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Original Research Article

Milan Scoring System in the Diagnosis of Salivary Gland Lesions for Assessment of Risk of Malignancy

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Abstract:

Background: Fine-needle aspiration cytology (FNAC) plays a pivotal role in the evaluation of salivary gland lesions. The Milan System for Reporting Salivary Gland Cytopathology (MSRSGC) provides standardized terminology and facilitates risk stratification according to the risk of malignancy (ROM).

Objective: To evaluate the diagnostic utility of the Milan System in salivary gland lesions and assess the associated risk of malignancy.

Methods: A retrospective observational study was conducted on 106 cases of salivary gland lesions evaluated in the Department of Pathology, Andhra Medical College, Andhra Pradesh, India, during 2016–2018. Archived FNAC cases were retrospectively reclassified according to the Milan System. Cytological diagnoses were correlated with histopathological findings wherever available. Diagnostic performance was assessed using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy. The association between Milan category and malignancy was evaluated using the chi-square test.

Results: Among the 106 cases, Category IVA benign neoplasm was the most frequent category, comprising 42 cases (39.6%), followed by Category II (non-neoplastic) with 21 cases (19.8%) and Category VI (malignant) with 16 cases (15.1%). Histopathological follow-up was available in 64 cases. The risk of malignancy was highest in Category VI (100.0%), followed by Category V (75.0%). Category III showed an intermediate risk of malignancy (33.3%). FNAC demonstrated a sensitivity of 85.2%, specificity of 92.4%, positive predictive value of 88.5%, negative predictive value of 90.6%, and overall diagnostic accuracy of 89.5%. A statistically significant association was observed between Milan category and malignancy status ($\chi^2 = 28.6$, $df = 5$, $p < 0.001$).

Conclusion: The Milan System provides a standardized approach for categorizing salivary gland lesions and estimating their risk of malignancy. Its application to FNAC provides useful diagnostic and risk-stratification information and may assist in clinical decision-making and management planning.

Keywords: Salivary Gland Lesions; Fine-Needle Aspiration Cytology; Milan System; Risk Of Malignancy; FNAC; Histopathology.

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Introduction

Salivary gland lesions encompass a wide spectrum ranging from non-neoplastic inflammatory conditions to benign and malignant neoplasms. Their morphological diversity may create diagnostic challenges, and accurate preoperative diagnosis is important for appropriate management and surgical planning. [1,2]

Fine-needle aspiration cytology is a minimally invasive, relatively rapid, and useful diagnostic technique for the evaluation of salivary gland lesions. [3] FNAC can provide valuable preoperative information; however, interpretation may be complicated by sampling limitations, morphological overlap, and the heterogeneity of salivary gland neoplasms. [4]

The Milan System for Reporting Salivary Gland Cytopathology (MSRSGC) was developed to provide standardized terminology and a risk-based reporting framework for salivary gland FNAC. [5,6] The first edition established standardized diagnostic categories linked to estimated risks of malignancy and clinical management recommendations. [5,6]

The Milan framework includes non-diagnostic, non-neoplastic, atypia of undetermined significance (AUS), neoplasm categories, suspicious for malignancy, and malignant categories. The neoplasm category is further subdivided into benign neoplasm (IVA) and salivary gland neoplasm of uncertain malignant potential (IVB/SUMP). [6,7]

Several studies have demonstrated that application of the Milan System facilitates risk stratification and improves communication between cytopathologists and clinicians. [8-13] Studies from different institutions have also demonstrated variation in the ROM of individual categories, supporting the importance of institution-specific evaluation. [9-13]

Histopathological correlation remains important for assessing the diagnostic performance of FNAC and for evaluating the ROM associated with individual Milan categories. [14,15]

The present study was undertaken to evaluate the diagnostic utility of the Milan System in salivary gland lesions, assess the risk of malignancy in individual categories, and determine the diagnostic performance of FNAC in a tertiary care setting.

Materials and Methods

Study Design: This was a retrospective observational study.

Study Place: The study was conducted in the Department of Pathology, Andhra Medical College, Andhra Pradesh, India.

Study Duration: The study included archived cases evaluated during the period 2016–2018.

