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FINE NEEDLE ASPIRATION CYTOLOGY VS CORE NEEDLE BIOPSY IN SALIVARY GLAND LESIONS: EXPERIENCE FROM A TERTIARY CARE ENT CENTRE IN SALEM, INDIA

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ABSTRACT

Background: Salivary gland lesions present a wide histopathological spectrum, making accurate preoperative diagnosis essential for appropriate clinical management. Fine needle aspiration cytology (FNAC) is widely used as an initial diagnostic modality; however, its limitations include inadequate sampling and lack of architectural detail. Core needle biopsy (CNB) has emerged as an alternative technique with potentially higher diagnostic accuracy.

Objectives: To compare the diagnostic performance of FNAC and CNB in salivary gland lesions using final histopathological diagnosis as the reference standard.

Methodology : This hospital-based observational comparative study was conducted at a tertiary care ENT centre in Salem, India. Forty patients with clinically or radiologically detected salivary gland lesions underwent both FNAC and ultrasound-guided CNB. Cytological and histological findings were compared with final histopathology. Sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy were calculated for both modalities.

Results: Of the 40 cases, 25 (62.5%) were benign and 15 (37.5%) were malignant on final histopathology. FNAC demonstrated a sensitivity of 66.7%, specificity of 88.0%, and overall diagnostic accuracy of 80.0%. CNB showed superior performance with a sensitivity of %, specificity of 96.0%, and overall diagnostic accuracy of 95.0%. The rate of inconclusive results was higher with FNAC (20%) compared to CNB (5%). Both procedures were safe, with no major complications observed.

Conclusion: CNB offers higher diagnostic accuracy and fewer inconclusive results compared to FNAC in salivary gland lesions. FNAC remains a useful initial diagnostic tool, while CNB should be employed in cases with indeterminate FNAC results or suspectedmalignancy.

KEYWORDS: Salivary gland lesions; Fine needle aspiration cytology; Core needle biopsy; Diagnostic accuracy; Histopathology

INTRODUCTION

Salivary gland lesions encompass a wide and heterogeneous spectrum of non-neoplastic, benign, and malignant entities, posing a significant diagnostic challenge to clinicians and pathologists. These lesions arise from major salivary glands—predominantly the parotid and submandibular glands—as well as minor salivary glands distributed throughout the upper aerodigestive tract[1]. Accurate preoperative diagnosis is essential, as management strategies vary widely, ranging from conservative follow-up to extensive surgical excision with or without adjuvant therapy. Inappropriate or delayed diagnosis may result in overtreatment of benign conditions or inadequate management of malignant tumors, potentially affecting functional and oncological outcomes[2].

Fine needle aspiration cytology (FNAC) has long been established as the first-line diagnostic tool for salivary gland swellings because of its simplicity, minimal invasiveness, cost- effectiveness, and outpatient feasibility[3]. However, FNAC is limited by sampling errors, cystic degeneration, overlapping cytomorphological features, and lack of architectural details, leading to inconclusive or indeterminate results in a considerable proportion of cases. Core needle biopsy (CNB), particularly when performed under ultrasound guidance, has emerged as an alternative technique that provides preserved tissue architecture, allowing better tumor subtyping and the use of ancillary techniques such as immunohistochemistry[4].

Salivary gland tumors are relatively uncommon, accounting for approximately 3–6% of all head and neck neoplasms. The parotid gland is the most frequently involved site, contributing to nearly 70–80% of cases, followed by the submandibular and minor salivary glands[5].

