

Frequency and pattern of salivary gland lesions at a tertiary care centre

Syed Muhammad Ali Naqvi¹, Uzma Bukhari², Syed Muhammad Zulfiqar Hyder Naqvi³, Talat Mirza⁴

ABSTRACT

Objective: To analyze the frequency and histo-morphological pattern of non-neoplastic and neoplastic salivary gland lesions at a tertiary care centre.

Study Design: Retrospective descriptive cross-sectional study

Place and Duration: Histopathology section, Dow Diagnostic Reference and Research Laboratory, Karachi from 1st February 2021 to 31st July, 2021.

Methodology: Data of all salivary gland lesions were retrieved from institutional database. All tissue specimens of parotid, submandibular and sublingual salivary glands lesions as well as possible minor salivary glands swellings were included for histopathological analysis. Type of benign or neoplastic lesion along with salivary gland involved were assessed.

Results: Out of a total of 739 samples, 28.0% were non-neoplastic whereas 72.0% were neoplastic lesions. Out of 207 non-neoplastic lesions, 55.1% were of inflammatory origin whereas 44.9% were mucoceles. Chronic sialadenitis (61.4%) was the most common non-neoplastic inflammatory lesion. Among mucoceles, those reported with no specification of type predominated (37.6%). Out of total 543 neoplastic lesions, 53.1% were benign whereas 19.3% were malignant. Pleomorphic adenoma (87.1%) was the commonest benign neoplastic lesion, followed by benign epidermal inclusion cysts (3.7%). Of the 127 malignant salivary gland tumors, mucoepidermoid carcinoma (39.4%) was the most common lesion, followed by adenoid cystic carcinoma (29.1%).

Conclusion: Chronic sialadenitis was the most common non-neoplastic lesion whereas pleomorphic adenoma was the predominant benign lesion. Moreover, mucoepidermoid carcinoma was the most common malignant lesion followed by adenoid cystic carcinoma.

Keywords: Salivary Glands, Neoplastic lesion, Non-neoplastic lesion, Frequency, Sialadenitis, Adenoma, Carcinoma

How to Cite This:

Naqvi SMA, Bukhari U, Naqvi SMZH, Mirza T. Frequency and pattern of salivary gland lesions at a tertiary care centre. *Isra Med J.* 2022; 14(2): 50-54. DOI: <https://doi.org/10.55282/imj.0a1279>

This is an Open Access article distributed under the terms of the Creative Commons Attribution-Noncommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

The histo-morphological pattern of salivary gland lesions has become an interesting avenue of research due to the distinctive anatomical position of salivary glands as well as the profound diversification in histological picture of the lesions¹. Literature thus far does not provide a very clear picture due to high variability in the available data². Salivary gland diseases are classified as infectious, inflammatory and neoplastic lesions^{3,4}. These diverse groups of lesions with varied biologic mechanisms are a therapeutic challenge for clinicians all over the world⁵.

A regional study reported 27.27% non-neoplastic and 72.72% neoplastic salivary gland lesions. Sialadenitis 16.36% followed by cystic lesions 10.9% were the most common non neoplastic lesions. Among the neoplasms studied, 75% cases were benign and 25% were malignant⁶.

Salivary gland tumors represent relatively rare neoplasms, accounting for about 3 to 4% of all head and neck neoplasms but demonstrate a striking morphological diversity between different tumor types and sometimes within an individual tumor mass. They constitute a wide variety of benign, malignant epithelial, soft tissue, hematolymphoid, and secondary tumors⁷. A retrospective study of 124 cases of salivary gland tumors conducted in Brazil identified 65.3% of benign and 34.6% of

1. Senior Lecturer of Oral Pathology, Dr. Ishrat ul Ebad Khan Institute of Oral Health Sciences, Dow University of Health Sciences, Ojha Campus, Karachi
2. Professor of Pathology, Dow International Medical College, Dow University of Health Sciences, Karachi
3. Assistant Professor of Community Medicine, Baqai Medical University, Karachi
4. Professor of Pathology & Research Dean, Ziauddin Medical University, Clifton, Karachi

Correspondence:

