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Original Research Article

Fine Needle Aspiration versus Fine Needle Capillary Sampling Technique in Cyto-diagnosis of Thyroid Lesions

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ABSTRACT:

Introduction: In diagnosis of thyroid lesions, the negative pressure applied during fine needle aspiration cytology (FNAC) frequently produces bloody smears. This results in a compromise in cellular concentration and architecture which may lead to improper interpretation. Fine needle capillary sampling cytology (FNCC), on the other hand, avoids active aspiration as it depends on capillary tension to collect tissue samples in the needle bore. This study evaluated the diagnostic performance of FNAC and FNCC in thyroid lesions. **Methods:** A total of 120 patients were included in this study conducted over a duration of 19 months. All thyroid swellings advised for cyto-diagnosis were sampled by both fine-needle aspiration (FNAC) and non-aspiration (FNCC) techniques. The slides were assessed according to the Mair et al. scoring system. **Results:** In the FNCC group, 72 (60%) smears were diagnostically superior while 54 (45%) smears were diagnostically superior in the FNAC group. Blood contamination (p=0.003), cellular trauma (p=0.019), and degree of cellular degeneration (p=0.026) were less and cellular architecture (p=0.047) was preserved more in FNCC in comparison to FNAC groups. **Conclusion**: This study showed the superiority of FNCC for the interpretation and diagnosis of thyroid lesions. However, the combination of both FNAC and FNCC could maximize the diagnostic yield.

Keywords: Fine needle aspiration cytology (FNAC), Fine needle capillary cytology (FNCC), Thyroid swelling

INTRODUCTION:

Fine needle aspiration cytology (FNAC) is a routine, well-established, and widely accepted investigation modality in the evaluation of palpable and non-palpable lesions in the body. It is a minimally invasive technique with high sensitivity, specificity, and accuracy. Thyroid nodules are the most common clinical problem encountered by surgeons in their out-patient department (OPD).[1] About 1-10% of the thyroid nodules are malignant. The incidence of thyroid malignancy has multiplied over the years due to the increased incidence of papillary thyroid carcinoma.[2] Therefore, a prompt diagnosis is necessary for its timely management. The quality of cellular material is a prerequisite for proper interpretation and diagnosis of thyroid specimens. The thyroid is a vascular organ and negative pressure exerted during aspiration techniques in FNAC procedure frequently causes a compromise in cellular preservation due to bloody smears which may lead to unsatisfactory sampling and improper interpretation. The majority of diagnostic failures are due to non-diagnostic samples or pathologists

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issuing diagnosis on samples with inadequate material.

In an attempt to overcome this problem, a new method called fine needle capillary cytology (FNCC), also known as fine needle capillary sampling (FNCS), fine needle non-aspiration cytology (FNNAC) and cyto-puncture was developed by Briffod in France in 1982.[3] It was first described in diagnosing thyroid nodules by Santos and Leiman in 1988.[4] The main mechanism for FNCC is capillary tension to suck the tissues; avoiding active aspiration. It was reported that, due to the absence of suction effect, FNCC was less traumatic, producing less bloody and higher quality smears, easier to perform, and less painful. There are many conflicting studies regarding the superiority of FNAC to FNCC and vice versa. Hence, this study aimed to compare the outcomes of FNCC with that of FNAC in thyroid lesions.

METHODS:

This prospective, observational study was conducted at the Department of Pathology, Lumbini Medical College and Teaching Hospital, Nepal from 1st November 2019 to 31st May 2020. Ethical clearance from the Institutional Review Committee (IRC-LMC 23-G/019) was obtained prior to starting the study.

