ORIGINAL RESEARCH PAPER
VOLUME-6 | ISSUE-6 | JUNE-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

Diagnostic accuracy of fine needle aspiration cytology and ultrasonography in detecting thyroid malignancy

Oncology

Dr. Abhinav Sharma Junior Resident Department of Otorhinolaryngology1 & Pathology2 Himalayan Institute of Medical Sciences Swami Rama Himalayan University, Jolly-grant, Doiwala Dehrdun 248140 (Uttarakhand) INDIA

Dr. Sampan Singh Bist Professor & Head Department of Otorhinolaryngology1 & Pathology2 Himalayan Institute of Medical Sciences Swami Rama Himalayan University, Jolly-grant, Doiwala Dehrdun 248140 (Uttarakhand) INDIA

Dr.Bhartendu Bharti Assistant Professor Department of Otorhinolaryngology1 & Pathology2 Himalayan Institute of Medical Sciences Swami Rama Himalayan University, Jolly-grant, Doiwala Dehrdun 248140 (Uttarakhand) INDIA

Dr. Smita Chandra Assistant Professor Department of Otorhinolaryngology1 & Pathology2 Himalayan Institute of Medical Sciences Swami Rama Himalayan University, Jolly-grant, Doiwala Dehrdun 248140 (Uttarakhand) INDIA

ABSTRACT

Introduction: Fine needle aspiration cytology is considered as a reliable investigation for evaluation of thyroid swelling to differentiate between benign and malignant lesion. Ultrasonography findings, such as echogenicity, size, composition, microcalcifications and vascularity pattern, have been found to be associated with malignancy.

Objective: The aim of this study was to evaluate the validity and reliability of Fine needle aspiration cytology and ultrasonography in patients with thyroid swelling.

Results: In present study, out of the 125 patients, Cytology diagnosed neoplasm in 14 (11.2%) patients. After excluding these patients the sensitivity of cytology in detecting malignancy in the remaining 114 (88.8%) patients was 25%, specificity was 98.83%. and p- value was 0.0001, which was statistically significant. The sensitivity of ultrasonography was statistically significant for size, vascularity and microcalcification while not significant for echogenicity and composition.

Conclusion: It was concluded a combination of various diagnostic modalities, rather than any single modality, will give optimal results and final diagnosis can be made on histopathological examination only.

KEYWORDS:

Fine needle aspiration cytology, ultrasonography, neoplasm.

INTRODUCTION

Thyroid nodules are extraordinarily common. The majority of thyroid nodules are asymptomatic. Palpable thyroid nodules occur in 4 to 7 percent of the population, but nodules found incidentally on ultrasonography (USG) suggest a prevalence of 19 to 67 percent (1). Thyroid cancer is the most common endocrine tumor and represents 1% of total human neoplasias and its annual incidence is estimated worldwide from 0.5 to 10 in 100,000 subjects in the world population (2). The presence of thyroid swelling causes concern to both patients and surgeon as far as the diagnosis and treatment in form of conservative or type of thyroidectomy is concerned. The goal of diagnostic workup is to select those patients for thyroidectomy who have a high likelihood of harboring malignancy in the nodule. At one extreme, the diagnosis of malignancy may be strongly suspected on clinical grounds and such patients generally require open exploration. On the other hand, one finds many patients in whom the history and clinical findings are not so conclusive. Many investigations are used to differentiate between benign and malignant nodules so as to avoid surgery in those who do not need it. Among these Fine needle aspiration cytology (FNAC) and USG are commonly used in association with clinical features but there are drawbacks of each technique and the final answer to the problem is still elusive. The aim of this study was to evaluate the validity and reliability of FNAC and USG in patients with thyroid swelling.

