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Original Article* / *Çalışma - Araştırma

Fine needle aspiration cytology of head and neck masses: a cytohistopathological correlation study with emphasis on false positives and false negatives

Baş ve boyun kitlelerinde ince iğne aspirasyon sitolojisi: Yanlış pozitif ve yanlış negatiflerin vurgulandığı sito-histopatolojik karşılaştırma çalışması

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Objectives: This study aims to evaluate the accuracy ratio of fine needle aspiration (FNA) cytology in the diagnosis of non-thyroidal head and neck masses.

Patients and Methods: Between 2000 January and 2003 December, the pathology reports of 571 patients (297 males, 274 females; mean age 45 years; range 4 to 83 years) with non-thyroidal head and neck masses who underwent FNA cytology during a four year period were retrospectively analyzed. Cytopathological and histopathological results of the samples were recorded. The smear results indicating an inconsistency were reviewed. The possible causes of the false positivity and false negativity were investigated.

Results: Of a total of 571 patients, 181 had a confirmed histopathological diagnosis. The overall accuracy ratio, specificity, sensitivity, negative predictive value and positive predictive value of FNA in the diagnosis of the head and neck masses were 83%, 85%, 81%, 84%, 83%, respectively.

Conclusion: The FNA has a high accuracy, sensitivity, specificity, negative and positive predictive values in the diagnosis of head and neck masses. If the major causes of misdiagnosis including inadequate sampling and misinterpretation are avoided, the diagnostic accuracy ratio of FNA in the head and neck and will be improved.

Key Words: Cytology; fine needle aspiration; head and neck.

Amaç: Bu çalışmada, tiroid dışı baş ve boyun kitlelerinde ince iğne aspirasyon (İİA) sitolojisinin doğruluk oranı değerlendirildi.

Hastalar ve Yöntemler: Dört yıllık süre boyunca Ocak 2000 - Aralık 2003 tiroid dışı baş ve boyun kitlelerine İİA sitolojisi yapılmış 571 hastanın (297 erkek, 274 kadın; ort. yaş 45 yıl; dağılım 4-83 yıl) patoloji raporları retrospektif olarak incelendi. Alınan numunelerin sitopatolojik ve histopatolojik sonuçları kaydedildi. Uyumsuz smear sonuçları tekrar gözden geçirildi. Yanlış pozitiflik ve yanlış negatifliklerin muhtemel nedenleri araştırıldı.

Bulgular: Toplam 571 hastanın 181'inin kesinleşmiş histopatolojik tanısı vardı. Baş ve boyun kitlelerinin tanısında İİA'nın genel doğruluk oranı, özgüllüğü, duyarlılığı, negatif beklenen değeri ve pozitif beklenen değeri sırasıyla %83, %85, %81, %84, %83 olarak bulundu.

Sonuç: Baş ve boyun kitlelerinin tanısında İİA'nın doğruluğu, özgüllüğü, duyarlılığı, negatif ve pozitif beklenen değeri yüksektir. Yetersiz örnekleme ve yanlış yorumlama gibi başlıca yanlış tanı nedenleri önlenirse, İİA'nın baş ve boyun bölgesinde tanısal doğruluk oranı artacaktır.

Anahtar Sözcükler: Sitoloji; ince iğne aspirasyonu; baş ve boyun.

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The head and neck area has a wide spectrum of lesions because it is a complicated and intricate area where many systems diverge. Fine needle aspiration (FNA) is a widely used, safe, fast and a cheap method in the diagnosis of masses in this complex region.[1] To make an accurate cytopathologic diagnosis is important, because it has serious effects on the treatment modality in this risky area. Although FNA of the head and neck has high diagnostic accuracy, there can be difficulties and limitations in diagnosis.[2]

In this study, we aimed to evaluate the accuracy, specificity, sensitivity, positive and negative predictive values of FNA in the diagnosis of head and neck masses by cytohistopathologic correlation, as well as to determine the causes of diagnostic errors and insufficiencies in order to improve diagnostic yield of FNA in head and neck masses.

PATIENTS AND METHODS

In this retrospective study, we analyzed the pathology files of 571 patients (297 males, 274 females; mean age 45 years; range 4 to 83 years) with FNA of a head or neck mass, excluding thyroid lesions for a four-year period. Of these, the cases with subsequent definitive histopathologic diagnoses were selected for the study. The FNAs were performed at various clinics such as otorhinolaryngology, general surgery and internal medicine. The procedures were done using a 21-23 gauge needle attached to a 10 ml syringe. Slides were stained with May-Grünwald-Giemsa, Papanicolaou or Hematoxylin and Eosin.

