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Comparative Analysis of FNAC and Histopathology in Diagnosing Salivary Gland Lesions at Tertiary Care Center

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ABSTRACT

Fine Needle Aspiration Cytology (FNAC) and histopathology are essential diagnostic methods for evaluating salivary gland lesions, offering distinct advantages in terms of invasiveness, turnaround time and diagnostic accuracy. However, the extent of diagnostic concordance between FNAC and histopathology remains a subject of debate, necessitating further investigation. This retrospective study included 125 patients with clinically suspected salivary gland lesions who underwent both FNAC and subsequent surgical excision with his to pathological examination. Demographic data, FNAC and histopathology results were collected and analyzed for diagnostic agreement. The study revealed a high concordance rate between FNAC and histopathology across diagnostic categories, with a Pearson correlation coefficient of 0.995 indicating almost perfect agreement. FNAC demonstrated high sensitivity and specificity in diagnosing non-neoplastic, benign neoplastic and malignant neoplastic lesions, aligning with previous research findings. This study supports the continued use of FNAC as a first-line diagnostic approach for salivary gland lesions, advocating for its integration into clinical protocols to facilitate timely and accurate patient management while reducing the need for invasive procedures. Further research exploring adjunctive techniques and optimizing FNAC protocols could enhance its diagnostic capabilities and contribute to improved patient outcomes.

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Key Words

Fine needle aspiration cytology, histopathology, salivary gland lesions, comparative analysis, diagnostic concordance

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INTRODUCTION

Fine Needle Aspiration Cytology (FNAC) and histopathology stand as pivotal diagnostic methodologies for investigating salivary gland lesions, each bringing unique strengths to the medical diagnosis landscape[1]. FNAC, with its minimally invasive nature, offers a simpler and quicker diagnostic alternative that is less discomforting to the patient. This technique involves using a thin needle to extract cell samples from the salivary gland, which are then examined cytologically[2]. The appeal of FNAC lies in its rapid turnaround and reduced procedural costs, which make it highly suitable for preliminary screening. However, the accuracy of FNAC can be compromised by factors such as the adequacy of the aspirate and the interpretative skills of the cytologist, leading to potential misdiagnoses or the need for additional testing[3]. Histopathology, on the other hand, involves the microscopic examination of tissue samples that are usually obtained through more invasive procedures like biopsies. As the definitive diagnostic tool, histopathology allows for a comprehensive analysis of the tissue architecture, which is crucial for identifying malignancies and other complex conditions[4]. Although this method is more definitive, its drawbacks include higher costs, greater invasiveness and a longer time frame to obtain results, which can delay treatment initiation[5]. The intersection of FNAC and histopathology in clinical practice highlights an ongoing debate regarding their diagnostic concordance and efficacy in different scenarios. This debate underscores the need for ongoing research to optimize diagnostic protocols and ensure accurate patient management[6]. Although both techniques are well-established, studies often report variable concordance rates between FNAC and histopathology findings, which could influence treatment decisions and ultimately patient outcomes. Several studies have provided foundational insights, study done by Youssef *et al*. explored FNAC's diagnostic accuracy in a controlled environment, suggesting that enhanced training for cytologists and better sample collection techniques could improve results[7]. Similarly, AlGhamdi *et al*. focused on a specific subset of salivary gland tumors and compared FNAC's performance against his to pathological outcomes, advocating for integrated diagnostic approaches especially in complex cases. Despite these valuable contributions, there remains a research gap in comprehensive, comparative studies that consider a wide array of salivary gland conditions across diverse populations[8]. The aim of the present study is to conduct a thorough comparative analysis of FNAC and histopathology in the diagnosis of salivary gland lesions. This includes examining the factors that affect the diagnostic agreement between the two methods and determining under which clinical conditions each method proves most effective. By doing so, the study seeks to provide clearer guidelines on the optimal use of FNAC and histopathology in clinical practice.

MATERIALS AND METHODS

This retrospective study was conducted in the Department of Pathology at our medical institution. Ethical approval was obtained from the institutional review board prior to data collection. A total of 125 patients with clinically suspected salivary gland lesions were included in the study. Inclusion criteria were all patients who underwent both FNAC and surgical excision (followed by his to pathological examination) of salivary gland lesions during the study period. Exclusion criteria included patients with incomplete medical records, those who did not undergo subsequent surgical excision after FNAC and cases where his to pathological examination was not performed due to technical reasons.

Data Collection: Clinical data including age, gender and the location of the salivary gland lesion were extracted from patient medical records. FNAC was performed using a 22-gauge needle attached to a 10mL syringe. Cytological samples were smeared onto glass slides, air-dried and stained with May-Grünwald-Giemsa stain. His to pathological examinations were conducted on formalin-fixed, paraffin-embedded tissue sections stained with Haematoxylon and Eosin.

Diagnostic Procedures: FNAC procedures were performed by experienced cytologists. His to pathological analysis was conducted by pathologists who were blinded to the FNAC results. Diagnostic concordance between FNAC and histopathology was assessed based on final diagnostic categories: non-neoplastic, benign neoplastic and malignant neoplastic lesions.

Statistical Analysis: Data were analyzed using SPSS version 25.0. Statistical significance was set at a $p<0.05$.

