

## **Research Article**

### **Clinicopathological Evaluation of Neck Masses**

**Dr. Hitender Basista<sup>1\*</sup>, Dr. Amit Modwal<sup>2</sup>, Dr. Beni Prasad<sup>3</sup>**

<sup>1</sup>P. G. Resident, NIMS Medical College and Hospital, Jaipur, Rajasthan, India.

<sup>2</sup>Professor, NIMS Medical College and Hospital, Jaipur, Rajasthan, India.

<sup>3</sup>Professor & Head department of Otorhinolaryngology, NIMS Medical College and Hospital, Jaipur, Rajasthan, India.

#### **\*Corresponding author**

Dr. Hitender Basista

Email: [hitbasista@gmail.com](mailto:hitbasista@gmail.com)

---

**Abstract:** FNAC is the most cost-effective invasive pre-operative investigation, whose simplicity and safety justify its use for “selective” surgery in diagnosing different types of masses. Masses located in the head and neck most commonly originates from cervical lymph nodes, thyroid, salivary glands and other neck masses. The primary objective of the study was to assess the spectrum of head and neck masses and to determine the accuracy of FNAC in detection of various lesions in National Institute of Medical Science and Research Hospital. A prospective study was conducted between the period from December, 2013 to May, 2015 and patients willing to be a part of the study were included. The study was time period specific i.e. the patients which came to NIMS OPD during the specific time period of our study, initiated on December 2013 to May 2015. A total 55 patients were included in the study for statistical ease. All patients were clinically examined. Out of 55 cases, FNAC was done in 52 cases and rest 03 cases were thyroglossal cyst (02) & plunging ranula (01) which was diagnosed clinically & sonographically and later confirmed directly with histopath. Histopathological examination was done in all 55 cases. The results of the FNAC were compared with the tissue diagnosis obtained after surgical removal of the mass. Out of 55 patients diagnosed clinically, in 43 cases the histopathological report confirmed the FNAC diagnosis. In 12 cases, the histopathology report was different. Out of the 55 patients, 13 (23.63%) were of lymph node, 26 (47%) were of thyroid, 7 (12.72%) were of salivary gland and 09 (16.36%) were of other neck masses. Our study evaluated 55 patients and found the overall sensitivity of FNAC in the diagnosis of neck masses to be 78.03%, specificity to be 100% and accuracy 89.57%. Sensitivity was highest (85.71%) for thyroid and lowest for other neck swellings (66.66%). Fine needle aspiration cytology offers a simple method of diagnosis of neoplastic and non neoplastic lesions in the neck to confirm clinical diagnosis. It can be performed as an outpatient procedure. It is the most accurate where there is a close cooperation between clinician, cyto-pathologist and radiologist. Ultrasound guided FNAC allows samples to be taken from a more representative site and increase in accuracy. FNAC is an important tool for preoperative clinical diagnosis of non cystic neck masses with history of more than 3 months. Thus, it helps in planning the surgical management of neck masses and can be confirmed with HPE which is a “gold standard” for diagnosis. Hence we conclude that Fine needle aspiration cytology is a safe, simple and rapid method that can be done in diagnosing wide range of neck masses.

**Keywords:** Neck Masses, FNAC, HPE, Surgery

---

#### **INTRODUCTION**

In our clinical practice we encounter various types of neck swelling, the evaluation of neck mass is common clinical dilemma and condition to which an ENT clinician routinely encountered [1,2]. Commonly presenting neck masses are within lymph nodes, thyroid gland and salivary glands. Less common presenting neck masses are from thyroglossal cysts, branchial cleft cysts, carotid body tumors, cystic hygromas, pharyngeal pouch abnormalities and lumps of skin appendages.

The head and neck region encompasses a wide range of lesions especially of thyroid, lymph nodes and

salivary glands with a variety of differential diagnosis ranging from inflammatory to neoplastic. To make an accurate and effective surgical intervention, it is essential to make a pre-operative assessment of the nature of these lesions [3].

Clinically masses can be classified into congenital, acquired, infective and neoplastic. Clinically according to symptoms, signs, examination of neck & routine investigation provisional diagnosis made, which can be further confirmed with FNAC for evaluation and early management of palpable lumps in head and neck.

