

## A Comparative Study of Aspiration Vs Non Aspiration Technique in Fine Needle Cytology of Thyroid Lesion

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### Abstract

**Background:** Fine-needle aspiration (FNA) of thyroid gland is a widely accepted, simple, safe and accurate method for evaluation of thyroid lesion. Fine needle non-aspiration/ Fine needle capillary cytology (FNNAC/FNC) is an alternative technique not commonly used, though it is easy to perform. Aim- To evaluate the efficacy of fine-needle non-aspiration cytology (FNNAC) with that of fine-needle aspiration cytology (FNAC) of thyroid lesions as regards to cellular and hemorrhagic yield and to compare these two cytological techniques.

**Methods:** The present study includes 129 thyroid cases carried out in the Department of pathology, Rajendra Institute of medical sciences, Ranchi during the one year period from November 2013 to October 2014.

The smears were scored using three objective parameters i.e. background blood or clot, amount of cellular material and retention of appropriate architecture in a single blind setting by a cyto-pathologist. The results were analyzed using Student t- test for independent sample as well as paired data.

**Results:** After evaluation of FNAC and FNNAC on the basis of these scores, FNAC yielded more cellular material than FNNAC ( $p < 0.001$ ). In a similar manner FNAC has higher average score for background blood ( $p < 0.001$ ) than FNNAC. However there was no statistical difference in average architecture score. Diagnostically superior samples were more by FNAC; FNNAC yielded more diagnostically adequate smears.

**Conclusions:** After evaluation of both techniques on the basis of these scores, larger numbers of diagnostically superior samples were obtained by FNNAC; however, by FNAC greater numbers of diagnostically adequate smears were observed.

**Keywords:** Thyroid, FNAC, Fine-needle non-aspiration cytology

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### I. Introduction

Thyroid lesions/nodules are a common clinical problem encountered by physicians, surgeons and radiologists who deal with the head and neck region. The distinction between lesions that are benign, malignant or indeterminate for malignancy is important for further management<sup>[1]</sup>. Fine needle aspiration cytology (FNAC) is established as a first line investigation for pretreatment evaluation of thyroid lesions. FNA when performed in vascular organs like the thyroid and vascular tumors results in hemorrhagic distortion of cell morphology in the aspirate. This hampers the study and diagnosis of the lesion thereby changing the course of management<sup>[2]</sup>. This problem is overcome by the FNNAC technique, which picks up a small amount of tissue in which the cell morphology and architecture is preserved.

The studies have shown that the two techniques have unique results in different areas; the sensitivity depends on whether the tumor is vascular, necrotic or other factors<sup>[3, 4]</sup>. In cases of thyroid lesions, promising results are encountered in favor of fine needle capillary cytology<sup>[3, 5]</sup>. FNNAC was developed in France by Brifford, Gentile and Hebert in 1982<sup>[6]</sup>. It avoids aspiration and relies on the physical property of capillary pressure to suck cells inside the needle bore. The French authors termed the technique "Cytopuncture." For thyroid lesions, this technique was first evaluated and compared with the conventional technique of FNA by Santos and Leiman<sup>[5]</sup>. Many studies have proved that FNNAC seemed to be better for diagnosing malignant lesions while FNA appeared better for diagnosing benign lesions<sup>[7-11]</sup>. They opined that FNNAC was more patient friendly, gave more cellular yield and that it will improve the quantity and quality of the material. Both the techniques should be used together yielding better diagnostic results.

With this idea in mind, the FNNAC technique can be used as a simple outpatient procedure in thyroid nodules, this study aims to compare the efficacy and quality of FNNAC with that of conventional technique of FNAC in thyroid lesions to promote accurate diagnosis and better management.

## **II. Materials And Methods**

The present study is a prospective study include 129cases and comparing FNAC and FNNAC on patients with a thyroid swelling/nodule and carried out in cytology section, Department of Pathology, Rajendra Institute of medical sciences, Ranchi during the one year period from November 2013 to October 2014 with due clearance from institutional ethical committee. The order of FNNAC and FNAC sampling was pre-planned; in 50% of patients FNNAC was first followed by FNA and the next 50% of the patients underwent FNA first followed by FNNAC. This was done to eliminate bias if any. Both techniques were performed at the same site as much as possible.

