

ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF FINE NEEDLE ASPIRATION OF THYROID NODULE VERSES BIOPSY IN THYROID LESIONS

Inamullah Khan, Salma Naz, Zahid Mehmood Akhter*, Nasir Aziz

Department of Pathology, Abbottabad International Medical College, Abbottabad, *King Edward Medical University, Lahore, Pakistan

Background: FNA biopsy of thyroid is a rapid, minimally invasive, and cost effective first line procedure in the evaluation of thyroid nodule. This study was conducted to evaluate the cytological accuracy, sensitivity and specificity of fine needle aspiration (FNA) of solitary thyroid nodules in correlation with post-surgical histological findings. **Methods:** This retrospective study was carried out at Department of Pathology, Abbottabad International Medical College, Abbottabad from January 2009 to December 2010. A total of 81 patients with clinically palpable solitary thyroid nodule were included in the study. Thyroid function tests were initially performed followed by FNA of thyroid nodules later operated and histopathological examination was conducted on the excised nodules. FNA diagnoses were correlated with the histological findings. The accuracy, sensitivity and specificity of the procedure were determined. **Results:** Out of 81 cases, 5 (6.2%) were unsatisfactory and 76 cases were satisfactory for cytological evaluation. Cyto-histopathological correlation was carried out for these cases. The study showed a diagnostic accuracy of 93% with sensitivity and specificity rates of 75% and 96% respectively. Positive predictive value is 81% and negative predictive value is 95%. **Conclusion:** Fine needle aspiration (FNA) has evolved as an accurate and sensitive diagnostic tool for the initial screening of patients with thyroid nodules, and has reduced the need for unnecessary surgery.

Keywords: Thyroid nodule, TSH, fine needle aspiration (FNA)

INTRODUCTION

Palpable thyroid nodule is a common reason for seeking medical advice all over the world. It occurs in 4–7% of the population, but nodules found incidentally on thyroid ultrasound suggest a prevalence of 19–67%.¹ The majority of thyroid nodules are asymptomatic, and they are four times more common in women than men.² The incidence increase with age, history of radiation exposure, and diet containing goitrogenic material.³ The majority of these thyroid nodules are benign with only a fraction representing malignant disease which accounts for approximately 1.1% of all cancer annually.⁴

Neoplasms of thyroid have a wide spectrum of phenotype, which range from benign follicular lesions to violently anaplastic cancer.⁵ Total thyroidectomy is considered the preferable initial surgical approach for thyroid cancers.⁶ The overall morbidity of total thyroidectomy includes temporary hypocalcaemia (1%), temporary recurrent nerve palsy (3%), permanent recurrent nerve palsy (1%), haemorrhage (3%), tracheomalacia (5%), and wound infection in (3%).⁵

The large number of benign thyroid nodules relative to the small number of malignant ones creates a clinical dilemma –how to manage patients with a detectable thyroid enlargement that statistically is more likely to be benign? Over the past three decades, FNA has developed as the most accurate and cost effective initial method for evaluating thyroid nodules.⁷

FNA biopsy of thyroid is a rapid, minimally invasive, and cost effective first line procedure in the evaluation of thyroid nodule.⁸ The main goal of thyroid

FNA is to distinguish nodules that require surgery from those that do not, thereby decreasing the number of diagnostic surgical procedures.⁹ This study was conducted to evaluate the diagnostic cytological accuracy of FNA of solitary thyroid nodules in correlation with post surgical histological findings.

PATIENTS AND METHODS

This retrospective study was performed at Department of Pathology, Abbottabad International Medical College, Abbottabad, over a period of 2 years from January 2009 to December 2010. The study included 81 patients with clinically palpable solitary thyroid nodules. Thyroid function test including free thyroxine, free tri-iodothyronine, and thyroid stimulating hormone were initially performed followed by FNA of thyroid nodules performed by pathologists. The aspiration technique was the standard one described in literature.¹⁰ Thyroid nodules were examined clinically to note their mobility, consistency and size. Cervical lymph nodes were palpated for any enlargement. Aspiration was performed under negative pressure using a disposable 23 gauge needle attached to a 5 ml syringe. Direct smears were prepared from the aspirated material. In cases of cystic lesions, the cyst contents were evacuated and smears were prepared from the cyst fluid and re-aspiration was performed if any solid mass palpable.