While the majority of parotid gland tumors are benign, lesions arising from submandibular and minor salivary glands have a higher likelihood of malignancy. The incidence of salivary gland tumors increases with age, with malignant lesions occurring more commonly in older individuals[6]. In the Indian population, delayed presentation and limited access to advanced diagnostic modalities further complicate preoperative evaluation, underscoring the need for reliable, accurate, and context-appropriate diagnostic approaches[7].Several studies have evaluated the diagnostic performance of FNAC in salivary gland lesions, reporting sensitivity ranging from 54% to 80% and specificity between 85% and 95%[8].Despite

high specificity, false-negative results and non-diagnostic samples remain notable limitations, particularly in low-grade malignancies and cystic lesions. The introduction of the Milan System for Reporting Salivary Gland Cytopathology has improved standardization; however, indeterminate categories continue to pose management dilemmas[4].

In contrast, multiple international studies have demonstrated superior diagnostic accuracy of CNB, with sensitivity and specificity often exceeding 90%[9]. CNB has shown particular advantage in distinguishing benign from malignant lesions, reducing the rate of inconclusive diagnoses, and enabling accurate histological typing. Concerns regarding complications such as facial nerve injury, tumor seeding, and hematoma have been largely mitigated by the use of ultrasound guidance and smaller gauge needles, with reported complication rates remaining low and comparable to FNAC[10].

Despite growing evidence supporting the diagnostic superiority of CNB, FNAC remains the predominant diagnostic modality in most Indian tertiary care settings due to familiarity, resource constraints, and limited local data on CNB outcomes. There is a paucity of region- specific comparative studies evaluating FNAC and CNB within the same patient cohort, particularly from South India. Given the diverse histopathological spectrum of salivary gland lesions and the clinical implications of preoperative diagnostic accuracy, a direct comparison of FNAC and CNB using final histopathology as the reference standard is warranted. This study aims to provide institution-based evidence to guide optimal diagnostic strategies for salivary gland lesions in routine clinical practice.

Aim:

To compare the diagnostic performance of Fine Needle Aspiration Cytology (FNAC) and Core Needle Biopsy (CNB) in the evaluation of salivary gland lesions at a tertiary care ENT centre in Salem, India.

Objectives:

1. To assess and compare the diagnostic accuracy of FNAC and CNB in salivary gland lesions by evaluating sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy using final histopathological diagnosis as the reference standard.
2. To determine the rate of inconclusive or non-diagnostic results obtained by FNAC and CNB and analyze their concordance with final histopathology.

METHODOLOGY

This was a hospital-based observational comparative study conducted in the Department of Otorhinolaryngology (ENT) at a tertiary care teaching hospital in Salem, Tamil Nadu, India. The study evaluated the diagnostic performance of fine needle aspiration cytology (FNAC) and core needle biopsy (CNB) in patients presenting with salivary gland lesions.

The study was carried out over a period of 16 months with clinically and/or radiologically detected salivary gland swellings . 40 Patients of either sex, aged ≥18 years with Presence of a palpable or radiologically evident salivary gland lesion (parotid, submandibular, or minor salivary glands) undergoing both FNAC and CNB for the same lesion and who subsequently underwent surgical excision with histopathological examination or had adequate clinicoradiological follow-up were included in the study.

Patients with bleeding disorders or contraindications to biopsy and with Inadequate or non- representative FNAC or CNB samples and Recurrent salivary gland tumors or previously treated cases were Excluded from the Study.

A detailed clinical history was obtained, including duration of swelling, pain, facial nerve involvement, and associated systemic symptoms. All patients underwent a thorough head and neck examination. Imaging studies such as ultrasonography and/or CT/MRI were performed where indicated.

FNAC was performed under aseptic precautions by either palpation guidance or ultrasonographic guidance and Cytological diagnosis was categorized as non-neoplastic, benign neoplastic, malignant, or inconclusive.