Fine needle aspiration was performed using the 23 gauge needles and 10 ml disposable plastic syringe while a non-aspiration technique was done without syringe or holder. In this technique the needle, held between the thumb and forefinger of one hand, was inserted gently into the nodule and moved in different directions. When material enters inside the hub of the needle by capillary action was then expressed onto clean glass slide and smears were prepared. Every slide was assessed without the prior knowledge of techniques utilised. Dry smears were stained with May-Grunwald Giemsa stain, and wet smears by Papanicolaou stain. On the basis of three criteria tabulated, a cumulative score between 00-06 points was allocated to each fine needle specimen who was then categorized to one of three categories.

1. Unsuitable for cytological diagnosis: Smears show mainly blood; and cellular material was scanty for determination of benign or malignant change.

2. Adequate for cytological diagnosis: It was possible to render an opinion on the nature of the lesion sampled. However, the cellular material present was sub-optimal due to poor cellularity, sample dilution, degenerative changes, or specimen entrapment in blood clot.

3. Diagnostically superior: If cells or cell aggregates were concentrated. They are well preserved, unobscured by background blood, and excellently retain architectural features, that is, textbook quality.

An individual slide was objectively analysed using pointscoring system<sup>[12, 13]</sup> to enable comparison between FNAC & FNNAC techniques as shown in (Table 1).

## **III. Results**

The study involved 129 patients, the patient age ranged from 11 to 80 years and majority of them were in the age group of 21-50 years with a mean age of 37 years (Table 2). Among 129 cytologically diagnosed cases ~84% cases were non neoplastic. They comprised mainly of nodular goiter (38 cases), colloid goiter i.e. simple colloid goiter (29 cases), colloid cyst (27 cases), thyroiditis (5 cases); which included Lymphocytic thyroiditis (3cases), granulomatous thyroiditis (1cases), sub- acute thyroiditis (1cases), thyroglossal cyst 3 and (7 cases) of hyperplastic nodule. Out of the 20 neoplasm's cases (~16% of the total) 15 were follicular neoplasm's, 1 cases of medullary, 1 cases of papillary carcinoma and 3 cases were of hurthle cell neoplasm (Table 3).

On categorizing all the smears obtained by FNAC and FNNAC technique on the basis of score obtained, it is apparent (Table 4) that by FNNAC we obtained greater number of diagnostically superior (36) cases with respect to FNAC which given (18) cases, and approximately same number of diagnostically inadequate i.e.; unsuitable for diagnosis with both the techniques, (15) in case of FNNAC and (16) by FNAC where as greater number of diagnostically adequate samples were obtained by FNNAC techniques (95) in comparison to non-aspiration (10). On statistical evaluation of each category of both the techniques separately as shown in (Table 5), non aspiration performed better than FNAC for criterion background blood or clot with statistically significant difference ( $p < 0.05$ ). Non-aspiration scored better than FNAC for the other parameter like amount of cellular material but with no statistical significance. FNAC scored better than FNNAC in case of retention of appropriate architecture but was not statistically significant ( $p > 0.05$ ). Overall Non-aspiration scored better than FNAC which was statistically significant ( $p < 0.05$ ).

## **IV. Discussion**

Fine Needle aspiration cytology has been well established as the base line investigation in evaluating the thyroid nodules<sup>[14, 15]</sup>. It is known for many advantages it provides like, simple technique, safe, rapid turn-around time etc<sup>[6]</sup>. It provides the primary information and or diagnosis which helps in choosing the further rightful management of the thyroid lesions. Being a blind technique, it has a few draw backs limiting its clinical utility. A major limitation of FNA of thyroid is blood in the samples, which interferes in the interpretation of the slide, thus leading to inferior quality samples (Fig.1). To combat this, non-aspiration technique has been tried by many researchers, Santos and Leiman described it first about its advantage over the FNA technique<sup>[15]</sup>. This was well supported many other studies quoting that FNNAC produces less bloody and higher quality samples<sup>[11, 13, 17]</sup>. Another study has established the value of FNNAC in other organs as well<sup>[18]</sup>.