All the patients referred from clinical OPDs with a thyroid swelling for cyto-diagnosis were enrolled into the study. The patients with thyrotoxicosis were excluded because it is a highly vascular condition and irrespective of the technique used, there exists a high probability of bloody smear. Thyroid swelling in every patient was sampled by both fine-needle aspiration (FNA) and non-aspiration (FNC) techniques by a single operator and also further interpreted by a single pathologist. Both the techniques were done using a 23 gauge needle. A 10 ml disposable plastic syringe was attached in the aspiration technique, while the non-aspiration technique was done without a syringe or holder. The needle held between the thumb and forefingers of aspirating hand was inserted into the nodule and moved in different directions within the nodule while performing FNCC sampling. The material received in the hub of the needle by capillary action was then expressed onto clean glass slides. The pathologist was unaware of the sampling method employed (FNAC/FNCC). To reduce the bias and standardize the method non-aspirate was always performed before the aspirate technique and slides were marked as "A" and "B" randomly. The dry smears were stained by Wright stain, and the wet smear was stained with Papanicolaou stain. Mair et al. scoring system was adopted for the interpretation of smears.[5] The two sampling techniques were compared by evaluating smears using five objective parameters: background clot/blood, cellularity, degree of cellular degeneration, degree of cellular trauma, and retention of appropriate architecture as shown in table 1. A cumulative score between 0 and 10 points was calculated for each specimen (smear) and categorized into one of the following three categories:

Category 1—(Score 0–2) unsuitable for diagnosis.

Category 2—(Score 3–6) adequate for cytological diagnosis.

Category 3—(Score 7–10) diagnostically superior

Table 1. The Mair et al. Scoring System.

Background blood/clot	Large amount, great compromise of diagnosis	0
	Moderate amount, diagnosis possible	1
	Minimal amount, diagnosis easy	2
Amount of cellular material	Minimal to absent, diagnosis not possible	0
	Sufficient for cytodiagnosis	1
	Abundant, diagnosis possible	2
Degree of cellular degeneration	Marked, diagnosis impossible	0
	Moderate, diagnosis possible	1
	Minimal, diagnosis easy	2
Degree of cellular trauma	Marked, diagnosis impossible	0
	Moderate, diagnosis possible	1
	Minimal, diagnosis obvious	2
Retention of appropriate architecture	Minimal to absent non diagnostic	0
	Moderate, some preservation of, for example, follicle, papillae, and acini	1
	Excellent architectural display closely reflecting histology, diagnosis obvious	2

The cytological interpretation was made based on Bethesda system for reporting thyroid

cytopathology (BSRTC).

All the data thus collected were analyzed using the Statistical Package for Social Sciences (SPSS™) software version 20. Qualitative data were presented in frequency and percentages and quantitative data as mean with standard deviations. Student's t test was used to compare means. A p value < 0.05 was considered statistically significant.

RESULTS:

During the study period, a total of 1000 samples were processed at our department for cyto-diagnosis, in which 150 cases were of the thyroid. Out of them, 120 cases underwent both FNAC and FNCC for thyroid lesions. The distribution with regards to age, sex, and diagnosis of all cases was analyzed and compared for the five objective parameters in-between the two techniques.

In this study, the age of the patients ranged from 16 to 89 years with the mean of 40.23±11.8 years. There were 88 (73.3 %) females and 32 males (26.6%) with a female-to-male ratio of 2.7:1. Thyroid lesions were more common in the age group 35-40 (n=48, 40%) followed by 25-30 years (n=42, 35%) and 50-55 years (n=30, 25%) respectively. The frequency of thyroid lesions encountered during the study is tabulated in table 2. Goiter was the most common lesion (n= 72, 60%) followed by thyroiditis (n=18, 15%).

Table 2. Frequency of various thyroid lesions on cytology (N=120).

Diagnosis	N (%)
Non-neoplastic lesions	
Nodular goitre (single)	18 (15 %)
Colloid goitre	30 (25%)
Multi nodular goiter	24 (20%)
Hashimoto's thyroiditis	12 (10%)
Lymphocytic thyroiditis	6 (5%)
Neoplastic lesions	
Papillary carcinoma	12 (10%)
Follicular neoplasm	6 (5%)
Follicular lesion of undetermined significance (FLUS)	5 (4.16%)
Suspicious for malignancy	4 (3.33%)
Medullary carcinoma	2 (1.66%)
Undifferentiated/ anaplastic carcinoma	1 (0.83%)
Total	120 (100%)