Sample Size: All eligible archived cases of salivary gland lesions evaluated by FNAC during the study period (2016–2018) were included. A total of 106 cases met the predefined inclusion criteria and constituted the final study sample.

Inclusion Criteria:

Patients with salivary gland lesions who underwent FNAC.

Availability of adequate cytological smears for interpretation.

Availability of adequate clinical information.

Exclusion Criteria

Inadequate or unsatisfactory samples.

Cases without adequate clinical information.

Methodology: FNAC was performed using standard cytological techniques. Cytological smears were prepared from the aspirated material and stained using hematoxylin and eosin and Giemsa staining techniques.

Because the study period preceded widespread implementation of the Milan System, the archived FNAC cases were retrospectively reclassified according to the Milan System for Reporting Salivary Gland Cytopathology. [5,6] Cytological findings were correlated with histopathological diagnoses wherever corresponding tissue specimens were available.

The cases were classified according to the Milan framework as follows:

Category I: Non-diagnostic

Category II: Non-neoplastic

Category III: Atypia of undetermined significance (AUS)

Category IVA: Neoplasm—benign

Category IVB: Salivary gland neoplasm of uncertain malignant potential (SUMP)

Category V: Suspicious for malignancy

Category VI: Malignant

The present study contained cases classified as benign neoplasm within Category IV; no separate IVB/SUMP cases were recorded in the study dataset. Therefore, Category IV in the tables represents the benign-neoplasm group (IVA).

Histopathological follow-up was considered available when a corresponding surgical or biopsy specimen provided a definitive histopathological diagnosis.

Statistical Analysis: Diagnostic performance was evaluated by calculating sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy.

The association between Milan cytological categories and malignancy status was assessed using the chi-square test. A p-value <0.05 was considered statistically significant.

Results

A total of 106 cases of salivary gland lesions were analyzed during the study period.

Distribution of Cases According to Milan Categories: The distribution of cases across the different Milan categories is presented in Table 1.

Table 1: Distribution of Cases According to Milan Categories (n = 106).

Milan Category	Description	Number of Cases	Percentage (%)
I	Non-diagnostic	5	4.7
II	Non-neoplastic	21	19.8
III	Atypia of undetermined significance	11	10.4
IVA	Neoplasm—benign	42	39.6
IVB	SUMP	0	0.0
V	Suspicious for malignancy	11	10.4
VI	Malignant	16	15.1
Total		106	100.0

Category IVA was the most common category, accounting for 42 cases (39.6%), followed by Category II with 21 cases (19.8%) and Category VI with 16 cases (15.1%) (Figure 1).

