ORIGINAL ARTICLE

Cytopathological Study of Salivary Gland Lesions Using Milan System

Palak Patel[1], Anupama Dayal[2], Deepak Joshi[3] and Suktara Sharma[4]
Resident of Pathology[1], Associate Professor of Pathology[2] Professor of Pathology[3] and Associate Professor of ENT[4]
G.C.S. Medical College, Hospital and Research Centre, Ahmedabad, Gujarat, India.

Abstract:

Introduction:
Salivary gland neoplasms comprise 2- 6.5% of all tumors of the head and neck. Fine Needle Aspiration (FNA) is the first line of investigation for swelling of salivary glands. Milan system provides a uniform reporting system for various morphologically heterogeneous lesions of salivary glands.

Aim:
To study various cytomorphological lesions of salivary gland and categorize them according to the MILAN system of reporting.

Materials and Methods:
This is a retrospective 3 year observational study of 146 salivary gland FNA samples received at the department of pathology of GCS Medical College, Hospital & Research Centre, Ahmedabad, Gujarat, from January 2017 to December 2019.Salivary gland cytopathologies were categorized based on Milan system of reporting; sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were assessed in comparison with histopathological diagnosis. Clinical data were retrieved from case notes prepared during history taking and clinical examination of patients.

Results and Discussion:
Mean age of patients was 40.1 years with male to female ratio of 1.14:1.As per Milan system, maximum cases were non- neoplastic (47.94%) followed by benign (17.12%), non-diagnostic (10.95%),malignant (8.9%), neoplasm of uncertain malignant potential(7.6%), atypia of undetermined significance(6.16%) and suspicious for malignancy(1.37%). In non-neoplastic and benign categories, the most common lesion was sialadenitis (34.4%) and pleomorphic adenoma (15.5%). Histopathological correlation was available in 42 cases. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of Milan system came out to be 87.5%, 96.2%, 93.3%,92.5% and 92.8% respectively.

Conclusion:
Milan system provides different categories with risk of malignancy of various salivary gland lesions. It helps to maintain international standards and creates easy and clear communication between cytologist and the physician for further management of the condition.

Key Words: Fine Needle Aspiration Cytology, Salivary gland, Milan system, Cytopathology.

Introduction:

Salivary glands are exocrine glands responsible for the production and secretion of saliva and consist of the parotid, submandibular, sublingual and the minor salivary glands. Microscopically these glands are composed of tubulo-alveolar structures embedded in a mixed supporting stroma and possess acinar and duct system.[1]The diseases affecting salivary glands are infections, inflammations, obstructions, functional impairment and neoplasms.

FNAC (Fine needle aspiration cytology) is being widely used in the diagnosis of the salivary gland swellings before performing any surgical procedure.[2] The heterogeneity of salivary gland lesions with overlapping cytomorphological features creates a diagnostic challenge for cytopathologist.[3] There arose a need for a uniform staging to overcome this diagnostic challenge and to guide at cytological diagnostic level for accurate surgical management of patients and further follow-up.[4] Milan System of Reporting Salivary Gland Cytology (MSRSGC) is a standardized classification system for effective reporting of salivary gland lesions. It was introduced in September 2015 at the European Congress of Cytology committee, held in Milan, Italy, under the guidance of the American society of Cytopathology (ASC) and the International academy of Cytology (IAC).[5] This classification system provides diagnostic staging information and facilitates communication between the reporting cytopathologist and the clinician. This study was carried out to assess our practice using the MSRSGC and to assess sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and accuracy using this system.

Materials and Methods:

A retrospective, observational study of 146 cases was carried out in the Department of Pathology, GCS Medical College, Hospital & Research centre, Ahmedabad, Gujarat, over a period of three years from January 2017 to December 2019.Ethical clearance from the Institutional Ethics Committee was obtained. All cases of salivary gland swellings presenting to the pathology department for FNAC were included in the present study. Patients who were uncooperative or unwilling or cases in which excision biopsy was directly sent for histopathology without FNAC were excluded. Detailed clinical history was taken and local examination followed by systemic examination was done in all patients. A 21-23 gauge needle was used to perform FNAC through direct percutaneous or transoral route and the needle was passed on an average of 1 to 4 times depending on the size of lesion. If the aspirate was insufficient, a repeat aspiration was done. The material was aspirated and the characters were noted. Routine smears were prepared, fixed in 95% alcohol and stained by hematoxylin and eosin stain, Pap stain was done whenever necessary. Stained smears were mounted with DPX (Dextrene Polystyrene Xylene) and examined under a light microscope. The results obtained on FNAC were divided into six categories as per Milan system: I Nondiagnostic, II Non-neoplastic, III Atypia of Undetermined Significance (AUS), IV Neoplastic (benign and suspicious for uncertain malignant potential, SUMP), V Suspicious for Malignancy (SFM) and VI Malignancy. Histopathological correlation was available in 42 out of 146cases. Histopathological examination was considered as 'Gold standard' and FNA cytology was considered as the index test. For statistical analysis, Atypia of Undetermined Significance (AUS), Suspicious for Uncertain Malignant Potential (SUMP), Suspicious for Malignancy (SFM) and Malignant categories on cytology were considered malignant. Results were analyzed statistically and sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated from following formulas. Accuracy of FNAC was assessed as per Milan system.