The current study compared the adequacy of the two techniques primarily by the scoring method as indicated in the (Table 1). There was statistically significant increase of adequate samples in FNNAC, which is

in compliant with other studies. The age incidence of thyroid gland disorders was between 11-80 years, which mainly comprises middle aged patients with a mean age of 37 years. This has previously been stated in literature and has also been observed by other authors<sup>[3, 5, 13]</sup>. Our study group was comprised of 82% female patients and 18% males.

In comparing both techniques on the parameter of blood clots; FNNAC was most likely to produce the least likelihood of hemorrhage, thereby giving a clear picture to the cytopathologist (Fig.2). This was also observed by Ali Rizvi<sup>[3]</sup> and other authors<sup>[5, 13]</sup>. The presence of blood cannot be totally prevented in thyroid gland cytology samples but its effect can be minimized by the capillary action of the FNNAC technique compared to the active high suction pressure of the FNA technique. In our study, for material with highly cellular lesions in which abundant material was obtained; FNNAC was more likely to be diagnostically superior; but FNA can diagnose most of the lesions. In less cellular lesions, FNA is more likely to be diagnostically superior to FNNAC. Some authors have reported similar findings but the majority found no significant difference. The cellular trauma and degeneration were generally the same in both techniques as these parameters depended on the method of smear making. The architecture was retained to a greater extent in the FNA smears than the FNNAC smears due to the additional material yield in FNA. But the architecture was a text book picture in whichever FNNAC smears that had good material. Gosh and Misra observed this in their study of FNNAC on thyroid lesions. This was the also one of parameter in which FNNAC scored better than FNA, as reported by other authors<sup>[5, 11, 13]</sup>.

The patients who were diagnosed to have thyroid cysts, all were subjected to both the technique. The overflow of fluid/colloid in case of FNNAC was overcome by attaching a air filled syringe to collect the cystic aspirate without applying any negative pressure. By FNAC aspirate was collected as usual and both fluid assessed cytologically after centrifugation of fluid separately. Overall FNAC scored better score than FNNAC in all aspect and appears to be a better and convenient technique in case of cystic lesions with better collection cystic fluid. This problem has also been previously encountered by Mair and team<sup>[12]</sup> and also by Kate et al<sup>[20]</sup>. They documented that FNAC is the procedure of choice for cystic lesions, as the fluid can be easily collected for cytological evaluation. The cysts usually disappear after the colloid is drained out completely; hence FNA becomes a therapeutic procedure.

Since we got only one case of papillary carcinoma and medullary carcinoma each, we can't say which a better technique in these cases because in both the cases FNA and FNNAC scored equally but in case papillary carcinoma the architecture was better retained by FNAC but FNNAC gave clear picture because of less blood in background. But according to Santos and Leiman who stated that FNNAC specimen were better in neoplasm's; we encountered the same in case of follicular neoplasm in which FNNAC scored much better than FNAC in most aspect except for architecture which was better maintained in case of FNAC samples. In cases of nodular goiter, colloid goiter and other benign lesions like thyroiditis etc, overall score was much better for FNNAC than FNAC and showed significant difference between them as shown table. The result was similar to as found by worker like Santos and Leiman. On the diagnostic performance, FNNAC was notably better, producing more of the diagnostically superior specimen (n=36; 28%), compared to FNA (n=18; 14%); however, FNA exhibited more diagnostically adequate specimen (n=95; ~74%) and less diagnostically inadequate cases. Santos and Leiman reported similar results which were 44% diagnostically superior, 50% diagnostically adequate and 3% diagnostically unsuitable with the FNAC technique. Rizvi and Hussain also reported that FNNAC yielded 44.7% diagnostically superior specimen, 53.3% diagnostically adequate and 2% diagnostically unsuitable specimen. But in contrast LF Tauro et al<sup>[21]</sup> reported that FNAC yielded more diagnostically superior cases (30%) compared to FNNAC (18%), but FNNAC produced more cases that were adequate for diagnosis (70%) than FNA (64%). Moreover, FNA exhibited half the number of diagnostically unsuitable cases (6%) compared to FNNAC (12%).