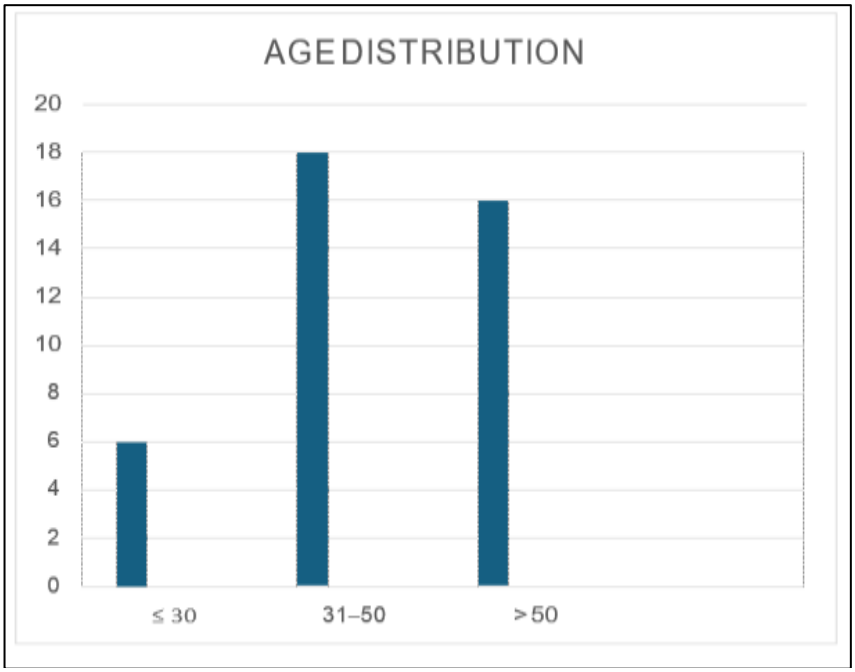
Core Needle Biopsy (CNB) was performed under ultrasonographic guidance using an 18- gauge automated or semi-automated core biopsy needle after local infiltration. Immunohistochemistry was performed when required for definitive diagnosis. Surgical excision specimens, when available, were considered the gold standard for final diagnosis. Histopathological findings were classified according to WHO classification of salivary gland tumors.

The diagnostic performance of FNAC and CNB was assessed by comparing Sensitivity, Specificity , Positive predictive value , Negative predictive value , Overall diagnostic accuracy and Rate of inconclusive diagnosis . Comparison between FNAC and CNB was done using the Chi-square test or Fisher's exact test, and a p-value <0.05 was considered statistically significant.

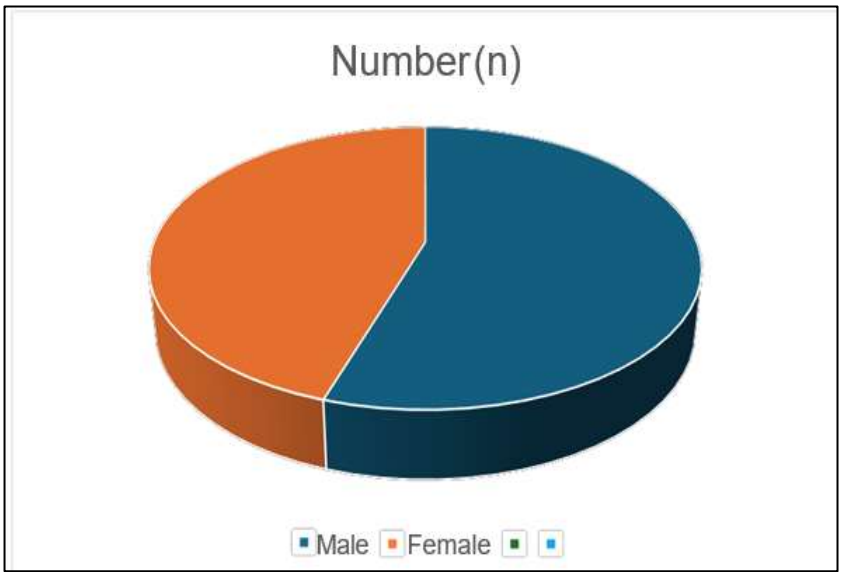
RESULTS

TABLE 1. Demographic and Clinical Profile of Study Participants (n = 40)