$$\text{Sensitivity} = \frac{\text{Number of true positives}}{\text{Number of true positives} + \text{Number of false negatives}}$$

$$\text{Specificity} = \frac{\text{Number of true negatives}}{\text{Number of true negatives} + \text{Number of false positives}}$$

$$\text{Positive predictive value} = \frac{\text{Number of true positives}}{\text{Number of false positives} + \text{Number of true positives}}$$

Negative predictive value =

$$\frac{\text{Number of true negatives}}{\text{Number of false negatives + Number of true negatives}}$$

Accuracy =

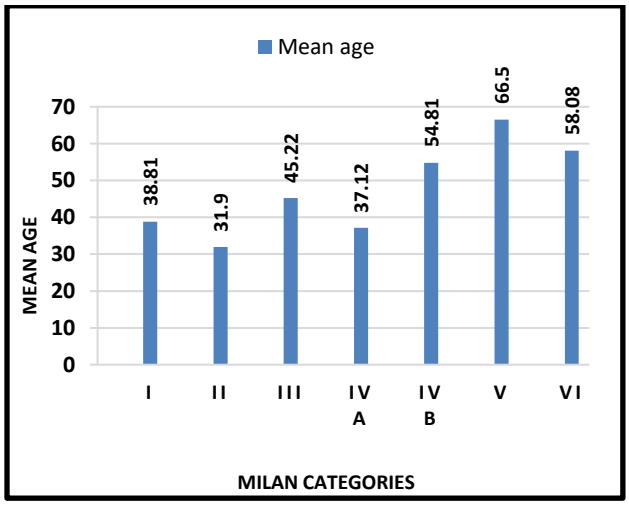
$$\frac{\text{Number of true negatives + Number of true positives}}{\text{Number of false positives + false negatives + true negatives + true positives}}$$

Cases where FNA cytology was able to detect malignant lesions correctly were labeled as true positive. Cases where both FNA cytology and histopathological examination were negative for malignancy were considered as true negative. Cases were considered as false positive when FNA cytology result was positive but histopathological examination was negative for malignancy. Cases where FNA cytology was not able to detect neoplastic lesions and were detected on histopathological examination were considered as false negative.

Results:

A total of 146 salivary gland FNA cases were received in the cytopathology section of the pathology department over a period of three years. The age group of the patients ranged from 6 years to 81 years with the mean age of 40.1 years (Figure -1).

Figure 1: Distribution of various categories according to mean age.



Seventy seven cases were males and Sixty Nine cases were females with M: F ratio of 1.1:1.Maximum lesions 69 (47.26%) were observed in submandibular salivary gland followed by 65(44.52%) and 08(5.44%) lesions in parotid and sublingual salivary glands respectively and 4 lesions (2.8%) were observed in the minor salivary glands.

Mean age for non-neoplastic lesions [Milan Category II] was 31.9 years while it was 45.9 years for neoplastic lesions [Milan Category IV].For malignant lesions and lesions suspicious of malignancy [Milan category V &VI],mean age was 62.3years.

Table-1 shows frequency distribution of cytopathological spectrum of salivary gland lesions**.** Out of 146 cases, 25 (17.2%), were of acute sialadenitis, 25(17.2%) were of chronic sialadenitis and pleomorphicadenoma accounted for 22 (15.5%) cases.

On categorization of FNA cytology by Milan system (Table-2), non-neoplastic lesions were most common 70 (47.91%), followed by neoplastic lesions (benign and SUMP) 36 (24.72%) &13 (8.90%) were malignant.

As most of the cases in our study were either inflammatory or mostly benign, they were treated conservatively and so their histological correlations were not available. Cyto-histological correlation was available in 42 cases out of 146 cases. On histological follow up, 39 out of 42 cases were concordant whereas 3 cases were discordant amongst which two cases belonged to benign and one case belonged to malignant category on cytology (Table-3). In 14 cases cytology was able to detect malignancy correctly (True Positive) while 25 cases were negative for malignancy both on histopathology and cytology (True Negative). In one case cytology was reported as suspicious for uncertain malignant potential (Milan category IVB) and turned out as Warthin's tumor on histology (False Positive). There were two false negative cases, one case was given as simple cyst with inflammatory cells – non-neoplastic category II on cytology and on histology diagnosed as low grade mucoepidermoid carcinoma. Other case was reported as inflammatory condition – category II on FNAC and turned out as

Table No. 1: Frequency distribution of cytopathological spectrum of salivary gland lesions

Salivary gland lesions	Male	Female	Total	Percentage
Non diagnostic samples	02	09	11	07.6
Acute sialadenitis	15	10	25	17.2
Chronic sialadenitis	15	10	25	17.2
Sialoadenosis	00	01	01	00.7
Granulomatous sialadenitis	05	05	10	6.70
Lymphadenitis (acute,reactive, chronic,granulomatous)	03	06	09	6.00
Non – mucinous cysts	02	03	05	3.40
AUS	06	03	09	6.20
Pleomorphic adenoma	08	14	22	15.50
Warthim's tumor	03	00	03	2.00
SUMP	08	03	11	7.30
Suspicious for malignancies	02	00	02	1.40
Mucoepidermoid carcinoma	02	01	03	2.00
Adenocystic carcinoma	00	03	03	2.00
Lymphoma	02	01	03	2.00
Metastasis	04	00	04	2.80
Total	77	69	146	100

Table No. 2: Frequency distribution of patterns in salivary gland lesions according to Milan System of reporting salivary gland cytology (MSRSGC)