The use of aspiration cytology was first reported by Kun in 1847. With advent of rapid access neck lump clinics, an FNAC result is obtained quickly and in majority cases a diagnosis procured immediately pre-operatively and final diagnosis were made after histo-pathological examination.

In head & neck region, it is of great value because of the multiplicity of accessible organs and heterogeneous pathologies encountered. Masses located within the region of head and neck including salivary glands, thyroid masses & lymph node can be readily diagnosed using this technique [4]. An early differentiation of infective, benign and malignant pathology greatly influences the planned treatment.

Fine needle aspiration cytology is performed in the outpatient clinic, it can be undertaken using palpation alone, and in case of deep seated lymph node FNAC can be performed under guidance of USG & CT. It causes minimal trauma to the patient and virtually carries no risk of complication. FNAC is considered to be the "gold standard" in the selection of patients for surgery [5] while HPE is the "gold standard" for diagnosis. Any solitary or dominant thyroid nodule larger than 1 cm should have cytology done as smaller nodules carry a very low risk of morbidity.

FNAC is clearly no substitute for histopathology, especially in determination of nodal architecture in lymphoma, the malignant pattern of follicular thyroid tumor, extra capsular spread in squamous carcinoma or in the distinction of pleomorphic from monomorphic adenoma.

## METHODS

A prospective study was conducted between the period from December, 2013 to May, 2015 and patients willing to be a part of the study were included. The Study was time period specific i.e. the patients which came to NIMS OPD during the specific time period of our study, initiated on December 2013 to May 2015. A total 55 patients were included in the study for statistical ease.

## SELECTION OF PATIENTS

### Inclusion criteria:

- All patients attending ENT OPD with neck swelling of both sexes and all age group

### Exclusion criteria:

- Patient who underwent FNAC but did not undergo subsequent histopathological diagnosis.
- Suspected neck masses of vascular origin on clinical examination.
- Neck abscess or neck swelling on aspiration pus comes out.

- According to Performa, a detailed history was taken, thorough examination will be carried out and basic relevant investigations were done in all the patients to arrive at a provisional diagnosis.

All the cases of neck swellings came to our department, where fine needle aspiration biopsy was done with 21 gauge needle attached to the 20ml plastic disposable syringe. With full aseptic precaution, needle was inserted to desired depth in all cases and by pulling the piston out firmly a negative pressure is created in the syringe.

The needle moved 2-3 times in different directions with piston pulled out to maintain negative pressure. The piston released to allow the pressure to equalize and the needle was then withdrawn. Pressure was applied over the puncture site for 1-2 minutes. The aspirate was injected on to the slide from the needle.

The aspirate will be air dried and stained with Haematoxylin and Eosin and MAY-GRUNWALD-GIEMSA stain and ethyl alcohol fixed smears were stained by Papanicolaou stain and sent to department of pathology.

Then all the cases were subjected for surgery either incisional or excisional biopsy. The biopsy material was sent to the department of pathology for HPE. The cytological features of all cases were reviewed with the corresponding histopathology features.

## Study design:

A clinico-pathological study of neck masses in patients attending ENT OPD in National Institute of Medical Sciences, Jaipur.

## Statistical Methods

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. The following assumptions on data is made, Assumptions: 1. Dependent variables should be normally distributed, 2. Samples drawn from the population should be random, Cases of the samples should be independent Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. Diagnostic statistics viz. Sensitivity, Specificity, PPV, NPV and Accuracy have been computed to find the correlation of FNAC and diagnosis with HPE findings. Significant figures

+ Suggestive significance (P value: 0.05 < P < 0.10)

\* Moderately significant (P value: 0.01 < P < 0.05)

\*\* Strongly significant (P value: P< 0.01)

**Statistical software**

Data was analyzed using the Statistical Package for Social Sciences (SPSS), version 16 (SPSS Inc., Chicago IL). Using this method, variables which show a significant difference at p value: 0.05<P<0.10 were considered to be suggestive significance, p value: 0.01<P 0.05 of moderate significance and P-value: P< 0.01 as strongly significant. Microsoft word and Excel have been used to generate graphs, tables etc.

