

# Comparative Study of Fine Needle Non-Aspiration and Fine Needle Aspiration in Cytological Diagnosis of Thyroid Lesions

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## ABSTRACT

**Background:** Fine needle aspiration (FNA) has been proven to be an important, simple, safe and first line investigation in evaluation of various thyroid lesions. But its efficacy is limited by presence of significant amount of blood in smears diluting the cellular yield. An alternate method fine needle non aspiration cytology (FNNAC) was developed which is less painful, easy to perform and shows better patient compliance. The present study was undertaken to compare the efficacy and quality of FNNAC with FNAC to determine whether it is a superior and the procedure of choice in vascular organs like thyroid.

**Methods:** The study was done on 120 patients attending the cytology section in department of Pathology SGRDIMSAR, Amritsar. All of these patients had undergone FNAC and FNNAC simultaneously by single operator. The smears were scored using five parameters- background blood or clot, amount of cellular material, degree of cellular degeneration, degree of cellular trauma and retention of appropriate architecture by the pathologist without the prior knowledge of technique used. All the results were tabulated and were statistically interpreted using student t test.

**Results:** Significant higher score favoured FNNAC for background blood ( $P < 0.001$ ), for cellular material and retention of architecture ( $P < 0.012$ ) over FNAC. For degree of cellular trauma and degeneration of material insignificant higher scores were observed. Total and average score favoured FNNAC over FNAC ( $P < 0.001$ ). Though FNAC yielded more diagnostically adequate samples but diagnostically superior case were higher in FNNAC smears.

**Conclusion:** It was concluded that FNNAC offers better quality smears. FNAC yielded more adequate samples. Both the techniques are complimentary to each other and diagnostic accuracy can be enhanced by combining both the techniques.

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## Introduction

Fine needle aspiration (FNA) has been proven to be an important, simple, safe and first line investigation in evaluation of various thyroid lesions. FNAC along with clinical evaluation and imaging by ultrasound is the mainstay in diagnosis of thyroid lesions. But its efficacy is limited by presence of significant amount of blood in smears in aspiration of vascular organs like thyroid therefore decreasing the cellular yield and limiting the diagnostic efficacy of the technique. An alternate method known by many names like non-aspiration cytology, fine needle capillary sampling (FNCS), cytopuncture and fine needle non-aspiration cytology (FNNAC) was developed in France in 1982.<sup>[1]</sup> and was applied in thyroid lesions in 1988.<sup>[2]</sup> This technique is less painful, easy to perform and shows better patient compliance. But its usefulness and efficacy as compared to FNAC needs to be validated.

The present study was undertaken to compare the efficacy and quality of FNNAC with FNAC to determine whether it is a superior and the procedure of choice in vascular organs like thyroid.

## Materials and Method

The study population consisted of 120 patients attending the cytology section in department of Pathology, Sri Guru Ram Das Institute of Medical Sciences and Research (SGRDIMSAR), Amritsar. All of these patients had undergone FNAC and FNNAC simultaneously by single operator. Each slide was evaluated without the prior knowledge of technique used. Thus making the study single blinded to prevent the observer bias. FNAC was done with 22 gauge needle and 10 cc of plastic syringe. FNNAC was done with 22 gauge needle only by holding it in finger tips and moving it back and forth in various directions at different depths. The material was expelled on the slide with the help of air filled syringe. Smears were air dried for May Grunwald Giemsa stain and fixed in 95% ethyl alcohol for Papanicolaou staining.

The smears were analysed using a scoring system developed by Mair et al.<sup>[3]</sup> Five parameters used for scoring were background blood or clot, amount of cellular material, degree of cellular degeneration, degree of cellular trauma and retention of appropriate architecture ( Table 1). A cumulative score was obtained and were categorized into 3 categories

1. Unsuitable for cytodiagnosis ( Score 0-2 )
2. Adequate for cytological diagnosis ( Score 3-6 )
3. Diagnostically superior (Score 7-10)

All the results were tabulated and were statistically interpreted using student t test .