MATERIALS AND METHODS

This study was conducted in the Department of Otorhinolaryngology, in a tertiary care postgraduate teaching hospital over a period of 24 months from May 2014 to April 2016. Inclusion Criteria- Patients presenting to Otorhinolaryngology OPD who subsequently underwent thyroidectomy. Exclusion Criteria-History of previous thyroid surgery or radiation to head and neck. Ethics-Patients were informed of the diagnostic and therapeutic procedure that would be performed, which includes FNAC, USG, surgery and histopathological examination (HPE) of surgical specimen. Written consent was obtained from the patients in accordance with guide lines of our institutional review board and ethics committee. All the patients were evaluated by thorough clinical examination followed by investigations including thyroid profile, FNAC, USG neck and postoperative HPE. A total of 125 patients who underwent thyroidectomy were enrolled. The aspirated material from FNAC was studied microscopically after staining with May Grunewald Giemsa (MGG) stain. Bethesda system was used for reporting the FNAC. Data were analyzed with statisticas Package for the Social Sciences (SPSS) version 22 and chi-square test was used for calculating the 'p' values.

OBSERVATIONS

FNAC was done in all the patients out of which, non neoplastic lesions were present in 10 (8%) patients and 115 (92%) patients had neoplastic lesions. Neoplastic lesions were further divided into colloid goitre, neoplasm and malignant disease, which were present in 96 (76.8%), 11 (8.8%) and 8 (6.4%) patients respectively. Out of the 11 patients with neoplasm, 2 (1.6%) patients had hurthle cell neoplasm and 9 (7.2%) patients had follicular neoplasm. Out of the 8 (6.4%) patients who had malignant disease, 7 (5.6%) patients had papillary carcinoma and 1 (0.8%) patient had follicular variant of papillary carcinoma. Betheseda classification system was applied, according to which, 85 (68%) patients belonged to the benign category, 8 (6.4%) patients belonged to the malignant category, while 6 (4.8%) were suspicious for malignancy. Atypia of undetermined significance was seen in 3 (2.4%) patients, follicular neoplasm was present in 11 (8.8%) patients, and 12 (9.6%) patients had a non diagnostic or unsatisfactory diagnosis and were further subjected to repeat FNAC or USG guided FNAC.

Five USG features in a thyroid nodule were studied, namely echogenicity, size, composition, microcalcification and vascularity pattern in the nodule. A nodule was considered more likely to be malignant if it was hypoechoic, more than 2 cm in size, entirely solid in composition, has a central vascularity pattern, with presence of microcalcification. Out of the 125 patients, USG revealed nodules as

hyperchoic in 71 (56.8%) patients, and hypoechoic in 54 (43.2%) patients. The size of the nodule was less than 2 cm in 43 (34.4%) patients and more than 2 cm in 82 (65.6%) patients. A total of 101 (80.8%) patients had nodules of cystic composition and 24 (19.2%) patients had nodules of entirely solid composition. Microcalcification was present in 22 (17.6%) patients and absent in 103 (82.4%) patients. Peripheral vascularity was present in 98 (78.4%) patients and central vascularity was present in 27 (21.6%) patients. All these results of FNAC and USG were compared with histopathology reports. Out of the 125 patients, non neoplastic lesions were present in 5 (4.0%) patients and neoplastic in 120 (96%) patients. Among these 120 (96%) patients who had neoplastic lesion, 83 (66.4%) patients had benign neoplasm and 37 (29.6%) patients had malignant neoplasm. Out of the 83 (66.4%) patients who had benign neoplasm, 31 (24.8%) patients had colloid goitre with cystic changes, 38 (30.4%) patients had multinodular goitre, 13 (10.4%) patients had follicular adenoma and only 1 (0.8%) patient had hurthle cell adenoma. Out of the 37 (29.6%) who had a malignant disease, 20 (16%) patients had follicular variant of papillary carcinoma, 13 (10.4%) patients had papillary carcinoma, 2 (1.6%) patients had follicular carcinoma, and 1 (0.8%) patient each had medullary carcinoma and non-Hodgkin's lymphoma. In present study, out of the 125 patients, FNAC diagnosed neoplasm in 14 (11.2%) patients. After excluding these patients the sensitivity of FNAC in detecting malignancy in the remaining 114 (88.8%) patients was 25%, specificity was 98.83%, negative predictive value was 79.43%, and positive predictive value was 87.5%. (Table-1) According to chi square test, p value was 0.0001, which was significant. The FNAC diagnosis was altered in 29 (23.2%) patients on final histopathological examination. Out of which, benign diagnosis on cytology was converted to malignant in 28 (22.4%) patients and 1 (0.8%) patient's malignant cytological diagnosis was converted to benign on histopathology.