Tables 3 and 4 show a comparison of both techniques. We found that the non-aspiration technique (FNCC) yielded more diagnostically superior smears as compared to FNAC. FNCC yielded diagnostically superior samples in 72 (60%) out of 120 cases as compared to FNAC method where diagnostically superior sample was seen in 54 (45%) cases as shown in table 3. FNCC also showed fewer numbers of inadequate samples. Out of 120 cases diagnostically inadequate smears were seen in 12 (10%) cases in FNCC and in 24 (20%) cases in FNAC group. FNAC on the other hand, showed more diagnostically adequate samples (n=42, 35%) than FNCC group (n=36, 30%). As per the individual criteria used in the Mair et al. scoring system, blood contamination was more in FNAC smears than in FNCC smears and this difference was statistically significant (p=0.003). The degree of cellular trauma was less in FNCC in comparison to FNAC smears (p=0.019). The degree of cellular degeneration was less in FNCC in comparison to FNAC smears (p =0.026). The cellular architecture was preserved more in FNCC smears than FNAC samples (p=0.047). FNAC performed well in case of amount of cellular material, it was retrieved more by FNAC technique than FNCC (p=0.019)

Table 3: Diagnostic performance of FNAC vs FNCC techniques.

	FNAC N(%)	FNCC N(%)
Diagnostically inadequate	24 (20)	12 (10)
Diagnostically adequate	42 (35)	36 (30)
Diagnostically superior	54 (45)	72 (60)
Total	120 (100)	120 (100)

DISCUSSION:

FNAC is a useful diagnostic adjunct to the conventional method of diagnosis in cases of palpable thyroid lesions and impalpable lesions under image guidance. It is a less time consuming, simple, minimally invasive, cost-effective technique with a low complication rate which facilitates diagnosis and surgical planning. It is reported to have a high sensitivity, specificity, and overall accuracy. [6] However, it has well-recognized limitations of inadequate sampling, requiring repeated aspirations.

Table 4. Comparison of FNAC and FNCC for various parameters.

Parameters	FNAC (Mean±SD)	FNCC (Mean ± SD)	Statistics
Background blood or clot	1.37±0.549	1.58_± 0.513	t = -3.037, df = 238 p = 0.003
Amount of cellular material	1.29±0.492	1.13 ± 0.549	t = 2.353, df =238 p = 0.019
Degree of cellular degeneration	1.36±0.786	1.56±0.577	t= -2.246, df=218.3 p=0.026
Degree of cellular trauma	1.21±0.732	1.42±0.630	t= -2.363, df=238 0.019
Retention of appropriate architecture	1.19±0.759	1.38±0.622	t=1.994, df=238 0.047

As the thyroid gland is highly vascular, samples can contain significant quantities of blood resulting in inferior quality cellular material which makes cytological interpretation difficult and compromise diagnostic accuracy. The present study was undertaken to compare the efficacy of both FNAC and FNCC techniques about the method itself and those related to the quality and quantity of material obtained by each technique.

In the present study, the non-aspiration technique (FNCC) yielded more diagnostically superior smears as compared to FNAC. FNCC yielded diagnostically superior samples in 72 (60%) out of 120 cases as compared to the FNAC method where the diagnostically superior sample was seen in 54 (45%) out of 120 cases. FNCC also showed fewer numbers of diagnostically inadequate samples, out of 120 cases diagnostically inadequate smears were seen in 12 (10%) cases in FNCC and in 24 (20%) cases in FNAC group. FNAC on the other hand, showed more diagnostically adequate samples, out of 120 cases diagnostically adequate smears were seen in 42 (35%) cases in FNAC and in 36 (30%) cases in FNCC group.