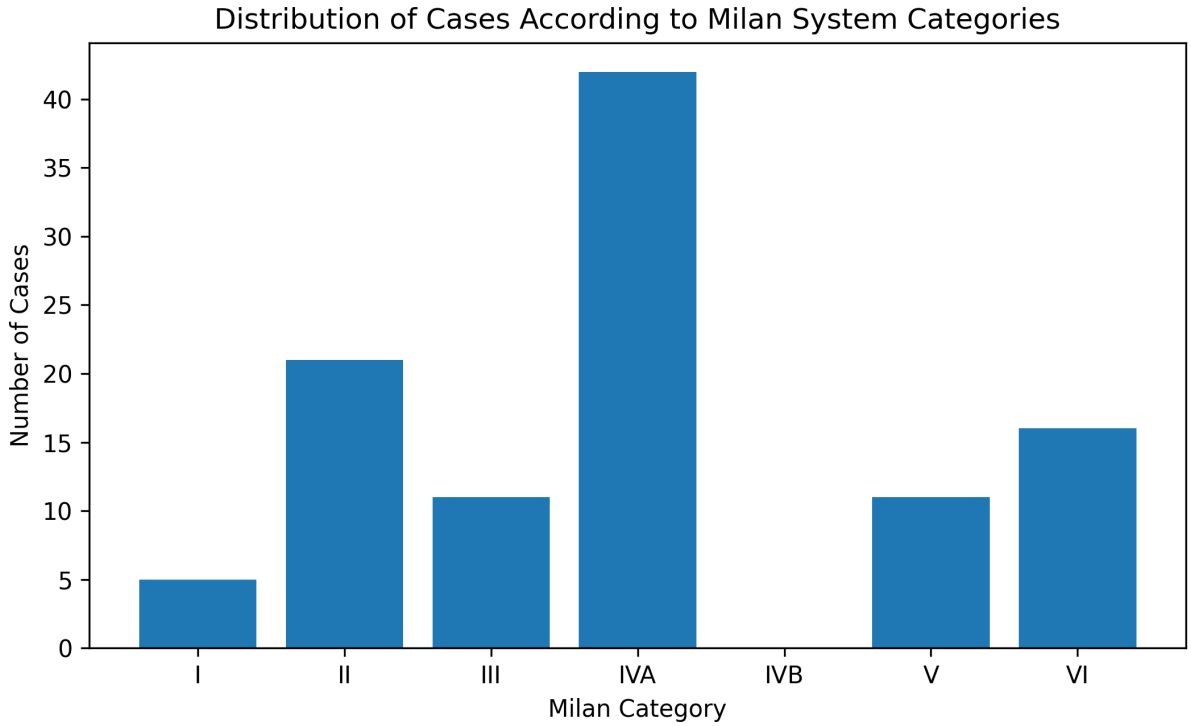

Figure 1: Distribution of cases according to Milan System categories.

Risk of Malignancy Across Milan Categories: Histopathological follow-up was available in 64 cases. The risk of malignancy according to individual Milan categories is summarized in Table 2.

Table 2: Risk of Malignancy in Different Milan Categories.

Milan Category	Cases with Histopathological Follow-up	Malignant Cases	ROM (%)
I	3	0	0.0
II	13	1	7.7
III	6	2	33.3
IVA	24	2	8.3
IVB	0	0	—
V	8	6	75.0
VI	10	10	100.0
Total	64	21	—

The risk of malignancy was highest in Category VI (100.0%), followed by Category V (75.0%). Category III demonstrated an intermediate ROM of 33.3%, whereas Categories II and IVA demonstrated relatively lower ROMs of 7.7% and 8.3%, respectively (Figure 2).

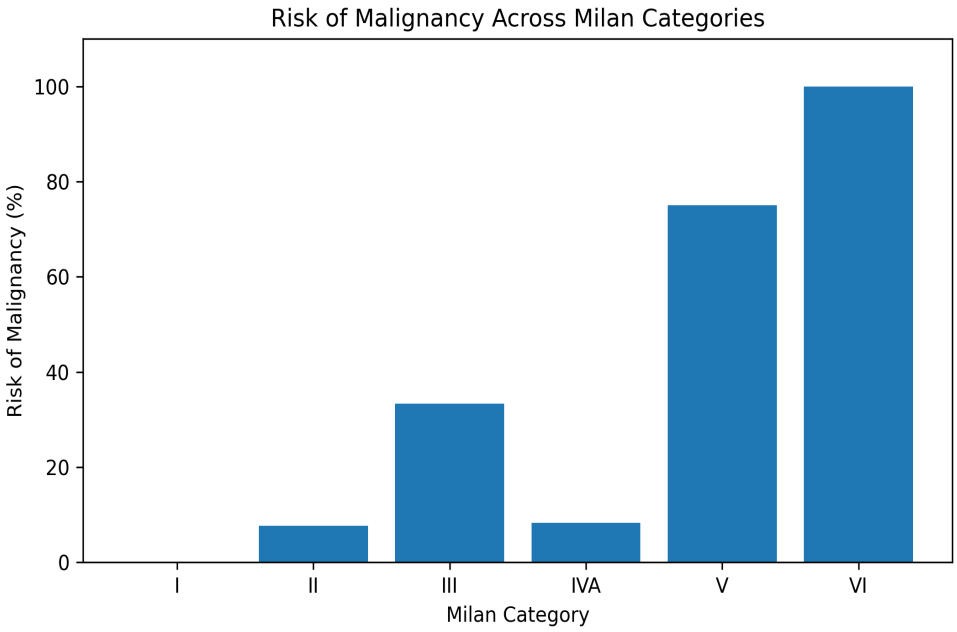

Figure 2: Risk of malignancy across Milan categories.