Category	Cyto - diagnosis		Male	Female	Total	Percentage
I	Non diagnostic		04	12	16	10.95
II	Non-neoplastic		38	32	70	47.91
III	Atypiaof undetermined significance (AUS)		06	03	09	06.16
IV	Neoplasm	A. Benign	11	14	25	17.12
		A.Suspicious of uncertain malignant potential (SUMP)	08	03	11	07.6
V	Suspicious for malignancy (SFM)		02	00	02	1.37
VI	Malignant		08	05	13	8.90
	Total		77	69	146	100

Table No.3: Histological correlation with the cytological categories according Milan System of reporting salivary gland cytology (MSRSGC)

	Cytological diagnosis	No. of cases	Concordant cases	Histopathological diagnosis Discordant cases	Risk of malignancy(ROM)
Non diagnostic	1.Hypocellular smear 2. Smear obscured by blood and artifacts.	01 01	01 01	1.Nil 2.Nil	00%
Non neoplastic	1.simplecyst with inflammatory condition. 2.Acute sialadenitis 3.Chronic sialadenitis 4.Granulomatous sialadenitis 5.Lymphadenitis 6.Presence of inflammation condition	01 04 06 02 01 01	00 04 06 02 01 00	1.Low grade mucoepidermoid carcinoma 2.Nil 3.Nil 4.Nil 5.Nil 6.Epithelialmyoepithelial carcinoma	13.33%
AUS	1.Mucinous cyst 2.Low cellularity malignancy not ruled out 3.Atypia presence with low cellularity	01 01 01	01 01 01	1.Low grade mucoepidermoid carcinoma 2.Adenocystic carcinoma 3.Intermediate mucoepidermoid carcinoma	100%
Neoplastic Benign	1.Pleomorphic adenoma 2.Warthin's tumor	06 04	06 04	1.Pleomorphic adenoma 2.Warthin's tumor	0%
SUMP	1.Adequatecelluarity with presence of malignant cells. 2.Presence of atypical squamous cell with proteinaceous background	02 01	01 00	1.Mucoepidermoid carcinoma 2.Warthin's tumor	33.33%
Suspicious for malignacy	1.suspicious of high grade malignancy with obscuring blood	01	01	1.High grade mucoepidermoidcarcinoma	100%
Malignancy	1.Mucoepidermoid carcinoma 2.adenoidcystic carcinoma 3.Lymphoma 4.Meastastic squamous cell carcinoma	03 02 01 02	03 02 01 02	1.Mucoepidermoid carcinoma 2.adenoidcystic carcinoma 3.Lymphoma 4.Meastastic squamous cell carcinoma	100%
Total		42	39	03	

Table No.4: Comparative assessment of salivary gland cytology with histology in salivary gland lesions

	Test	**Total**	**Gold standard test – histology**	
			Malignancy	**Benign**
Cytology	Malignancy	15	14 (True positive)	1 (False Positive)
		100%	93.3%(Positive predictive value)	6.7%
		35.7%	87.5%(Sensitivity)	3.8%
	Benign	27	2 (False Positive)	25 (True Negative)
		100%	7.5%	92.5%(Negative Predictive Value)
		64.3%	12.5%	96.2%(Specificity)
Total	Number	42	16	26

epithelial myoepithelial carcinoma on histopathology.
The ROM (Risk Of Malignancy) for individual categories were non diagnostic 0%, non-neoplastic 13.33%,Atypia of undetermined significance (AUS) 100%, Benign 0%, Suspicious for uncertained malignant potential (SUMP) 33.33%, Suspicious for malignancy (SFM) 100% and Malignacy100%(Table-3). Sensitivity, specificity, positive predictive value and negative predictive value of FNA as per Milan system were found to be 87.5%, 96.1%.93.3% and 92.5% respectively (Table-4).
Overall cytological diagnostic accuracy was 92.8% in our study.

Discussion:

The FNAC is widely used test due to the ease of its performance and rapidity in diagnosis and has wide acceptance among clinicians. FNAC is performed to determine the origin of lesion, type of pathology, and nature of disease, either benign or malignant. It was developed in Europe in 1950 by Antoine Zajdela.[6]
In this study, 146 salivary gland FNA cases were studied and reclassified retrospectively according to Milan system so as to establish the ROMs of each category.

In present study, there were 77 males &69 females with M:F ratio of 1.1:1. Similar results were also seen in studies done by Jain C et al.[7], Mahammadtalha B et al[8] and Gandhi SH et al[9] showing male preponderance**.** Most of the cases were in age group of 31-40 years with a mean age of 40.1 years, which was comparable to studies done by Mahammadtalha B et al [8], Kakoty S et al [10] and Shafkat A et al.[11]Benign tumors were more common in the age group of 21- 60 year and malignant tumors were more common in the age group of 61-80 years which was comparable to the study done by Mahammadtalha B et al.[8]
Submandibular gland was found to be most commonly affected followed by parotid, sublingual and minor salivary glands. These findings are consistent with study done by Mahammadtalha B et al. [8], Singh A et al. [12] andAsharf et al. [13]
There are various classification systems available in the literature for lesions of salivary gland, described by Miller et al.[14], Tessyet et al. [15] and Tushar K et al.[16] This leads to lots of confusions regarding category-wise distribution of types of lesion, descriptive reports (no categories) and how to guide surgical management. Therefore, Milan system for reporting salivary gland

cytopathology (MSRSGC) was developed by the American society of Cytopathology(ASC) and the International academy of Cytology(IAC) in 2015 and it gave six categories for classification of various salivary gland lesions. Many of the diagnostic difficulties like predominantly cystic components, overlapping morphological features between benign and malignant lesions and oncocytic metaplasia have now been addressed in the Milan system.

