Original Article

Application of the Milan System for Reporting Salivary Gland Cytopathology: A Tertiary Care Experience

Jheel Sureshbhai Anjaria*, Purvi Sharad Patel, Shital P. Vaghasiya, Dipalben Kantibhai Hadavani, Sree Pooja Rajmohan, Hansa Goswami

Department of Pathology, B. J. Medical College and Civil Hospital, Ahmedabad, Gujarat, India

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***Corresponding Author**:
Dr Jheel Sureshbhai Anjaria
anjariajheel1997@gmail.com

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Abstract

Background: Fine-needle aspiration cytology (FNAC) of salivary gland lesions poses diagnostic challenges due to diverse features and overlapping characteristics. To address this, the Milan System for Reporting Salivary Gland Cytopathology (MSRSGC) was established to promote standardized reporting and improve clinico-pathologic correlation. The aim of the present study was to assess the application of the MSRSGC on FNAC specimens of salivary gland lesions at B.J. Medical College and Hospital.

Materials and Methods: A retrospective study was conducted, retrieving clinical information and cytology smear slides from salivary gland lesions diagnosed between January 2022 and July 2024. The cytological features were evaluated and the cases were classified according to the MSRSGC.

Results: A total of 118 cases were evaluated cytologically. The distribution of cases into different categories was as follows: Non-diagnostic (12.71%), Non-neoplastic (38.99%), Atypia of Undetermined Significance (5.08%), Neoplasm: Benign (33.05%), Salivary Gland Neoplasm of Uncertain Malignant Potential (3.39%), Suspicious for Malignancy (1.69%), and Malignancy (5.08%). The Risk of Malignancy (ROM) for non-diagnostic, non-neoplastic, benign neoplasms, AUS, SUMP, SFM, and malignant were 0%, 0%, 50%, 2.7%, 100%, 100%, and 100%, respectively.

Conclusion: The MSRSGC is an essential tool for standardizing reporting and preoperatively stratifying cases. The findings of this study reinforce the value of MSRSGC in enhancing diagnostic accuracy, stratifying malignancy risk, and facilitating collaborative patient management between cytopathologists and clinicians, highlighting the need for ongoing refinement and widespread adoption.

Keywords:

The MILAN System, Salivary Glands, Fine-Needle Aspiration Cytology, Malignant

Introduction

Fine Needle Aspiration Cytology (FNAC) is a diagnostic technique that analyzes individual cells and small cell groups aspirated with a fine needle, providing morphologic findings. Introduced in the 1920s, FNAC quickly gained acceptance among clinicians due to its simplicity and rapid results. Today, FNAC is a fundamental diagnostic tool for head and neck swellings [1].

The widespread adoption of FNAC for assessing salivary gland (SG) lesions is attributed to its numerous advantages, including

easy accessibility, procedural simplicity, minimal invasiveness, cost-effectiveness, low risk of complications, and impressive diagnostic accuracy, with sensitivity ranging from 83% to 92% and specificity ranging from 93% to 100% [2].

In cases of suspected salivary gland swellings, FNAC serves two crucial purposes: distinguishing salivary gland lesions from similar-appearing lymph node swellings and providing a preliminary diagnosis to form treatment plans. FNAC reliably differentiates between inflammatory and neoplastic lesions [1].

The diagnosis of salivary gland lesions through fine-needle aspiration cytology (FNAC) can be challenging due to varied and overlapping characteristics. To simplify this process, the Milan System for Reporting Salivary Gland Cytopathology (MSRSGC) was developed, providing a standardized framework for FNAC reporting and facilitating clearer communication between clinicians and pathologists, which ultimately enhances patient care [3].

Hence, the Milan System for Reporting Salivary Gland Cytopathology (MSRSGC) represents a standardized, evidence-based reporting system for salivary gland lesions [4].

It is a six-tier system which provides risk stratification with risk of malignancy, which is helpful in deciding the further management [4]. The main objective of the present study is to diagnose and classify the salivary gland lesions according to the MILAN System for better management and to determine the risk of malignancy (ROM) for each category.

Materials and Methods

A retrospective study was conducted in the Pathology Department at B.J. Medical College during the period of January 2022 to July 2024. A total of 118 patients with salivary gland lesions who were sent to the Pathology Department for FNAC were aspirated and subsequently examined. Patients' consent was taken before the procedure. The clinical data pertaining to patients' age, sex, and anatomical site were recorded. Aspirations were performed under aseptic conditions using a 10 cc syringe with a 22-gauge needle, and smears were prepared. The air-dried smears were stained with May-Grunwald Giemsa, and methanol-fixed smears were stained with Hematoxylin and Eosin and Papanicolaou stain.