## Results

Five parameters studied objectively in all 120 cases. It was noted that background blood was more in aspiration smears than non aspiration smears with statistical significant difference (p <0.001). Similarly amount of cellular material and retention of architecture favoured FNNAC by a significant difference of P<0.012. On comparison for the degree of cellular degeneration and degree of cellular trauma it was observed that scores were higher in non aspiration smears than aspiration ones but this difference was not statistically significant. On analysing the total and average score for each technique it was observed that non - aspiration was significantly superior than aspiration (P< 0.001) ( Table 2).

On comparison for the performance of both the techniques, it was seen that diagnostically superior cases were more in FNNAC- 65 cases (54.2%) vs. 40 cases (33.3%) of FNAC. But FNAC yielded more diagnostically adequate cases- 60 cases (50%) as compared to 48 cases (40%) of non- aspiration. It was observed that 20 cases (16.7 %) were diagnostically inadequate by FNAC as compared to 7 cases (5.8%) of FNNAC (Table 3). Frequency of various thyroid lesion was as per given in (Table 4).

**Table 1: Methodology of a Point Allocation.**

S.No	Criterion	Quantitative Description	Point score
1	Background blood or clot	Large amount; great compromise in diagnosis.	0
		Moderate amount; diagnosis possible	1
		Minimal; diagnosis easy, specimen of textbook quality	2
2	Amount of cellular material	Minimal to absent; diagnosis not possible	0
		Moderate; Sufficient for cytodiagnosis	1
		Abundant; diagnosis easy	2
3	Degree of cellular degeneration	Marked; diagnosis impossible	0
		Moderate; diagnosis possible	1
		Minimal; good preservation; diagnosis simple	2
4	Degree of cellular trauma	Marked; diagnosis impossible	0
		Moderate; diagnosis possible	1
		Minimal; diagnosis easy	2

S.No	Criterion	Quantitative Description	Point score
5	Retention of appropriate architecture	Minimal to absent; diagnosis not possible	0
		Moderate; some preservation of e.g Follicle, papillae, acini, flat sheets, syncytia or single cell patterns.	1
		Excellent architecture display closely reflecting histology; diagnosis obvious	2

**Table 2: Comparison of FNAC and FNNAC for Various Parameters.**

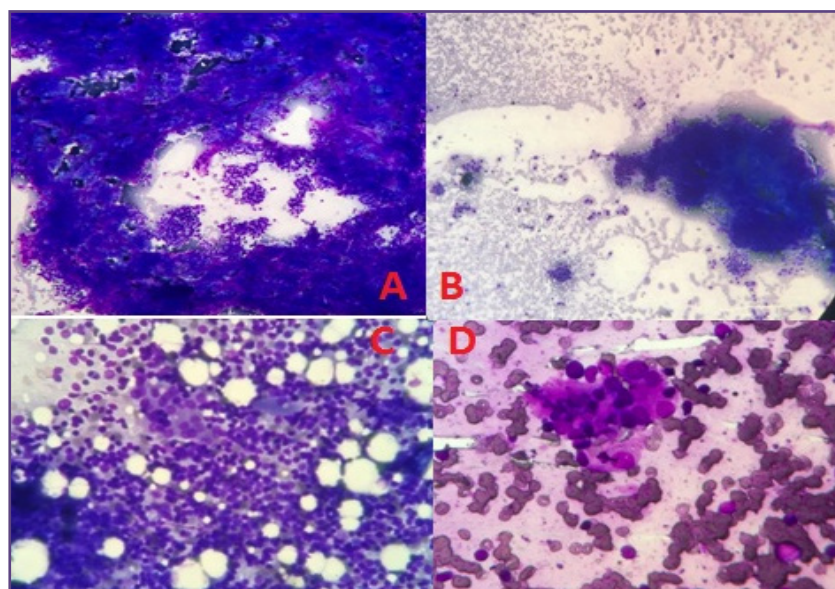
S.No	Criterion	Mean FNAC $\pm$ SD	Total	Mean FNNAC $\pm$ SD	Total	P value
1.	Background Blood/clot	0.62 $\pm$ 0.490	72	1.69 $\pm$ 0.482	192	<0.001
2.	Amount of cellular material	1.15 $\pm$ 0.389	132	1.74 $\pm$ 0.632	179	<0.012
3.	Degree of cellular degeneration	0.92 $\pm$ 0.462	98	1.08 $\pm$ 0.478	120	<0.08
4.	Degree of cellular trauma	0.95 $\pm$ 0.412	125	1.13 $\pm$ 0.518	142	<0.08
5.	Retention of appropriate architecture	1.07 $\pm$ 0.6480	110	1.65 $\pm$ 0.5431	162	<0.012
<b>Total Score</b>		<b>4.71 <math>\pm</math> 2.401</b>	<b>537</b>	<b>7.29 <math>\pm</math> 2.653</b>	<b>795</b>	<b>&lt;0.001</b>