Age (years)	Number (n)	Percentage (%)
≤ 30	6	15.0
31–50	18	45.0
> 50	16	40.0



Gender	Number (n)	Percentage (%)
Male	22	55.0
Female	18	45.0



Salivary gland involved	Number (n)	Percentage (%)
Parotid gland	26	65.0
Submandibular gland	12	30.0
Minor salivary glands	2	5.0

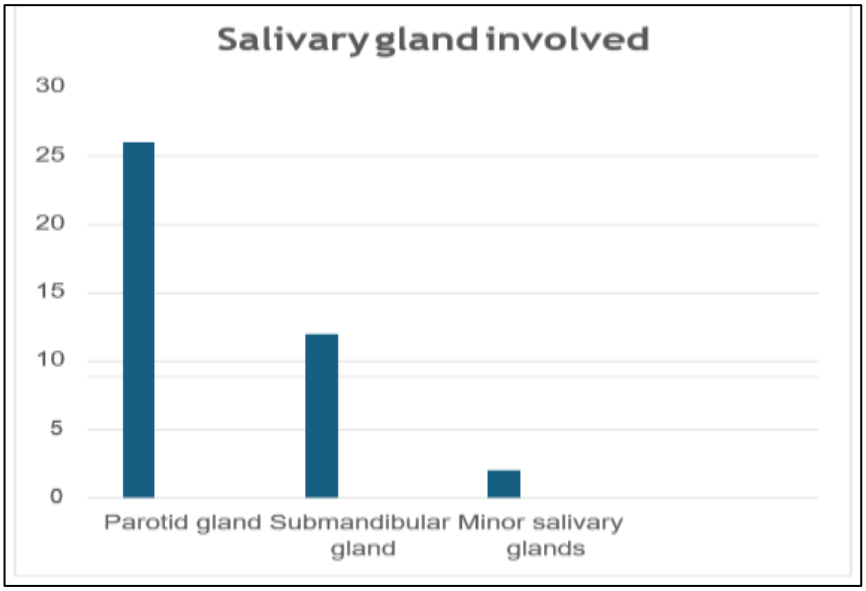


TABLE 2. Distribution of FNAC and CNB Diagnostic Categories (n = 40)

Diagnosis category	FNAC n (%)	CNB n (%)
Benign	22 (55.0)	24 (60.0)
Malignant	10 (25.0)	14 (35.0)
Inconclusive / Non-diagnostic	8 (20.0)	2 (5.0)
Total	40 (100)	40 (100)

