

# Diagnostic Accuracy Of Fine-Needle Aspiration Cytology Versus Frozen Section In Solitary Thyroid Nodules

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## Abstract

Aim:

The purpose of the study was to assess the role of frozen section (FS) in surgical management of solitary thyroid nodules, in the presence of adequate fine-needle aspiration cytology (FNAC).

Methods:

FNAC and FS were evaluated in 64 patients who had surgery for a non-toxic solitary thyroid nodule. FNAC was classified as negative, positive and others. Frozen section was classified as benign, deferred and malignant. Accuracy of FNAC and FS were assessed by definitive histological section as reference. Sensitivity, specificity, positive predictive value and negative predictive value were calculated for both FS and FNAC.

Results:

Out of 64 patients, 12 were positive for malignancy, 49 were benign and 3 were "others" in FNAC. Over all accuracy was 89%. Thirteen were positive, 49 were benign and 2 were "deferred" in frozen section. Over all accuracy was 96%.

Conclusion:

Frozen section evaluation remains useful and complementary to FNAC in surgical management of solitary thyroid nodules. FNAC can be used primarily to select patients for surgery. Frozen section can be employed to plan the extent of surgery, a role requiring high specificity. In our study, frozen section had a good sensitivity, specificity, positive predictive value and negative predictive value.

## AIM

The aim of the study was to assess the role of frozen section in surgical management of solitary thyroid nodules, in the presence of adequate fine needle aspiration cytology.

## INTRODUCTION

Solitary nodules of the thyroid gland are extremely common. A small percentage of these nodules are malignant. Existing clinical and investigative methods prove to be poor preoperative predictors of malignancy. Traditionally, any suspicious nodule of the thyroid gland is subjected to an ipsilateral hemithyroidectomy followed by intraoperative frozen section to determine the extent of subsequent surgery.

This technique, however, is not infallible. False positive diagnoses can lead to unnecessary resections and complications, false negative and indeterminate diagnosis can lead to incomplete resection and necessitate reexploration and resection.<sup>1</sup>

Preoperative fine-needle aspiration cytology (FNAC) of the nodules has currently become the most widely used technique to select patients for thyroidectomy. It is an accurate predictor of malignancy and significantly reduces surgery in benign conditions.<sup>2</sup>

This study compares fine needle aspiration cytology and frozen section to final histopathologic diagnosis.

## MATERIAL AND METHODS

All patients admitted to Kasturba Medical College, Manipal with a clinical diagnosis of a non-toxic solitary nodule from August 2001 to April 2006 were included in the study, irrespective of age and sex.

Initial evaluation included a detailed history and clinical examination. A thyroid function test was done for all patients. Patients in whom ultrasonography and Radioiodine scan were suspicious of malignancy were excluded from our series. Patient's then underwent a FNAC.

Patients were then classified on the basis of their FNAC report as follows:

Negative:

Benign cyst  
Papillary Adenoma  
Colloid nodule  
Thyroiditis – with absence of atypical follicular cells

Borderline:

Atypical follicular cells  
Suspicious papillary formation  
Follicular adenoma

Positive:

Malignant cells seen

Indications for surgery included:

1. Cytological diagnosis of malignancy
2. Indeterminate FNAC reports
3. Cosmetic reasons
4. Progressive growth
5. Compressive symptoms

Patients were subjected to a hemithyroidectomy followed by frozen section. The extent of further surgery was determined by the frozen section report. Only patients in whom FNAC and frozen section were done were included in the study.

Frozen section reports were classified as:

Benign  
Deferred or indeterminate  
Malignant

Histological sections assessed the accuracy of FNAC and frozen section. Sensitivity, specificity, positive predictive value and negative predictive value were calculated for both FNAC and frozen section and compared.

## RESULTS

A total of 64 cases with clinical diagnosis of a non-toxic solitary thyroid nodule and who underwent both FNAC and frozen section were included in the series.

### SEX

A total of 46 patients (71%) were females and 18 (29%) were males [ref. fig. 1], [table1]. There is a significant female preponderance in our series, which compares favorable with other studies.<sup>3,4</sup>

### AGE

The youngest patient was 20 years old and the oldest patient was 73 years.

The highest incidence of a solitary nodule in our series was observed in the 4<sup>th</sup> decade of life i.e. in 25 patients.

### Figure 1

Table 1: Age and sex incidence

Age	Male	Female	Total	Percentage
20-30	4	8	12	19
31-40	6	19	25	39
41-50	1	16	17	27
51-60	4	2	6	9
61-70	2	1	3	4.5
71-80	1	0	1	1.5
Total	18	46	64	100

## SURGERY

All the patients underwent a hemithyroidectomy and frozen section. The extent of further surgery was carried out based on the report of the frozen section. The commonest surgery done was hemithyroidectomy in 49 cases (77%).

Total thyroidectomy was done in 13 patients (20%). Completion thyroidectomy was done in 2 cases (3%) as the report of frozen section was indeterminate and later reports proved malignancy. There was no perioperative mortality and no major postoperative complication.