**Table 3: The Performance of FNAC and FNNAC Technique in Thyroid Lesions.**

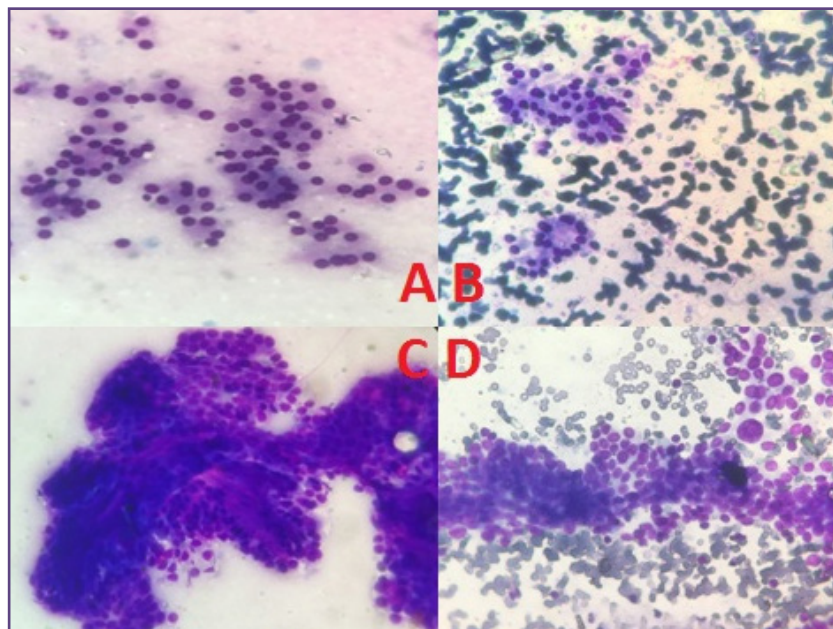
S. No	Performance	Technique	
		FNAC	FNNAC
1	Diagnostically inadequate	20(16.7%)	7(5.8%)
2	Diagnostically adequate	60(50%)	48(40%)
3	Diagnostically superior	40(33.3%)	65(54.2%)

**Table 4: Frequency of Various Thyroid Lesions.**

S No	Type of lesion	No of cases	Percentage
1	Colloid goitre	30	25%
2	Adenomatous goitre	35	29.2%
3	Thyroiditis	24	20%
4	Follicular neoplasm	22	18.4%
5	Papillary carcinoma	8	6.6%
6	Medullary carcinoma	1	0.8%
<b>Total</b>		<b>120</b>	<b>100</b>



**Fig. 1 (A): FNNAC smear of Adenomatous goitre showing high cellularity and minimal blood; (B) : FNAC smear of Adenomatous goitre showing less cellularity and blood contamination; (C): FNNAC smear of Thyroiditis showing high cellularity and minimal blood; (D): FNAC smear of Thyroiditis showing less cellularity and blood contamination (MGG,100X).**