Syed Muhammad Ali Naqvi
Senior Lecturer of Oral Pathology, Dr. Ishrat ul Ebad Khan Institute of Oral Health Sciences, Dow University of Health Sciences, Ojha Campus, Karachi.
Email: syed.naqvi@duhs.edu.pk

Received for Publication: July 25, 2021

1st Revision of Manuscript: October 19, 2021

2nd Revision of Manuscript: November 24, 2021

3rd Revision of Manuscript: March 03, 2022

4th Revision of Manuscript: April 08, 2022

Accepted for Publication: May 31, 2022

malignant salivary gland tumours. Parotid gland was the most common site of tumours 57.2%. The most common benign tumor was pleomorphic adenoma (48.2%) and the most common malignant tumor was mucoepidermoid carcinoma (8.7%)⁸. A recent local study on total 73 patients operated for salivary gland tumours estimated 57.53% of benign tumours and 42.4% of malignant tumours. The most common site of tumours was parotid gland 67.12%. Most common benign tumor was pleomorphic adenoma (43.8%) while mucoepidermoid carcinoma was most common malignant tumor (23.28%)⁹.

Literature about frequency and prevalence of salivary gland lesions not only increases awareness of disease patterns within populations, but highlights the lesions that are most likely to be encountered by a histopathologist and surgeons in daily practice. Recent literature highlighted issue of very few histopathological studies globally that include a comprehensive spectrum of oral lesions. Most of the published studies are designed to analyze only a specific disease or lesion, and limited to a certain age group or based on screenings or clinical surveys, without histological diagnostic confirmation. A 20-fold global variation in the incidence of these lesions is apparent in international databases¹⁰.

To the best of investigators' knowledge, data regarding histomorphological presentation of salivary gland lesions in Pakistan are limited at best. Majority of the publications are either case reports or case studies with relatively small number of patients, and deal with single disease entities, thereby lacking any generalizable results. The objective of this study was therefore to describe the frequency and histo-morphological pattern of non-neoplastic and neoplastic salivary gland lesions at a tertiary care hospital in Karachi. As we do not have a National Tumor Registry, this study will contribute valuable data to the existing body of scientific literature regarding salivary gland lesions in Pakistan. This study was conducted with an objective to analyze the frequency and histo-morphological pattern of non-neoplastic and neoplastic salivary gland lesions at a tertiary care hospital.

METHODOLOGY

This retrospective, descriptive cross-sectional study was carried out from 1st February 2021 to 31st July 2021 at histopathology section of Dow Diagnostic, Reference and Research Laboratory (DDRRL), Dow University of Health Sciences, Ojha Campus, Karachi.

Keeping the percentage frequency of the study outcome at 50% for most liberal estimate, with 95% confidence level and 4% precision, the minimum required sample size was calculated to be 601 patients. The hospital records of histopathology data were in the form of monthly reports books as well as digital data. To ensure accuracy of data; it was first retrieved from record books, than rechecked from digital data.

Relevant data of all patients who underwent biopsies of major and possible minor salivary gland areas from January 2009 to December 2018 were taken from hospital records and recorded on the study pro forma. This included patient's age gender and type and site of both non-neoplastic and neoplastic salivary gland

lesions. Records with missing data or in which type and location of salivary gland not mentioned were excluded from the study.

Histopathology data/reports of salivary gland tissue samples were collected and reviewed by the study investigators as a team. Histopathology slides were reviewed, wherever required, for further confirmations which were mostly stained by Haematoxylin and Eosin (H & E) with addition of special stains and immunostains. Special stains including PAS, PAS Alcian blue and Trichrome were performed. Immunohistochemical stains including CKAE1/AE3, P63, CK7, EMA, CK5/6 and BerEp4 were performed wherever required for diagnosis.

Data Analysis: SPSS version 20 was used for statistical analysis. After data coding and entry, descriptive analysis was performed by generating means and standard deviations for continuous variables such as age and frequencies and percentages for categorical variables such as gender, and type and site of salivary gland lesions.

