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Fine Needle Aspiration Cytology (FNAC) of Salivary Gland Swellings with Histopathological Correlation

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Abstract **Original Research Article**

Background: Salivary gland swelling is a common clinical presentation in Head Neck region. The parotid gland is the most commonly affected site. Accurate diagnosis is imperative considering wide-ranging differential diagnoses comprising infectious, inflammatory conditions, cysts, benign and malignant tumors. Fine needle aspiration cytology (FNAC) has emerged as a useful, quick, nontraumatic diagnostic modality in this field by providing relevant information about the nature of such swellings. ***The study aims:*** to assess the diagnostic validity of FNAC in patients presenting with salivary gland swellings comparing the findings obtained from FNAC with histopathological findings. ***Methods:*** A cross-sectional study was carried out from November 2018 to November 2019 among the patients who presented to the Department of Otolaryngology & Head-Neck Surgery of Sir Salimullah Medical College Mitford Hospital, Dhaka. The sample size consists of a total of 50 patients presenting with salivary gland swellings. FNAC was done for all the patients, and the results were compared with the surgical biopsy and histopathological examination. ***Results:*** Of the 50 cases, 78% were neoplastic. The benign tumor most encountered was pleomorphic adenoma, constituting 59.26%, while the most common malignant tumor was mucoepidermoid carcinoma, which accounted for 38.46%. The sensitivity of the FNAC came to 76.9%, specificity was 94.6%, PPV constituted 83.3%, NPV was 92.1%, and overall diagnostic accuracy came to 90.0%. ***Conclusion:*** FNAC is a very useful and effective diagnostic modality in the work-up of salivary gland swellings, with high diagnostic accuracy with respect to distinguishing benign from malignant lesions. The findings indicate that FNAC diagnosis should be integrated with clinical correlation and histopathological confirmation to achieve maximum benefit in patient care with minimal diagnostic discrepancy.

Keywords: Fine needle aspiration cytology (FNAC), salivary gland swellings, diagnostic accuracy, benign lesions, malignant lesions.

INTRODUCTION

Salivary gland swellings are a frequently encountered in dental and medical practices. Usually, the parotid gland is involved and these account for about 70% of all salivary gland tumors [1]. The swelling may result from a number of pathologic disorders, ranging from inflammatory diseases, cysts and both benign and malignant tumors [2]. Since the differential diagnoses for swellings of salivary glands are so wide, an exact diagnosis is going to be mandatory for appropriate clinical management since these lesions range from non-

neoplastic to highly aggressive malignant lesions. FNAC has emerged as an established, minimally invasive diagnostic modality in the workup of salivary gland swellings [3]. It has received favor due to its simplicity, inexpensiveness, and provision for rapid preliminary diagnostic information [4]. FNAC entails the aspiration of cells along a fine needle, which then undergo cytological examination under the microscope. This is of particular value in distinguishing benign from malignant lesions-a very critical guide to patient management [5]. It has gained wide acceptance in outpatient departments for its high sensitivity, which varies between 80% and 98%, and specificity, which varies from 92% to 100%, based on the quality of the aspirated sample and expertise of the cytopathologist [6,7]. Among all benign tumors, the most common is pleomorphic adenoma, accounting for 60-70% of all benign neoplasms of the salivary gland [8]. Next in line comes Warthin's tumor. On the malignant side, FNAC has been of paramount importance in diagnosing conditions like mucoepidermoid carcinoma, the most common malignant tumor representing 10 to 15% [9], and adenoid cystic carcinoma, known for its aggressive behavior with perineural invasion. Despite the generally high degree of diagnostic accuracy, limitations do exist in regard to FNAC, such as an inadequate sample or overlapping cytological features, which may result in diagnostic errors. Adenoid cystic carcinoma might also commonly be mistaken for pleomorphic adenoma, while the low-grade mucoepidermoid carcinoma may closely resemble a benign cyst. Histopathological examination still is the most definite diagnostic modality for lesions of the salivary gland [10], providing detailed information on tissue architecture, tumor margins, and malignant potential. FNAC is most reliable if applied in combination with clinical assessment and supplemented with histopathological confirmation. These studies also indicate that the diagnostic accuracy of FNAC, when compared with histopathology, lies within the range of 85% to 95% [11,12]. This emphasizes the practical value of FNAC as a first-order diagnostic tool, particularly in resource-constrained settings where further invasive procedures may not be available. The correlation of FNAC findings with histopathology is very important for confirmation of diagnosis and treatment. Such correlations help a lot in reducing the diagnostic errors and thus facilitating better patient outcomes. In this context, FNAC serves as a very important preliminary tool, while the final confirmation comes from histopathology. The study aims at assessing the diagnostic accuracy of FNAC in swellings of salivary glands by correlating cytological findings with histopathology diagnosis concerning sensitivity, specificity, and predictive value.