The cytological features were evaluated, and the cases were classified according to MSRSGC as follows: Category I: Non-diagnostic (ND), Category II: Non-neoplastic (NN), Category III: Atypia of undetermined significance (AUS), Category IVA: Neoplasm: Benign (NB), Category IVB: Neoplasm: Salivary gland neoplasm of uncertain malignant potential (SUMP), Category V: Suspicious of malignancy (SM), Category VI: Malignant (M).

The histological reports and clinical follow-up, wherever available, were compared. The risk of malignancy (ROM) was calculated for each category. ROM was determined by dividing the number of malignant cases on histopathology in each category by the total number of patients whose histopathologic report was available in that particular category.

Results

The distribution of 118 FNAC cases according to demographic and anatomical characteristics is presented in Table 1. A slight male predominance was observed (1.6:1 male-to-female ratio). The majority of cases fell within the 41–60 age group (38.11%), followed by the 21–40 age group (29.7%). The parotid gland was the most frequently involved site (66.1%), followed by the submandibular gland (30.5%) and minor salivary glands (3.4%).

The MSRSGC categorization of 118 FNAC cases revealed a predominant distribution in the Non-Neoplastic (NN) category II

(39.0%), followed closely by Neoplasm: Benign (NB) category IVA (36.4%). The remaining categories demonstrated significantly lower frequencies: Non-Diagnostic category I (ND, 9.3%), Malignant category VI (M, 5.9%), Atypia of Undetermined Significance category III (AUS, 4.2%), Salivary gland neoplasm of Uncertain Malignant Potential category IVB (SUMP, 3.4%), and Suspicious for Malignancy category V (SM, 2.4%).

Table 1: Distribution of cases according to age, sex, and site of involvement

PARAMETER	NO OF CASES	PERCENTAGE
SEX		
Male	72	61.1%
Female	46	38.9%
AGE GROUP		
≤ 20	10	8.5%
21-40	35	29.7%
41-60	45	38.1%
61-80	28	23.7%
>80	0	0%
GLAND INVOLVED		
Parotid gland	78	66.1%
Submandibular gland	36	30.5%
Minor salivary gland	4	3.4%

The histopathological follow-up of 46 cases was available out of 118 cases. ROM for each category was 0%, 0%, 50%, 2.7%, 100%, 100%, and 100% for Non-Diagnostic (ND), Non-Neoplastic (NN), Atypia of Undetermined Significance (AUS), Neoplasm: Benign (NB), Neoplasm: Salivary Gland Neoplasm of Uncertain Malignant Potential (SUMP), Suspicious for Malignancy (SM), and Malignant (M), respectively. These findings are detailed in Table 2.

In Category II: Non-Neoplastic (NN), the most common lesion was Chronic Sialadenitis (45.6%), while in Category IVA: Neoplasm: Benign (NB), the most frequent lesion was Pleomorphic Adenoma (70%) (Figure 1), followed by Warthin Tumor (23.3%) (Figure 2). In Category IVB: Neoplasm: Salivary Gland Neoplasm of Uncertain Malignant Potential (SUMP), Cellular Basaloid Neoplasm was the most frequent lesion. Suspicious for low-grade mucoepidermoid carcinoma was the most common lesion in Category V: Suspicious for Malignancy (SM). In Category VI: Malignant (M), Mucoepidermoid Carcinoma (Figure 3) was the commonest lesion encountered.

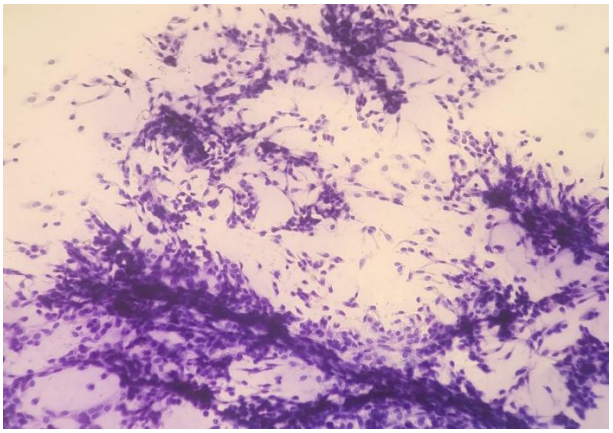

Figure 1: Cytology of Pleomorphic Adenoma: Category IVA: MILAN System. HE Stain, 20X.