Similar results have been shown by various other studies. In a study conducted by Rizvi et al. in 150 patients, they found more diagnostically superior samples (n=67, 44.66%) by FNCC than (n=30, 20%) by FNAC technique, and diagnostically inadequate samples were less in FNCC (n=3, 2%) than FNAC (n=10, 6.66%). Whereas more diagnostically adequate samples were shown by FNAC (n=110, 73.33%) in comparison to FNCC (n=80, 53.33%).[7]

In the study conducted by Mainali et al., among 87 patients 19 (21.84%) samples showed diagnostic superiority in the FNCC technique while 7 (8.06%) samples showed diagnostic superiority in FNAC. Twelve (13.79%) samples were unsuitable diagnostically in the FNCC technique and 26 (29.89%) in the FNAC technique. In contrast to our study, diagnostically adequate smears were seen more in the FNCC group. Fifty-six (64.37%) cases showed diagnostically adequate smears in the FNCC technique while 54 (62.05%) cases showed diagnostic adequate smears in the FNAC technique.[8]

Maurya et al. observed in a study of 50 cases that diagnostically superior samples were more in FNCC (46%) than FNAC (40%) group. Similar to our study, diagnostically adequate samples were obtained more by FNAC (24%) than FNCC (18%) technique.[9] In contrast to our study the percentage of inadequate sampling was more with non-aspiration (38%) than with aspiration (34%) technique.

The superiority of FNCC in a vascular organ like the thyroid is shown in various studies. Santos and Leiman compared the two techniques in thyroid lesions.[4] In both benign and malignant lesions, their study has shown that diagnostically superior specimens were obtained more frequently by the FNCC technique in thyroid lesions. Diagnostic superiority of FNCC was also supported by Mair et al. and Mahajan et al. who showed that FNAC sampling was diagnostic in a greater number of cases, whereas diagnostically superior smears were obtained more frequently by the non-aspiration technique.[5,10]

In our study, as per the individual criteria used in Mair et al. scoring system, background blood/ clot, degree of cellular degeneration and degree of cellular trauma were less in samples taken by FNCC as well as retention of appropriate architecture was more in FNCC samples .Whereas more amount of cellular material was obtained in samples taken by FNAC.

Background blood/ clot was significantly less in the study done by Mainali et al., Pinki et al. and Ramachandra et al. in FNCC samples similar to our study.[8,11,12] But in contrast to our study,

Mainali et al. found the amount of cellular material was significantly more in FNCC group and degree of cellular degeneration, degree of cellular trauma and retention of appropriate architecture did not show any statistical significance between FNCC and FNAC techniques.

In a study by Kamal et al. statistically significant difference in favor of FNCC was observed only for the amount of cellular material. For the rest of the parameters i.e. background blood or clot, degree of cellular degeneration, degree of cellular trauma and retention of architecture, the average score favored FNCC but was not statistically significant. Although FNCC sampling was diagnostic in a greater number of cases than FNAC sampling, this study did not prove a clear superiority of FNCC over FNAC.[13]

Similar to our study Kumar et al. also concluded FNCC as a better technique than FNAC in the cytological diagnosis of solitary thyroid nodules.[14] It showed more diagnostically superior smears by FNCC, 19.44% in comparison to 13.88% by FNAC and better cellular architecture preservation with less blood/colloid background in non-aspiration technique. Romitelli et al. found retention of architecture to be better in the non-aspiration technique.[15]

Unlike our study, Haddadi et al. concluded that FNCC is not superior to FNAC in the cytopathologic studies of thyroid nodules.[16] Similarly, Song et al. revealed that both techniques are equally useful in the assessment of thyroid nodules and opined the selection of technique depends on the personal preference of the operator.[17]

CONCLUSION:

This study concluded that FNCC yielded superior quality smears due to a significant improvement in the retention of cellular architecture, less cellular trauma, reduced cellular degeneration and less blood contamination in this technique. It found FNAC to be superior in yielding a greater amount of cellular material. Therefore, to increase the number and quality of results, both techniques (FNCC and FNAC) could be supplementary in lesions of vascular organs like thyroid.

Conflict of Interest: The authors declare that no competing interests exist.