METHODOLOGY

This cross-sectional study was carried out at the Department of Otolaryngology & Head-Neck Surgery of Sir Salimullah Medical College Mitford Hospital, Dhaka, and all were included in the study over a period from November 2018 to November 2019. The estimated sample size for the study can be calculated using the formula for cross-sectional studies as follows: Sample size = z2pq / d2. In this equation, z is the z-value for a standard normal distribution at a confidence level of 95% and is equal to 1.96. The expected proportion of salivary gland swellings, p, was assumed to be 50% due to lack of prior information. As such, q= 1 - p was also 50%. The allowable error or precision in the estimate, d, was taken as 5%. Using these values in the formula, the sample size turned out to be 384. However, it was bound by very limited time and the patients received; hence, the sample for the study is 50 purposive samplings of patients. Inclusion criteria for the study included all age groups and both sexes presenting with swellings of salivary glands of both non-neoplastic and neoplastic etiology, diagnosed initially on FNAC and later confirmed by surgical procedure and histopathology. Patients in whom the salivary gland lesions were diagnosed on FNAC but not later biopsied surgically were excluded from the study. FNAC was the major diagnostic modality adopted in this study. FNAC is a well-established, quick, and inexpensive method for sampling suspicious masses for cells to study their cytology. A fine needle was used to aspirate a few cells from the swellings in the salivary gland. These aspirated cells, after being smeared onto glass slides, were stained and observed under a microscope, thus facilitating diagnosis. Histopathology was used as a confirmatory diagnostic approach. The tissue samples, after collection via surgical biopsies, were fixed in 10% formalin and labeled and dispatched for histopathology. The histopathology would involve the microscopic examination of stained tissue sections for identifying the presence and nature of disease conditions. The variables of outcomes for the study included demographics of the patients regarding age and sex, cytological findings from the FNAC of the salivary gland swellings, and the subsequent histopathological reports. The study was approved by the Ethical Committee of Sir Salimullah Medical College Mitford Hospital. All the patients were informed about the nature of the study, its purpose, risks, and benefits. Informed written consent was obtained. Data collection was done through a detailed history from the patients, clinical examinations, routine laboratory investigations, FNAC and histopathological examinations. A great importance was attached to eliciting detail information about the presenting complaint, duration of the lump, changes in size, associated symptoms, and previous medical or surgical history. Associated systemic disorders like diabetes, hypertension, and anemia were optimized prior to surgery. The surgical specimens collected were sent for histopathology examination, and the report was matched with preoperative FNAC findings with due care. Data analysis and statistical computation were carried out using SPSS-22 for Windows. Qualitative and quantitative data were presented as descriptive statistics. Means for continuous variables were computed. The

level of significance was set at 0.05, and a p-value ≤ 0.05 was considered significant, which would give a stamp of authenticity to the results of this study.