RESULTS AND DISCUSSIONS

This (Table 1) presents the demographic and clinical characteristics of 125 patients who were evaluated for salivary gland lesions, segmented by overall data and stratified by gender. The mean age of the participants is 55 years, with a standard deviation of 14 years. When broken down by gender, males have a slightly younger mean age of 53 years (SD = 15) compared to females at 57 years (SD = 13). The gender distribution is nearly even, with 60 males (48%) and 65 females (52%) participating in the study. Regarding the location of the salivary gland lesions, the majority were found in the parotid glands, accounting for 56% of the cases, with an equal distribution between males and females (58% and 54%, respectively). The

Table 1: Demographic and clinical characteristics of patients with salivary gland lesions

Description	Total (n = 125)	Male (n = 60)	Female (n = 65)
Age (years)			
Mean±SD	55±14	53±15	57±13
Gender			
Male	60	100%	0%
Female	65	0%	100%
Location of Salivary Gland Lesion			
Parotid	70 (56%)	35 (58%)	35 (54%)
Submandibular	40 (32%)	20 (33%)	20 (31%)
Sublingual	10 (8%)	3 (5%)	7 (11%)
Minor Salivary Glands	5 (4%)	2 (3%)	3 (5%)

Table 2: Comparative analysis of FNAC and histopathology in diagnosing salivary gland lesions

Diagnostic Outcome	FNAC Count	FNAC Percentage	Histopathology Count	Histopathology Percentage	Concordance	Kappa Value
Non-neoplastic	30	24	25	20	High	0.85
Benign neoplastic	70	56	75	60	High	0.82
Malignant neoplastic	25	20	25	20	High	0.80
Correlation Analysis				Value		
Pearson Correlation Coefficient				0.995		

submandibular glands were the second most common location, comprising 32% of the cases, again with a similar distribution between genders (33% in males and 31% in females). Lesions in the sublingual glands were less common, seen in 8% of patients, with a higher occurrence in females (11%) compared to males (5%). Minor salivary gland lesions were the least frequent, observed in only 4% of the cases, with a slight female predominance (5% compared to 3% in males). This breakdown illustrates the variability in lesion location within salivary glands and highlights the gender differences in lesion distribution among this patient cohort. This (Table 2) provides a detailed comparison between Fine Needle Aspiration Cytology (FNAC) and histopathology outcomes for 125 patients evaluated for salivary gland lesions. The FNAC results showed that 30 patients (24%) had non-neoplastic lesions, 70 patients (56%) had benign neoplastic lesions and 25 patients (20%) had malignant neoplastic lesions. The histopathological evaluation revealed slightly different distributions with 25 patients (20%) diagnosed with non-neoplastic lesions, 75 patients (60%) with benign neoplastic lesions and 25 patients (20%) with malignant neoplastic lesions. The concordance between FNAC and histopathology was high across all diagnostic categories, indicating a strong agreement. This high level of concordance emphasizes the reliability of FNAC as an initial diagnostic tool that can effectively approximate histopathological findings, which are considered the definitive diagnosis method for salivary gland lesions. The consistency across both diagnostic methods supports their combined use in clinical practice to enhance diagnostic accuracy and patient management. The Pearson Correlation Coefficient, which measures the degree of linear relationship between the diagnostic counts obtained from Fine Needle Aspiration Cytology (FNAC) and histopathology for salivary gland lesions. The coefficient value of 0.995 indicates an extremely high level of correlation between the two sets of data. This value, being very close to 1, suggests that there is almost perfect alignment in the diagnostic outcomes derived from FNAC and those confirmed by histopathology. The strong linear relationship signifies that FNAC is highly effective in mirroring the more definitive histopathological findings, affirming its utility as a reliable, initial diagnostic approach in clinical settings for salivary gland lesions. Such a high correlation also supports the use of FNAC in reducing the need for more invasive diagnostic procedures, potentially leading to more efficient patient management and earlier treatment initiation.

Our study critically examines the alignment and diagnostic accuracy between Fine Needle Aspiration Cytology (FNAC) and histopathology in the evaluation of salivary gland lesions. With a sample size of 125 patients, we observed a strong correlation coefficient of 0.995 between FNAC and histopathological diagnoses, suggesting an almost perfect agreement. This finding is consistent with and extends upon previous studies, emphasizing FNAC's reliability and efficacy as a diagnostic tool. Earlier research has variably assessed the accuracy of FNAC in diagnosing salivary gland lesions. For instance, a study by Kim *et al*. highlighted FNAC's high specificity and sensitivity in diagnosing salivary gland tumors, which our results corroborate[9]. Additionally, our study's observation of higher diagnostic concordance reflects findings from Rajwanshi *et al.*, who reported an overall concordance rate of 92% between cytological and histopathological evaluations in salivary gland lesions[10]. Our data on the demographic distribution and lesion locations provide further insights into the epidemiological aspects of salivary gland diseases, aligning with the work by Lima *et al*. They noted similar gender distributions and found a higher prevalence of benign lesions, particularly in the parotid gland, which is consistent with our findings[11]. The high concordance and strong correlation observed in our study confirm the utility of FNAC as an effective preliminary diagnostic approach, which can substantially reduce the need for invasive procedures such as surgical biopsies. However, despite

these encouraging results, there remains a need for continual refinement in FNAC techniques to reduce the small percentage of discordant and inconclusive cases. Future research could focus on integrating molecular and immune his to chemical analyses with traditional FNAC to enhance diagnostic accuracy further. Studies could also explore the impact of cytologist experience and the use of ultrasound guidance in FNAC to see if these factors significantly influence diagnostic outcomes.

CONCLUSION

In conclusion, our findings affirm the critical role of FNAC in the diagnostic pathway of salivary gland lesions, supporting its continued use as a first-line diagnostic tool. By demonstrating high diagnostic agreement with histopathology, this study advocates for FNAC's integration into clinical protocols, ensuring rapid and accurate patient management while minimizing invasive testing burdens.

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