Diagnostic Performance of FNAC: The diagnostic performance of FNAC using the Milan System for identification of malignant lesions is presented in Table 3.

Table 3: Diagnostic Performance of FNAC Using the Milan System.

Diagnostic Parameter	Value (%)
Sensitivity	85.2
Specificity	92.4
PPV	88.5
NPV	90.6
Accuracy	89.5

FNAC demonstrated good diagnostic performance in detecting malignant salivary gland lesions. The sensitivity was 85.2%, while specificity was 92.4%. The positive predictive value and negative predictive value were 88.5% and 90.6%, respectively. The overall diagnostic accuracy was 89.5% (Figure 3).

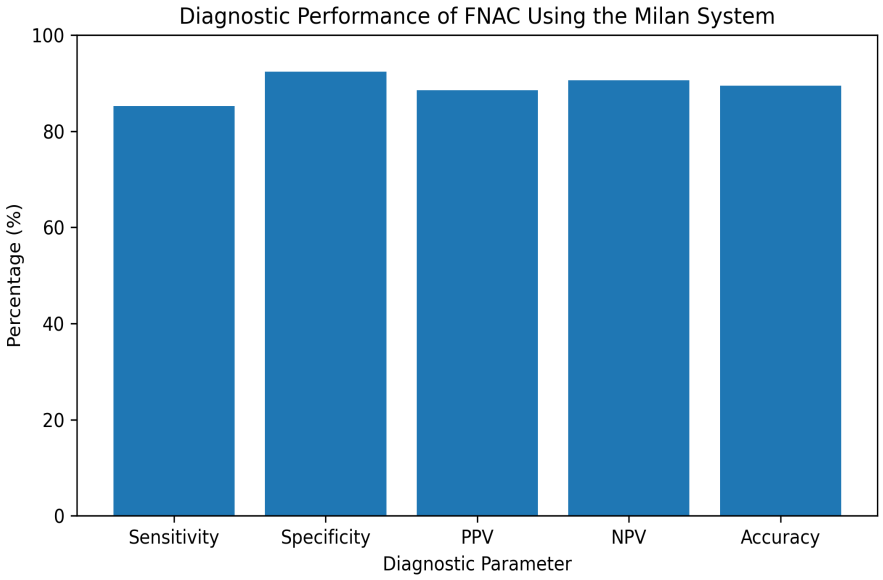

Figure 3: Diagnostic performance of FNAC using the Milan System.

Association Between Milan Category and Malignancy: Statistical analysis demonstrated a significant association between Milan category and malignancy status.

$\chi^2 = 28.6$

Degrees of freedom = 5

$p < 0.001$

The association was statistically significant, indicating that malignancy status varied significantly across the Milan cytological categories.

Summary of Key Findings

Category IVA (benign neoplasm) was the most common Milan category, accounting for 39.6% of cases.

Category II accounted for 19.8% of cases.

Category VI accounted for 15.1% of cases.

No separate Category IVB/SUMP cases were recorded.

The risk of malignancy was highest in Category VI (100.0%).

Category V demonstrated a high risk of malignancy (75.0%).

Category III demonstrated an intermediate risk of malignancy (33.3%).

FNAC demonstrated 85.2% sensitivity and 92.4% specificity.

Overall diagnostic accuracy was 89.5%.

A statistically significant association was observed between Milan category and malignancy ($p < 0.001$).

Discussion

The present study evaluates the diagnostic utility of the Milan System in categorizing salivary gland lesions and assessing their risk of malignancy. Category IVA (benign neoplasm) constituted the largest proportion of cases, accounting for 39.6% of the study population. This predominance of benign neoplasms is consistent with the recognized distribution of salivary gland lesions and with institutional studies evaluating the Milan System. [1,16]

The Milan System provides a standardized framework for reporting salivary gland FNAC specimens and facilitates communication between pathologists and clinicians. By linking cytological categories with estimated risks of malignancy, the system provides a structured basis for clinical decision-making. [5,6]