Diagnosis of Category I can be given only after processing & examining all the aspirated material from salivary gland lesions.[17] In the present study, non-diagnostic cases [category I] (Figure-2a) were 16 (10.95%) which is comparable with the study done by Jaiswal P et al.[18]

Aspirates with benign cytomorphological changes associated with or without inflammation were included in category II (Figure-2b, 2c, 2d) i.e. non-neoplastic. This category formed the major group in the present study and chronic sialadenitis was the most common lesion. Similar distribution of lesions were also noted in a study done by Pukhrambam GD et al.[19] and Karuna V et al.[20]

There is wide variation in the frequency of non-neoplastic lesions reported in the literature ranging from 16% to 70% (Table 5). A higher frequency was observed in this study, which could be due to the low socioeconomic status of the population and also the discretion of the physicians ordering the investigation.

Out of 77 cases, 6.16% belonged to category III/ AUS (Figure3a&3b), which included predominantly mucinous aspirates with scanty or absent cellularity, reactive atypia inconclusive for neoplasm and oncocytic changes. Similar results were also obtained in studies done by Viswanathan K et al[21,] Mahammadtalha B. et al.[8] and Pukhramban GD et al.[19] The advantage of AUS category is that it potentially reduces the number of false-negative diagnoses in the"Non-Neoplastic" category as well as reducing the number of false positive diagnoses in the "Neoplasm" category.[17]

FNA cytology showing characteristic features of benign neoplasm of salivary gland without any atypia were considered in category IVA and comprised of 17.12% cases. Study done by Mahammadtalha B. et al.[8] and Viswanathan K et al.[21] showed similar findings where as other studies reported a higher frequency (Table-5).Amongst the benign neoplasms, pleomorphic adenoma (Figure-3c) was most common benign lesions followed by Warthin's tumor (Figure-3d). These findings are consistent with studies done by Kattar R. et al.[22], KarunaV.etal.[21] and Pukhrambam GD et al.[19]

Smears with adequate cellularity diagnostic of neoplasm but showing mild to moderate atypia making it difficult to differentiate between benign or malignant lesions were classified as category IV B/SUMP and accounted for 7.6% of cases (Figure-4a). Similar results were also obtained in studies done by Viswanathan K et al.[19] and Karuna V. et al.[20]

Smears with scanty cellularity or obscured by blood and inflammation but showing marked cellular atypia were included in category V/ Suspicious For Malignancy (Figure-4b) and accounted for 1.37% of cases. These results were similar to a study by Viswanathan K et al.[21] and Pukhramban GD et al.[19]

Out of 146 cases, 8.9% were positive for malignancy and belonged to category VI (Figure-4c, 4d, 5a, 5b, 5c and 5d) of Milan system. FNA cytology with adequate cellularity and showing clear evidence of malignant neoplasm were included in this category. Studies done by Viswanathan K et al.[21],Mahammadtalha B. et al.[8] and Pukhramban GD et al.[19] also found similar results. Amongst the malignant lesions mucoepidermoid carcinoma (Figure4c &4d) was the most common.

Table 5 gives a comparison of salivary gland lesion according Milan system in the present study with other studies. Result of category I, II & IV-A in the present study are similar to the studies done by Mahammadtalha B. et al.[8] andViswanathan K et al.[21] Result of category III in the present study are similar to studies done by Mahammadtalha B. et al.[8], Pukhramban GD et al.[19] and Viswanathan K et al.[21]

Results of category IV-B in the present study are similar to studies done by Viswanathan K et al.[21]and Karuna V. et al.[20] Results of category V in thepresent study are similar to the studies done by Pukhramban GD et al.[19] and Viswanathan K et al.[21] Result of category VI in the present study are similar to the studies done by Mahammadtalha B. et al.[8] Pukhramban GD et al.[19] andViswanathan K et al.[21]and Kattar R. et al.[22]

Out of 42 cases available for cytohistological correlation, three cases were found to be discordant, one was false positive and two were false negative.The cytological diagnoses have been tabulated with particular mention of those discordant histopathological diagnoses (Table 3).

Amongst the two false negative cases, one belonged to the non- neoplastic category, which was diagnosed as cystic fluid with inflammatory cells on cytology (Figure-6a) but turned out to be low grade mucoepidermoid carcinoma on histology (Figure-6b). Mucoepidermoid carcinoma is a glandular epithelial neoplasm characterized by epidermoid, intermediate and goblet type mucus cells, which vary in proportion depending upon histological grade. Low grade mucoepidermoid carcinoma has a predominant cystic component lined by mucus secreting goblet cells and thus can lead to an aspiration of predominantly cystic fluid with scanty cellularity. Secondary associated inflammation could have been responsible for the inflammatory component seen on smears.

Another false negative case given as inflammatory condition on cytology (Figure-6c) turned out to be epithelial-myoepithelial carcinoma on histology (Figure-6d). Inadequate sampling leading to lack of lesional cells like myoepithelial cells having clear cytoplasm and presence of inflammatory cells in the background could have been responsible for under diagnosis**.**

In AUS (III) category, histological follow up of all the cases turned out to be malignant predominantly mucoepidermoid carcinoma and adenoid cystic carcinoma.