**RESULTS**

In our study the most common presenting patient was in age group was 41-50 yr. No patient encountered below 10 yr age in this study. The clinical diagnosis of the study patients of which 26 were diagnosed clinically as thyroid swellings, 13 as lymph node swellings, 7 as salivary gland swellings and 9 as other neck masses as mentioned in table 1

**Table 1: Clinical diagnosis of the study patient**

Types of clinically detected swelling	Number of patients	%
Thyroid swellings	26	47
Lymph node swellings	13	24
Salivary gland swellings	7	13
Others	9	16

The comparison of FNAC against HPE in our study out of 26 thyroid swellings, 11 were reported as colloid goiter on FNAC which was the most common presenting thyroid swelling (42%) confirmed by HPE.

- 6 cases were reported as nodular goiter on FNAC which also come same on HPE.
- 4 cases were reported as adenomatous goiter on FNAC out of these 04 cases HPE shows.

- 1 case of adenomatous goiter rest 03 cases were diagnosed as follicular adenoma (02) and nodular goiter (01).
- 05 cases of follicular neoplasm on FNAC were diagnosed as follicular adenoma (02), hyalinizing trabecular adenoma (01) & follicular carcinoma (02) on HPE.

**Table 2: Comparison of FNAC with HPE in thyroid swellings**

Comparison of FNAC with HPE			
Thyroid swelling	FNAC	HPE	Test score
Nodular goitre	6	7	P=0.037*
Colloid goitre	11	11	
Follicular adenoma	0	4	
Adenomatous goitre	4	1	
Follicular carcinoma	0	2	
Trabecular thyroid adenoma	0	1	
Follicular neoplasm	5	0	

+ Suggestive significance (P value: 0.05<P<0.10)

\* Moderately significant (P value: 0.01<P 0.05)

\*\* Strongly significant (P value: P< 0.01)

The comparison of FNAC against HPE in our study out of 07 salivary gland swellings of which 06 cases underwent FNAC and the rest 01 case was diagnosed as plunging ranula clinically & sonographically which was later confirmed as same on HPE.

FNAC of 02 cases of parotid swelling reported as pleomorphic adenoma of parotid. On HPE of these 02 swelling one was diagnosed as pleomorphic

adenoma of parotid & other confirmed as Lymphoepithelial CA of parotid. FNAC of 03 cases of submandibular swelling reported as chronic sialadenitis. On HPE of these 03 swelling two was diagnosed as same & 01 was diagnosed as Kuttner’s tumor.

FNAC of 01 case of submandibular gland reported as pleomorphic adenoma of submandibular gland and confirmed on histopathology.

**Table 3: Comparison of FNAC with HPE in salivary gland swellings**

Comparison of FNAC with HPE			
Salivary gland swellings	FNAC	HPE	Test score
chronic sialadenitis	3	2	0.07+
PA of parotid gland	2	1	
PA of submandibular gland	1	1	
kuttner's tumor	0	1	
lymphoepithelial CA of parotid gland	0	1	

The comparison of FNAC against HPE in our study of 13 lymphnode swellings and FNAC done in all cases.

- 05 cases were reported as malignant metastasis on FNAC which was all confirmed by HPE.
- 04 cases were reported as reactive lymphadenitis on FNAC out of these 03 were

same as histopathology and the rest 01 was diagnosed as TB lymphadenitis on HPE.

- 03 cases were reported as TB lymphadenitis on FNAC which also come same on HPE.
- 01 case was reported as Lympho-proliferative disease on FNAC confirmed as Hodgkin's lymphoma (nodular sclerosis) on histopath.

**Table 4: Comparison of FNAC with HPE in lymph node swelling**

Comparison of FNAC with HPE			
LYMPH NODE swelling	FNAC	HPE	Test score
Reactive lymphadenitis	4	3	p=0.077+
TB lymphadenitis	3	3	
Malignant metastasis	5	6	
Hodgkin's lymphoma (N-S)	1	1	

The comparison of FNAC against HPE in our study of 09 cases were diagnosed as other neck swelling, out of which 07 underwent FNAC and rest 02 cases were diagnosed clinically & sonographically and confirmed with histopathology. Histopathological

examination was done in all 09 cases. 03 cases diagnosed as epidermoid cyst on FNAC out of which 02 were same on HPE and 01 was confirmed as syringoma on histopathology. 04 cases diagnosed as lipoma on FNAC all were confirmed on HPE.