## FINAL HISTOPATHOLOGICAL DIAGNOSIS

Benign lesions were found in 49 cases (77%), the

commonest being the adenomatous nodule with 32 cases (50%). Malignancy was found in 15 of the cases (23%). Papillary carcinoma was the commonest malignancy. The incidence of malignancy in our series is comparable to other studies, which report similar incidences.<sup>5,6,7</sup>

**Figure 2**

Table 2: Histological diagnosis

Diagnosis	No. of patients	Percentage
Adenomatous nodule	32	50
Hashimoto's thyroiditis	4	6
Follicular lesion	7	10.5
Hurthle cell adenoma	6	9
Papillary carcinoma	14	23
Follicular carcinoma	1	1.5

## FNAC ANALYSIS

A definitive cytological diagnosis was obtained in 61 of the cases (95%). Forty-nine of these were benign, 12 were malignant. The remaining 3 cases were indeterminate on FNAC. Following histological assessment one of the 3 cases proved to be a malignant nodule (follicular variant of papillary carcinoma). The other 2 returned as benign.

Of the 49 cases, which were reported as benign on FNAC, 45 cases (92%) were confirmed as benign on final histopathological diagnosis. The remaining 4 cases (false negative cases, 9%) histologically were papillary carcinoma of the thyroid.

Of 12 samples that were considered malignant, only 10 (83%) turned out to be malignant; all of them were papillary carcinoma. Two samples (17%) which were considered malignant turned out to be benign lesions on final histological diagnosis. Other studies have reported similar results.<sup>8,9</sup>

**Figure 3**

Table 3: Comparison of FNAC vs. final histological diagnosis

FNAC	NO.	Final histological diagnosis	
		Malignant	Benign
Positive	12	10	2
Indeterminate	3	1	2
Negative	49	4	45
Total	64	15	49

## FROZEN SECTION ANALYSIS

Frozen section evaluation suggested that 49 lesions were benign and this was confirmed histologically in 48 cases (98%), while one lesion (2%) was subsequently recognized as papillary carcinoma and this patient underwent second operation. In two cases (31%) the intraoperative diagnosis was deferred to definitive evaluation. In one case, it proved to be benign lesion (follicular adenoma) and in the other one, it was malignant (follicular carcinoma). This patient underwent second operation. Thirteen samples which were considered malignant on frozen section all were confirmed malignant on final histological diagnosis; there were no false positive cases. Other studies have reported similar results.<sup>9,10</sup>

**Figure 4**

Table 4: Comparison of frozen section vs. final histological diagnosis

Frozen section	NO.	Final histological diagnosis	
		Malignant	Benign
Positive	13	13	0
Indeterminate	2	1	1
Negative	49	1	48
Total	64	15	49

## STATISTICAL EVALUATION

For statistical evaluation of FNAC the classification of "others" (atypical cells) was included in the benign group, because of the effect on the surgical decision. In FNAC there were 2 false positive cases, 10 true positive cases, 5 false negative cases and 47 true negative cases. For statistical evaluation of frozen section, the deferred samples were classified in the benign group. In FS, there were NO false positive cases, 13 true positive cases, 2 false negative cases and 49 true negative ones.

Sensitivity was 66% for FNAC and 86% for FS, specificity 95% for FNAC and 100% for FS, positive predictive value 83% for FNAC and 100% for FS and negative predictive value 90% for FNAC and 96% for FS. Accuracy was 89% for FNAC and 96% for FS. Accuracy was higher for FS than for FNAC in surgical management of the solitary thyroid nodule, comparable with other reported series.<sup>8,9,10</sup>

**Figure 5**

Table 5: Comparison of Fine-Needle Aspiration Cytology (FNAC) with Frozen Section (FS) (all values expressed as percentages)

Parameters	FNAC	FS
Sensitivity	66	86
Specificity	95	100
Positive predictive value	83	100
Negative predictive value	90	96
Accuracy	89	96

## DISCUSSION

The use of FS is an important adjunct to the operative management of many forms of cancer. The economic impact of the introduction of routine preoperative FNAC in the management of the solitary thyroid nodule was illustrated by investigations from the Mayo clinic that reported that FNAC reduced the number of patients requiring surgery from 67 to 43% and increased the proportion of surgically proven cancers from 14 to 29%.<sup>11</sup>

In our study FS is considered to be more sensitive, specific and accurate in diagnosis of the solitary thyroid nodule. FNAC is good for selecting patients who need surgery but low specificity and accuracy do not permit adequate planning of the extent of surgery.

FS had high specificity (100%) and led to a reduction in the number of late re-operation. Had the surgical decision been based on FNAC only, 5 patients would have required second operation and 2 patients would have undergone extensive surgery for a benign lesion. As frozen section was done, only 2 patients required a second operation and extensive surgery was also avoided in 2 patients. The specificity of FS is 100% as there were no false positives. Only in 2 cases FS was deferred, one was follicular carcinoma and the other one was follicular adenoma on final histological diagnosis.

There was also another case reported benign in frozen section with the final histological diagnosis of papillary carcinoma. Only these two cases required second operations. As an adequate number of follicular carcinoma cases were not available, it is not possible to comment on them. Accuracy of frozen section was 96% (higher than for FNAC with 89%). Other series have reported comparable results.<sup>1,2,8,9,10</sup>

## CONCLUSIONS

Frozen section evaluation remains useful and complementary to FNAC in surgical management of solitary thyroid nodules. FNAC can be used primarily to select patient for surgery. Frozen section can be employed to plan the extent of surgery, a role requiring high specificity. In our study, frozen section had a good sensitivity, specificity, positive and negative predictive value.

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