In neoplastic – benign tumor (IVA) category, on histological correlation all cases were concordant diagnosed as pleomorphic adenoma and Warthin's tumour on histology.

In SUMP category (IVB), all cases were concordant and were malignant on histology except one, which turned out to be Warthin's tumour, a benign lesion on histology (false positive) (Figure7b). Warthin's tumor has tripartite appearance with dirty proteinaceous background, lymphocytes and sheets of oncocytes. Degenerated oncocytes may look like atypical squamous cells combined with a background of necrotic debris which led to a false positive diagnosis of SUMP in this case (Figure-7a).[17]

In suspicious cases of malignancy, category(V) and in malignant category(VI)all cases turned out to be malignant after histopathological follow up.

Present study demonstrated sensitivity, specificity, positive predictive value and negative predictive value of FNA as per Milan system to be 87.5%, 96.1%, 93.3% and 92.5% respectively**.** These findings are in coherence with studies done by Pukhrambam GD et al.[19], Piccioni et al.[23] and López Pazos et al.[24] Cytological diagnostic accuracy for differentiating malignant from benign lesions was 92.85% similar to the study done by Karuna V et al.[20] ROMs of all the cases having histological correlation were calculated for each category of MSRSGC (Table 3).

The ROMs for individual categories were non diagnostic(I) 0%, non-neoplastic (II) 13.33%,AUS(III) 100%, Benign(IVA) 0%, SUMP(IVB) 33.33%, suspicious for malignancy(V) 100% and malignancy(VI) 100%. Our findings were consistent with those of Rossi ED et al.[25] for categories II, IVA, IVB and VI, which reported ROM as 10%, < 5%, 35% and 90% for the respective categories. However ROM was lower as compared to 25% for category I and higher for category III (100% vs. 20%) and V(100% vs. 60%). Higher ROM in the above categories could be due to less number of cases with even lesser number showing histological follow up.

Other study done by Pukhrambam GD et al.[19]showed similar ROMs for category I, V & VI. Lower frequency was seen in category II and III Compared to our study. MSRSGC is an evidence based system derived from the literature which correlates diagnostic categories with ROMs for better communication between clinicians and between institutions in order to improve overall diagnosis.[17]

Table No.5: Milan category wise comparison in salivary gland lesions

Category	Studies					
	Pukhrambam GD et al[19].	**Viswanathan K et al [21].**	**Kattar R. et al [22].**	**Karuna V. et al [20]**	**Mahammadtalha B. et al[17]**	**Present study**
I	4(1.4%)	75(12%)	3(4.3%)	3(2.85%)	16(10.67%)	16(10.95%)
II	154(52.9%)	179(28.5%)	9(13%)	17(16.20%)	70(46.67%)	70(47.91%)
III	25(8.6%)	38(6.1%)	1(1.4%)	3(2.85%)	9(6%)	9(6.16%)
IV-A	84(28.9%)	197(31.4%)	43(62.3%)	54(51.43%)	35(23.33%)	25(17.12%)
IV-B	1(3%)	62(9.9%)	2(2.8%)	6(5.71%)	2(1.33%)	11(7.60%)
V	1(3%)	17(2.7%)	3(4.3%)	5(4.76%)	6(4%)	2(1.37%)
VI	22(7.6%)	59(9.4%)	8(11.6%)	17(16.20)	12(8%)	13(8.90%)
Total	291(100%)	627(100%)	69(100%)	105(100%)	150(100%)	146(100%)

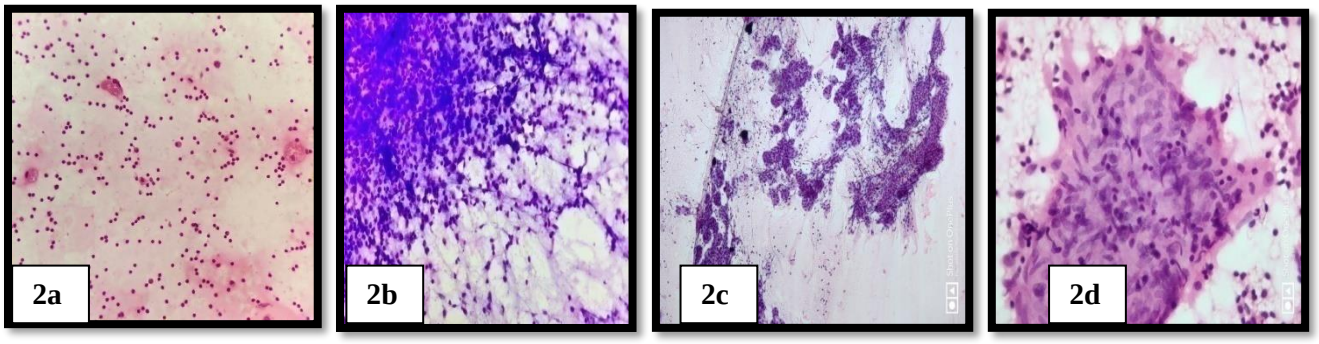


Figure.2a - Smear of non-mucinous cyst showing proteinaceous background with cystic macrophages and inflammatory cells predominantly lymphocytes (Nondiagnostic I).[H&E: 40X].
Figure.2b - Smear of Acute sialadenitis showing of acute inflammatory cells with presence of background debris (Non-neoplastic II). [H&E: 40X].
Figure.2c- Smear of chronic sialadenitis showing bland looking ductal cells admixed with chronic inflammatory cells (Non-neoplastic II). [H&E: 10X]
Figure.2d - Smear of Tuberculous lymphadenitis showing large group of epithelioid cells with presence of caseous necrosis (Non-neoplastic II). [H&E: 40X]