In the present study, the risk of malignancy was substantially higher in the upper Milan categories. Category VI demonstrated the highest ROM at 100%, while Category V showed a ROM of 75.0%. These findings are consistent with previous institutional studies in which suspicious and malignant categories demonstrated substantially higher risks of malignancy than benign and non-neoplastic categories. [9,11,13,16]

Category III, representing atypia of undetermined significance, demonstrated an intermediate ROM of 33.3%. The AUS category remains diagnostically challenging because cytological atypia may occur in reactive, inflammatory, and neoplastic conditions. Clinical and radiological correlation, repeat sampling, ancillary investigations, or histopathological assessment may therefore be required in selected cases. [7,15]

The present study demonstrated good diagnostic performance of FNAC, with a sensitivity of 85.2% and specificity of 92.4%. The positive predictive value was 88.5%, while the negative predictive value was 90.6%. The overall diagnostic accuracy was 89.5%. These findings are broadly consistent with previous studies demonstrating useful diagnostic performance of FNAC in salivary gland lesions. [14,17,18]

Rohilla et al., in a three-year cytohistological correlation study, reported an overall diagnostic accuracy of 91.4% for differentiating malignant from benign lesions and demonstrated marked variation in ROM among Milan categories. [13] Similarly, other institutional studies have shown that application of the Milan System provides meaningful risk stratification and maintains good diagnostic performance. [9,11,16]

The significant association between Milan category and malignancy status in the present study further supports the value of Milan categorization for risk stratification. The significant chi-square result indicates that the probability of malignancy differed substantially according to the assigned cytological category.

The Milan System also has important clinical implications. Its purpose is not simply to provide a descriptive cytological diagnosis but to associate each category with an estimated risk of malignancy and an appropriate clinical management pathway. [5,6] The second edition further refined ROM estimates and updated recommendations concerning ancillary testing, imaging, nomenclature, and clinical management. [19]

The strengths of the present study include systematic retrospective categorization of salivary gland FNAC specimens according to the Milan System, assessment of ROM using histopathological correlation, and evaluation of conventional diagnostic performance parameters.

The study has certain limitations. The retrospective design may introduce selection bias. Histopathological follow-up was not available for every case, which may influence the calculated ROM. In addition, interobserver variation in cytological interpretation cannot be completely excluded. The absence of IVB/SUMP cases also limits assessment of this specific Milan category. Larger prospective studies with complete histopathological follow-up would further strengthen evaluation of the Milan System.

Conclusion

The Milan System for Reporting Salivary Gland Cytopathology provides an effective and standardized approach for categorizing salivary gland lesions and assessing their risk of malignancy. In the present study, higher Milan categories, particularly Categories V and VI, were associated with substantially increased risks of malignancy. FNAC demonstrated good diagnostic performance, with a sensitivity of 85.2%, specificity of 92.4%, and overall diagnostic accuracy of 89.5%. A statistically significant association was observed between Milan category and malignancy status. The findings support the usefulness of the Milan System as a standardized risk-stratification framework for salivary gland FNAC and indicate that its application can provide valuable information for diagnostic assessment and clinical management planning.