**Fig. 2(A): FNNAC smear of Follicular Neoplasm showing high cellularity and minimal blood; (B) : FNAC smear of Follicular Neoplasm showing less cellularity and blood contamination; (C): FNNAC smear of Papillary Carcinoma Thyroid showing high cellularity and minimal blood; (D): FNAC smear of Papillary Carcinoma Thyroid showing less cellularity and blood contamination (MGG,400X).**

## Discussion

Fine needle aspiration of thyroid has been proved to be widely accepted, accurate, simple, safe and cost effective technique in evaluation of thyroid lesions.<sup>[4]</sup> But the common challenge remains the haemorrhage material in the smears diluting the cellularity specially in a vascular organ like thyroid.<sup>[5]</sup> To overcome this, modified technique FNNAC came into the picture obviating the need of suction as the material yield depends upon the capillary action in narrow channel. The fluid and semifluids ascends in inverse proportion of the diameter of capillary.<sup>[2]</sup> FNNAC has its advantage of being easily operable with better control over the procedure due to good perception of the lesion. Patients tolerate the procedure as it is less traumatic and less painful.<sup>[6]</sup>

On comparison for blood contamination between two techniques, it significantly favoured non aspiration ( $P < 0.001$ ). This was in accordance with the results of various previous studies conducted.<sup>[7,8]</sup> However some of the researchers did not notice significant difference between the two techniques for background blood and clot.<sup>[9]</sup>

Similarly cellularity and retention of architecture in the smears of FNNAC was significantly better than FNAC ( $P < 0.012$ ) corroborating the findings of the other studies.<sup>[7,8]</sup> Akhtar et al and other researchers observed the high cellular yield and retention of architecture in non aspiration samples though the difference was not statistically significant.<sup>[9,10]</sup> Some other studies revealed higher yield in FNAC smears than non aspiration.<sup>[11]</sup>

Lesser degree of cellular trauma and lesser degree of cellular degeneration was seen by non aspiration technique; however the difference was statically insignificant. Similar results had been observed by the workers in previous studies.<sup>[12,13]</sup> Total and average score was significantly higher for non aspiration as compared to FNAC ( $< 0.001$ ) which was in agreement with the findings of previous studies.<sup>[14,15]</sup>

On comparing the performance of both the techniques, it was observed that FNNAC yielded more diagnostic superior cases than FNAC (65 cases vs 40 cases) and diagnostically adequate cases were more frequent in FNAC as compared to FNNAC (60 cases vs 48 cases). Similar findings had been observed in other studies.<sup>[16,17]</sup> Diagnostically inadequate cases were 16.7% (20 cases) in FNAC while this percentage was only 5.8% (7 cases) in FNNAC agreeing the results obtained by Rizvi et al and Ciatto et al.<sup>[16,18]</sup> Dilution of the cellularity with the blood is the cause of higher inadequacy rate in FNAC as it involves high suction pressure filling the needle with the blood leading to early withdrawal of the needle. So, less of time is available to manipulate the needle leading to less cellular yield. On the contrary in FNNAC no suction is applied and spontaneous ascent of the material with capillary action is allowed thus yielding high cellularity with less blood contamination. Specially in thyroid malignancies dilution of the cellularity poses more of the difficulty as these tumours are highly vascular with increased fragility of the malignant cells. FNNAC offers less contamination



and better preservation of cellularity in such cases. An adequate material in the smears is the mainstay of accurate diagnosis and subsequent treatment of the patient.

Though on ultimate analysis for total and average score for each criteria for both techniques FNNAC scored significantly better than FNAC ( $P < 0.001$ ), diagnostically adequate cases were more frequent in FNAC as compared to FNNAC.