In this study, FNNAC appears to be a good technique in certain aspects compared to FNA. Each of these techniques has its own advantages and disadvantages<sup>[22]</sup>. Sanjeev et al<sup>[23]</sup> conducted a similar study on lymph node lesions and the results proved the technical superiority of FNNAC technique in cellular lymph node lesions. While Carvalho et al<sup>[24]</sup> suggested that FNA and FNNAC provide similar sample adequacy and diagnostic accuracy. Overall, the decision to choose which technique to adopt rests with the operator to select the method that will produce a high yield of good quality material, with minimal diagnostic failures. Though there was no significant difference between the two techniques, if done in tandem at two different sites on the same lesion; they can add up to ease the diagnosis<sup>[25, 26]</sup>.

## **V. Conclusion And Summary**

It was observed that both the techniques have their own advantages and disadvantages. FNAC smears give adequate result in most of the cases. In addition simple benign lesion or abscesses which can be drained by aspiration for therapeutic purpose. Non-aspiration technique is less traumatic, produces less bloody samples, allows a more sensitive fingertip feeling of lesion and improves the precision in the sampling of small lesions. It

provides text book quality specimen of superior diagnostic value. Moreover, this technique is cheaper, simple and well tolerated by children. This technique is not suitable in cystic and fibrous lesions.

In summary, both techniques FNNAC and FNAC are advised to be used in tandem; however, they should be done on different sites of the same thyroid lesion. Preferably, FNNAC should be performed initially, and then followed by FNAC in order to attain clear and accurate cytological diagnosis. In highly cellular lesions where abundant material was obtained, FNNAC was most likely to be diagnostically superior, although FNAC can also diagnose most of the lesions. In less cellular lesions, however; FNAC was most likely to be diagnostically superior to FNNAC.

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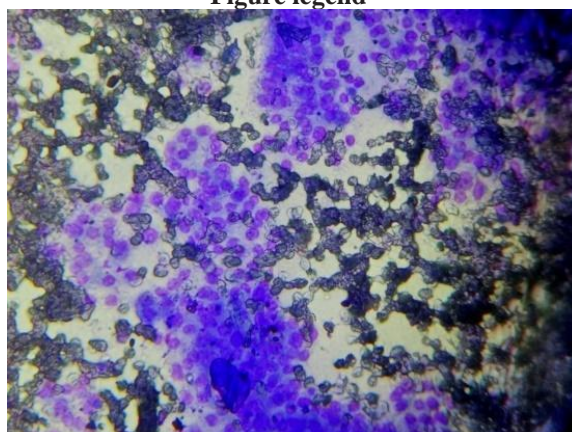
**8. Ethical approval:** Approved by Ethical Committee.

