A Comparative Study of Fine Needle Aspiration Cytology (FNAC) and Fine Needle Non-aspiration Cytology (FNNAC) Technique in Lesions of Thyroid Gland

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Abstract The present study was done to compare diagnostic yield by fine needle non aspiration technique (FNNAC) with Fine Needle Aspiration cytology (FNAC) of lesions in thyroid gland. FNNAC and FNAC both were performed on 69 patients presenting with thyroid lesions, except those suffering from thyrotoxicosis. Smears were then cytologically interpreted by a single pathologist as unsuitable, diagnostically adequate or diagnostically superior for opinion, without the knowledge of sampling method employed. Slides were evaluated for following aspects namely cellularity, presence of colloid, inflammatory cell, hemosiderin laden macrophages, papillary clusters nuclear overlapping, nuclear grooving, hurthle cells. FNNAC gave better results in form of better quality of cellularity and less field obscurity by blood in lesions of thyroid. Diagnostically superior specimens were obtained more frequently by FNNAC, so this technique should be used alone or in tandem with FNAC for better diagnostic yield.

Keywords FNNAC · FNAC

Introduction

Fine needle aspiration cytology (FNAC) is widely accepted as a primary method for diagnosis of thyroid lesions.

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An alternative to FNAC is fine needle sampling without aspiration (FNNAC) also called cytopuncture or fine needle capillary sampling, used first in France for breast tumors and later for peri-orbital tumors. The thyroid gland which is very vascular often yields aspirates marked admixed with blood, it has been suggested that FNNAC, by eliminating the negative pressure employed in FNAC decreases dilution of thyroid cells by blood.

In FNNAC, a similar sized needle is used as in FNAC. The needle is used with no syringe attached to it. The needle is passed through the lesion in the same way as in FNAC, but no suction is applied. The contents of the needle are then spread onto a slide and interpreted. For thyroid lesions this technique was first evaluated and compared with the conventional technique of FNAC by Santos and Leiman 1988 [1] in 50 nodular lesions.

Materials and Methods

This is a prospective study conducted on 69 patients in Department of Surgery, Kasturba Hospital, Manipal from July 2005 to June 2007.

Exclusion Criteria: Patients Suffering from Thyrotoxicosis

Thyroid swelling in every patient was sampled by both aspiration as well as non-aspiration by a single operator. To maintain consistency of results, non-aspirate was always performed before the aspirate technique and marked as slides “A” and “B” randomly to avoid bias of pathologist, that is, in some cases FNAC was marked as slides “A” and FNNAC as slides “B” and at times FNNAC was marked as slides “A” and FNAC as slides “B”.

Table 1 Number of cases and their diagnostic quality

FNNAC	FNAC		
	Diagnostically superior	Diagnostically adequate	Unsuitable
Diagnostically superior	01	07	06
Diagnostically adequate	04	39	04
Unsuitable	00	01	07

Both procedures were done using 22 or 23 gauge needle. Fine needle aspiration was performed using a 10 ml syringe, while the non-aspirate technique was done without syringe or holder. The needle held between thumb and forefinger of aspirating hand, was inserted into the nodule and moved in different directions within the nodule. The material entering the hub of the needle by capillary action was then expressed onto clean glass slides after attaching an air filled syringe to it. All smears were interpreted by a single pathologist. The pathologist was unaware of sampling method employed (FNAC/FNNAC).

Apart from diagnosis, comments were made on the quality of slides. For this, proper three qualitative categories were created. They are:

- 1) Unsuitable specimens: Consisted mainly of red blood cells or absent cellularity making them inadequate for cytodiagnosis.
- 2) Diagnostically adequate: Possible to render an opinion on nature of lesion sampled but the cellular material present was sub-optimal due to poor cellularity, sample dilution, degenerative changes, or specimen entrapment in blood clots.
- 3) Diagnostically superior: Cell aggregates were prominent, well preserved, and unobscured by background blood and cellular morphology was well displayed.