**Table 5: Comparison of FNAC with HPE in other neck swellings**

Comparison of FNAC with HPE in other neck swellings			
Types of swelling	FNAC	HPE	Test score
Lipoma	4	4	0.025+
Epidermoid cyst	3	2	
Syringoma	0	1	

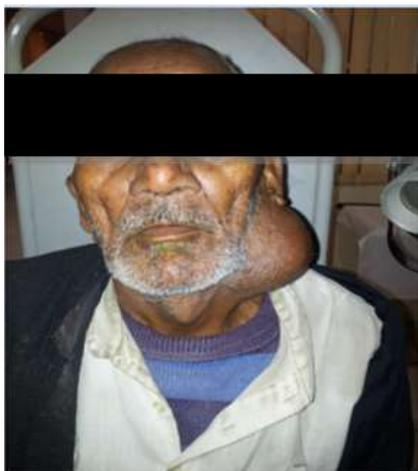
**Table 6: Sensitivity, Specificity, Accuracy, NPV, PPV of FNAC over HPE in this study.**

SWELLINGS	SENSITIVITY	SPECIFICITY	ACCURACY	PPV	NPV
Thyroid	85.71	100	96.15	100	95
Salivary Gland	75	100	85.71	100	75
Lymphnode	83.33	100	92.30	100	87.56
Other Neck Swellings	66.66	100	86.71	100	80
Average	77.37	100	89.96	100	84.32

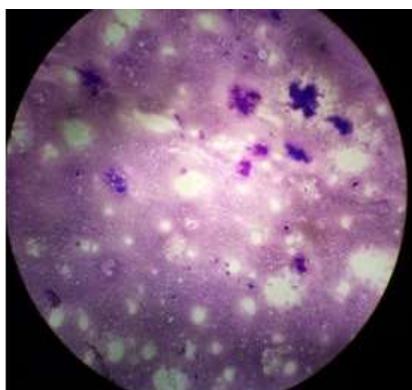
Sensitivity: 77.37, Specificity :100, PPV:100, NPV:84.32, Accuracy:89.96  
P value: 0.052 + Suggestive significance (P value: 0.05<P<0.10).

Our study evaluated 55 patients and found the overall sensitivity of FNAC in the diagnosis of neck masses to be 78.03%, specificity to be 100% and

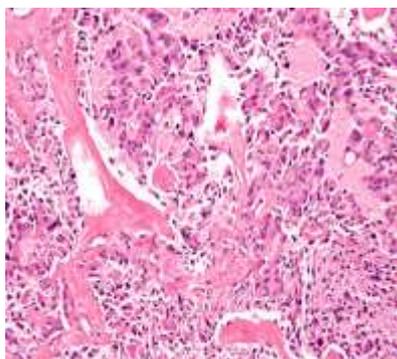
accuracy 89.57%. Sensitivity was highest (85.71%) for thyroid and lowest for other neck swellings (66.66%).



**Fig. 1: Clinical Picture of Rare case**



**Fig. 2: FNAC Picture of Case (Pleomorphic Adenoma: cluster of benign epithelial cells with faintly eosinophilic stroma)**



**Fig. 3: Histopathology Picture of Case (Lymphoepithelial CA of Parotid: malignant epithelial islands resembling non keratinizing large cells CA & lymphoid cells with germinal centre.)**

## DISCUSSION

The present study was carried out in the department of Otorhinolaryngology and head & neck surgery, National Institute of Medical Sciences, Jaipur from November 2013 to May 2015 in hospital. Total 55 cases of neck swellings were evaluated out of which most common were thyroid swellings 26 in number, 13 were lymph node swellings, 7 were salivary gland

swellings and 9 were other neck swelling. There were 34 female patients and 21 male patients. Maximum number of patients were between the age group of 21-50 yrs. The mean age of patient was 39.41 years and male female ratio was 1.5:1. The youngest patient was a 13 year old and the oldest was a 75 year old. This is comparable with study done by S. Soniet *al*<sup>6</sup> and Jamal Akhavan - Moghadam *et al*<sup>[7]</sup>.

Of total 26 thyroid swellings, 11 were diagnosed as colloid goiter on FNAC and the most common presenting thyroid swelling (42%) which was all confirmed by HPE. This is comparable with the study done by Khageswar Rout *et al* [8].