Cases were separated into three groups: salivary glands, lymph nodes and other head and neck masses. Cytopathology reports of these cases were classified into the following diagnostic categories: benign, malignant, suspicious for malignancy, and nondiagnostic. We also tried to subtype the lesions as we possibly could. The nondiagnostic category included the smears which did not have enough cellularity or quality (fixation and staining).

Cytopathologic and histopathologic results of all cases were correlated. We reviewed the FNA slides of cases which demonstrated discordance between cytopathologic and histopathologic results and analyzed the reasons for the false positive and false negative results. Accuracy, sensitivity, specificity, positive predictive value and negative predictive value of FNA in head and neck masses were calculated. In the statistical calculation, cases diagnosed as suspicious for malignancy or malignant were considered positive and nondiagnostic cases were not included.

Statistical calculation

- Accuracy= True positive + true negative/ true positive + true negative + false positive + false negative
- Sensitivity= True positive/true positive + false negative
- Specificity= True negative/true negative + false positive
- Positive predictive value= True positive/ true positive + false positive
- Negative predictive value= True negative/ true negative + false negative

RESULTS

During the period of the study, 571 patients who underwent FNA of a head or neck mass were identified. Fine needle aspiration diagnoses were benign in 241 (42%), malignant in 54 (9%), suspicious for malignancy in 50 (9%), and nondiagnostic in 226 (40%). Of the 571 patients, 181 (32%) had subsequent definitive histopathologic diagnoses.

The ages of the 181 patients ranged from 12 to 80 years with a M:F ratio of 1:4. Of the 181, 43 (24%) had salivary gland lesions, 73 (40%) had lymph node lesions, and 65 (37%) had head and neck masses other than salivary gland or lymph node lesions.

Out of 181 patients, the FNA diagnoses were benign in 62 (34%), malignant in 27 (15%), suspicious for malignancy in 25 (14%), nondiagnostic in 67 (37%). Histopathologically, 101 (56%) were benign and 80 (44%) were malignant.

The salivary glands

There were 113 patients who had undergone FNA of salivary gland mass. Of 113 FNAs, 60 (53%) were reported as benign, seven (6%) as malignant, 10 (9%) as suspicious for malignancy, 36 (32%) as nondiagnostic. Of all FNAs, 92 (81%) were from the parotid gland, followed by

Table 1. Statistical analysis of fine needle aspiration results of the head and neck masses

Localization	Total FNAs	Histopathologic diagnosis	False negative FNAs	False positive FNAs	Accuracy rate	Specificity	Sensitivity	NPV	PPV
	n	n	n	n	%	%	%	%	%
Salivary glands	113	43	2	4	82	86	60	92	43
Lymph nodes	216	73	6	2	84	85	83	65	94
Other head and neck masses	242	65	2	3	82	85	83	89	77
Total	571	181	10	9	83	85	81	84	83

NPV: Negative predictive value; PPV: Positive predictive value.

16 (14%) from the submandibular gland, two (2%) from the palate, two (2%) from the maxillary sinus, and one (1%) from the nasopharynx. Histopathologic diagnoses were available for 43 (38%) cases of which 79% were benign and 21% were malignant. Of the 43 cases, FNA diagnoses were benign in 26 (61%), malignant in three (7%), suspicious for malignancy in four (9%), and nondiagnostic in 10 (23%).

The accuracy ratio, specificity, sensitivity, negative predictive value and positive predictive value of FNA in the diagnosis of salivary gland masses were 82%, 86%, 60%, 92%, and 43% respectively (Table 1).

Fine needle aspiration and histopathologic diagnoses of the salivary gland lesions were shown in (Table 2).

Table 2. Correlation of fine needle aspiration and histopathologic diagnoses of 43 salivary gland masses