A single pathologist was requested to classify the slides as mentioned above and interpret the slides to come to a

Table 2 Comparision of diagnostic quality between FNNAC and FNAC

Results/Performance	Technique			
	FNNAC		FNAC	
	No of cases	%	No of cases	%
Diagnostic superior	14	20.3	5	7.3
Diagnostic adequate	47	68	47	68
Unsuitable	8	11.6	17	24.6

Table 3 Neoplastic

	FNNAC	FNAC
Diagnostic superior	1 (8.33%)	0
Diagnostic adequate	9 (75%)	7 (58.33%)
Unsuitable	2 (16.67%)	5 (41.67%)
Total	12	12

diagnosis, so that erratic classification of slides by different pathologist is overcome.

Observations and Results

In our study the total number of patients was 69; out of which 62 were female and 7 male. The number of cases confirmed with histopathology reports were 44 (Tables 1, 2, 3 and 4)

Interpretations

1. Number of cases found to be diagnostically superior by FNNAC were 14/69 (20.3%).
2. Number of cases found to be diagnostically superior by FNAC were 5/69 (7.3%).
3. There were 6/69 (8.69%) cases found to be diagnostically superior by FNNAC but unsuitable for diagnosis by FNAC. However, there was no case in which FNNAC was unsuitable and FNAC was diagnostically superior.
4. Number of cases found to be diagnostically unsuitable by FNAC was 17/69 (24.6%).
5. Number of cases found to be diagnostically unsuitable by FNNAC was 8/69 (11.6%).
6. Number of cases found to be diagnostically adequate by both FNAC and FNNAC were equal 39/69 (56.5%).
7. However, both FNAC and FNNAC had similar diagnostic ability in 47/69 (68%), out of which, 1 case was diagnostically superior by both. 39 cases were diagnostically adequate and 7 were unsuitable by both methods.

Table 4 Benign

	FNNAC	FNAC
Diagnostic superior	6 (18.76%)	2 (6.25%)
Diagnostic adequate	23 (71.87%)	24 (75%)
Unsuitable	3 (9.37%)	6 (18.76%)
Total	32	32

Table 5 Comparison of various studies

	Study	Authors	No of cases	Organ	A	B	C
<i>A</i> Aspirate superior to non-aspirate	I	Jayaram G (1991) [10]	220	Thyroid			
				a) Nodular (94)	48%	2%	50%
				b) Diffuse			
				(i) Soft (54)	0	0	100%
<i>B</i> Nonaspirate superior to aspirate	II	Santos & Leiman (1988) [4]	50	Thyroid	8%	44%	48%
	III	Present study (2007)	69	Thyroid	7%	25%	68%
<i>C</i> Nonaspirate = aspirate							

8. In 17/69 cases (25%), FNNAC had better diagnostic ability over FNAC, 7 cases were diagnostically superior by FNNAC but diagnostically adequate by FNAC, 6 cases were diagnostically superior by FNNAC but unsuitable by FNAC, 4 cases were diagnostically adequate by FNNAC but unsuitable by FNAC.
9. In 5/69 cases (7%), FNAC had better diagnostic ability over FNNAC, 4 cases were diagnostically superior by FNAC but diagnostically adequate by FNNAC, 1 case was diagnostically adequate by FNAC but unsuitable by FNNAC.
10. Out of 69 cases, 44 cases were correlated with final histopathology report.
11. Out of 44 cases, 12 cases were neoplastic and 32 cases were benign.
12. In both neoplastic and benign group, the diagnostic ability of FNNAC was better than FNAC.
13. Using Mc Nemar study, *p* value is 0.035, which is statistically significant.

Discussion

The usefulness of FNAC diagnosis in the assessment of palpable and non-palpable masses has been documented worldwide. In 1930, Martin and Ellis [1], first presented a tumor diagnosis by needle aspiration, termed aspiration biopsy. Franzen et al. in 1955 introduced a special syringe holder and thus improved the technique (Kate et al. 1998) [2]. Zajdela et al. 1987, [3] documented their experience of FNNAC in breast lumps. They studied a large series of mammary tumors in order to compare the results of FNAC

with those of FNNAC. However, since FNAC was employed for the diagnosis of all their study cases prior to 1981, while FNNAC was used for those presenting later. The two techniques were performed on neither the same tumor nor the same patient population.