RESULTS

Data of total seven hundred and thirty nine patients were analyzed for the study. The mean age of the patients was 35.33±15.36 years, 385 (52.1%) of them were males while 354 (47.9%) were females. Out of total 750 salivary gland specimens evaluated, 207 (28.0%) were found to be non-neoplastic, 398 (53.9%) were benign whereas 134 (18.1%) were malignant salivary gland lesions.

Among 207 cases of non-neoplastic lesions, 114 (55.1%) were of inflammatory/infectious origin while 93 (44.9%) were mucoceles. Chronic sialadenitis was the most common inflammatory lesion accounting for 70 (61.4%) cases, followed by 28 (24.6%) cases of chronic inflammatory/granulomatous lesions and 11 (9.6%) cases of sialolithiasis. Among mucoceles, those with no specification of its types predominated as 35 (37.6%) cases followed by extravasation mucoceles as 34 (36.6%) cases and mucous retention cysts as 14 (15.1%) cases. Ranula accounted for 10 (10.8%) cases (table I).

Table – I: Details of non-neoplastic salivary gland lesions (n=207)

Variables	Count (%)	
Types of Non Neoplastic Salivary Glands Lesions	Inflammatory/Infectious	114 (55.1%)
	Mucoceles	93 (44.9%)
Inflammatory Infectious Lesions¹	Chronic sialadenitis	70 (61.4%)
	Chronic inflammatory/Granulomatous tissue lesions	28 (24.6%)
	Sialolithiasis	11 (9.6%)
	Chronic sclerosing sialadenitis	4 (3.5%)
	Mickulicz's disease	1 (0.9%)
	Mucoceles²	Mucocele
Extravasation mucocele	34 (36.6%)	
Mucous retention cyst	14 (15.1%)	
Ranula	10 (10.8%)	

¹n=114

²n=93

For inflammatory/infectious lesions, submandibular gland was reported as the most common location, in 64 (56.1%) cases while for mucoceles lower lip was the most commonly affected site, in 67 (72%) cases.

Out of total 398 benign salivary gland lesions, 355 (89.2%) were benign salivary gland tumours, 29 (7.3%) were benign cystic lesions and 14 (3.5%) were benign soft tissue lesions. Among benign salivary gland tumours, pleomorphic adenoma was found as the most common lesion (n=347, 97.7%). It was also the most common neoplastic lesion (n=347, 63.9%) as well as the most common salivary gland lesion (n=347, 46.2%) in this study (table IIA).

Table – IIA: Details of benign neoplastic salivary gland lesions (n=398)

Variables		Count (%)
Types of Benign Neoplastic Salivary Gland Lesions	Benign salivary gland tumors	355 (89.2%)
	Benign cystic salivary gland lesions	29 (7.3%)
	Benign soft tissue salivary gland lesions	14 (3.5%)
Benign Salivary Gland Tumors	Pleomorphic adenoma	347 (97.7%)
	Warthin’s tumor	6 (1.7%)
	Myoepithelioma	2 (0.6%)
Benign Cystic Salivary Gland Lesions	Benign epidermal inclusion cyst	15 (51.7%)
	Benign Lympho-epithelial cyst	11 (37.9%)
	Dermoid cyst	3 (10.3%)
Benign Soft Tissue Salivary Gland Lesions	Lipoma	7 (50.0%)
	Haemangioma	3 (21.4%)
	Infantile haemangio-endothelioma	1 (7.1%)
	Lymphangioma	1 (7.1%)
	Schwannoma	2(14.2%)

Parotid gland was the most common site of pleomorphic adenoma (n=235, 67.7%), followed by submandibular gland (n=61, 17.6%).

Out of 134 malignant salivary glands lesions, 127 (94.8%) were malignant salivary gland tumors while 7 (5.2%) cases were of hematolymphoid salivary gland tumors. Among malignant salivary gland tumors, mucoepidermoid carcinoma was the most common tumor (n=50, 37.3%) followed by adenoid cystic carcinoma (n=48, 34.7%) and acinic cell carcinoma (n=10, 7.2%) (Table IIB).

Out of 50 mucoepidermoid, 33(66%) of these mucoepidermoid carcinoma were of low grade category, 4 (8%) were of intermediate grade, 3 (6%) were of high grade while grading of 10 (20%) cases was not reported.