At least two smear were fixed with alcohol and two air dried. Alcohol fixed smears were stained by Papanicolaou method while the air dried smears were stained by May-Grunwald-Giemsa technique. All the

smears were screened and reported by pathologists. The cytology smear were interpreted according to the criteria described by Orell¹⁰, Ramzy¹¹, and Cibas and Ducatman¹².

Smear which contained no diagnostic cellular material or were heavily blood stained were considered unsatisfactory for cytological evaluation. The cytological diagnosis was classified as benign (goitre, Graves disease, colloid cyst and Hashimoto's thyroiditis), inconclusive (follicular neoplasm and Hurthle cell tumours) and malignant (papillary carcinoma, medullary carcinoma)

A total of 81 patients underwent thyroid surgery, 50 had hemi thyroidectomy and 31 total thyroidectomy. Postoperative histopathological reports of the cases were collected. The final histopathological diagnosis was then compared with the corresponding cytological diagnosis and Cyto-histopathological correlations were established. Sensitivity and specificity were calculated using standard statistical formulas.¹³

Cases with cytological diagnosis of follicular neoplasm and Hurthle cell tumours were regarded as inconclusive because it is not possible to differentiate follicular adenoma (benign) from follicular carcinoma (malignant) based on cytological assessment only. Hence, those cases were not included for statistical analyses (sensitivity, specificity, positive and negative predictive values and diagnostic accuracy). Unsatisfactory cases were also excluded from calculation.

Those cases which were found to be malignant by cytology as well as by histology were labelled as True Positive (TP). False positive (FP) were those diagnosed as malignant on cytology and turned to be benign on histology. True negative (TN) were benign on both cytology and histology. False negative (FN) were negative on cytology but positive for malignancy on histology. The diagnostic accuracy was calculated as:¹³

$$\frac{(TP+TN)}{(TP+FP+TN+FN)}$$

RESULT

In this study, 81 patients who presented with enlarged thyroid nodule underwent FNA. Satisfactory aspirates were obtained in 76 patients, in which 13 (17.0%) were male and 53 (83.0%) female. Age of population studied ranged between 17 to 88 years with a median of 45 years. Female to male ratio was 1:4.

Seven (8%) patients had low TSH levels and were considered hyperthyroid. Eight (9%) patients had increased TSH level and were considered hypothyroid. Sixty-six (81%) patients had normal TSH levels and were considered euthyroid.

In five (6.2%) cases the smears were considered as inadequate thus excluded from cytological evaluation. From the remaining 76 cases, 62 (81%) were classified as benign, 11 (14%) malignant and 3 (3.9%)

were inconclusive on cytology. Out of these 76 cases, 3 (3.7%) were regarded as inconclusive; hence they were also not included in the calculation.

In 73 patients, 59 (80%) had benign cytological finding by FNA, which were also confirmed as benign by histopathological examination, representing true negative cases.

There were 3 (4%) false negative cases which were diagnosed as benign upon FNA cytological but turned out to be papillary carcinoma after histopathological examination.

Out of 73 patients, 9 (12.3%) were diagnosed as malignant on FNA cytology as well as on histopathological examination, thus considered as true positive cases.

There were 2 (2.7%) false positive cases, which were cytologically diagnosed as papillary carcinoma but turned out to be goitre upon histopathological examination.

Table-1: Cytological and histopathological diagnoses

FNA Cytology	Histopathology	
	Benign	Malignant
Benign	59 (80%) (TN)	3 (4%) (FN)
Malignant	2 (2.7%) (TN)	9 (12.3%) (TP)

Sensitivity rate for thyroid FNA was 75% and specificity rate was 96%. Positive predictive value was 81% and negative predictive value was 95%. Diagnostic accuracy of FNA was calculated as 93%.