Table 1: Sensitivity and specificity of FNAC in detecting malignancies (n=114)

	HPE			Total
	Malignant (n=28)	Benign (n=86)		
FNAC	Malignant (n=8)	7	1	8(7.01%)
	Benign (n=106)	21	85	106(92.99%)
Total	28 (24.5%)	86 (75.5%)	114	

With respect to echogenicity, among the 37 histopathologically malignant swellings, 21 (56.75%) patients had hypoechoic nodules, and in 88 histopathologically benign swellings, 33 (37.5%) patients had hypoechic nodules. The sensitivity of USG based on the type of echogenicity was 56.75%, specificity was 62.5%, negative predictive value was 71.42%, and positive predictive value was 38.88%. According to chi square test, p value was 0.0741, which was not statistically significant.According to our study, out of 125 patients, 82 (65.6%) patients had swelling of greater than 2 cm in size out of which, 31 (37.8%) patients had malignancy. Swelling of 2 cm or less than 2 cm in size was present in 43 (34.4%) patients out of which, 6 (13.95%) patients had malignancy. Thus in this aspect, the sensitivity of USG was 83.78%, specificity was 42.04%, negative predictive value was 86.04%, and positive predictive value was 37.8%. Chi square test was applied according to which p value was 0.0102, which was statistically significant. According to our study, out of 125 patients, 101 (80.8%) patients had cystic swellings out of which, 28 (27.72%) patients had malignancy. Solid swelling was present in 24 (19.2%) patients out of which, 9 (37.5%) patients had malignancy. Thus in this aspect, the sensitivity of USG was 24.32%, specificity was 84.95%, negative predictive value was 72.27%, and positive predictive value was 37.5%. Chi square test was applied according to which p value was 0.4030, which was not statistically significant.With respect to microcalcification, among the 37 histopathologically malignant swellings, 13 (35.13%) patients had microcalcification, and in 88 histopathologically benign swellings, 9 (10.22%) patients had microcalcifications. The sensitivity of USG based on presence of microcalcification was 35.13%, specificity was 89.77%, negative predictive value was 76.69%, and positive predictive value was 59.09%. According to chi square test, p value was 0.0021, which was statistically significant. With respect to vascularity pattern, among the 37 histopathologically malignant swellings, 16 (43.24%) patients had central vascularity, and in 88 histopathologically benign swellings, 11 (12.5%) patients had central vascularity. The sensitivity of USG based on vascularity pattern was 43.24%, specificity was 87.50%, negative predictive value was 78.57%, and positive predictive value was 59.25%.(Table-2) According to chi square test, p value was 0.0004, which was statistically significant. Among the 125 patients, the cytological and histopathological diagnosis was found to be different in 29 (23.2%) patients. Out of which, benign diagnosis on cytology was converted to malignant in 28 (22.4%) patients and 1 (0.8%) patient's malignant cytological diagnosis was converted to benign on histopathology.