Parotid gland was the most common site of mucoepidermoid carcinoma with 33 (62.5%) cases followed by 6 (12%) cases at submandibular gland. Submandibular gland was the most

common salivary glands site of occurrence for adenoid cystic carcinoma with 13 (27%) cases followed by 11 (22.9%) cases at parotid gland (data not shown).

Table – IIB: Details of malignant neoplastic salivary gland lesions (n=134)

Variables		Count (%)
Types of Malignant Neoplastic Salivary Gland Lesions	Malignant salivary gland tumors	127 (94.8%)
	Hemato lymphoid salivary gland tumors	7 (5.2%)
Malignant Salivary Gland Tumors	Mucoepidermoid carcinoma	50 (39.4%)
	Adenoid cystic carcinoma	37 (29.1%)
	Acinic cell carcinoma	10 (7.9%)
	Adeno carcinoma, NOS	7 (5.5%)
	Salivary duct carcinoma	5 (3.9%)
	Myoepithelial carcinoma	4(3.1%)
	Carcinoma ex pleomorphic adenoma	3 (2.4%)
	Lymphoepithelial carcinoma	1 (0.8%)
	Metastatic squamous cell carcinoma	1 (0.8%)
	High grade sarcoma	1 (0.8%)
Unclassified	8 (5.8%)	
Hematolymphoid Salivary Gland Tumors	Diffuse large B cell lymphoma/Non Hodgkin lymphoma	6 (85.7%)
	Hodgkin lymphoma	1 (14.3%)

DISCUSSION

Current study analyzed the frequency and pattern of non-neoplastic and neoplastic salivary glands lesions in a single institute of Karachi. We found chronic sialadenitis with 61.4% cases was the most common cause of non-neoplastic inflammatory condition with the submandibular gland being the most common site in 56.1% of cases. Similar findings have been reported by national and international studies¹¹⁻¹³.

The WHO histological classification¹⁰ of salivary gland lesions mentioned parotid gland as the most commonly involved salivary gland followed by palate and buccal mucosa. This is a finding similar with our study and two others local studies^{14,15}.

In neoplastic conditions, the current study showed a higher percentage of benign lesions as compared to malignant neoplastic lesions. Pleomorphic adenoma was the commonest benign neoplastic lesion in our study. Our findings are in accordance with a recent study by Mahmood et al¹⁶ who reported 65.3% benign neoplastic lesions with 61.1% comprising of pleomorphic adenomas. Likewise, a similar finding has been reported by Obimakinde et al⁴ who reported 60% salivary gland

neoplasms with 87.2% of pleomorphic adenomas. Da silva et al¹⁷ reported 57.7% benign neoplastic lesions consisting 82.2% of pleomorphic adenomas.

Parotid gland was the most common site of Pleomorphic adenoma in 67.7% of cases followed by submandibular gland in 17.6% of cases, a finding in line with the results of recently published studies from India¹⁸ and the Netherland¹⁹.

Though Warthin's tumor was found as a rare entity among benign salivary gland lesions in the present study; it has been reported as the second and the third most common benign tumor secondary to pleomorphic adenoma in two earlier studies^{12,20} A recent study in Greece by Kadletz et al²¹ reported a rising incidence of Warthin's tumor in recent years that has been correlated with obesity, alcohol consumption, and cigarette smoking.

Regarding the malignant neoplastic lesions, current study reported mucoepidermoid carcinoma as the most common salivary gland cancer followed by adenoid cystic carcinoma and acinic cell carcinoma. Our findings are in accordance with studies^{14,15} who also found mucoepidermoid carcinoma as a common malignant tumor of salivary gland. However, a recent study by Ahmed et al²² mentioned a higher prevalence of adenoid cystic carcinoma, followed by mucoepidermoid carcinoma and acinic cell carcinoma in an African population.

Out of 50 Muco-epidermoid carcinoma, present study reported (33 cases, 66%) of low grade Muco-epidermoid carcinoma which is consistent with a recent study in USA by Shafique et al²³ classified majority of mucoepidermoid carcinoma as low grade(44 cases, 64%) out of 69 cases.