**References**

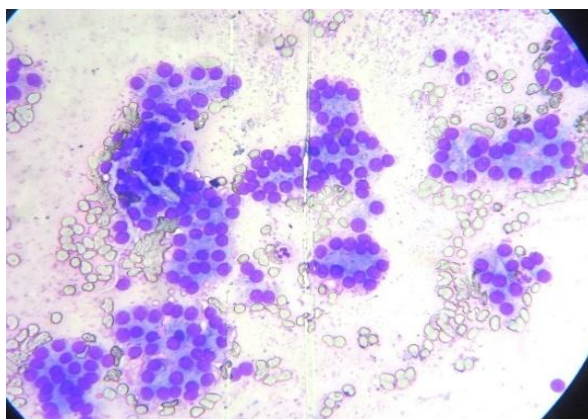
- [1]. DeMay RM. Thyroid. In: The art and science of cytopathology. Chicago, IL: ASCP Press; 1996. pp 704-778.
- [2]. Dey P, Ray R. Comparison of fine needle sampling by capillary action and fine needle aspiration. *Cytopathology* 1993; 4(5):299-303 [PubMed]
- [3]. Rizvi SA, Husain M, Khan S, Mohsin M. A comparative study of fine needle aspiration cytology versus nonaspiration technique in thyroid lesions. *Surgeon* 2005. Aug;3(4):273-276.
- [4]. Braun H, Walch C, Beham A, Moinfar F. Fine needle capillary cytology versus fine needle aspiration cytology—a comparison of quality between puncture techniques in the ENT area. *Laryngorhinootologie* 1997. Jun; 76(6):358-363
- [5]. Santos JE, Leiman G. Nonaspiration fine needle cytology. Application of a new technique to nodular thyroid disease. *Acta Cytol* 1988. May-Jun; 32(3):353-356 [PubMed]
- [6]. Briffod M, Gentile A, Hébert H. Cytopuncture in the follow-up of breast carcinoma. *Acta Cytol* 1982. Mar-Apr; 26(2):195-200 [PubMed].
- [7]. Pothier DD, Narula AA. Should we apply suction during fine needle cytology of thyroid lesions? A systematic review and meta-analysis. *Ann R Coll Surg Engl* 2006. Nov; 88(7):643-645.
- [8]. Suen KC, Quenville NF. Fine needle aspiration biopsy of the thyroid gland: a study of 304 cases. *J Clin Pathol* 1983. Sep; 36(9):1036-1045.
- [9]. Jayaram N, Chetan M, Prasad SR, Ramaprasad AV. Thyroiditis: Thyroid Function and Cytologic Correlation-A study of 66 cases. *Journal of Cytology* 1996; 13:21-24
- [10]. Kamal MM, Arjune DG, Kulkarni HR. Comparative study of fine needle aspiration and fine needle capillary sampling of thyroid lesions. *Acta Cytol* 2002. Jan-Feb;46(1):30-34
- [11]. Raghuvueer CV, Leekha I, Pai MR, Adhikari P. Fine Needle Aspiration cytology versus Fine Needle Sampling without aspiration. A prospective study of 200 cases. *Indian J Med Sci* 2002. Sep; 56(9):431-439 [PubMed]
- [12]. Mair S, Dunbar F, Becker PJ, Du Plessis W. Fine needle cytology: Is aspiration suction necessary. A study of 100 masses in various sites. *Acta cytology* 1989; 33: 809-13.
- [13]. Haddadi-Nehzad S, Larijan B, Tavangar SM, Nouraei SM. Comparison of fine- needle-non-aspiration with fine-needle aspiration technique in the cytologic studies of thyroid nodules. *Endocr Pathol* 2003; 14: 369-73.
- [14]. TamasSolymosi, GyulaLukacsToth and MiklosBodo: Diagnostic accuracy of fine needle aspiration cytology of the thyroid. *Acta cytological* 45: 669-674,2001.
- [15]. P. Krishnappa, S. Ramakrishnappa, M.H. Kulkarni. "Comparison of Free Hand versus Ultrasound guided Fine Needle Aspiration of Thyroid with Histopathological correlation". *Journal of Environmental pathology, Toxicology & Oncology*. 2013 Vol.32 Issue 2: 149-155.
- [16]. Meherbano MK, Arjune DG, Kulkarni HR. Comparative study of fine needle aspiration and fine needle capillary sampling of thyroid lesions. *Acta Cytol*;2002. 46:30-34
- [17]. Ko HM, Jhu IK, Yang SH, Lee JH, Nam JH, Juhng SW, Choi C: Clinicopathologic analysis of fine needle aspiration cytology of the thyroid. A review of 1613 cases and correlation with histopathologic diagnoses. *ActaCytol*; 2003; 47(5): 727-32.
- [18]. Dey P, Shashirekha, Ray R. Fine needle sampling without suction in intra-abdominal lesion. *ActaCyta* 1994; 38:495-97
- [19]. Jayaram G, Gupta B. Non aspiration fine needle cytology in diffuse and nodular thyroid lesions: a study of 220 cases. *Acta Cytol* 1991. Nov-Dec;35(6):789-790 [PubMed]
- [20]. Kate MS, Kamal MM, Bobhate SK, Kher AV. Evaluation of fine needle capillary sampling in superficial and deep-seated lesions. An analysis of 670 cases. *Acta Cytol* 1998 May-Jun;42(3):679-684.
- [21]. Tauro LF, Lobo GJ Fernandes H, A comparative Study on Fine Needle Aspiration Cytology versus Fine Needle Capillary Cytology in Thyroid Nodules, *Oman Med J* 2012Jul;27(2):151-156.
- [22]. Orrel SR, Gregory F, Sterrett, Whitaker D, *Fine Needle Aspiration Cytology*, 4th ed, New Delhi, Elsevier, 2005; pg 125-64
- [23]. Sajeev S, Siddaraju N. A comparative analysis of fine-needle capillary cytology vs. fine-needle aspiration cytology in superficial lymph node lesions. *DiagnCytopathol* 2009Nov;37(11):787-791.
- [24]. de Carvalho GA, Paz-Filho G, Cavalcanti TC, Graf H. Adequacy and diagnostic accuracy of aspiration vs. capillary fine needle thyroid biopsies. *Endocr Pathol* 2009;20(4):204-208.
- [25]. Ceresini G, Corcione L, Morganti S, Milli B, Bertone L, Prampolini R, et al. Ultrasound-guided fine-needle capillary biopsy of thyroid nodules, coupled with on-site cytologic review, improves results. *Thyroid* 2004 May;14(5):385-389.
- [26]. Baksh S, Masih K, Singh S, Das S. Diagnostic utility of fine needle non-aspiration cytology versus fine needle aspiration cytology in breast masses. *Indian J PatholMicrobiol* 2004Jul;47(3):319-321.