Table 2- USG neck (n=125)

USG features	Number of patients	Percentage
1. Echogenicity		
Hyperechoic	71	56.8%
Hypoechoic	54	43.2%
Total	125	100%
2. Size		
Less than 2 cm	43	34.4%
More than 2 cm	82	65.6%
Total	125	100%
3. Composition		
Cystic	101	80.8%
Solid	24	19.2%
Total	125	100%
4. Microcalcification		
Absent	103	82.4%
Present	22	17.6%
Total	125	100%
5. Vascularity pattern		
Peripheral	98	78.4%
Central	27	21.6%
Total	125	100%

DISCUSSION

Unique features of thyroid gland are that it is first endocrine gland to appear in fetus, largest endocrine gland and have important physiological function in growth and development and also in calcium metabolism. There may be solitary nodule, multinodulargoiter or diffuse enlargement of thyroid gland. There might be neoplastic or non neoplastic pathology in thyroid gland. Various diagnostic protocols are preferred in different centers. After clinical evaluation, FNAC is most widely accepted test because of its cost effectiveness, availability, sensitivity, and specificity (3). Majority of thyroid nodules can be correctly diagnosed by FNAC; only follicular neoplasm and hurthle cell neoplasm cannot be identified. When the results are inconclusive or it is suspicious for malignancy, further diagnostic steps are necessary in order to decide whether surgery would be appropriate and such measures include ultrasound, radionuclide imaging, and clinical risk stratification by means of age, gender, nodule size, nodule growth rate, and previous use of neck radiation (4). Although thyroid cancers account for 90% of all endocrine malignancies, it causes only 0.4% of cancer death. Usually less than 10% of patients with thyroid nodules may have thyroid cancer (5). When FNAC results are clearly suggestive of benign lesions, one can go for conservative surgery like lobectomy and when suggestive of malignancy, total thyroidectomy is advocated. Nondiagnostic thyroid FNAC remains significant problem in taking the decision regarding management of patients regarding the management, because if lobectomy or hemithyroidectomy is done and histopathology report comes malignant, then one has to do completion thyroidectomy and radical surgery has its own disadvantages, such as hypocalcemia, tetany, hypothyroidism, and recurrent laryngeal nerve damage (6). In our study, out of 125 FNACs, non neoplastic lesions were present in 10 (8%) patients and 115 (92%) patients had neoplastic lesions. Neoplastic lesions were further divided into colloid goitre, neoplasm and malignant disease, which were present in 96 (76.8%), 11

(8.8%) and 8 (6.4%) patients respectively. Out of the 11 patients with neoplasm, 2 (1.6%) patients had hurthle cell neoplasm and 9 (7.2%) patients had follicular neoplasm. Out of the 8 (6.4%) patients who had malignant disease, 7 (5.6%) patients had papillary carcinoma and 1 (0.8%) patient had follicular variant of papillary carcinoma. On comparing with the final HPE diagnosis, non neoplastic lesions were present in 5 (4.0%) patients and neoplastic in 120 (96%) patients. Among these 120 (96%) patients who had neoplastic lesion, 83 (66.4%) patients had benign neoplasm and 37 (29.6%) patients had malignant neoplasm. Out of the 83 (66.4%) patients who had benign neoplasm, 31 (24.8%) patients had colloid goitre with cystic changes, 38 (30.4%) patients had multinodular goitre, 13 (10.4%) patients had follicular adenoma and only 1 (0.8%) patient had hurthle cell adenoma. Out of the 37 (29.6%) who had a malignant disease, 20 (16%) patients had follicular variant of papillary carcinoma, 13 (10.4%) patients had papillary carcinoma, 2 (1.6%) patients had follicular carcinoma, and 1 (0.8%) patient each had medullary carcinoma and non-Hodgkin's lymphoma. This could be attributed mainly to the fact that since our set up is a tertiary care teaching hospital there are different levels of skill, seniority and experience among reporting cytologist. Moreover all the FNACs were done without USG guidance and majority of the patients had multinodular goiter which could lead to the sampling error. A Single false positive case was detected where one patient was diagnosed as malignancy on FNAC which was reported benign on histopathology. The sensitivity and specificity of FNAC were 83.3 and 100% respectively according to Kaur K et al (7). 79 and 98.5% according to Goellner et al (8), and 12.06 and 78.4% according to Jena et al (9). The results from our study were also in parallel to these studies. According to a study on 144 patients conducted by Rahimi M et al, 66 (45.8%) patients had hypoechoic nodules and 78 (54.2%) patients had hyperechoic nodules. Out of the 14 (9.72%) patients with malignancy, 12 (85.7%) patients had hypoechoic nodules and out of the 130 (90.28%) patients, only 2 (1.53%) patients had hypoechoic nodules (10). According to the study conducted by Nilkanthan et al, on the basis of composition, USG has a sensitivity of 20% and specificity of 97.67% in detecting malignancy (11). In a study by Jena A et al, out of 146 patients, the sensitivity and specificity of USG with respect to size was 62.06% and 22.72% respectively (7). In a study by Kim B Y et al, they concluded that microcalcification were commonly associated with thyroid carcinoma (12).