Histopathologic diagnosis	n	Fine needle aspiration diagnosis	n
Non-neoplastic (n=3)		*Non-neoplastic (n=3)*	
Chronic sialoadenitis	2	Abscess	1
		**Suspicious for lymphoma	1
Hematoma	1	Hemorrhagic cyst content	1
Neoplastic, benign (n=31)		*Neoplastic, benign (n=31)*	
Pleomorphic adenoma	23	Plemorphic adenoma	18
		**Suspicious for pleomorphic adenoma ex carcinoma	2
		Nondiagnostic	3
Basal cell adenoma	2	Nondiagnostic	2
Warthin's tumor	6	Warthin's tumor	2
		Abscess	1
		Reactive lymph node	1
		**Suspicious for low-grade mucoepidermoid carcinoma	1
		Nondiagnostic	1
Neoplastic, malignant (n=9)		*Neoplastic, malignant (n=9)*	
Acinic cell carcinoma	1	*Monomorphic adenoma	1
Mucoepidermoid carcinoma	1	*Pleomorphic adenoma	1
Adenoid cystic carcinoma	4	Adenoid cystic carcinoma	1
		Nondiagnostic	3
Squamous cell carcinoma	2	Mucoepidermoid carcinoma	1
		Nondiagnostic	1
Poorly differentiated adenocarcinoma	1	Carcinoma	1

* False negative cases; ** False positive cases.

In this study, two false negative cases were identified. The first was an acinic cell carcinoma which was diagnosed as monomorphic adenoma on FNA. The aspirates showed numerous stripped nuclei in the background, and vacuolated cytoplasms of the cells were overlooked. The second false negative case was a mucoepidermoid carcinoma (maxillary sinus). In its FNA, uniform epithelial cell groups, squamous cells without atypia and background eosinophilic material were seen. Fine needle aspiration findings were misinterpreted as pleomorphic adenoma (PA) with squamous differentiation because tumor cells had minimal atypia and the eosinophilic material looked like matrix material in PA.

Four cases were found to be false positive. Two were PA cases which were diagnosed as suspicious for malignancy on FNA because of the presence of large cells with hyperchromatic nuclei and prominent nucleoli as well as characteristic cytomorphological features of PA. The other false positive cases were a Warthin's tumor (WT) and a chronic sialadenitis which were diagnosed as suspicious for low-grade mucoepidermoid carcinoma and suspicious for lymphoma, respectively.

The lymph nodes

There were 216 patients who had undergone FNA of lymph nodes in the head and neck area. Of 216 FNAs, 105 (48.6%) were benign, 33 (15.3%) malignant, 28 (13.0%) suspicious for malignancy and 50 (23.1%) nondiagnostic. Histopathologic diagnoses were available for 73 cases of which 21 (29%) were benign and 52 (71%) were malignant. Of 73 cases, FNA diagnoses were benign in 17 (24%), malignant in 16 (22%), suspicious for malignancy in 16 (22%) and nondiagnostic in 24 (32%).

The accuracy ratio, specificity, sensitivity, negative predictive value and positive predictive value of FNA in the diagnosis of the lymph nodes of head and neck were 84%, 85%, 83%, 65%, and 94% respectively (Table 1).

Fine needle aspiration and histopathologic diagnoses of the lymph nodes of the head and neck are shown in Table 3.

There were six false negative cases. Of these cases two were lymphoma, two were metastatic squamous cell carcinoma, one was metastatic papillary thyroid carcinoma, and one was metastatic anaplastic thyroid carcinoma. The smears were rescreened and in the first five cases no atypical cells were found. In the metastatic anaplastic thyroid carcinoma case FNA smears showed necrosis and polymorphonuclear leukocytes. The cytomorphologic findings were interpreted as inflammation but when the smears were reviewed it was seen that rare atypical cells had been missed.

Two false positive lymph node cases were identified in the study. They were diagnosed as suspicious for non-Hodgkin's lymphoma on FNA. The lymphoid cells observed in the aspirates were misinterpreted as monomorphic and there were no epithelioid histiocytes. But the final diagnosis of one of them turned out to be granulomatous lymphadenitis and the other toxoplasma lymphadenitis.

Other head and neck masses

There were 242 patients who had undergone FNA of head and neck masses other than salivary gland and lymph node lesions. Of 242 FNAs, 76 (31%) were benign, 14 (6%) malignant, 12 (5%) suspicious for malignancy and 140 (58%) nondiagnostic. Histopathologic diagnoses were available for 65 (27%) cases of which 71% were benign and 29% were malignant. Of 65 cases, FNA diagnoses were benign in 19 (29%), malignant in eight (12%), suspicious for malignancy in five (8%) and nondiagnostic in 33 (51%).

The accuracy ratio, specificity, sensitivity, negative predictive value and positive predictive value of FNA in the diagnosis of the head and neck masses other than salivary gland and lymph node lesions were 82%, 85%, 83%, 89%, and 77% respectively (Table 1).

Fine needle aspiration and histopathologic diagnoses of the lymph nodes of the head and neck masses other than salivary gland and lymph node lesions are shown in Table 4.