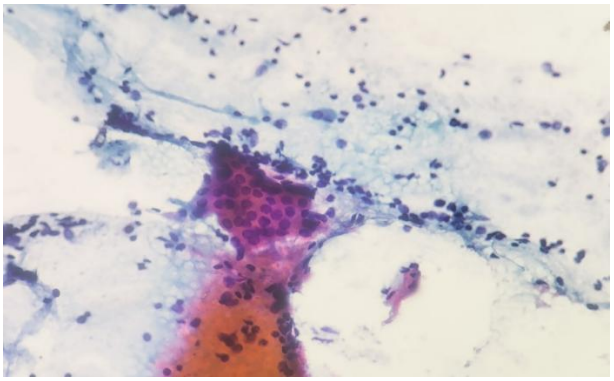

Figure 2: Cytology of Warthin Tumor: Category IV A: MILAN System. PAP Stain, 40X.

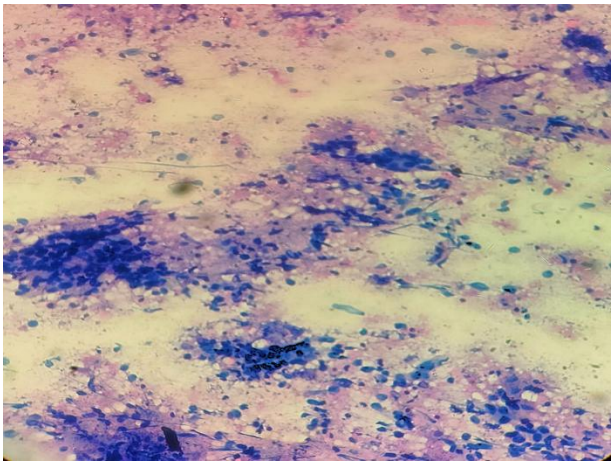

Figure 3: Cytology of Mucoepidermoid Carcinoma: Category VI: MILAN System HE Stain, 20X

Discussion

FNAC has been extensively utilized for more than fifty years for the initial assessment and triage of patients with salivary gland lesions [5,6]. In the present study, 118 salivary gland lesions were studied and classified using the MILAN system.

There were 72 males (61.1%) and 46 females (38.9%) in our study, with a male-to-female ratio of 1.6:1. This is comparable with the studies done by Tochtermann G et al., Kala C et al., Rohilla M et al., and Datta B et al., which had male-to-female ratios of 1.3:1, 1.2:1, 1.7:1, and 1.2:1 respectively [2,7,8,9].

Our study population's mean age was 45.9 years. This is similar to the findings of studies done by Rohilla M et al. and Jha S et al., in which the mean ages were 43.7 years and 42.65 years respectively [8,10]. Our study showed a significant predilection for parotid gland involvement (66.1%), with submandibular gland (30.5%) and minor salivary gland (3.4%) involvement being substantially less common. This pattern is consistent with published studies by Datta B et al., with 70.2% for parotid gland, 26.3% for submandibular gland, and the remaining 3.5% for other minor glands, and by Karuna V et al., with 59.1% for parotid gland, 31.4% for submandibular, and 9.5% for other minor glands [9,11].

In the present study, the percentage of cases classified in non-diagnostic category I is 9.3%, which aligns with findings from the existing literature by Dutta B et al., Jha S et al., and Viswanathan K et al., which had 8.7%, 10.6%, and 12% category I cases respectively [9,10,12]. The non-diagnostic criteria were applied strictly in accordance with the published MSRSGC guidelines.

Table 2: Distribution of cases of present study according to The Milan System for Reporting Salivary Gland Cytopathology

MILAN CATEGORY		NO. OF CASES	PERCEN-TAGE	HISTOL-OGICAL FOLLOW UP CASES	MALIG-NANT	RISK OF MALIGN-ANCY (ROM) %	% ROM ACC. TO MSRSGC [4]
I	**Non-Diagnostic** (Insufficient cellular material for a cytological diagnosis)	11	9.3%	2	0	0	15% (0-50%)
II	**Non-Neoplastic** (Benign entities such as acute and chronic sialadenitis, reactive lymph node, sialadenosis, and infection)	46	39.0%	3	0	0	11% (0-100%)
III	**Atypia of Undetermined Significance (AUS)**	5	4.2%	2	1	50%	30% (0-100%)
IV A	**Neoplasm: Benign** (Pleomorphic adenoma, Warthin tumor etc)	43	36.4%	36	1	2.70%	<3% (0-50%)
IV B	**Neoplasm: Salivary gland neoplasm of Uncertain Malignant Potential (SUMP)** (This diagnosis should be used for cases where a malignant neoplasm cannot be excluded)	4	3.4%	1	1	100%	35% (0-100%)
V	**Suspicions for Malignancy** (This category is for FNA samples showing features that are highly suggestive of, but not unequivocal for malignancy.)	2	1.7%	1	1	100%	83% (50-100%)
VI	**Malignant** (This category is for FNA specimens that are diagnostic of malignancy)	7	5.9%	1	1	100%	98% (80-100%)
	TOTAL	**118**		**46**	**5**		

Table 3: Comparison of Risk of Malignancy (ROM) of Present Study with Published Literature.

