CORRELATING THE ACCURACY OF FINE NEEDLE ASPIRATION CYTOLOGY AND HISTOPATHOLOGY IN DIAGNOSIS OF PAROTID TUMORS

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Abstract

Objective: *To compute up to what extend the FNAC results are precise by correlating it with final histology.*

Study: *retrospective review*

Methods: *132 patients, who presented with parotid swelling from the year 2014-2023 were included in the study. Only patients under-went FNAC from Liaquat national hospital were included. Patient's age, gender, diseases pattern and pathological characteristics were extracted from record. The FNAC and histology results were cross-tabulated in a 2 x 2 contingency table, from which we calculated the diagnostic accuracy, sensitivity, specificity, and positive and negative predictive values.*

Results: *Out of 132 patients, mean age was 46.2 years with range of 12 to 80 years. 72 patients were males and 60 were females. The diagnosis on FNAC was correlated with histopathology. Statistical analysis showed FNAC had a sensitivity of 70%, specificity of 99%, positive predictive value of 93%, and negative predictive value of 94.8%. However, the overall accuracy in this study was determined to be 94.6%. The most common diagnosis was Pleomorphic adenoma (80 patients, 60.6%), Warthin tumors (27 patients, 20.5%), most common malignant tumor was Mucoepidermoid carcinoma (11 patients, 8.3%), followed by Adenocarcinoma (6 patients, 4.5 %). Some rare tumors are also found on final histology report included Dermatofibrosarcoma putuberance (1 patient, 0.8%) and Markel cell carcinoma (1 patients, 0.8%).*

Conclusions: *This study found that FNAC correlated with histopathology in the diagnosis of parotid tumors. FNAC is useful in the preoperative assessment of parotid tumors as it provides a preoperative diagnosis.*

INTRODUCTION

Neoplasms of the salivary glands accounts for 3% to 5% of all head and neck neoplasms, having a high risk of cancer depending on the primary site of origin. Less than 0.5% of all malignant lesions are malignant tumors of the minor salivary glands. Whereas 14% to 22% of all salivary gland tumors are carcinomas (1).

Parotid tumors form 0.6% of all human body malignancies and 3% of all head and neck tumors. In the order of occurrence, they commonly affect the parotid, submandibular, sublingual, and minor salivary glands. Parotid tumors are generally benign (85%), primarily of the pleomorphic adenoma type. Whereas, Mucoepidermoid carcinoma is the most common malignant tumor of parotid gland. Parotid gland masses can also result from other causes, including lymphoma, inflammatory diseases, and metastatic malignances. (2-3)

Establishing whether pathology originates from the salivary gland or from nearby structures like lymph nodes, soft tissues, or skin can be challenging at times. Fine Needle Aspiration Cytology (FNAC) is a frequently used technique that is safe, easy to perform, and can yield crucial results promptly. (4). Fine needle aspiration cytology's (FNAC) origins date back to the 1920s, when it began to be simultaneously used in the US and Europe. (5-6).

The morphological features of individual cells, clusters of cells, and tissue micro particles obtained with a needle are the basis of the cyto-diagnostic technique known as FNAC. (2). It is widely acknowledged that FNAC is useful in the diagnosis of salivary gland masses. Due to the possibility of tumor leakage and facial nerve injury, the conventional open biopsy is no longer recommended (7). When it comes to cytologic diagnosis, this method has a high degree of sensitivity (62-97.6%) and specificity (94.3-100%) for differentiating salivary gland malignancies from non-neoplastic lesions. (4).

The parotid gland's unique anatomy makes it difficult to interpret FNAC results accurately, which makes its usefulness debatable. However, the use of FNAC aids in the differentiation of neoplastic lesions between benign and malignant, enabling appropriate planning prior to commencing any therapy. Clinical and radiological studies are necessary for surgical planning, however it is simple to counsel patients and schedule surgery if the pathology is known prior to surgery. FNAC can be helpful in this situation, particularly with malignant tumors. (2)

In order to evaluate the sensitivity, specificity, and diagnostic accuracy of FNAC, the current study compared the cytologic results of salivary gland lesions with their histology diagnoses, with a focus on discordant cases.

This study is linked to give the accuracy of FNAC related outcomes with the final histopathology, predicting the importance and need of FNAC to improve the outcomes of parotid lesion management.

MATERIAL & METHODS:

Study subjects and data acquisition:

A retrospective single center observational study was, carried out during 2014 – 2023 in our institute. The patients presented with parotid swelling, with both gender, age from 12 to 80 years, and which underwent fine needle aspiration followed by surgery, were included in the study. The cases in which patients were kept under follow-up without surgical intervention based on the clinical, radiological and aspiration cytology findings were excluded. The cases with FNAC diagnosis from our center and underwent surgery from outside centers or cases with FNAC diagnosis from outside centers and underwent surgery in our center were also excluded. Ethical committee of Liaquat National hospital and Medical College, Karachi, approved the study.