Two false negative cases were detected in this group. One of them was a squamous cell carcinoma of the neck. Fine needle aspiration smears showed no evidence of malignant cells and revealed only findings of abscess. The other case was a diffuse large B cell lymphoma in the parapharyngeal region. The neoplastic lymphoid cells seen in the smears were misinterpreted as reactive lymphocytes.

There were three false positive cases. Two were branchial cleft cyst and hyperplastic squamous

Table 3. Correlation of fine needle aspiration and histopathologic diagnoses of 73 lymph node lesions

Histopathologic diagnosis	n	Fine needle aspiration diagnosis	n
Non-neoplastic (n=21)		*Non-neoplastic (n=21)*	
Reactive lymphoid hyperplasia	4	Benign	1
		Nondiagnostic	3
Granulomatous lympadenitis	16	Benign	9
		Granulomatous lymphadenitis	1
		**Suspicious for lymphoma	1
		Nondiagnostic	5
Toxoplasma lymphadenitis	1	**Suspicious for lymphoma	1
Neoplastic (n=52)		*Neoplastic (n=52)*	
Hodgkin's lymphoma	10	Hodgkin's lymphoma	2
		Suspicious for lymphoma	2
		Suspicious for carcinoma	1
		*Benign	1
		Nondiagnostic	4
Non-Hodgkin's lymphoma	11	Lymphoma	1
		Suspicious for lymphoma	5
		*Benign	1
		Nondiagnostic	4
Metastatic squamous cell carcinoma	14	Metastatic squamous cell carcinoma	2
		Poorly differentiated carcinoma metastasis	1
		Suspicious for malignancy	5
		*Benign	2
		Nondiagnostic	4
Metastatic papillary thyroid carcinoma	4	Metastatic papillary thyroid carcinoma	1
		*Benign	1
		Nondiagnostic	2
Metastatic medullary thyroid carcinoma	1	Metastatic medullary thyroid carcinoma	1
Metastatic anaplastic thyroid carcinoma	1	*Benign	1
Metastatic adenocarcinoma	4	Metastatic adenocarcinoma	2
		Suspicious for malignancy	1
		Nondiagnostic	1
Metastatic malignant melanoma	2	Metastatic malignant melanoma	2
Metastatic urothelial carcinoma	2	Malignant	1
		Suspicious for metastatic carcinoma	1
Metastatic combined small cell lung carcinoma	1	Metastatic poorly differentiated carcinoma	1
Metastatic adenoid cystic carcinoma	1	Nondiagnostic	1
Metastatic osteosarcoma	1	Malignant	1

* False negative cases; ** False positive cases.

epithelium in the neck in the previous incision area that were diagnosed as suspicious and positive for squamous cell carcinoma, respectively, due to the presence of atypical squamous cells in the aspirates. The third was inflammatory granulation tissue in the neck which was diagnosed as suspicious for malignancy because of the atypical looking endothelial cells in the smears.

The overall accuracy ratio, specificity, sensitivity, negative predictive value and positive predictive value of FNA in the diagnosis of the head and

Table 4. Correlation of fine needle aspiration and histopathologic diagnoses of 65 other head and neck masses