The diagnostic accuracy of FNAC in thyroid swellings in our study was 96.15%. The sensitivity of FNAC for thyroid swellings was 85.51%, whereas the specificity has been found to be 100%. This is comparable with the study done by Khageswar Rout *et al* [8] shows that the diagnostic accuracy of FNAC for thyroid swellings in this series was 96.05%. Altavilla *et al*<sup>[9]</sup> 92.86% and Handa *et al* [10] Grant *et al* [11] found a false -ve rate of only 0.7% in 439 patients. For thyroid masses sensitivity was 64.28% and specificity was 83.3%.

In our study out of total 55 cases, 13 were diagnosed clinically as lymph node swellings and FNAC done in all cases. Malignant metastasis was most common among the lymph node swelling (38%) followed by TB lymphadenitis (31%), reactive lymphadenitis (23%) and nodular sclerosis Hodgkin's lymphoma. This is comparable with the study Anne R *et al* [12] stated that the malignancies in lymph nodes in our country are predominantly metastatic in nature with an incidence varying from 35.7% [1] to 50.4% [2].

The diagnostic accuracy of FNAC in lymph node swelling in our study is 92.30%. The sensitivity of FNAC for lymph nodes has been 83.33, whereas the specificity has been found to be 100%. This is comparable with Anne R *et al*<sup>12</sup> which showed that the diagnostic accuracy of FNAC in metastatic disease varies from 87% to 97.9% [13, 14] and for lymphomas is 82% [13]. The sensitivity of FNAC for metastatic lesions to lymph nodes has varied from 97.9% to 100%, whereas the specificity has been found to be 100%.

Out of total 55 cases, 07 were clinically diagnosed as salivary gland swellings of which 06 cases underwent FNAC and the rest 01 case was diagnosed as plunging ranula clinically & sonographically which was later confirmed as same on HPE.

Salivary gland lesions either neoplastic or non neoplastic lesion. Of total 07 cases, 05 were matched with histopath, 02 were not matched with it. The

swelling were seen commonly in the parotid and submandibular region. Majority of diagnosis include neoplastic lesion i.e. 56 % and the rest 44% were non neoplastic. The commonest non neoplastic lesion include chronic sialdenitis, the commonest benign tumor encountered was pleomorphic adenoma seen in 3 cases. The neoplastic lesion was lymphoepithelial carcinoma of parotid, a rare case diagnosed as pleomorphic adenoma on FNAC. Cyto - histological correlation possible in all except 1 case of plunging ranula diagnosed clinically & sonographically and confirmed directly with histopath. Pitfalls in cytological diagnosis included chronic sialdenitis and pleomorphic adenoma diagnosed as kuttners tumor and lymphoepithelial carcinoma respectively. Thus concluded that FNAC of salivary gland was an effective tool in the preoperative workup of the patient with diagnostic accuracy of 85.71%, sensitivity of 75% and specificity of 100%. It is comparable with the study Suresh *et al* [15] showed that the diagnostic accuracy was 92.30% in salivary gland lesions.

Out of total 55 cases, 09 were clinically diagnosed as other neck swelling, out of which 07 underwent FNAC and rest 02 cases were diagnosed clinically & sonographically as thyroglossal cyst and confirmed with histopath. Histopathological examination was done in all 09 cases.

These 09 cases were divided into cystic and non cystic. Majority of diagnosis include non cystic lesion i.e. 56 % and the rest 44% were cystic. The commonest non cystic lesion include lipoma and the commonest cystic lesion was epidermoid cyst and thyroglossal cyst. Pitfall in cytological diagnosis include cystic lesion i.e. syringoma diagnosed as epidermoid cyst on FNAC. Cyto- histological correlation possible in all except 02 cases of thyroglossal cyst diagnosed clinically & sonographically and confirmed directly with histopath. Thus concluded that FNAC of other neck swelling was an effective tool in the preoperative workup of the patient with diagnostic accuracy of 86.71%, sensitivity of 66.66% and specificity of 100%.