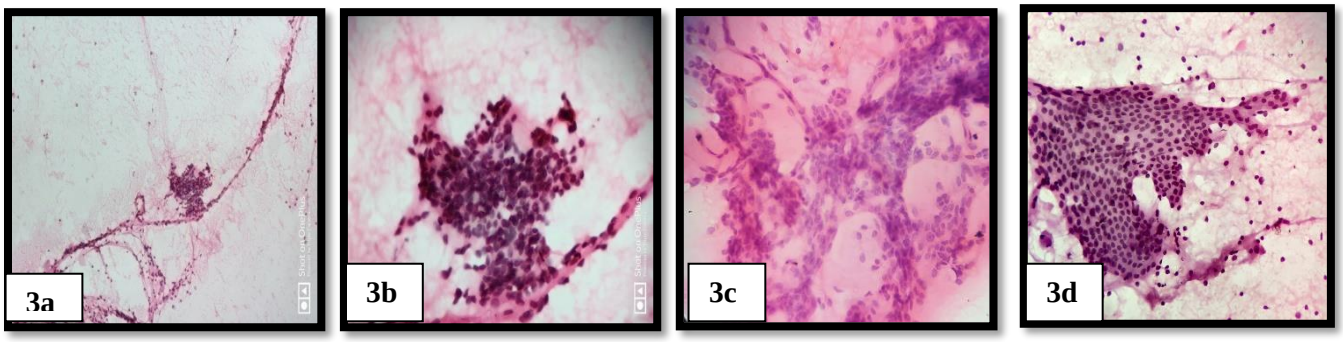


Figure.3a & 3b- Hypocellular smears showing groups of crowded epithelial cells admixed with mild atypia having overlapping nuclei (AUS- atypia of undetermined significance III) [H&E:10X] and [H&E:40X]
Figure.3c-Smear of pleomorphic adenoma showing bland epithelial cells with spindle shaped myoepithelial cells with distinctive chondromyxoid background (benign IVA)[H&E:40X].
Figure.3d- Smear of Warthin's tumor showing presence of oncocytic cells, epithelial cells having proteinaceousbackground(benign IVA)[H&E:40X]

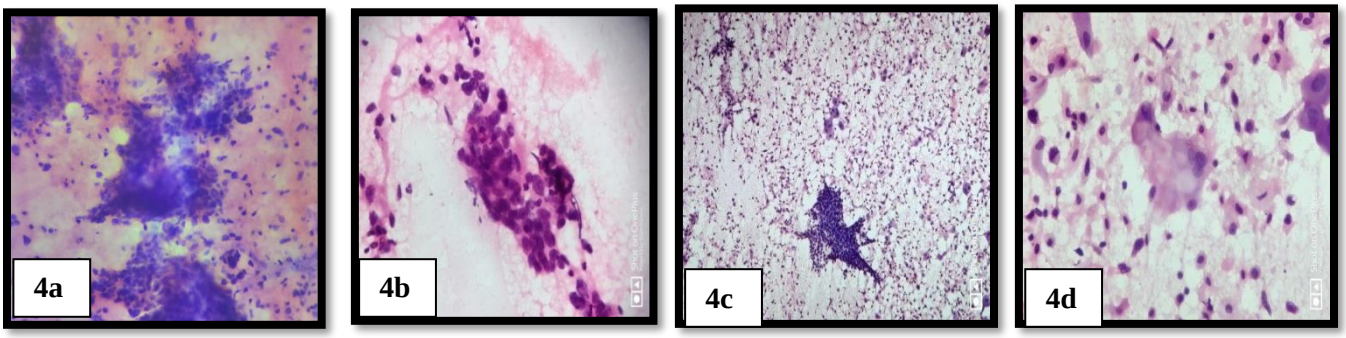


Figure.4a- Smear of SUMP showing adequate cellularity with groups of cells showing features of malignancy with obscuring inflammatory cells(Suspicious of uncertained malignant potential IVB).[H&E: 40X].
Figure.4b- Smear of Suspicious for malignancy showing scanty cellularity with atypical cells having hyperchromatic nuclei, malignancy could not be ruled out.(Suspicious for malignancy V) [H&E: 40X].
Figure.4c &4d- Smear of mucoepidermoid carcinoma showing bland epidermoid& intermediate cells admixed with mucinous cells with presence of mucin and lymphocytes in background.(Malignant VI)[3a: H&E: 10X]&[3b: H&E: 40X]