ROM % of different studies	Cat I	Cat II	Cat III	Cat IV A	Cat IV B	Cat V	Cat IV
MSRSGC: Baloch, Z et al. [4]	15	11	30	<3	35	83	98
Tochtermann G et al. [2]	26.7	5.7	34	1.1	21.8	92	99.2
Kala C et al. [7]	25	5	20	4.4	33.3	85.7	97.5
Karuna V et al. [11]	0	0	50	2.44	33.33	100	93.33
Rohilla M et al. [8]	0	17.4	100	7.3	50	-	96
Jha S et al. [10]	42.86	26.67	100	10.17	0	71.42	100
Viswanathan K et al. [12]	6.7	7.1	38.9	5	34.2	92.9	92.3
Present study	0	0	50	2.7	100	100	100

These are: fewer than 60 lesional cells, poorly prepared slides with artefacts precluding proper assessment, non-mucinous cyst contents, or normal salivary gland elements in the setting of a clinically or radiologically defined mass.

The percentage of the non-neoplastic category II in our study is highest, at 39.0%. This is similar to studies done by Tochtermann G et al., Singh G et al., and Kala C et al., in which cases were 32%, 31.7%, and 38.2% respectively [2,3,7]. Chronic sialadenitis was the commonest lesion diagnosed on cytology. Atypia of Undetermined Significance is used for lesions that show morphological features overlapping between non-neoplastic and neoplastic conditions [4]. The AUS category III accounted for 4.2% of lesions in our study, aligning with findings of 2.7% and 6.1% from Kala C et al. and Viswanathan K et al. respectively, and was slightly higher in the study by Song S et al. (10.8%) [7,12,13]. The percentage of benign category IV A in our study is

36.4%. Similar findings were noted in published literature by Tochtermann G et al., Singh G et al., and Leite et al., i.e. 39%, 39.8%, and 40.4% respectively [2,3,14]. Pleomorphic adenoma was the commonest salivary gland neoplasm.

The diagnosis of category IV B (SUMP) is applied to salivary gland FNAs where the morphological features suggest a neoplastic process, but the differential diagnosis includes both benign and malignant conditions [4]. The percentage of cases in our study was 3.4%, which was similar to the studies done by Tochtermann G et al. and Kala C et al., that had 5% and 2% cases respectively [2,7]. The study done by Viswanathan K et al. had slightly higher cases, i.e. 9.9% [12]. The most frequent lesion in this category was Cellular basaloid neoplasm in the present study.

The diagnosis of suspicious for malignancy (SM) category V is reserved for those salivary gland FNACs where overall cytologic features suggest malignancy; however, all the criteria for a specific diagnosis of malignancy are not present [4]. The percentage of cases of SM category V in our study is 1.7%, which is similar to findings of studies done by Singh G et al., Kala C et al., and Dutta B et al., that had 1.6%, 2.4%, and 1.8% cases respectively [3,7,9]. In the present study, the most common lesion in this category was low-grade mucoepidermoid carcinoma.

The malignant category in MSRSGC includes salivary gland FNAs that exhibit a combination of cytomorphologic features, which, either on their own or in conjunction with ancillary studies, are diagnostic of malignancy. In our study, the percentage of cases classified under the malignant category is 5.9%, which aligns with findings from studies by Singh G et al. and Leite A et al., which had 5.6% and 5.8% cases respectively [3,14]. In the present study, mucoepidermoid carcinoma was the most common lesion in this category.

The risk of malignancy (ROM) in our study was 0%, 0%, 50%, 2.7%, 100%, 100%, and 100% for each respective category. These findings are variable, as limited histopathological follow-up was available due to the retrospective nature of the study, and are compared with those reported in the MSRSGC and other recent studies. See Table 3.

Conclusion

This study highlights the utility of the Milan System for Reporting Salivary Gland Cytopathology (MSRSGC) in evaluating salivary gland lesions, showing that FNAC combined with MSRSGC aids in risk stratification and clinical decision-making. The results align with existing literature, highlighting MSRSGC's role in improving diagnostic accuracy and communication between cytopathologists and clinicians. However, the retrospective design and limited histopathological follow-up hinder ROM calculation. The study advocates for further similar studies, especially prospective ones, to refine the system and enhance patient outcomes in salivary gland lesion management.

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