**Figure legend-**



**Fig.1-**Photomicrograph of FNAC smears of follicular neoplasm showing hypercellularity with extensive blood contamination and less architectural details in comparison to FNNAC smear (May-Grunwald Giemsa, ×400).



**Figure 2-**Photomicrograph of FNNAC smear of follicular neoplasm showing hypercellularity and minimal blood contamination. (May-Grunwald Giemsa, ×400)

**Table 1:** Table for point allocation

Characteristics:	Description	Points
1. Amount of cellular material	(a) Abundant; diagnosis simple	02
	(b) Sufficient for cytodiagnosis	01
	(c) Minimal to absent; diagnosis not possible	00
2. Background blood or clot	(a) Minimal; diagnosis easy; specimen of textbook quality	02
	(b) Moderate amount; diagnosis possible	01
	(c) Large amount; great compromise to diagnosis	00
3. Retention of appropriate architecture	(a) Excellent architectural display closely reflecting histology; diagnosis obvious	02
	(b) Moderate; some preservation e.g., follicles, papillae acini, flat sheets, syncytia or single cell pattern	01
	(c) Minimal to absent; non-diagnostic	00

**Table 2:** Age group of the patients

Age group (years)	No. of patient	% of patient
0-10	00	00
11-20	15	11.6
21-30	34	26.4
31-40	30	23.3
41-50	29	22.4
51-60	17	13.2
61-70	03	2.3
71-80	01	0.8
TOTAL	129	100

**Table 3:**frequency of different thyroid lesions

Thyroid Lesion	Number of cases	Percent (%)
Colloid goiter	29	22.5
Nodular goiter	38	29.5
Colloid cyst	27	20.9
Thyroiditis	5	3.9
Thyroglossal cyst	3	2.3
Hyperplastic nodule	7	5.4
Hurthle cell neoplasm	3	2.4
Follicular neoplasm	15	11.6
Papillary carcinoma	1	0.8
Medullary carcinoma	1	0.8
Total	129	100

**Table 4:** The performance of FNAC and FNNAC technique.

Performance	Technique	
	FNAC	FNNAC
Diagnostically superior	18 (13.9%)	36 (27.9%)
Diagnostically adequate	95 (73.7%)	78 (60.5%)
Unsuitable for diagnosis	16 (12.4%)	15 (11.6%)
Total	129 (100%)	129(100%)

**Table 5:** Showing average score per case for each category in 129 thyroid lesions

Criteria's		Total points	Mean	Standard deviation	Standard error of mean	p-value
Background blood or clot	FNAC	144	1.12	0.494	0.044	0.000***
	FNNAC	205	1.59	0.509	0.045	
Amount of cellular Material	FNAC	169	1.31	0.497	0.044	0.885
	FNNAC	168	1.30	0.509	0.045	
Retention of appropriate architecture	FNAC	139	1.08	0.509	0.045	0.027
	FNNAC	126	0.98	0.475	0.042	
Total	FNAC	452	3.50	0.953	0.084	0.000***
	FNNAC	499	3.87	1.092	0.096	

\*\*\* showing highly significant value