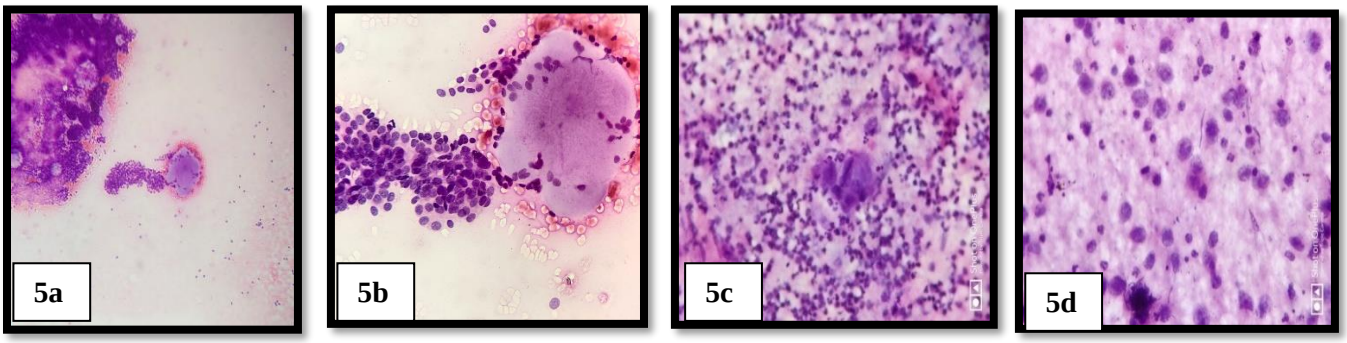


Figure.5a & 5b- Smear of Adenoid cystic carcinoma showing basaloid tumor cells having high N:C ratio with presence of acellular amorphous pink material(Malignant VI). [4a:H&E: 10X]&[4b: H&E: 40X]
Figure. 5c-Smear showing presence of groups of high-grade malignant cells with abundant cytoplasm, nuclear pleomorphism and prominent nucleoli suggestive of metastasis (Malignant VI). [H&E: 40X]
Figure. 5d- smear of non Hodgkin's lymphoma showing presence of small to intermediated sized lymphocytes, scanty cytoplasm, coarse chromatin & round to irregular nuclei(Malignant VI).[H&E: 40X]

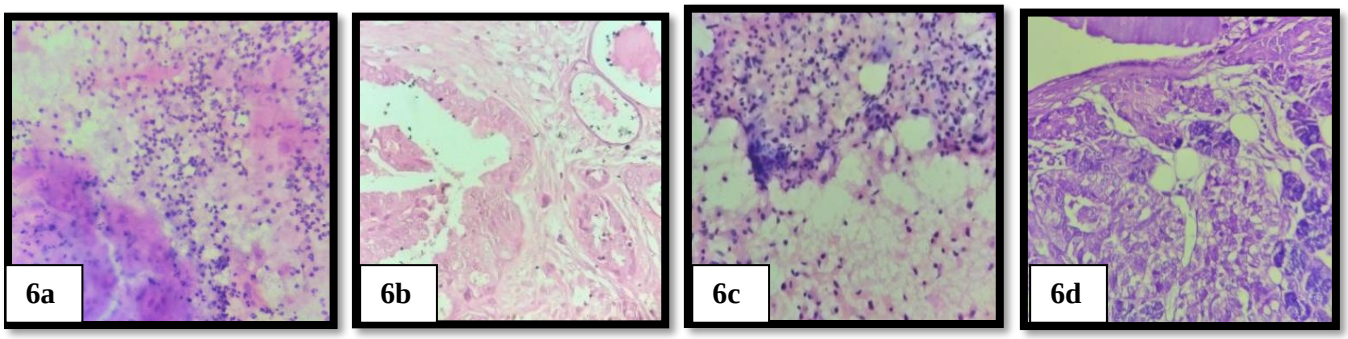


Figure. 6a- Cytology smear of simple cyst showing presence of epithelial cells admixed with abundant inflammatory cells with some mucinous areas (non-neoplastic category II).[H&E: 40X].
Figure. 6b- Histology sections of low grade mucoepidermoid carcinoma showing presence ofclusters of mucinous and intermediate cells with bland nuclei form glandular spaces(malignant VI) [H&E 10X]
Figure. 6c- Cytological smear showing cells groups of epithelial cells admixed with inflammatory cells(non-neoplastic category II). [H&E: 40X].
Figure. 6d- Histology section of epithelialmyoepithelial carcinoma showing epithelial and myoepithelial cells with clear cytoplasm and nuclear pleomorphism(malignant VI).[H &E 40X]

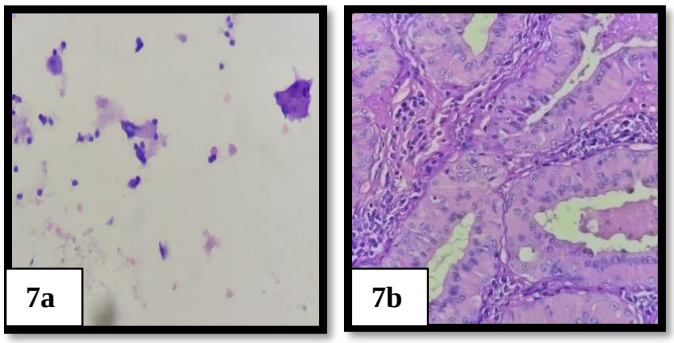


Figure. 7a- Cytological smear showing presence of occasional epithelialcellswith atypical squamous cells in a background of lymphocytes, indefinite for a neoplasm (suspicious Of undetermined malignant potential IVB). [H&E: 40X].
Figure. 7b- Histology section of Warthin's tumor shows double layer of epithelial cells resting on dense lymphoid stroma with variable germinal centers [H&E 40X]

Conflict of Interest - Nil

Sources of Support - Nil

References:

1. McHugsh JB. Major and minor salivary glands. In: Goldblum JR, Lumps LW, Mc Kenney JK, et al, eds. Rosai and Ackerman's surgical pathology. 11th edition. Philadelphia: Elsevier 2018:235-268.pp.235-259.
2. Akhter J, Hirachand S, Lakhey M. Role of FNAC in the diagnosis of salivary gland swellings. Kathmandu University Medical Journal (KUMJ) 2008; 6(2):204-208.