DISCUSSION

Thyroid nodules are common, occurring in 4–7% of the population.¹⁴ Women are affected more commonly than men. Excising all thyroid nodules is impractical, as most thyroid nodules are benign and thyroid surgery is not without risks. An effective screening test is therefore needed to identify patients who require surgery.

Fine needle aspiration cytology has been advocated as the 1st investigation of choice when assessing thyroid nodules.¹⁵ The procedure is relatively simple and cheap, and can be performed in a doctor's office with relatively few complications. The effectiveness of FNA cytology in the assessment of thyroid nodules is well documented and the technique can reduce the percentage of people requiring surgery for a non-neoplastic lesion-from 40% to 3% of the screened population.¹⁶

For thyroid FNA cytology to be clinically useful, a satisfactory sample must be obtained. Smears from thyroid aspirates are considered satisfactory when the material is representative of the lesion, adequate in quantity and the cytopreparation is excellent. Our unsatisfactory rate is 6.2%, which is in favour with previous study conducted by IAEL Hag *et al*, who found inadequate thyroid FNA smears reported to be 2.3%.¹⁷

In this study, we obtained a sensitivity rate of 75% and specificity rate of 96%, which gives a diagnostic accuracy of 93%. Our results are comparable with the studies conducted by Sanggali *et al*, and Vojvodich *et al*, which reported sensitivity rates between 65% to 98%, specificity rates between 72% to 100%, and diagnostic accuracy rates between 70% to 90%.¹⁸⁻¹⁹ A study conducted by Nurismah M *et al* on fine needle aspiration (FNA) cytology of the thyroid: A cyto-histopathological study of 361 cases in hospital University Kebangsaan Malaysia in 2007, and obtained a sensitivity rate of 87.7% and specificity rate of 98.4%, which gives a diagnostic accuracy of 96.2%.¹³ Our study supported these studies.

A study was published by El Hag *et al* in 2003. They basically checked the role of FNA in initial management of thyroid lesions. They found sensitivity of 85.7%, specificity of 97.6%, with overall accuracy of 94%.¹⁷ Another study conducted by Yeoh in 1999 analysed the diagnostic value of fine needle aspiration cytology in the assessment of thyroid nodules. They found 56% sensitivity, 90% specificity, and 79% diagnostic accuracy.²⁰ Our results are comparable with these studies.

Our false negative rate was 4%, which is in agreement with the other studies like Sanggali *et al*¹⁸ who reported false negative rate as 1–11%, and Nurismah *et al*¹³ reported false negative rates to be 3.2%. Our false positive cases giving a rate of 2.7% which is in agreement to previous rates calculated by Nurismah *et al*¹³ and Suresh *et al*²¹, who found false positive rates to be 6.6% and 0.3–10% respectively.

Our positive predictive value in this study was 81% and is found to be the same from a previous study conducted by Yeoh who found positive predictive value to be 74%.²⁰ Negative predictive value calculated in this study was 95%, and it is found similar to study found by Yeoh as rate of 80%.²⁰

CONCLUSION

The sensitivity, specificity and diagnostic accuracy of FNA were high, thus confirming the important role of fine needle aspiration cytology as the initial diagnostic utility in management of thyroid nodules. False negativity due to sampling error may be reduced by incorporating other clinical parameters as index of suspicion of malignancy and utilising radiology-guided aspiration.

Address for Correspondence:

Dr. Inamullah Khan, Department of Pathology, Abbottabad International Medical College, Abbottabad, Pakistan.

Tel: +92-992-383188.

