) thyroiditis and 1 (0.80%) each colloid cyst and thyroglossal cyst. This was followed by 23 (18.40%) thyroid lesions in the age group of 21-30 years, comprising 12 (9.60%) colloid goiters, and 11 (8.80%) thyroiditis. There were 18 (14.40%), 16 (12.80%), 10 (8%), 8 (6.40%), 7 (5.60%) non-neoplastic thyroid lesions in the age group 41-50, 51-60, 11-20, <10 and 61-70 years respectively. Moreover, 2 (1.60%) each were observed in age groups 71-80 and >81 years (Table 2).

Table 2: Age wise frequency of non-neoplastic lesions

Age group (in years)	Colloid goiter (n=72)		Colloid cyst (n=4)		Thyroiditis (n=42)		Thyroglossal cyst (n=7)		Total (n=125)	
	No.	%	No.	%	No.	%	No.	%	No.	%
<10	2	1.60	0	0.00	1	0.80	5	4.00	8	6.40
11–20	3	2.40	1	0.80	6	4.80	0	0.00	10	8.00
21–30	12	9.60	0	0.00	11	8.80	0	0.00	23	18.40
31–40	20	16.00	1	0.80	17	13.60	1	0.80	39	31.20
41–50	13	10.40	0	0.00	5	4.00	0	0.00	18	14.40
51–60	13	10.40	1	0.80	1	0.80	1	0.80	16	12.80
61–70	6	4.80	1	0.80	0	0.00	0	0.00	7	5.60
71–80	1	0.80	0	0.00	1	0.80	0	0.00	2	1.60
>81	2	1.60	0	0.00	0	0.00	0	0.00	2	1.60
Total	72	57.60	4	3.20	42	33.60	7	5.60	125	100.00

Comparison of diagnostic quality between FNAC and FNNAC of non-neoplastic thyroid lesions showed that 14 (11.20%) lesions were observed unsuitable for cytodiagnosis by FNAC as compared to 6 (4.80%) by FNNAC. Statistically the result was not significant (p>0.05).More lesions were observed as diagnostically adequate by FNAC (69; 55.20%) as compared to FNNAC (42; 33.60%). Statistically, the result was highly significant in favour of FNAC (p=0.0009). Diagnostically superior lesions were more in case of FNNAC (77; 61.60%) as compared to FNAC (42; 33.60%), the result being statistically highly significant in favour of FNNAC (p<0.0001) (Table 3).

Table 3: Comparison of diagnostic quality between FNAC and FNNAC of non-neoplastic lesions

Diagnostic quality	FNAC		FNNAC		Fisher's exact test
	No.	%	No.	%	
Unsuitable for cytodiagnosis	14	11.20	6	4.80	p = 0.10 *
Diagnostically adequate	69	55.20	42	33.60	p = 0.0009 **
Diagnostically superior	42	33.60	77	61.60	p < 0.0001

*Not significant; **Highly significant

Discussion

Fine needle cytology (FNC) is one of the most innovative diagnostic procedures in the evaluation of thyroid lesions. It differentiates inflammatory, reactive, cystic lesions from neoplasms, as well as benign neoplastic lesions from malignant ones. It is safe, simple, cost-effective and well tolerated by affected patients. FNC can be performed with or without aspiration. The more commonly used aspiration technique uses syringe-created negative pressure as well as the shearing effect of the needle to collect material from the biopsied lesion. In contrast, non-aspiration technique or fine-needle capillary sampling method relies on

capillary action to draw the sheared cells within the small-caliber needle [11]. Less bleeding occurs with the non-aspiration technique, an advantage in the biopsy of more vascular tissue such as the thyroid gland. Studies have shown no statistically significant difference between aspiration and non-aspiration techniques in the successful retrieval of cytologic material [12].

A total of 105 (84%) female and 20 (16%) male patients were observed with non-neoplastic thyroid lesions. Most of the female patients either had colloid goiter (50.40%) or thyrioditis (30.40%).

Pandey *et al.*[13] reported that most frequently encountered lesion among non-neoplastic thyroid lesions (n=308) was colloid goiter (75%) followed by thyroiditis (22.08%), adenomatous goiter (1.62%) and thyroglossal cysts (1.30%). In a study by Patel *et al.*[14], out of 180 non-neoplastic lesions, colloid goitre (61.67%) was observed in most patients, followed by throiditis (25%), adenomatous goitre (11.11%) and benign cysts consistent with thyroglossal cyst (2.22%), which is similar to our study.

Modified scoring system advocated by Mair *et al.*[10] was used to assess smears of FNAC and FNNAC which his based on background blood/clot, amount of cellular material, degree of cellular degeneration and degree of cellular trauma and retention of appropriate architecture. A score ranging from 0-2 is assigned to each of these criteria. A cumulative score between 0-10 points is allocated to each FNNAC and FNAC specimen which is then assigned to one of the three categories based on total points scored. These categories are: unsuitable for cytodiagnosis 0-2; diagnostically adequate 3-6; and diagnostically superior 7-10.

The cumulative score was found significantly more in case of FNNAC than FNAC, including colloid goiter (467 vs 393; p<0.0001), thyroiditis (281 vs 226; p<0.0001) and thyroglossal cyst (50 vs 41; p=0.002). However, in case of colloid cyst, the cumulative score was found to be comparable (28 vs 26; p=0.422). In cases of colloid cyst, non-aspiration technique was performed first and a colloid overflow was encountered. It was drained using aspiration technique. The cyst disappeared after colloid was drained and hence FNA becomes therapeutic procedure [15]. Thus, we observed that both techniques had comparable scores in cases of colloid cyst.

Comparison of diagnostic quality of non-neoplastic lesions between FNAC and FNNAC showed statistically comparable results for 'unsuitable for cytodiagnosis' criteria, while for 'diagnostically adequate' criteria FNAC yielded significantly (p=0.0009) more results as compared to FNNAC and for 'diagnostically superior' criteria FNNAC yielded significantly (p<0.0001) more results as compared to FNAC.

Similar findings were reported by Kaur *et al.*[16] and Pandey *et al*[17]. However, unlike our study, Tauro *et al.*[15] found that dignostically FNAC was notably better, producing more superior specimen compared to FNNAC. Also, FNNAC exhibited more diagnostically adequate specimen.

Conclusion

Diagnostically adequate results were significantly more for non-neoplastic lesions when FNAC technique was employed, while diagnostically superior results were significantly more when FNNAC technique was employed. Both the techniques were found to be equally suitable for cytological diagnosis of thyroid non-neoplastic lesions and can be employed as preoperative diagnostic procedure in the management of patients with non-neoplastic thyroid lesions.

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