**Table 7: Comparison between Sensitivity, Specificity & Accuracy of our study & other study**

	Present study (2015)	Tilak <i>et al</i> [16] (1994)	Tadon <i>et al</i> [17]	Mobley <i>et al</i> [18]	Adhikari.P. (2001) [19]	Soni <i>et al</i> [20] (2009)	Chauhan <i>et al</i> [21] (2012)	Howlett <i>et al</i> [22] (2013)
Sensitivity	78.03	90.9	89.6	96.6	80.6	83.01	93.1	71.1
Specificity	100	93.2	96.5	97.7	100	78.94	100	81.1
Accuracy	89.57	92.7	93	94.4	100	-	98.4	-

Our study evaluated 55 patients and found the overall sensitivity of FNAC in the diagnosis of neck masses to be 78.03%, specificity to be 100% and accuracy 89.57%.

Study by Soni *et al* [20] had sensitivity of 83.01% and specificity of 78.94%. Out of the 59 patients, 28 were of neck nodes, 14 were thyroid, 13 were of salivary gland masses and 4 were other types of neck masses[21]. Howlett DC., *et al* [22], studied a total of 276 patients and found FNAC of neck nodes to have a sensitivity of 89% and a specificity of 57%; for thyroid masses, the sensitivity was 62% and specificity was 86%; and for salivary glands, the sensitivity was 64% and specificity was 100%.

Tilak V *et al*. [16] studied 550 patients and found the overall sensitivity of FNAC for neck masses to be 90%. Another study was reported by Richard Schwarz, *et al* [23], in which the authors evaluated 165 patients. In their study, the sensitivity of FNAC for metastatic carcinoma was 92% and for lymphoma was 100%. In their study, the accuracy was highest for the malignant salivary group and lowest for the benign salivary gland group. Finally, James Edward M., *et al*, observed an overall accuracy for FNAC of 94.5%. Thyroid metastasis or benign node lesion had an

accuracy of approximately 95%. The diagnosis of lymphomatous lesion had a lower accuracy of 75%.

Adhikari P *et al*. [24], studied in total patients 55 of which Tuberculous Lymphadenopathies 25, Granulomatous lymphadenopathies 14, Reactive Lymphadenopathies 9, Metastatic Lymphadenopathies 7 the sensitivity and specificity of FNAC of lymphadenopathy to diagnose tubercular lymphadenopathy were 80.0% and 100.0%. Similarly, false positive value, false negative value, positive predictive value and negative predictive value were 0.00%, 20.0%, 100.0% and 82.14% respectively.

James Edward M. *et al* [25], observed an overall accuracy for FNAC of 94.5%. Thyroid metastasis or benign node lesion had an accuracy of approximately 95%. The diagnosis of lymphomatous lesion had a lower accuracy of 75%.

In our study, blind FNAC was performed by different technicians without ultrasound guidance, which may cause variation in result in respect to other studies.

**CONCLUSION**

Fine needle aspiration cytology offers a simple method of diagnosis of neoplastic and non neoplastic lesions in the neck to confirm clinical diagnosis. It can

be performed as an outpatient procedure. The procedure is acceptable to most of the patients. There is no need for anesthesia and speedy results are available.

FNAC is an important tool for preoperative clinical diagnosis of non cystic neck masses with history of more than 3 months. Thus, it helps in planning the surgical management of neck masses and can be confirmed with HPE which is a “gold standard” for diagnosis.

Hence we conclude that Fine needle aspiration cytology is a safe, simple and rapid method that can be done in diagnosing wide range of neck masses.