Email: gadwel@hotmail.com

REFERENCES

1. Welker MJ, Orliv D. Thyroid nodules. *Am Fam Physician* 2003;67:559–66.
2. Mazzaferri EL. Management of a solitary thyroid nodule. *N Engl J Med* 1993;328:553–9.
3. Amrikachi M, Ramzy I, Rubinfeld S, Wheeler TM. Accuracy of fine-needle aspiration of thyroid. *Arch Pathol Lab Med* 2001;125:484–8.
4. DeLellis RA, Lloyd RV, Heitz PU, Eng C, World Health Organization Classification of Tumors: Tumors of Endocrine Organs. Lyon: IARC Press, 2004. p. 26–7
5. Abdul-Jaber HB, Lynn J. The surgical management of thyroid cancer. *Nucl Med Commun* 2004;25:869–72.
6. Mishra A, Mishra SK. Total thyroidectomy for differentiated thyroid cancer: primary compared with completion thyroidectomy. *Eur J Surg* 2002;168:283–7.
7. Yang J, Schnadig V, Logrono R, Wasserman PG. Fine-needle aspiration of thyroid nodules: a study of 4703 patients with histologic and clinical correlations. *Cancer Cytopathol* 2007;111:306–15.
8. Neven M, Irena T, Nina D, Vlado P, Zvonko K. Diagnostic relevance of fine-needle aspiration cytology for follicular lesions of the thyroid: retrospective study. *CMJ* 2002;43:606–9.
9. Gharib H, Goellner JR. Fine-needle aspiration biopsy of the thyroid. *Ann Intern Med* 1993;118:282–9.
10. Orell SR, Sterrett GF, Walters MN, Whitaker D (Editors). Head and neck. In: *Manual and Atlas of fine needle aspiration cytology*. 3rd Ed. London: Elsevier Science Limited; 1999. p. 110–44.
11. Ramzy I (Editor). *Clinical cytopathology and aspiration biopsy*. In: *Fundamental principles and practice*. Second edition. Hong Kong: The McGraw-Hill; 2001. P361–87.
12. Cibas E, Ducatman BS. *Cytology: Diagnostic principles and clinical correlates*. Second edition. UK: Elsevier limited; 2003. p. 247–72.
13. Nurismah MI, Sharifah NA, Usama AE, Rohaizak M, Naqiyah I, Jasmi A. Fine needle aspiration cytology of thyroid: a cyto-histopathological study of 361 cases in hospital university Kebangsaan Malaysia. *Med Health* 2007;2:58–65.
14. Tunbridge WM, Evered DC, Hall R. The spectrum of thyroid disease in a community. The Wickham Survey. *Clin Endocrinol* 1997;7:481–93.
15. Orel SR, Sterrett GF, Walters MN, Whitaker D. (Editors). The thyroid gland. In: *Manual and atlas of fine needle aspiration cytology*. Edinburgh: Churchill Livingstone; 1992:96.
16. Kendall CH. Fine needle aspiration of thyroid nodules: three years experience. *J Clin Pathol* 1989;42:23–7.
17. El Hag IA, Kollur SM, Chiedozi CL. The role of FNA in initial management of thyroid lesions: 7 year experience in a district general hospital. *Cytopathology* 2003;14:126–30.
18. Sanggali G, Serio C, Zampatti M, Lomuscio BG. Fine needle aspiration cytology of thyroid: a comparison of 5469 cytological and final histological diagnosis. *Cytopathology*. 2006;17:245–50.
19. Vojvodich SM, Ballagh RH, Howard HC. Accuracy of fine needle aspiration in the preoperative diagnosis of thyroid neoplasia. *J Otolaryngol* 1994;23:360–5.
20. Yeoh GPS, Chan KW. The diagnostic value of fine needle aspiration cytology in the assessment of thyroid nodules: a retrospective 5 year analysis. *Hong Kong Med J* 1999;5:140–4.
21. Suresh R, Shenovi M, Nisha SN, Roque GWP, Suzette M. Role of fine needle aspiration cytology as the initial modality in the investigation of thyroid lesions. *Acta Cytologica* 1995;39:898–904.