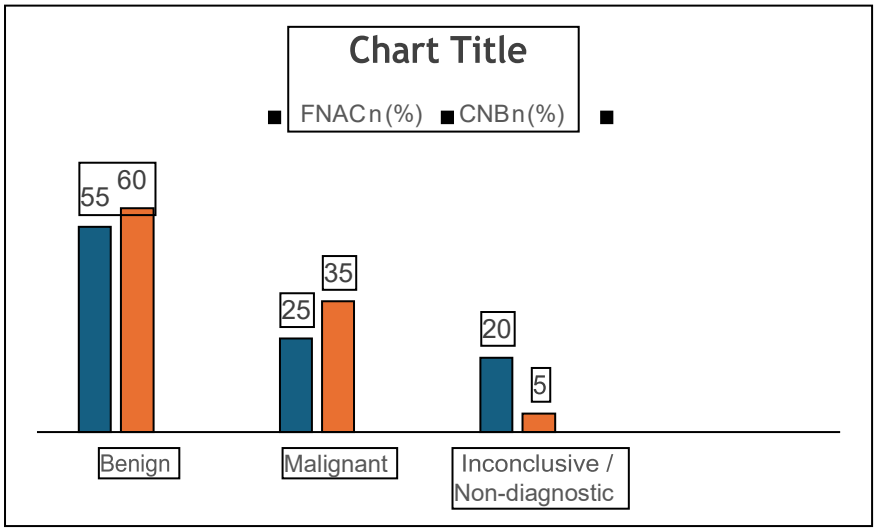
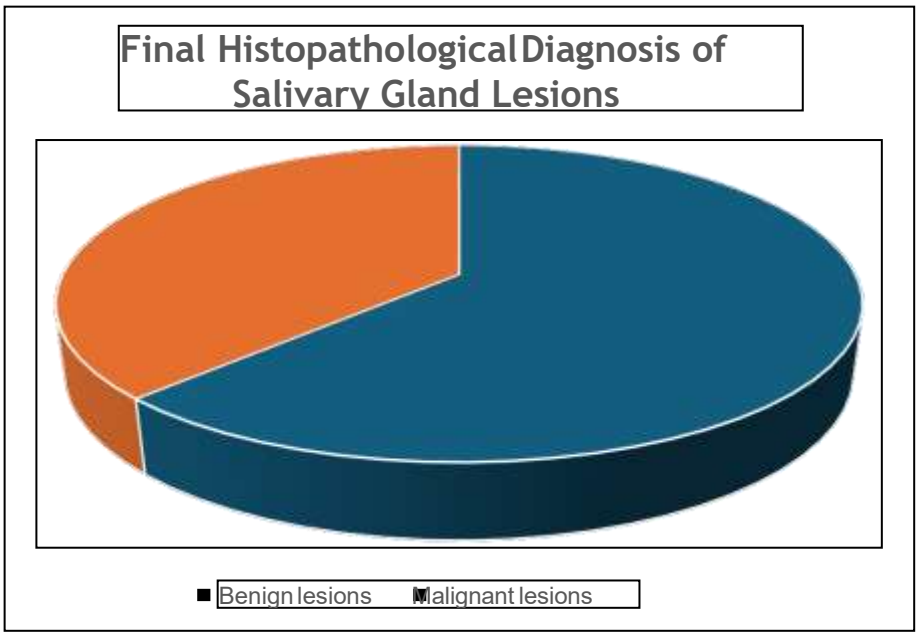
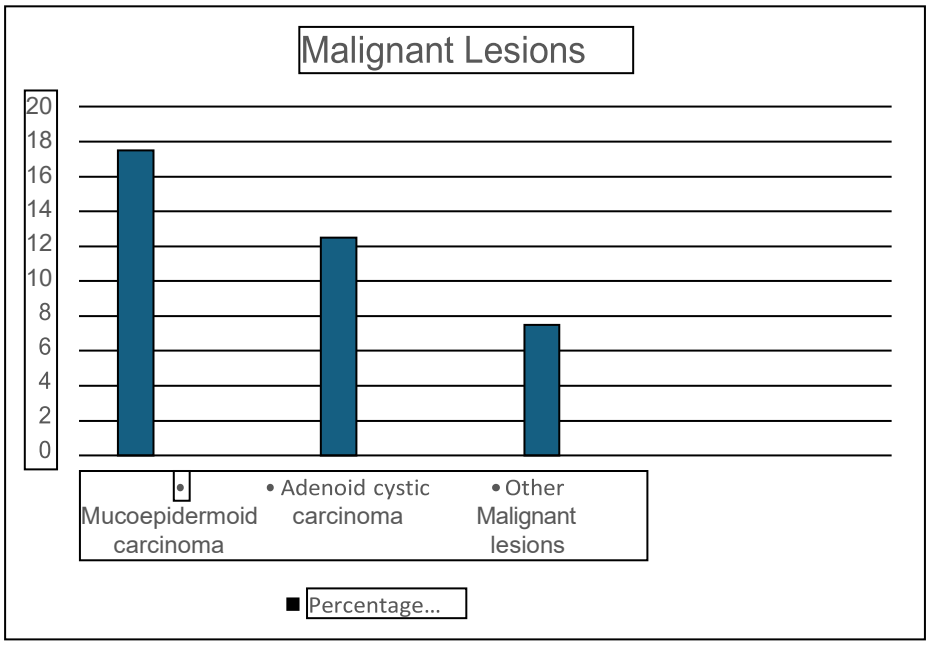


