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Diagnostic Accuracy of Fine Needle Aspiration Cytology as Compared to Histopathology in Parotid Gland Swelling

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ABSTRACT

Background: The diagnosis of parotid swelling is challenging and investigations like imaging and needle aspiration cytology are helpful. The objective of this study was to determine the diagnostic accuracy of fine needle aspiration cytology (FNAC) as compared to the histopathology in parotid gland swelling.

Methods: It was a descriptive cross sectional study carried out in the Department of ENT-Head & Neck Surgery, Tribhuvan University Teaching Hospital, Institute of Medicine, Kathmandu by reviewing the medical record charts of the patients who had undergone surgery for parotid lesions during the study period of seven and half years. All patients whose fine needle aspiration cytology and histopathology reports were available were included in the study. The data were presented as mean, standard deviation, ratio and percentages. Microsoft excel was used for data analysis.

Results: There were 75 patients included in the study. The age ranged from nine years to 78 years and the mean age being 38.3± 17.42 years. The male to female ratio was 1:1.78. The concordance rate between fine needle aspiration cytology and histopathology was 82.7%. The sensitivity and specificity of the fine needle aspiration cytology were 80% and 95% respectively. Similarly, the positive predictive and negative predictive values were 84% and 93% respectively. The diagnostic accuracy of the fine needle aspiration cytology was 91% for the parotid swelling in our study.

Conclusions: The diagnostic accuracy of fine needle aspiration cytology for parotid swellings in our study was excellent. The result of fine needle aspiration cytology is helpful in deciding management plan for parotid lesions.

Keywords: Benign; cytology; histopathology; malignant; parotid.

INTRODUCTION

The pathologies involving the parotid gland which are rare comprise about 3% of all head and neck neoplasms.[1,2] However, the clinical significance of the pathologies involving parotid glands is high due to the wider histological and behavioural diversity as well as being in close proximity with the vital structure like facial nerve.[3] Fine needle aspiration cytology (FNAC) is a safe, cost effective, quick to perform and well accepted by the patients as an initial modality of investigation.[4-7] However; there are challenges in interpretation due to the considerable overlap of cyto-morphological patterns and rarity of many parotid tumors.[2,6]

Although there are plenty of reports on the accuracy of FNAC in parotid swellings in literature, there are limited studies done at our center and in Nepal. The objective of this study was to know the diagnostic accuracy of FNAC at our center as compared to the histopathology.

METHODS

It was a descriptive, cross-sectional study done to evaluate the diagnostic accuracy of fine needle aspiration cytology in the patients presenting with the parotid gland swelling. It was carried out retrospectively by reviewing the chart of the patients who underwent the parotid gland surgery during the study period of

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seven and half years in the Department of ENT-Head and Neck Surgery, TU Teaching Hospital & Maharajgunj Medical Campus, Institute of Medicine. Ethical clearance for the study was obtained from the Institutional Review Committee (IRC) of Institute of Medicine (Reference number: 490(6-11) E^2 077/078).

The study population included all the patients who presented with parotid swelling during the study period. Convenient sampling design was used for the study. Patients of all age groups and both genders with preoperative FNAC and histopathology report at our center were included in the study. When one or both of FNAC and histopathology report were not done at our center, they were excluded to avoid any sampling error or differing criteria used for the evaluation.

The data for the study was collected by using a performa prepared for the study. The data collected were hospital number of patient, demographic information (age and gender of patient, address, contact number), FNAC finding, date and type of surgery performed and the histopathology report. The collected data were analyzed as the frequency and percentages. The sensitivity, specificity and accuracy were measured as percentages and rate.