RESULTS

The cross-sectional study was carried out at the Department of Otolaryngology & Head-Neck Surgery, SSMCMH, Dhaka, from November 2018 to November 2019. The objectives were to compare the efficacy of preoperative FNAC of salivary gland swellings with postoperative histopathology for diagnosis and optimum management. Fifty salivary gland swellings were included in the study, and their age group range was 40.8 yr (SD ± 19.8 yr). The age distribution manifested that the two most representative groups in the series were patients aged 21-30 years and > 60 years, each contributing 20% of cases (Table II). The study population consisted of 27 males (54%) and 23 females (46%), yielding a male to female ratio of 1.17:1 (Table III). Among these, the parotid gland was involved in 39 cases (78%) and the submandibular gland in 11 cases (22%) (Table V). FNAC reports categorized these cases as neoplastic (39, 78%) and non-neoplastic (11, 22%). Neoplastic lesions were benign with the predominance of pleomorphic adenoma accounting for 59.26% (Table VII). Histopathology showed benign in 52% and malignant in 26% lesions. Again, pleomorphic adenoma was the most common benign neoplasm accounting for about 69.23% and mucoepidermoid carcinoma was the most prevalent malignancy accounting for 38.46% Table IX. Performance characteristics of FNAC against histopathology are depicted in Table XII. Sensitivity of FNAC was 76.9%, specificity was 94.6%, PPV was 83.3%, NPV was 92.1%, and overall accuracy was 90.0%.

Table 1: Distribution of the Study Population According to Age (N=50)

Age (Group)	Number of Cases	Percentage (%)
≤20 Yrs.	8	16.0
21-30 Yrs.	10	20.0
31-40 Yrs.	9	18.0
41-50 Yrs.	8	16.0
51-60 Yrs.	5	10.0
>60 Yrs.	10	20.0
Mean ± SD	40.8 ± 19.8	
Min - Max	3 - 75	

Table 2: Distribution of the Study Population According to Sex (N=50)

Sex	Number of Cases	Percentage (%)
Male	27	54.0
Female	23	46.0

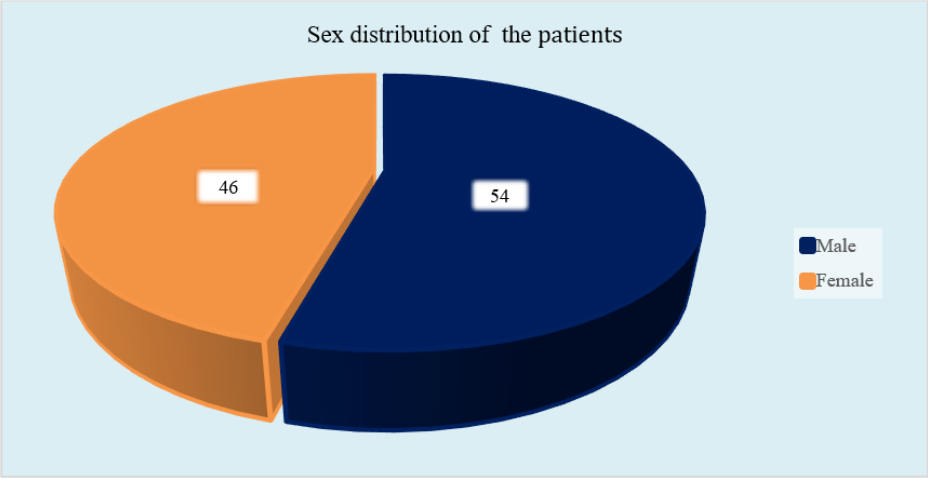

Figure I: Pie chart showed sex wise patients distribution (N=50)

Table 3: Distribution of Salivary Glands with Respect to Location (N=50)

Salivary Gland	Number of Cases	Percentage (%)
Parotid	39	78.0
Submandibular	11	22.0