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REFERENCES:

1. Ahmad T, Naeem M, Ahmad S, Samad A, Nasir A. Fine needle aspiration cytology (FNAC) and neck swellings in the surgical outpatient. J Ayub Med Coll Abbottabad. 2008;20(3):30-2. PMID: 19610510
2. Pacini F, Burroni L, Ciuoli C, Di Cairano G, Guarino E. Management of thyroid nodules: a clinicopathological, evidence-based approach. European Journal of Nuclear Medicine and Molecular Imaging. 2004;31(10):1443-9. Available from: https://search.proquest.com/openview/c371e476bbf059be8d05a94541246c18/1?pq-origsite=gscholar&cbl=42802
3. Briffod M, Gentile A, Hebert H. Cytopuncture in the follow-up of breast carcinoma. Acta Cytol. 1982;26(2):195-200. PMID: 6952722
4. Santos JE, Leiman G. Nonaspiration fine needle cytology. Application of a new technique to nodular thyroid disease. Acta Cytol. 1988;32(3):353-6. PMID: 3376702
5. 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. PMID: 2488680
6. Bista M, KC T, Regmi D, Maharjan M, Kafle P, Shrestha S. Diagnostic Accuracy of Fine Needle Aspiration Cytology in Thyroid Swellings. J Nepal Health Res Counc. 2011;9(18):14-6. DOI: https://doi.org/10.33314/jnhrc.v0i0.246
7. Rizvi SAA, Husain M, Khan S, Mohsin M. A comparative study of fine needle aspiration cytology versus non-aspiration technique in thyroid lesions. The Surgeon. 2005;3(4):273-6. DOI: https://doi.org/10.1016/S1479-666X(05)80091-5
8. Mainali N, Nepal N, Choudhary PK, Homagai N, Khanal B. Aspiration and non-aspiration technique in the study of thyroid gland lesion cytology. Journal of Pathology of Nepal. 2018;8(1):1257-60. Available from: https://www.nepjol.info/index.php/JPN/issue/view/1247
9. 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. PMID: 21157549. DOI: https://doi.org/10.4103/0970-9371.70737
10. Mahajan P, Sharma PR. Fine-needle aspiration versus non aspiration technique of cytodiagnosis in thyroid lesions. JK Sci. 2010;12(3):120-22. Available from: https://www.jkscience.org/list_articles.php?volume=12&issueno=3
11. Pinki P, Alok D, Ranjan A, Nanak Chand M. Fine Needle Aspiration Cytology versus Fine Needle Capillary Sampling in Cytological Diagnosis of Thyroid Lesions. Iran J Pathol. 2015;10(1):47-53. PMID: 26516325.
12. Ramachandra L, Kudva R, Rao BHA, Agrawal S. A Comparative Study of Fine Needle Aspiration Cytology (FNAC) and Fine Needle Non-aspiration Cytology (FNNAC) Technique in Lesions of Thyroid Gland. Indian J Surg. 2011;73(4):287-90. PMID: 22851843. DOI: https://doi.org/10.1007/s12262-011-0283-9
13. 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. PMID: 11843555. DOI: https://doi.org/10.1159/000326712
14. C HK, C YK. Comparative study of aspiration versus non-aspiration fine needle technique in thyroid nodule and its correlation with post-operative histopathological examination. International Surgery Journal. 2018;5(3):1046-51. DOI: http://dx.doi.org/10.18203/2349-2902.isj20180828
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(2):108-13. PMID: 19377844. DOI: https://doi.org/10.1007/s12022-009-9074-2
16. Haddadi-Nezhad S, Larijani B, Tavangar SM, Nouraei SM. Comparison of fine-needle-nonaspiration with fine-needle-aspiration technique in the cytologic studies of thyroid nodules. Endocrine Pathology. 2003;14(4):369-73. DOI: https://doi.org/10.1385/EP:14:4:369
17. Song H, Wei C, Li D, Hua K, Song J, Maskey N, et al. Comparison of fine needle aspiration and fine needle nonaspiration cytology of thyroid nodules: A meta-analysis. Bio Med Res Int. 2015;2015:796120. PMID: 26491689. DOI: https://doi.org/10.1155/2015/796120