The FNAC was obtained by the pathologists themselves to avoid the sampling error due to inadequacy of sample. The process of obtaining sample for FNAC, its preparation and processing was done following defined format. When the results of the FNAC was non-diagnostic, USG guided FNAC was obtained by the radiologist and was sent for the examination by the pathologists. The histopathological examination was performed by pathologists after the specimen was sent after surgical excision. The standard protocol was followed for the examination. However, as the study was done at the teaching hospital, multiple pathologists were involved in the evaluation of the cases. For the purpose of calculating sensitivity and specificity, the malignant diagnoses were taken as positive results and non-malignant diagnoses were taken as negative results. When both FNAC and histopathology reports were benign, it was true negative and when both were malignant, it was true positive. If FNAC was benign and histopathology was malignant, it was false negative. Similarly, if FNAC was malignant and histopathology was benign, it was false positive.

RESULTS

There were a total of 98 parotid surgeries carried out from June 2014 to February 2022 for various parotid pathologies. The patients who met inclusion criteria were 75. Out of the 75 patients, there were 27 males and 48 females with male to female ratio of 1:1.78. The age of the patients included in our study ranged from nine to 78 years with mean age of 38.3± 17.42 years. The patients were grouped into different age groups with the largest numbers of the patients in the age group of 21-40 years (Table 1).

Table 1. Age distribution of the patients.

S. No	Age group (in Years)	Number (n)	Percentages (%)
1.	≤ 20	12	16.0
2.	21-40	35	46.7
3.	41-60	15	20.0
4.	> 60	13	17.3
	Total	75	100

The majority (56/75, 74.7%) were benign and 25.3% (19/75) were malignant lesions based on FNAC report (Table 2). Among the benign lesions, vast majorities (87.5%) were Pleomorphic adenomas. The most common malignancy was Acinic cell carcinoma (42.1%) followed by Mucoepidermoid carcinoma (21%). In five cases, the parotid malignancy could not be specified by FNAC.

Table 2. Diagnosis of the parotid swellings based on FNAC findings.

Benign lesions			Malignant lesions		
S. No.	Diagnosis	Numbers	S. No.	Diagnosis	Numbers
1	Pleomorphic Adenoma	49	1.	Acinic Cell Carcinoma	8
2	Warthin Tumor	5	2.	Parotid Malignancy Unspecified	5
3	Cystic Lymphangioma	1	3.	Mucoepidermoid Carcinoma	4
4	Chronic Granulomatous Lymphadenitis	1	4.	Adenoid Cystic Carcinoma	1
			5.	Adenocarcinoma	1
Total		56	Total		19

The final histopathological examination (HPE) report had 73.3% (55/75) benign lesions and 26.7% (20/75) malignant lesions (Table 3). The most common benign pathology was pleomorphic adenoma (74.5%) followed by Warthin tumor (12.7%). Among the malignant pathologies, most common was mucoepidermoid carcinoma (45%) which was followed by acinic cell carcinoma (40%). Other malignant lesions diagnosed were secretory carcinoma (10%) and adenoid cystic carcinoma (5%).

Table 3. Histopathological diagnosis of the parotid swelling after surgical excision.					
Benign lesions			**Malignant lesions**		
S. No.	**Diagnosis**	**Numbers**	**S. No.**	**Diagnosis**	**Numbers**
1.	Pleomorphic Adenoma	41	1.	Mucoepidermoid Carcinoma	9
2.	Warthin Tumor	7	2.	Acinic Cell Carcinoma	8
3.	Chronic Granulomatous Lesion	3	3.	Secretory Carcinoma	2
4.	Basal Cell Adenoma	2	4.	Adenoid Cystic Carcinoma	1
5.	Sialadenosis	1			
6.	Sialadenitis	1			
Total		55	Total		20

Out of the total cases, the FNAC was able to truly diagnose the parotid pathology in 82.7% (62/75) of the cases. In remaining17.3% (13/75) cases the final histopathology report was different than the diagnosis made by the FNAC.

The results of FNAC and histopathology was cross tabulated (Table 4). The sensitivity of the FNAC was 80% and specificity was 95%. The positive predictive and negative predictive values were 84% and 93% respectively. The false-positive rate in our study was 4% (3/75) and false-negative rate was 5.3% (4/75). The overall diagnostic accuracy of the FNAC for the parotid swelling in our study was 91%.