## REFERENCES

1. Pacini F, Schlumberger M, Dralle H, Elisei R, Smit JW, Wiersinga A; European consensus for the management of patients with differentiated thyroid carcinoma of the follicular epithelium. *Eur J Endocrinol.* 2006;154:787–803.
2. Castro MR, Gharib H; Thyroid fine-needle aspiration biopsy: Progress, practice, and pitfalls. *Endocr Pract.* 2003; 9:128–36.
3. Parikh UR, Goswami HM, Shah AM, Mehta NP, Gonsai RN; Fine needle aspiration cytology (FNAC) study of thyroid lesions-study of 240 cases. *GMJ.* 2012; 67(2): 25-8.
4. KC S, Karki R, Rayamajhi P, Rai K, Piya E; Role of FNAC in the diagnosis of thyroid malignancy and its comparison with histopathology. *Nep J of ENT head and neck surgery.* 2012; 3(1): 9-10.
5. Polyzos SA, Kita M, Avramidis A; Thyroid nodules - stepwise diagnosis and management. *Hormones (Athens),* 2007;6:101–19.
6. Soni S, Pippal SK, Yashweer B, Srivastava P; Efficacy of fine needle aspiration cytology in diagnosis of neck masses. *World article in ear, nose and throat,* 2010; 3(2)
7. Akhavan-Moghadam J, Afaaghi M, Maleki AR, Saburi A; Fine needle aspiration: an atraumatic method to diagnose head and neck masses. *Trauma monthly,* 2013; 18(3):117.
8. Rout K, Ray CS, Behera SK, Biswal R; A Comparative Study of FNAC and Histopathology of Thyroid Swellings. *Indian Journal of Otolaryngology and Head & Neck Surgery,* 2011; 63(4):370-372.
9. Altavilla JG; Fine needle aspiration biopsy & diagnosis of thyroid cancer, 1997; 98:53–56
10. Handa U, Garg S, Mohan H, Nagarkar N; Role of FNAC in diagnosis and -management of thyroid lesions: A study on 434 patients. *J Cytol.* 2008;25:13–7.
11. Grant WK; Fine needle aspiration biopsy of thyroid, neck mass & lymph node mass, primary case. *J Laryngol Otol,* 1986; 3:544–564.
12. Anne Wilkinson AR, Mahore SD, Maimoon SA; FNAC in the diagnosis of lymph node malignancies: A simple and sensitive tool. *Indian J Med Paediatr Oncol,* 2012;33:21-4.
13. Jasani JH, Vaishnani HV, Vekaria PN, Patel D, Shah Y; Retrospective study of fine needle aspiration cytology of head and neck lesions in tertiary care hospital. *IJBAR,* 2013;4:253-6.
14. Martin H, Ellis EB. Biopsy of needle puncture and aspiration. *Ann Surg*1930;92:169-81.
15. Bhagavath P; Role of FNAC in diagnosing salivary gland lesions. *International Journal of AJ Institute Medical Sciences,* 2012; 1(2):118-124.
16. Tilak V, Dhaded AV, Jain R; Fine needle aspiration cytology of head and neck masses. *Indian journal of pathology & microbiology,* 2002; 45(1):23-29.
17. Tandon S, Shahab R, Benton JI, Ghosh SK, Sheard J, Jones TM; Fine-needle aspiration cytology in a regional head and neck cancer center: comparison with a systematic review and meta-analysis. *Head Neck,* 2008;30(9):1246-52.
18. Mobley DL, Wakely PE, Frable MAN; Fine needle aspiration biopsy: Application to pediatric head and neck masses. *Laryngoscope.* 1991;101:469–72.
19. Adhikari P, Sinha BK, Baskota DK; Comparison of fine needle aspiration cytology and histopathology in diagnosing cervical lymphadenopathies. *AMJ,* 2011; 4(2):97-99.
20. Soni S, Pippal SK, Yashweer B, Srivastava P; Efficacy of fine needle aspiration cytology in diagnosis of neck masses. *World article in ear, nose and throat,*2010; 3(2).
21. Savithri C, Dimple D, Dholakia A; Original article fine needle aspiration cytology of neck lesion- an experience at tertiary care hospital in central Gujarat. *National journal of medical research,* 2012;2(3):255-259.
22. Howlett DC, Harper B, Quante M, Berresford A, Morley M, Grant J, Ramesar K, Barnes S; Diagnostic adequacy and accuracy of fine needle aspiration cytology in neck lump assessment: results from a regional cancer network over a one year period. *J Laryngol Otol.* 2007; 121(6):571-9.
23. Schwarz R, Chan NH, MacFarlane JK; Fine needle aspiration cytology in theevaluation of head and neck masses. *Am J Surg.* 1990;159(5):482-5.
24. Adhikari P, Sinha BK, Baskota DK; Comparison of fine needle aspiration cytology and histopathology in diagnosing cervical lymphadenopathies. *AMJ,* 2011, 4, 2, 97-99.
25. Edward J, Young MD; Needle aspiration cytologic biopsy in head and neck masses. *The American Journal of surgery.* 1981;142(4).