Santos and Leiman (1988) [4] performed a more exhaustive comparative analysis using both FNAC and FNNAC sampling on 50 thyroid lesions. In their study, diagnostically superior material was obtained in 22 (44%) of the non-aspiration samples versus 4 (8%) of aspiration samples and this difference was statistically significant ($P=0.0033$). (Tables 5 and 6)

With FNNAC, more precise entry into the mass was possible and this is particularly important in location, like orbit and thyroid, to avoid injury to the eyeball and trachea (Rajshekhar et al., 1991) [5]. However, Mair et al., 1989, did not find the needle syringe combination hindering in anyway once the mass was well localized. Although, both methods use syringe and needle, the function of syringe is different. In FNNAC the syringe is used to express the material after the procedure is completed. Whereas, in FNAC it used to create a suction force to aspirate cells into the needle and syringe (Rajshekhar et al. 1991). A separate sterile syringe is not required for FNNAC as it is only required to provide pressure to express the material. In centers where a large number of cytologies are carried out this could also mean a financial saving on syringes. The patient is also less apprehensive when the large syringe and holder are not seen (Kumarsinghe and Sheriffdeen 1995) [6]. FNNAC is likely to produce less haemorrhage as cellular yield depends on capillary action and not on negative suction (Dey and Ray 1993) [7]. This technique is believed to draw material into the needle due to scraping

Table 6 Comparison of various studies

			FNNAC			FNAC		
			DS	DA	U	DS	DA	U
<i>DS</i> Diagnostically superior	Santos & Leiman (1988) [4]	50	22	25	3	4	39	7
<i>DA</i> Diagnostically adequate	Rizvi et al. (2005) [9]	150	67	80	3	30	110	10
<i>U</i> Unsuitable	Present study (2007)	69	14	47	8	5	47	17

or cutting effect of the oblique needle tip enhancing the tissue. The capillary pressure within the needle holds the scraped cells within the lumen of the needle. Unlike the classical FNAC, no negative pressure is created within the syringe and so blood in the sample and cell distortion are considerably less (Kumarsinghe and Sherifdeen, 1995). Application of only FNNAC reduced blood contamination of the material, thereby minimizing the artifacts. It causes least damage to the tissues. Excessive blood can also cause artifacts rendering the interpretation difficult. There is also a possibility of losing the cells trapped in the clot (Rajshekhar et al. 1991). However, lack of dilution of cellular material by blood, although preferable in some cases may cause difficulty in spreading a heavily cellular sample on the slide, thus resulting in a thick smear. It has been suggested that delaying the withdrawal of needle from the lesion until a small amount of blood is visible in the hub of the needle can alleviate this problem. This assures the proper proportion of cellular material and blood in the sample (Akhtar et al.) [8].

In the present study the cellular yield in the thyroid lesions was higher for FNNAC as compared to FNAC. We tried to overcome the pitfalls of other studies by performing both procedures (FNAC/FNNAC) on the same patient by the single individual and evaluating the slides by the single pathologist.

Our study was designed as a comparative evaluation of FNNAC and FNAC for thyroid lesions. The thyroid gland was selected for the non-aspiration technique, as it is a vascular organ that frequently produces heavily blood stained aspirates. However, many diagnostic pitfalls exist in the interpretation of thyroid specimens, making excellence of cellular material prerequisite for diagnosis.

In our study, the pathologist was unaware of the sampling method employed (FNAC/FNNAC) for any particular set of slides to avoid individual bias.

It was observed that FNNAC (Tables 1, 2, 3, 4, 5 and 6) yielded more diagnostically better specimens as compared with FNAC. The number of unsuitable smears was also

greater in FNAC. Similar to our study Rizvi [9] et al., 2005, observed statistically significant difference in favour of FNNAC.

Conclusion

FNNAC is a simple, easy to perform, and produces better results in the form of better quality of cellularity and less field obscuration by blood in lesions of the thyroid. This technique should be used alone or in tandem with FNAC for better diagnostic yield.

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