Table 4. Comparison of the findings of Present with Histopathology report			
FNAC	Malignancy of Parotid (Histopathology result)		
	Present	Absent	Total
Malignant (positive)	16	3	19
Benign (Absent)	4	52	56
Total	20	55	75

DISCUSSION

In our study population, the number of females was higher than males as in various literature.[5,8,9] Kim *et al.* (2006) in their series of 521 patients also had slightly higher male to female ratio of 1:1.08.[10] However, other studies have reported either equal number of males and females or higher number of males.[1,3,4,11-15] These results show that the ratio of males to females varies with the studies and it can be assumed that there is no gender predilection for the salivary gland lesions.

The mean age of 38 years in our study was slightly older than few studies.[5,12] However; the mean age of the patients included in many others studies was older than our study population which ranged from 42 years to 65 years.[1,3,8,10,14,15] The age of the patients included in these studies range from 12 years to 91 years was similar to ours. The differing mean age in various studies could be due to the difference in the criteria used for the management and surgical excision of lesions. Also the prevalence of disease type makes the age group difference. Inclusion or exclusion of non-surgical cases also makes mean age differences. Similar to our study, maximum patients were in the age group 21-40 years which in some studies was more than 50% of the total numbers.[1,4,13] This may be the reason for a majority of the lesions being benign.

In our study, there were 2.6% non-neoplastic cases. In a study by Gandhi et al (2013), there were 40% non-neoplastic cases and 60% neoplastic cases.[11]This difference could be due to the inclusion of only operated cases in our study. However, all cases undergoing FNAC were included in their study. Many non-neoplastic lesions can be managed non-surgically.

The final HPE report had 73.3% (55/75) benign lesions and 26.7% (20/75) malignant lesions. Similar to our findings, the benign lesions were ranging from 67% to 81% and the malignant lesions were 19.5% to 33% in the various studies.[1,4,12,16-19] These study had pleomorphic adenoma and followed by Warthin tumor as two common benign parotid pathologies as in our study.[4,11,12] Pleomorphic adenoma was most the common benign tumor and non-Hodgkin's Lymphoma was most common

malignant tumor followed by Acinic cell carcinoma in a study done in Bangladesh.[15] Here, the number of non-Hodgkin's Lymphoma was most common due to inclusion of all FNAC cases and also inclusion of submandibular gland swelling in their study. There were no cases of lymphoma in our study because they are managed non-surgically. Mucoepidermoid carcinoma was most common parotid malignancy in our study similar to other studies.[1,4,5] A study done in Australia had metastatic squamous cell carcinoma as most common malignant tumor followed by mucoepidermoid carcinoma and then adenocarcinoma.[14] This was due to higher incidence of skin cancer in Australia.

The concordance rate of FNAC and histopathology reports varied from 78% to 95.6% in various studies similar to the finding in our study.[1,3,4,8,19] However, one study reported low concordance rate of FNAC and histopathology reports who did their study in teaching hospital which involved multiple pathologists with various experiences and even trainees.[14] Very good concordance rate can be achieved by experienced pathologists. The reason for discordant results could be due to the overlapping cytological features and rarity of the various parotid pathologies. Inflammatory lesions were confused as neoplastic lesions. Sialadenosis and sialadenitis were falsely reported as malignant lesions by the FNAC, while granulomatous lesions were reported as pleomorphic adenoma. FNAC is not very helpful in distinguishing inflammatory lesions such as sialadenitis from squamous metaplasia and similarly normal salivary tissue from low-grade tumors such as oncocytomas, Warthin tumors, and acinic cell carcinoma.[20] FNAC is also unhelpful in separating reactive lymphoid hyperplasia from Lymphoma.[21] Adenomas of salivary glands are difficult to distinguish from malignant lesions such as low-grade polymorphous adenocarcinoma and adenoid cystic carcinomas.[22] Cases with confusing findings may be reported as the commoner pathology like pleomorphic adenoma. In one case of a secretory carcinoma, FNAC finding was suggestive of cystic lymphangioma. This could be due to inability to obtain representative cell by the aspirated sample due to the cystic nature of the swelling. Low-grade mucoepidermoid carcinoma was misdiagnosed as Warthin tumor in one patient. In two cases, the malignant lesions were not correctly identified. A case of secretory carcinoma was reported as acinic cell carcinoma and in other case; high grade mucoepidermoid carcinoma was reported as adenocarcinoma.