Histopathologic diagnosis	n	Fine needle aspiration diagnosis	n
Non-neoplastic (n=26)		*Non-neoplastic (n=26)*	
Inflammatory process	4	Inflammatory process	2
Neck, submandibular, nasopharynx		Nondiagnostic	2
Granulation tissue	7	Inflammatory process	3
Neck, tongue, submandibular		**Suspicious for malignancy	1
		Nondiagnostic	3
Granulomatous inflammation	4	Inflammatory process	2
Neck, tongue		Abscess	1
		Nondiagnostic	1
Glossitis with microabscess	1	Nondiagnostic	1
Keratinous cyst	3	Nondiagnostic	1
Mastoid cavity, mandibular, submandibular		Benign cyst lined by squamous epithelium	2
Branchial cyst	3	Benign cyst lined by squamous epithelium	2
Neck		**Suspicious for squamous cell carcinoma	1
Dermoid cyst	1	Benign cyst lined by squamous epithelium	1
Benign lymphoepithelial cyst	1	Benign	1
Neck			
Radicular cyst	1	Benign cyst content	1
Maxillary sinus			
Hyperplastic squamous epithelium	1	**Squamous cell carcinoma	1
neck previous incision area			
Neoplastic, benign (n=17)		*Neoplastic, benign (n=17)*	
Extraarticular synovial chondromatosis	1	Nondiagnostic	1
Parotid region			
Hemangioma,	2	Nondiagnostic	2
Buccal, preauricular			
Kimura's disease	1	Nondiagnostic	1
Postauricular			
Angiomyoma	1	Benign	1
Mandibula			
Schwannoma	3	Nondiagnostic	3
Neck			
Neurofibroma	3	Nondiagnostic	3
Mandibula, parafaringeal			
Collagenous fibroma	1	Nondiagnostic	1
Neck			
Lipoma	5	Nondiagnostic	4
Neck, buccal, parotid region		Benign	1
Neoplastic, malignant (n=22)		*Neoplastic, malignant (n=22)*	
Chordoma	1	Nondiagnostic	1
Paraganglioma	3	Nondiagnostic	3
Squamous cell carcinoma	12	Squamous cell carcinoma	5
Neck, mandibular, submandibular, hypopharynx,		Carcinoma	1
oropharynx, tonsil, buccal, maxillary sinus		Suspicious for squamous cell carcinoma	2
		*Abscess	1
		Nondiagnostic	3
Carcinosarcoma	1	Nondiagnostic	1
Neck			
Plasmacytoma	1	Malignant	1
Submandibular			
Non-Hodgkin's lymphoma	4	Suspicious for malignancy	1
Tonsilla, nasopharynx, parapharyngeal		*Benign	1
		Nondiagnosic	2

* False negative cases; ** False positive cases.

neck masses were 83%, 85%, 81%, 84%, and 83% respectively (Table 1).

DISCUSSION

Fine needle aspiration is a widely used tool in the investigation of head and neck masses. It is a cheap, rapid method with high diagnostic accuracy and low complication rates. In our study, the diagnostic accuracy, specificity, sensitivity, negative predictive value and positive predictive value of FNA in the diagnosis of head and neck masses ranged between 83%, 85%, 81%, 84%, and 83% respectively. The cytologic diagnosis of most of the false positive cases (n=9) were "suspicious for malignancy" (n=8), not "malignant". If suspicious cytologic results were not considered as positive, the specificity of FNA in the head and neck masses would be 98%.

In the literature, the diagnostic accuracy of FNA in the salivary glands is between 81-98%.[3-12] Consistent with the literature, our accuracy rate of FNA in the diagnosis of salivary glands was 82%.

The most frequent lesion in the salivary glands was PA in our series. Fine needle aspiration diagnosis of PA is not difficult. The presence of myxoid or myxochondroid fibrillary stroma with embedded myoepithelial cells in the smears is a very reliable finding for the diagnosis of PA. Ninety percent of our PA cases were accurately diagnosed on FNA. This ratio is in accordance with the ratio in the literature which is between 82-100%.[3,6,11,13,14] Two of the PA cases were diagnosed as suspicious for carcinoma ex PA due to some atypical cells with prominent nucleoli and large hyperchromatic nuclei in the FNA smears. Viguer et al.[15] retrospectively analyzed 212 PA cases and detected cellular atypia in 36 (20.6%) of them. Seventeen of 316 PA cases in the study of Eneroth and Zajicek[16] and 15 of 31 PA cases in the study of Chan et al.[17] had cellular atypia on FNA. Viguer et al.[18] reported that malignancy shouldn't be considered if these atypical cells are rare and accompanied by many benign-looking cells in the absence of abnormal chromatin pattern and necrosis, and it should be accepted as degenerative atypia. The findings in our cases also confirm this opinion.

Warthin's tumor is the most frequent oncocytic neoplasm of the head and neck.[19] It is easily recognized on histopathologic specimens. However, WT can have several diagnostic pitfalls on FNA because of its various cytomorphologic features or lack of typical cytologic findings.[20,21] Two out of our six WT cases had characteristic cytomorphologic features and were accurately diagnosed as WT. One of our WT cases was diagnosed as suspicious for low-grade mucoepidermoid carcinoma due to the presence of mucoid background and squamous metaplastic cells on FNA smears. Another case had necrotic debris and acute inflammatory cells in the smears and was diagnosed as abscess. Another case had only lymphoid cell population on FNA and was diagnosed as reactive lymph node. When the literature is examined, it is found that WT is most frequently confused with squamous cell carcinoma,[19,20,22-24] low-grade mucoepidermoid carcinoma,[19,20,22-24] pleomorphic adenoma,[20] oncocytoma,[19,20,22] sialadenitis,[22-25] salivary gland cyst,[19,22] and reactive lymph node[22,25] on FNA. According to the literature survey of Veder et al.,[26] there were 11 (5.4%) false positive and six (2.9%) false negative diagnoses of WT in 202 cases of FNA cytology. Most of these false positive diagnoses were acinic cell carcinoma and mucoepidermoid carcinoma. Reasons for false negativity were misinterpretation of dispersed cells as benign, few tumor cells and absence of components in the smears and interpreting tumor cells as oncocytes, similar to our experience.