TABLE 3. Final Histopathological Diagnosis of Salivary Gland Lesions (Gold Standard) (n = 40)

Histopathological diagnosis	Number (n)	Percentage (%)
Benign lesions	25	62.5
• Pleomorphic adenoma	16	40.0
• Warthin's tumour	6	15.0
• Other Benign Lesions	3	7.5
Malignant lesions	15	37.5
• Mucoepidermoid carcinoma	7	17.5
• Adenoid cystic carcinoma	5	12.5
• Other Malignant lesions	3	7.5





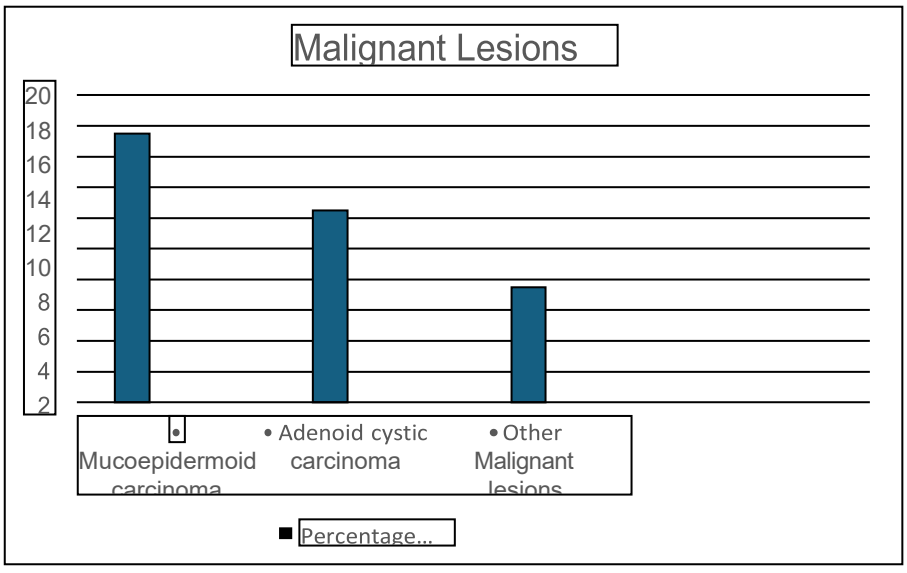


TABLE 4. Diagnostic Performance of FNAC and CNB Compared with Final Histopathology

Diagnostic parameter	FNAC	CNB

Sensitivity (%)	66.7	93.3
Specificity (%)	88.0	96.0
Positive Predictive Value (%)	80.0	93.3
Negative Predictive Value (%)	78.6	96.0
Overall diagnostic accuracy (%)	80.0	95.0