Fine needle aspiration sample processing:

For FNAC procedure at our institute, a 22–23 gauge needle was used, and smears and cell block preparation were made. Smears were stained with Hematoxylin and Eosin (H & E), Giemsa and PAP stains. Repeat aspiration was done for cases with inadequate smears. FNAC of the parotid lesion is being reported according to World Health Organization classification. (8).

Statistical analysis:

Categorical data is represented in the form of percentages. The performance of cytology was assessed for its sensitivity, specificity, diagnostic accuracy, positive predictive value and negative predictive value. The sensitivity, specificity, diagnostic accuracy, positive predictive value (PPV) and negative predictive value (NPV) of FNAC in diagnosing parotid lesions were calculated according to the following equation:

1. *Sensitivity (True positive rate): True positive (TP) / [True positive (TP) + False negative (FN)]*
2. *Specificity (True negative rate): True negative (TN) / [True negative (TN) + False positive (FP)]*
3. *Positive predictive value (PPV): True positive (TP) / [True positive (TP) + False positive (FP)]*
4. *Negative predictive value (NPV): True negative (TN) / [True negative (TN) + False negative (FN)]*
5. *False positive rate (FPR): False positive (FP) / [False positive (FP) + True negative (TN)]*
6. *False negative rate (FNR): False negative (FN) / [False negative (FN) + True positive (TN)]*
7. *Total accuracy: True positive (TP) + True negative (TN) / Total number of cases*

A *true positive (TP)* is a positive result for a neoplasm with subsequent final histopathological verification. A *true negative (TN)* is a negative result for neoplasm with subsequent final histopathological confirmation. A *false positive (FP)* is a positive cytological result for a neoplasm and a benign result on the final histopathological diagnosis. A *false negative (FN)* is a reading consistent with benign disease and a neoplasm on final histopathological diagnosis. Statistical analysis was done using SPSS software.

RESULTS:

In our study, total 132 patients underwent parotid surgery of which, 72 patients were males and 60 were females (as shown in *figure 1*). The age group was between 12- 80 years, with the mean age 46.2 years.

Figure 1: Percentages of patients according to gender (n= 132)
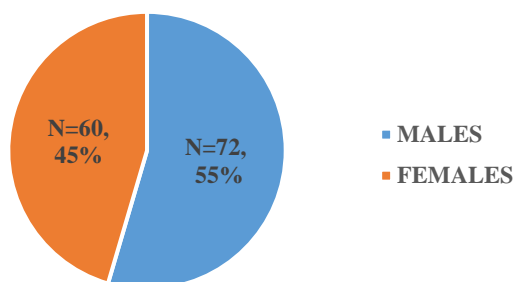
The diagnosis on FNAC was correlated with histopathology. Statistical analysis was calculated by 2 x 2 table as shown in *table 1*. FNAC had a sensitivity of 70%, specificity of 99%, positive predictive value of 93%, and negative predictive value of 94.8%. The overall diagnostic accuracy in this study was 94.6%.

Table 1: Statistical analysis of thyroid lesion

Total patients: n= 132	FINAL HISTOLOGY	
FNAC	**True Positive** (FNAC + HP = malignant) 14	**False Positive** (FNAC malignant, HP benign) 1
	False negative (FNAC benign, HP malignant) 6	**True Negative** (FNAC + HP = benign) 111

 FNAC: fine needle aspiration cytology, HP: histopathology

The cytological diagnosis was true-positive in 14 cases and true-negative in 111cases. (Tables 2 and 3). There were 6 false negative and 1 false positive results. (Table 4 and 5).

Table 2: Cytological and Histologic Diagnoses of Lesions with True-Positive Results: (n=14)

Fine needle aspiration cytology	Histology
1. Mucoepidermoid carcinoma (10) 2. Adenocarcinoma (4)	1. Mucoepidermoid carcinoma (10) 2. Adenocarcinoma (4)

Table 3: Cytological and Histologic Diagnoses of Lesions with True-Negative Results: (n=111)

Fine needle aspiration cytology	Histology
1. Pleomorphic adenoma (80 patients) 2. Warthin's tumor (27) 3. Lymphoepithelial cyst (3) 4. Schwannoma (1) 5. Oncocytoma (1)	1. Pleomorphic adenoma (80 patients) 2. Warthin's tumor (27) 3. Lymphoepithelial cyst (3) 4. Schwannoma (1) 5. Oncocytoma (1)

Table 4: Cytological and Histologic Diagnoses of Lesions with False-Positive Results: (n=1)