We found the sensitivity of FNA in salivary gland lesions to be 60%. This ratio ranges from 54% to 100% in the literature.[3,4,6,13,27-32] We had two false negative cases. The first was acinic cell carcinoma which was misdiagnosed as monomorphic adenoma. There were numerous naked nuclei in the smears. The vacuolated cytoplasm of the cells was overlooked by the pathologist. The second case was mucoepidermoid carcinoma misdiagnosed as pleomorphic adenoma. Fine needle aspiration smears consisted of uniform epithelial cell groups and background eosinophilic material that was misinterpreted as fibrillary matrix. These false negative and false positive diagnoses that were caused by overlapping cytologic features and interpretation errors could be prevented by combining cytomorphologic findings with radiologic and clinical findings.

The sensitivity and specificity of FNA in lymph node lesions are quite high. In the literature, the sensitivity of FNA of lymph nodes is 83-97%

and specificity is 95-98%, and the sensitivity of FNA for metastatic carcinomas is higher than lymphomas.[33-38] In our study the sensitivity of FNA for metastatic carcinomas (81.1%) was also higher than lymphomas (76.9%).

We detected six false negative cases in lymph nodes; four of them were metastatic carcinoma and two were lymphoma. Five of the samples did not represent the lesion. It would have been better to report them as nondiagnostic instead of benign cytology. A metastatic anaplastic thyroid carcinoma case was interpreted as acute inflammation. However tumor diathesis and rare atypical cells were missed.

There was no case with malignant cytology and benign histology in the lymph nodes. The histopathologic diagnosis of two cases with a diagnosis of suspicious for non-Hodgkin's lymphoma on FNA were toxoplasma lymphadenitis and granulomatous lymphadenitis.

In the study of Carter et al.,[39] there were four false positives in 84 cases with a cytologic diagnosis of lymphoma or suspicious for lymphoma in the lymph nodes of various body sites. Histologic diagnoses of false positive cases were granulomatous lymphadenitis in two cases and reactive lympadenitis in one case. One case didn't have a surgical specimen but the clinical course of the patient was benign. Martins and Santos[40] analyzed 627 cases of FNA of superficial lymph nodes and found two false positive cases which were diagnosed as metastatic adenocarcinoma or undifferentiated nasopharyngeal carcinoma (lymphoepithelial type) and Hodgkin's disease.

In our study, the ratio of non-diagnostic FNAs was approximately 40%. In patients with nondiagnostic cytology, the rates of malignancy and neoplasia were 45% and 76%, respectively. Most of the nondiagnostic specimens were from soft tissue lesions of the head and neck. The high ratio of nondiagnostic FNAs was mainly due to inadequate sampling by inexperienced doctors who perform the FNA at various clinics. Adequate sampling is a prerequisite to render a cytopathologic diagnosis. Increased experience with performance of FNA will improve the diagnostic yield of FNA. The use of image guidance such as ultrasound, computed tomography or magnetic resonance imaging, and on-site cytologic evaluation are other important factors improving the adequacy rate of FNA.[41-45] In the study of Ganguly et al.[46] ultrasound-guided FNAs of 274 patients with a neck lump were immediately examined by the cytopathologist and it was shown that there was a 90% reduction in the number of inadequate specimens with on site cytology. Robinson and Cozens[42] compared the results of FNA of head and neck masses performed in an ultrasound-guided cytology clinic staffed by a radiologist and pathologist to those obtained by clinician-guided aspiration. They found an 84% reduction in inadequate samples.[46] If image guidance could be used more frequently as an adjunct to FNA and on-site adequacy assessment could be done in our hospital, the ratio of inadequate FNAs would have been less.[42]

In conclusion, FNA is a powerful diagnostic tool in head and neck masses, despite its some possible failures. Experience in performing FNA and obtaining cytologic material adequate in quality and quantity, using image guidance as an adjunct to FNA, on-site cytologic evaluation, experience of the pathologist and giving regard to clinical, radiologic and laboratory findings will increase the diagnostic accuracy rate of FNA in this complex area.

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