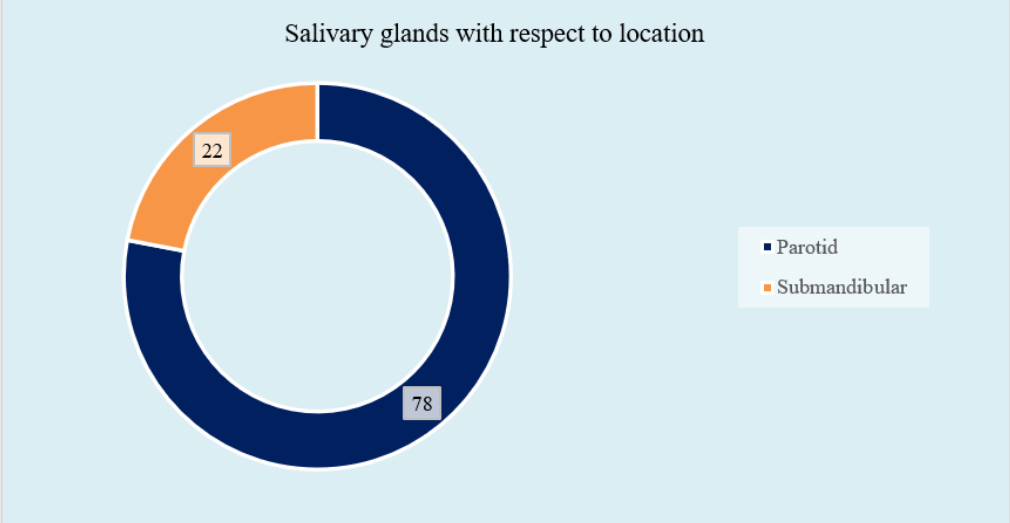

Figure II: Ring chart showed involved salivary glands (N=50)

Table 4: Distribution of Non-Neoplastic and Neoplastic Salivary Gland Swellings on FNAC (N=50)

Type of Salivary Gland	Non-Neoplastic	Benign	Malignant	Total (%)
Parotid	5	25	9	39 (78%)
Submandibular	6	2	3	11 (22%)
Total	11 (22%)	27 (54%)	12 (24%)	50(100%)

Table 5: Histopathological Diagnosis of the Study Population (N=50)

Diagnosis	Number of Cases	Percentage (%)
Benign	26	52.0
Malignant	13	26.0
Not Available / Others	11	22.0

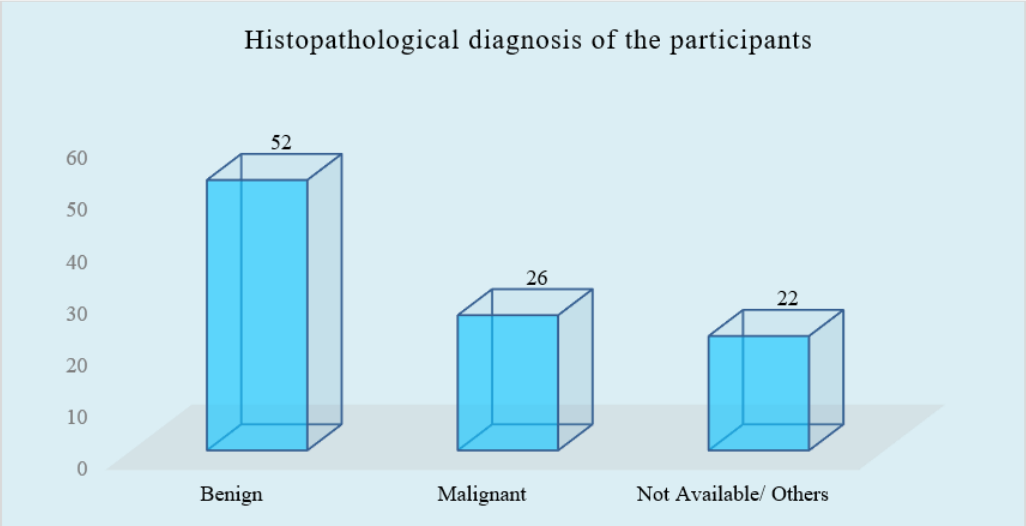

Figure III: Column chart showed histopathological diagnosis wise patients (N=50)

Table 6: Performance Characteristics of FNAC Against Histopathology (N=50)

Performance Metric	Value
Sensitivity	76.9%
Specificity	94.6%
Positive Predictive Value (PPV)	83.3%
Negative Predictive Value (NPV)	92.1%
Overall Accuracy	90.0%