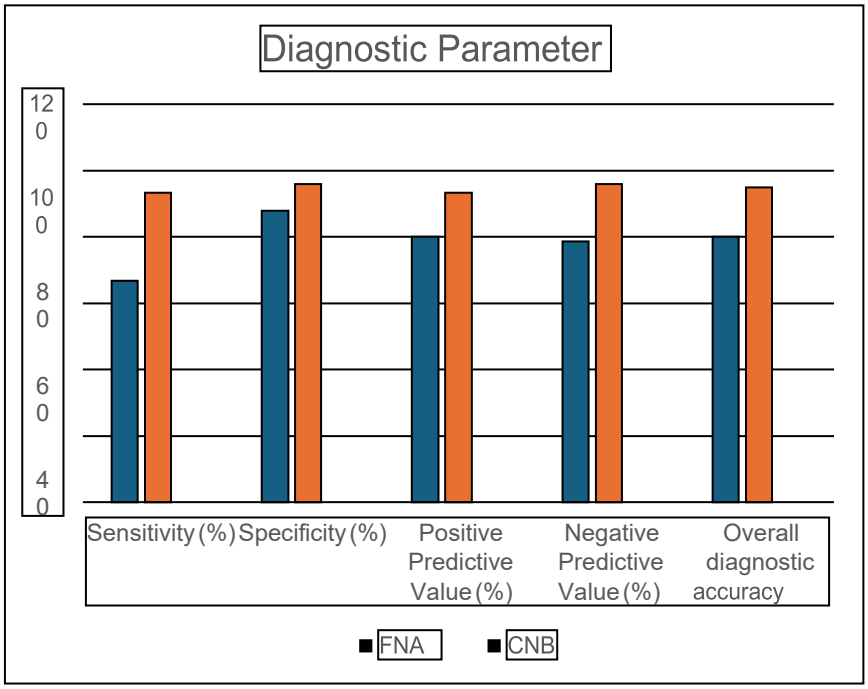
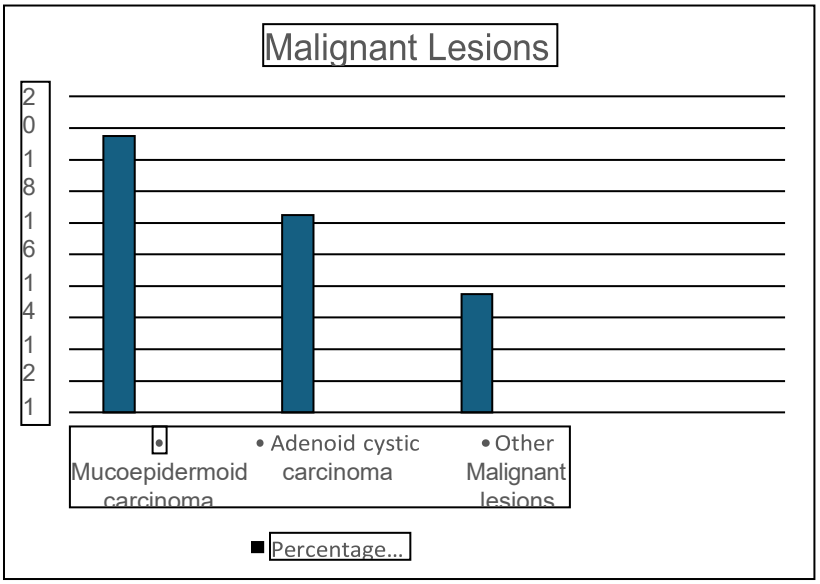


TABLE 5. Comparison of Inconclusive Results and Complications between FNAC and CNB

Parameter	FNAC n (%)	CNB n (%)
Inconclusive / non-diagnostic samples	8 (20.0)	2 (5.0)
Minor pain/swelling	4 (10.0)	6 (15.0)
Hematoma	0	1 (2.5)
Facial nerve injury	0	0



DISCUSSION

Accurate preoperative diagnosis of salivary gland lesions is crucial for appropriate surgical planning and prognostication due to the wide histological diversity and overlapping clinical presentation of benign and malignant entities. The present study compared the diagnostic performance of fine needle aspiration cytology (FNAC) and core needle biopsy (CNB) using final histopathology as the gold standard and demonstrated the superior diagnostic utility of CNB in this

setting.Diagnostic Accuracy of FNAC
In the present study, FNAC showed a sensitivity of 66.7%, specificity of 88.0%, and an overall diagnostic accuracy of 80.0%. These findings are consistent with previously published literature, where FNAC sensitivity for salivary gland lesions has ranged from 54% to 80%, while specificity has generally remained high. Schmidt et al.[8], in a systematic review and meta-analysis, reported a pooled sensitivity of 80% and specificity of 97% for FNAC, highlighting its reliability in confirming benign disease but its limitations in ruling out malignancy. Similar sensitivity values were reported by Layfield et al.[2], who emphasized sampling error and tumor heterogeneity as key contributors to false-negative results.
The relatively lower sensitivity observed in the present study may be attributed to cystic lesions, low-grade malignancies such as mucoepidermoid carcinoma, and overlapping cytomorphological features between benign and malignant tumors. Additionally, the higher proportion of inconclusive FNAC results (20%) aligns with earlier studies reporting non-diagnostic rates between 15% and 25%, particularly in deep-seated and parotid gland lesions.