References

1. Speight PM, Barrett AW. Salivary gland tumours. Oral Dis. 2002;8(5):229-240. doi:10.1034/j.1601-0825.2002.02870.x.
2. Ellis GL, Auclair PL. Tumors of the Salivary Glands. 3rd ed. Washington, DC: Armed Forces Institute of Pathology; 1996.
3. Orell SR, Sterrett GF. Orell and Sterrett's Fine Needle Aspiration Cytology. 5th ed. Edinburgh: Churchill Livingstone; 2012.
4. Kocjan G, Nayagam M, Harris M. Fine needle aspiration cytology of salivary gland lesions: advantages and pitfalls. Cytopathology. 1990;1(5):269-275. doi:10.1111/j.1365-2303.1990.tb00360.x.
5. Faquin WC, Rossi ED, Baloch Z, Barkan GA, Foschini MP, Kurtycz DFI, Pusztaszeri M, Vielh P, editors. The Milan System for Reporting Salivary Gland Cytopathology. Cham: Springer; 2018. doi:10.1007/978-3-319-71285-7.
6. Rossi ED, Baloch Z, Pusztaszeri M, Faquin WC. The Milan System for Reporting Salivary Gland Cytopathology (MSRSGC): an ASC-IAC-sponsored system for reporting salivary gland fine-needle aspiration. J Am Soc Cytopathol. 2018;7(3):111-118. doi:10.1016/j.jasc.2018.02.002.
7. Griffith CC, Pai RK, Schneider F, et al. Salivary gland tumor fine-needle aspiration cytology: a proposal for a risk stratification classification. Am J Clin Pathol. 2015;143(6):839-853. doi:10.1309/AJCPMII6OSD2HSJA.
8. Wei S, Layfield LJ, LiVolsi VA, Montone KT, Baloch ZW. Reporting of fine needle aspiration (FNA) specimens of salivary gland lesions: a comprehensive review. Diagn Cytopathol. 2017;45(9):820-827. doi:10.1002/dc.23716.
9. Kala C, Kala S, Khan L. Milan System for Reporting Salivary Gland Cytopathology: an experience with the implication for risk of malignancy. J Cytol. 2019;36(3):160-164. doi:10.4103/JOC.JOC_165_18.
10. Baloch ZW, Faquin WC, Layfield LJ. Is it time to develop a tiered classification scheme for salivary gland fine-needle aspiration specimens? Diagn Cytopathol. 2017;45(4):285-286. doi:10.1002/dc.23601.
11. Wang H, Fundakowski C, Khurana JS, Jhala N. Fine-needle aspiration biopsy of salivary gland lesions. Arch Pathol Lab Med. 2015;139(12):1491-1497. doi:10.5858/arpa.2015-0222-RA.
12. Zbären P, Triantafyllou A, Devaney KO, Vander Poorten V, Hellquist H, Rinaldo A, Ferlito A. Preoperative diagnostic of parotid gland neoplasms: fine-needle aspiration cytology or core needle biopsy? Eur Arch Otorhinolaryngol. 2018;275(11):2609-2613. doi:10.1007/s00405-018-5131-0.
13. Rohilla M, Singh P, Rajwanshi A, Gupta N, Srinivasan R, Dey P, Vashishta RK. Three-year cytohistological correlation of salivary gland FNA cytology at a tertiary center with the application of the Milan system for risk stratification. Cancer Cytopathol. 2017;125(10):767-775. doi:10.1002/cncy.21900.
14. Jain R, Gupta R, Kudesia M, Singh S. Fine needle aspiration cytology in diagnosis of salivary gland lesions: a study with histologic comparison. Cytojournal. 2013;10:5. doi:10.4103/1742-6413.109547.
15. Tyagi R, Dey P. Diagnostic problems of salivary gland tumors. Diagn Cytopathol. 2015;43(6):495-509. doi:10.1002/dc.23255.
16. Viswanathan K, Sung S, Scognamiglio T, Yang GCH, Siddiqui MT, Rao RA. The role of the Milan System for Reporting Salivary Gland Cytopathology: a 5-year institutional experience. Cancer Cytopathol. 2018;126(8):541-551. doi:10.1002/cncy.22016.
17. Singh S, Singh P, Auplish R, Khanna SP, Verma K, Aulakh SK. Application of Milan system for reporting of salivary gland pathology and risk stratification: an institutional experience. J Oral Maxillofac Pathol.

2020;24(2):266-272. doi:10.4103/jomfp.JOMFP_6_20.
18. Karuna V, Gupta P, Rathi M, Grover K, Nigam JS, Verma N. Effectuation to cognize malignancy risk and accuracy of fine needle aspiration cytology in salivary gland using "Milan System for Reporting Salivary Gland Cytopathology": a 2 years retrospective study in academic institution. Indian J Pathol Microbiol. 2019;62(1):11-16. doi:10.4103/IJPM.IJPM_380_18.
19. Rossi ED, Baloch Z, Barkan G, et al. Second edition of the Milan System for Reporting Salivary Gland Cytopathology: refining the role of salivary gland FNA. Cancer Cytopathol. 2024;132(1):10-21. doi:10.1002/cncy.22753.