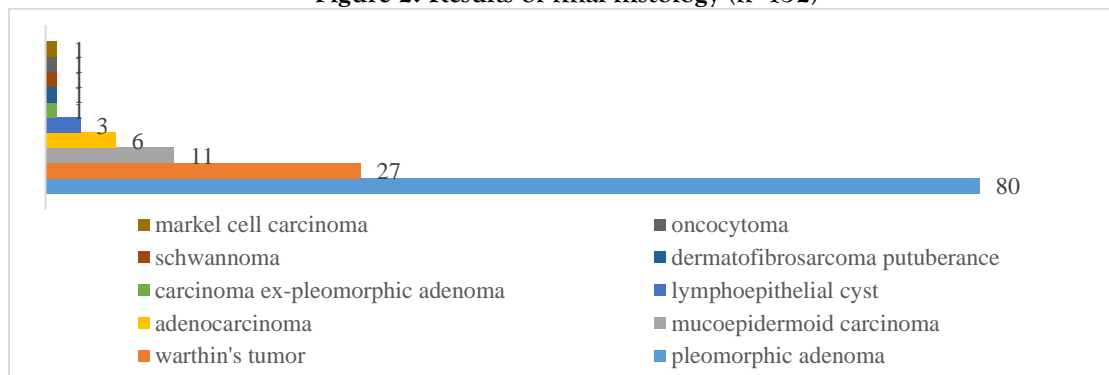| Fine needle aspiration cytology	Histology
1. Mucoepidermoid carcinoma (1)	1. Warthin's tumor (1)

Table 5: Cytological and Histologic Diagnoses of Lesions with False- Negative Results: (n=6)

Fine needle aspiration cytology	Histology
1. Pleomorphic adenoma (6)	1. Adenocarcinoma (2) 2. Mucoepidermoid carcinoma (1) 3. Carcinoma Ex-pleomorphic adenoma (1) 4. Markel cell carcinoma (1) 5. Dermatofibrosarcoma putuberance (1)

Among 132 studied cases, the results of final histology showed, 80 patients (60.6%), were having pleomorphic adenoma, followed by 27 (20.5%) patients were having Warthin's tumor, 11 (8.3%) had Mucoepidermoid carcinoma and 6 (4.5%) had adenocarcinoma. Some rare pathologies also reported in final histology report were Markel cell carcinoma (1 patient, 0.8%) and 1 patient of Dermatofibrosarcoma putuberance 0.8%, as shown in *figure 2*.

Figure 2: Results of final histology (n=132)

- markel cell carcinoma
- oncocytoma
- schwannoma
- dermatofibrosarcoma putuberance
- carcinoma ex-pleomorphic adenoma
- lymphoepithelial cyst
- adenocarcinoma
- mucoepidermoid carcinoma
- warthin's tumor
- pleomorphic adenoma

DISCUSSION:

Fine-needle aspiration cytology is an easy and safe diagnostic procedure that causes little discomfort to the patient. The main objective of cytological diagnosis of parotid masses is the differential diagnosis between benign lesions and malignant tumors.

In this analysis, FNAC showed a sensitivity of 70%, specificity of 99% and accuracy of 94.6%. These findings were similar with the results of a meta-analysis performed by Schmidth et al., (9), which showed sensitivity of 76% and specificity of 97% for FNAC. Another study performed by Tryggvason et al., reported sensitivity of 85.7%, specificity of 99.5%, and accuracy of 95.4%. (10).

False-positive findings (Table 4) are rare (in our series, 0.75%). In the recent literature, the false-positive rate ranges from 0% - 7 %. (11-12).

In addition, 14 of 15 (93%) (Table 2) malignant tumors (true-positive) and 111 of 117 (94.8%) (Table 3) benign lesions (true-negative) were classified accurately on cytological evaluation with regard to tumor type. AlKhafaji et al. (12) found an accurate tumor type classification for malignant tumors and benign tumors in 84% and 92% of cases, respectively.

In literature, it is seems to be the most problematic to diagnose on FNAC is Mucoepidermoid carcinoma, (13), however in our study 10 of 11 (90.9%) Mucoepidermoid carcinoma were accurately classified.

In this study pleomorphic adenoma 80 cases (60.6%), and warthin's tumor in 27 cases (20.5%), collectively accounted (106 of 111 patients) for 95.4%, which was being comparable with 85% of all benign tumors. (14-15).

In this study, only 6 parotid cancers were misdiagnosed as pleomorphic adenoma on FNAC. Among these 6 cases, 2 had adenocarcinoma, 1 had carcinoma of ex-pleomorphic, 1 had Mucoepidermoid carcinoma, 1 had Dermatofibrosarcoma putuberance, and 1 had Markel cell carcinoma, that also being comparable with Alphs H. et al. (16).

CONCLUSION:

This study showed that FNAC of parotid lesions is an accurate and a useful investigation for preoperative evaluation and therapeutic planning. Moreover, preoperative recognition of malignant tumors helps in preparing for an appropriate surgical procedure. Fine-needle aspiration cytology may be considered a safe and cost-effective procedure without contraindications for its use in the parotid gland. There have been no reports of cases of infection, facial nerve damage, or tumor spread as a result of FNAC of the parotid gland.

Author's contribution:

A. Conceived of the presented idea.
B. Developed the theory and performed the computations
C. Verified the analytical methods
D. Performed the analytic calculations and performed the numerical
E. Supervised the project.
All authors discussed the results and contributed to the final manuscript.
Authors contribution: 1 (A, C, D), 2 (B), 3 (B), 4-6 (E)

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