## Conclusion

It was concluded that FNNAC offers better quality smears with less of contamination with blood, high cellular yield and better preservation of the architecture and FNAC yields more of diagnostically adequate smears. FNNAC has extra advantage of easy operability, better control over the procedure with more perception of the swelling. It also offers better patient compliance of being less traumatic and less intimidating by innocuous needle, syringe and handle. So both the techniques have their own advantages and disadvantages. Both the techniques are supplementary to each other and can be substitutive in some cases. Though this study proves more efficacy and quality superiority for FNNAC over FNAC, further studies are required with interobserver comparison using two evaluators for the study to have the better insight of role and efficacy of both the techniques. We recommend that both the techniques are complimentary to each other and diagnostic accuracy can be enhanced by combining both the techniques.

## Funding

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## Competing Interests

None Declared

## References

1. Zajdela A, Zillhardt T, Voillemet N. Cytological diagnosis by fine needle sampling without aspiration. *Cancer*. 1987;59(6):1201-5.
2. Santos JE, Leiman G. Non aspiration fine needle cytology: Application of a new technique to nodular thyroid diseases. *Acta Cytol*. 1988;32(3):353-6.
3. 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 cytol*. 1989;33(6):809-13.
4. Hamberger B, Gharib H, Melton Lj. Fine needle aspiration of thyroid nodules : impact on thyroid practice and cost of care. *Am j Med*. 1982;73:381-4.
5. Santos JEC, Leiman G. Non aspiration fine needle cytology : Application of a new technique to nodular thyroid diseases. *Acta Cytol*. 1988;32:353-6.
6. Meherbano MK, Arjune DG, Kulkarni HR. Comparative study of fine needle aspiration and fine needle capillary sampling of thyroid lesions. *Acta cytol*. 2000;46:30-4.
7. Pinki P, Alok D, Ranjan A, Chand MN. Fine needle aspiration cytology versus fine needle capillary sampling in cytological diagnosis of thyroid lesions. *Iranian J Pathol*. 2015;10(1):47-53.
8. Ghosh A, Misra RK, Sharma SP, Singh HN, Chaturvedi AK. Aspiration vs nonaspiration technique of cytodiagnosis- A critical evaluation in 160 cases. *Indian J Pathol Microbiol*. 2000;43(2):107-12.
9. Akhtar SS, Huq IU, Faiz-U-Din M, Reyes LM. Efficacy of fine needle capillary biopsy in the assessment of patients with superficial lymphadenopathy. *Cancer cytopathol*. 1997;81(5):277-80.
10. Maurya AK, Mehta A, Mani NS, Nijhawan VS, Batra R. Comparison of aspiration vs non aspiration techniques in fine needle cytology of thyroid lesions. *J cytol*. 2010;27(2):51-4
11. Kamal MM, Arjune DG, Kulkarni HR. Comparative study of fine needle aspiration and fine needle capillary sampling of thyroid lesions. *Acta Cytol*. 2002;46(1):30-4.
12. Raghuveer 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;56(9):431-9.
13. Pontheir DD, Narula AA. Should we apply suction during needle cytology of thyroid lesions? A systematic review and meta-analysis. *Ann R Coll Surg Engl*. 2006;88(7):643-5.
14. Dey P, Shashirekha, Ray R. Fine needle sampling without suction in intra-abdominal lesion. *Acta Cytol*. 1994;38:495-7.
15. Romitelli F, Di Stasio E, Santoro C, Iozzino M, Orsini A, Cesareo R. A comparative study of fine needle aspiration and fine needle non aspiration biopsy on suspected thyroid nodules. *Endocr Pathol*. 2009;20:108-13.
16. Rizvi SA, Husain M, Khan S, Mohsin M. A comparative study of fine needle aspiration cytology versus non aspiration technique in thyroid lesions. *Surgeon*. 2005;3(4):273-6.
17. Mahajan P, Sharma PR. Fine needle aspiration versus non- aspiration technique in cytodiagnosis in thyroid lesions. *JK science*. 2010;12(3):120-2.
18. Ciatto S, Lossa A, Cicchi P. Non aspiration fine needle cytology of thyroid tumors. *Acta Cytol*. 1983;33(5):939.