3. Savant D, Jin C, Chau K. Risk stratification of salivary gland cytology utilizing the Milan system of classification. Diagnostic Cytopathology 2019;47(3):172-180.
4. Rossi ED, Faquin WC, Baloch Z. The Milan System for Reporting Salivary Gland Cytopathology: Analysis and suggestions of initial survey. Cancer Cytopathology 2017;125(10):757-766.
5. Thiryayi SA, Low YX, Shelton D, Narine N, Slater D, Rana DN. A retrospective 3-year study of salivary gland FNAC with categorisation using the Milan reporting system. Cytopathology 2018;29(4):343-348.
6. Naz S, Hashmi AA, Khurshid A. Diagnostic role of fine needle aspiration cytology (FNAC) in the evaluation of salivary gland swelling: an institutional experience. BMC Research Notes 2015; 8:101.
7. 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.
8. Mahammadtalha B, Swami S.Y. Cytopathological study of salivary gland lesions inpopulation: Use of the Milan system for reporting. Tropical Journal of Pathology and Microbiology 2019;5(2):100-106.
9. Gandhi, Shilpa. FNAC diagnosis of salivary gland Lesions with histopathological correlation. National Journal of Integrated Research in Medicine 2013;(4):70-77.
10. Kakoty S, Baruah TD, Babu CPG. FNAC and histopathological correlation of salivary gland lesions: an observational study. International Surgery Journal 2017;4: 2148-2152.
11. Shafkat A, Mohammad L, Rouf A. Clinico-pathological study of primary salivary gland tumours in kashmir. JK-Practioner 2002; 9(4): 231- 233.
12. Singh A, Haritwal A, Murali B. Correlation between cytology and histopathology of the salivary glam. Australasian Medical Journal 2011;4(2):66-71.
13. Ashraf A, Shaikh AS, Kamal F, Sarfraz R, BukhariMH. Diagnostic reliability of FNAC for salivary gland swellings: a comparative study. Diagnostic Cytopathology 2010; 38(7):499-504.
14. Rajendra Santosh AB, Bakki SR, Manthapuri S. A review of research on cytological approach in salivary gland masses. Indian Journal of Dental Research 2018; 29:93‑106.
15. Tessy PJ, Jayalekshmy PS, Cicy PJ, Usha P. Fine needle aspiration cytology of salivary gland lesions with histopathological correlation – A two year study. International Journal of Healthcare and Biomedical Research 2015;3:91‑99.
16. Tushar K, Banyameen I, Amardeep P, Harsh K. Diagnostic role of FNAC in salivary gland lesions and its histopathological correlation. Indian Journal of Pathology and Oncology 2016;3:372‑325.
17. Zubair B, Andrew SF, Nora K, Bruce MW. The Milan System for Reporting Salivary Gland Cytopathology, 1st ed. William CF, Esther DR, editors. Springer International Publishing AG. 2018.
18. Pooja Jaiswal, Mousumi Sharma, FarazAhmad,NausheenSanaullah Khan, Siddhartha Sinha,MeghaAgarwal. Risk-based Stratification of Salivary Gland Lesions on Cytology: An Institutional Experience. Iranian Journal of Pathology, 2018; 13(2): 220-228.
19. PukhrambamGD, Laishram RS, Marina A. Study of the cytomorphology of salivary gland lesions using the Milan system of reporting in a tertiary care hospital. Journal of Evidence Based Medicine and Healthcare 2019; 6(46): 2926-2930.

20. 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 Journal of Pathology and Microbiology 2019;62:11-16.
21. 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 Cytopathology 2018;126(8):541-551.
22. Katta R, Changanti DP. Application of Milan system of reporting salivary cytopathology – retrospective correlation study. Journal of NTR University of Health Sciences 2019; 8:11-17.
23. PiccioniLO, Fabiano B, Gemma M, Sarandria D, Bussi M. Fine-needle aspiration cytology in the diagnosis of parotid lesions. Acta Otorhinolaryngol Italica 2011;31(1):1-4.
24. Lopez-Pazos P, Peres-Sayans M, Chamoro-Petronacci C. Fine needle aspiration cytology-efficacy in presurgical diagnosis of salivary gland tumors. Biomedical Research 2018;29(13):2863-2865.
25. Rossi ED, Wong LQ, Bizzarro T. The impact of FNAC in the management of salivary gland lesions: Institutional experiences leading to a risk-based classification scheme. Cancer Cytopathology 2016;124(6):388-396.

Address for correspondence: Dr. Anupama Dayal, Associate Professor of Pathology, G.C.S. Medical College, Hospital and Research Centre, Ahmedabad, Gujarat, India.
Email: anupamadayal2019@gmail.com Mobile: +91 9898264571

Received date: 21/08/2020 Revised date: 24/09/2020 Accepted date: 27/11/2020

How to cite this article: Palak Patel, Anupama Dayal, Deepak Joshi and Suktara Sharma, Cytopathological study of salivary gland lesions using Milan system. Walawalkar International Medical Journal 2020; 7(2):59- 72
http://www.wimjournal.com