CONCLUSION

It can be concluded that none of the investigations are absolutely confirmatory and a combination of investigations is usually required. The final diagnosis can be made by histopathological examination only. However, a combination of various diagnostic modalities, rather than any single modality, will give optimal results and avoid inappropriate or revision surgery in a great number of patients without missing any malignancy.

REFERENCES

1. Hegedus L, Bonnema SJ, Bennedbaek FN. Management of simple nodular goitre: current status and future perspectives. Endocrine reviews 2003; 24: 102-32.
2. Gharib H, Papini E, Paschke R. Thyroid nodules: A review of current guidelines, practices, and prospects. European Journal of Endocrinology. 2008; 159: 493-505.
3. Nggada H, Musa A, Gali B, Khalil M. Fine needle aspiration cytology of thyroid nodule(S): a Nigerian tertiary hospital experience. Int J Pathol 2006; 5 (1):214-17.
4. Welker MJ, Orlov D. Thyroid nodules. American Family Physician, 2003 Feb; 67 (3):559-73.
5. Hussain N, Anwar M. Pattern of surgically treated thyroid diseases in Karachi. Biomedica 2005; 21 (1):18-20.
6. Rehman A, Lumachi SF, Varotto L, Borsato S, et al. Usefulness of 99mTc-pertechnetate scintigraphy and fine-needle aspiration cytology in patients with solitary thyroid nodules and thyroid cancer. Anticancer Res 2004 Jul-Aug; 24(4):2531-34.
7. Kaur K, Sonkhya N, Bapna A, Mital P. A comparative study of fine needle aspiration cytology, ultrasnography and radionuclide scan in the management of solitary thyroid nodule: A prospective analysis of 50 cases. Indian Journal of Otolaryngology and Head and Neck Surgery 2002; 54(2), 96-101.
8. Kessler A, Gavriel H, Zahav S, Vaiman M, Shlamkovitch N, et al. Accuracy and consistency of fine needle aspiration biopsy in the diagnosis and management of solitary thyroid nodules. IMAJ 2005; 7, 371-73.
9. Jena A, Patnayak R, Prakash J, Alok S, Suresh V, et al. Malignancy in solitary thyroid nodule: A clinicoradiopathological evaluation. IJEM 2015; 134454.
10. Rahimi M, Farshchian N, Rezaee E, Shahebrahimi K, Madani H. To differentiate benign from malignant thyrid nodule comparison of sonography with FNAC findings. Pak J Med Sci 2013; 29(1), 77-80.
11. Nilakantan A, Venkatesh MD, Raghavan D, Datta R, Sharma V. Ultrasonography: its role in nodular thyroid disease. Indian J Otolaryngol. Head and Neck Surg. 2007; 59: 332-35.
12. Kim BY, Choi YS, Kwon HJ, Lee JS, Heo JJ, et al. Relationship between patterns of calcification in thyroid nodules and histopathlogical findings. Endocrine Journal. 2013; 60 (2): 155-60.