DISCUSSION

The study strongly emphasizes that FNAC plays a vital role in the assessment of salivary gland swellings. By virtue of its safety, economy, and low complication rates, FNAC becomes an important preoperative modality that helps the clinicians in the proper management of the case conditions. Preoperative differentiation of benign and malignant tumor is of immense importance, especially in recurrent or inoperable malignancies, where cytological diagnosis can give the mode of treatment without open biopsies. In our cross-sectional study conducted at the Department of Otolaryngology & Head-Neck Surgery, SSMCMH, Dhaka from November 2018 to November 2019, we evaluated 50 patients presenting with salivary gland swelling. The age of the participants ranged from 3 to 75 years with a mean age of 40.8 years SD ±19.8. This finding agreed with the previous studies that had comparable mean ages in affected populations [13]. The male to female ratio that was found in the current study to be 1.17:1 agreed with earlier findings in the literature. Distribution in terms of the site of swelling showed that the most affected site was the parotid gland, with 39 cases representing 78%, followed by the submandibular gland, with 11 cases representing 22%. Our findings are in agreement with previous studies that neoplasms involving the parotid gland are more common compared to neoplasms affecting the submandibular and minor salivary glands. Surprisingly, our findings have disagreed with Ahmed's study, where neoplastic involvement was seen at 70% in the parotid gland. Our FNAC results showed that 22% of the cases were non-neoplastic, while 78% were neoplastic, which included 54% benign and 24% malignant tumors. Among the non-neoplastic cases, chronic sialadenitis was the most frequent finding and accounted for 90.90%. In benign neoplasms, the most common finding was pleomorphic adenoma, which accounted for 59.26%, while mucoepidermoid carcinoma formed 50% of malignant cases. This confirms the literature where most of the time, pleomorphic adenoma is reported as the most frequent benign neoplasm of the salivary gland [14, 15] The histopathological findings confirmed 22% as non-neoplastic, 52% benign, and 26% malignant. However, there were some discrepancies, where two benign tumors and one pleomorphic adenoma were wrongly diagnosed as malignant on histopathology. On the other hand, one adenocarcinoma and one mucoepidermoid carcinoma were diagnosed as pleomorphic adenoma on FNAC. Sensitivity of FNAC, as calculated in the present study, was 76.9%, with a specificity of 94.6% and an overall diagnostic accuracy of 90.0%. These are comparable to the metrics derived from other series, in which the sensitivity of FNAC was as low as 54% and as high as 97.6%, depending on the population and clinical setting. Considering the overall success with the technique of FNAC, there were certain specific diagnostic inaccuracies noted in our study, including three false negatives at 6% and two false positives at 4%, thus indicating the vulnerabilities inherent in this modality. These discrepancies in part reflect the variation in operator skill and experience, as well as inherent limitations in cytological interpretation. The inability to conduct advanced imaging with either CT or MRI on all patients for financial reasons may further hinder our ability to correctly stage neoplastic lesions and metastasis [16]. In other words, FNA cytology is a highly valuable preoperative diagnostic modality for swellings of the salivary gland; neoplastic from non-neoplastic swellings and benign from malignant tumors can be differentiated. Though FNA cytology may not always provide type-specific diagnosis for malignancies, the majority exclude malignancy. This study recommends the continued use of FNA cytology in clinical practice and reiterates the necessity for further studies to enhance the diagnostic accuracy to reduce false results.

LIMITATIONS

The small size; 50 patients cannot be representative in wide demographic prevalence of salivary gland swellings in our region. The subjective nature inter-observer variability among different pathologists while interpreting cytological samples remains another important factor that could affect our results. Limitation of advanced radiology modalities like MRI or CT impeded us from assessing the full extent of the tumor and lymph nodes metastasis as well.

RECOMMENDATIONS

1. All surgically resected lesions of the salivary gland need to be histologically confirmed.
2. To ensure better diagnostic standards, the panel of pathologists for diagnosing FNAC needs to be limited to reduce diagnostic variability.
3. Future studies should therefore have larger cohorts over greater durations in addition to being in a multicentric design for wider applicability of the results.

CONCLUSIONS

This study further reiterates the fact that FNAC forms an integral part of the diagnostic workup in the preoperative evaluation of salivary gland swellings. It is imperative in guiding surgical management, given that it further characterizes lesions as neoplastic versus non-neoplastic and benign versus malignant. However, dependence on the skill of the operator speaks to the need for standardized protocols and further training in order to minimize the rates of false-negative and false-positive diagnoses.

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