FNAC also has difficulty in parotid pathologies like pleomorphic adenoma, basal cell adenoma, low grade mucoepidermoid carcinoma, and acinic cell carcinoma.[23] A cellular pleomorphic adenoma can be confused on FNAC with monomorphic adenoma, myoepithelioma, and adenoid cystic carcinoma.[24] Presence of myxoid acellular material and hyaline globules may make distinction between pleomorphic adenoma and adenoid cystic carcinoma difficult.[9] Similarity in cellular finding may create confusion between pleomorphic adenoma and carcinoma ex pleomorphic adenoma. Pleomorphic adenoma and low grade mucoepidermoid carcinoma are difficult to differentiate by the presence of goblet cells or squamous metaplasia.[13] Low grade mucoepidermoid carcinoma can also be confused with various pathologies like chronic sialadenitis, Warthin tumor, mucous retention cysts and adenomatoid hyperplasia.[25] Similarly, cystic lesions such as Warthin tumor and mucoepidermoid carcinoma are difficult to differentiate.[2]

The misdiagnosis can be in the form of false positive or false negative for the malignancy. The false-positive rate in our study was 4% (3/75) and false-negative rate was 5.3% (4/75). Correia-Sá *et al*. (2017) had false-negative rate of 9.2% and false-positive rate of 12.3%.[1] The most common cause for false-negative FNAC report was sampling error. The false-negative was due to non-representative sample, inadequate or too scanty specimen.[8]

The sensitivity in various studies ranges from 57% to 100%. However, most studies have sensitivity from 80-90%.[1,3,4,11,14,18,19,26] The sensitivity of 80% in our study is comparable to these studies. The lower sensitivity of FNAC could be dependent on the skills of cyto-technician at performing FNAC and the expertise of pathologist at assessing adequacy and accurate examination of the specimen.[4] The sensitivity of FNAC is low especially for malignant lesions.[14]

The specificity is better than the sensitivity for FNAC as shown by our and other studies. The specificity varies in literature from 82% to 100%.[1,3,4,11,14,18,19,26] The sensitivity and specificity of FNAC in the meta-analysis was 80% and 97% respectively.[17] The sensitivity and specificity of repeat FNAC was 84% and 93% when previous results were inconclusive.[6] FNAC is highly sensitive and specific diagnostic technique for most salivary gland swelling except for malignant neoplastic lesions where its sensitivity is intermediate.[5]

The diagnostic accuracy of FNAC in our study was 91%. It was comparable to the result of most of the studies which have accuracy of more than 90%.[1,3,4,11,14,18,19,26]

The low accuracy of 56% was reported in a study from Australia which was carried out at teaching hospital setting and multiple cyto-technician, cytopathologists and pathologists were involved. Our study was also carried out at a teaching hospital with multiple pathologists with different experiences involved but our result was comparable to the studies carried out at different setting. A study from Korea had diagnostic accuracy of 98.9% for high grade malignancy compared to low or intermediate grade tumor.[10] Keratin containing cyst, squamous cell carcinoma or mucoepidermoid carcinoma may be confused in presence of the numerous keratin debris or mucoid material.[27]

CONCLUSIONS

The diagnostic accuracy of FNAC for the parotid swelling was excellent when compared to histopathology. Our study had good sensitivity and specificity of FNAC for the malignant parotid lesions and it was comparable to the various studies done at different centers. FNAC as an initial evaluation tool for the parotid lesion is reliable and is helpful in deciding further management plan. It is useful in determining whether the lesion is benign or malignant as the management plan differs for these lesions.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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