Diagnostic Performance of Core Needle Biopsy:
CNB demonstrated significantly higher sensitivity (93.3%), specificity (96.0%), and overall diagnostic accuracy (95.0%) compared to FNAC in the current study. These results are in agreement with multiple international studies that have reported sensitivity and specificity values exceeding 90% for CNB. Novoa et al.[7], in a systematic review, reported a pooled sensitivity of 94% and specificity of 98% for CNB in salivary gland tumors, underscoring its diagnostic superiority.
The enhanced performance of CNB can be attributed to the preservation of tissue architecture, allowing better differentiation between tumor subtypes and facilitating the use of immunohistochemistry when required. This advantage is particularly relevant for tumors such as adenoid cystic carcinoma and carcinoma ex pleomorphic adenoma, where architectural patterns play a decisive diagnostic role. In the present study, CNB correctly classified a higher number of malignant lesions compared to FNAC, reducing the risk of underdiagnosis.

Inconclusive Rates and Sample Adequacy:
The inconclusive rate was markedly lower with CNB (5%) compared to FNAC (20%) in this study. This finding mirrors those of Eom et al[9]. and Howlett et al.[10], who reported non- diagnostic rates of less than 5% for ultrasound-guided CNB. Reduced inconclusive results have important clinical implications, as they minimize the need for repeat procedures and delays in definitive management.

Safety and Complications:
Both FNAC and CNB were found to be safe procedures in the present study, with no major complications such as facial nerve injury or tumor seeding observed. Minor pain and swelling were slightly more common following CNB, and a single case of small hematoma was noted, which resolved conservatively. These findings are consistent with existing literature indicating that ultrasound-guided CNB is a safe technique with complication rates comparable to FNAC when performed by trained personnel.

Clinical Implications:
While FNAC remains a valuable initial diagnostic modality due to its simplicity, low cost, and outpatient feasibility—especially in resource-limited settings—its limitations in sensitivity and higher inconclusive rates cannot be overlooked. The findings of this study
support a stepwise diagnostic approach, wherein FNAC serves as the first-line investigation, followed by CNB in cases with indeterminate cytology or high clinical suspicion of malignancy. This approach aligns with contemporary recommendations and balances diagnostic accuracy with procedural invasiveness.

Limitations and Future Directions:
The single-center design and relatively small sample size of the present study may limit generalizability. Additionally, interobserver variability among cytopathologists and histopathologists was not assessed. Larger multicentric studies incorporating standardized reporting systems such as the Milan System for FNAC and uniform CNB protocols may further refine diagnostic algorithms for salivary gland lesions.

CONCLUSION
The present study demonstrates that core needle biopsy (CNB) has superior diagnostic performance compared to fine needle aspiration cytology (FNAC) in the evaluation of salivary gland lesions. CNB showed higher sensitivity, specificity, and overall diagnostic accuracy, with a markedly lower rate of inconclusive results. While FNAC remains a valuable initial diagnostic tool owing to its simplicity, cost-effectiveness, and minimal invasiveness, its limitations in providing architectural details may lead to indeterminate diagnoses, particularly in cystic and deep-seated lesions. CNB, when performed under image guidance, offers a more reliable preoperative diagnosis and aids in accurate tumor characterization, thereby facilitating appropriate surgical planning. A stepwise diagnostic approach, utilizing FNAC as the first-line investigation followed by CNB in selected cases, is recommended for optimal management of salivary gland lesions.

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