Acinic cell carcinoma presented as the third most common malignancy in present study, a finding similar to Chavda et al²⁴ and Huang et al²⁵. However, Arrangoiz et al²⁶ mentioned acinic cell carcinoma as the second most common malignancy in parotid gland.

In the present study, mucoepidermoid carcinoma and adenoid cystic carcinoma were found in very close percentages followed by acinic cell carcinoma. This finding is almost similar to the results of an earlier study by Mejía-Velázquez et al²⁷ which showed an equal prevalence of both mucoepidermoid and adenoid cystic carcinoma. A similarity in anatomical presentation of both of these malignancies in palatal minor salivary glands is may be a possible reason of their close prevalence.

Ko et al²⁸ reported the submandibular gland as the most common site of adenoid cystic carcinoma followed by parotid and palatal glands, a finding consistent with the results of the present study. However, a local study by Nizam et al²⁹ among the population of Khyber Pakhtunkhwa province, Pakistan, showed adenoid cystic carcinoma as the most common tumor among all minor salivary gland tumors. A possible reason of this difference is may be related with some geographical variation in anatomical presentation of this malignancy.

A higher percentage of benign tumors as compared to malignant tumors were seen in the current study, although a study from Sri Lanka by Tilakaratne et al³⁰ showed equal percentage of benign and malignant tumors. This difference in study results could be

due to different population characteristics or varied environmental exposures.

The study results showed that major salivary gland tumors mostly presented with nonspecific clinical symptoms, needing a high degree of accuracy in diagnosis. Clinicians, surgeons, and pathologists may therefore use minor surgical procedures like Fine Needle Aspiration Cytology, a highly reliable technique for pre-operative diagnosis of salivary gland lesions, before any major invasive procedure to aid in deciding the type and extent of surgery.

CONCLUSION

The results of our study highlighted that majority of salivary gland lesions are benign conditions. Chronic sialadenitis was found to be the most common non-neoplastic lesion, pleomorphic adenoma to be the most common benign lesion whereas mucoepidermoid carcinoma was the most common malignant lesion followed by adenoid cystic carcinoma.

AUTHOR'S CONTRIBUTION

Naqvi SMA: Designed methodology, Data collection, Literature search, Data interpretation

Bukhari U: Designed methodology, Data collection, Data analysis, Literature review.

Naqvi SMZH: Data interpretation, Data analysis, Statistical analysis, Literature review.

Mirza T: Conceived idea, Final approval of manuscript.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

REFERENCES

- Gellrich D, Bichler M, Reichel CA, Schrötzmair F, Zengel P. Salivary Gland Disorders in Children and Adolescents a 15-year Experience. *Int Arch Otorhinolaryngol.* 2020; 24(1):e31–e37.
- Lubin D, Song S, Baloch Z, LiVolsi VA. Pathology of benign and malignant neoplasms of salivary glands. *Oper Tech Otolaryngol Head Neck Surg.* 2018; 29 (3):101-115.
- Paintal A.S, Memon K, Gabr A, Zhang S, Riaz A. Atlas of Cytopathology and Radiology. 1st edition. Switzerland: Springer; 2020:Pp234-245.
- Obimakinde O.S, Olajuyin O.A, Adegbiiji W.A, Omonisi A.E, Omotayo J.A, Ibidun C.O. Clinico-Pathologic Study of Salivary Gland Disorders at a Sub-Urban Nigerian Tertiary Hospital: A 5 Year Retrospective Review. *Int J Otolaryngol.* 2019; 8: 106-112.
- Khurram S.A, Barrett A.W, Speight P.M. Diagnostic difficulties in lesions of the minor salivary glands. *Diagn Pathol.* 2017; 23(6) 250-259.
- Kumar MA, Kalahasti R, Sekhar KPAC. Histopathological Study of Neoplastic and Non-neoplastic Lesions of Salivary Gland: An Institutional Experience of 5 Years. *Int J Sci Stud*

- 2017; 4(12):69-72.
7. Noel L, Medford S, Islam S, Muddeen A, Greaves W, Juman S. Epidemiology of salivary gland tumours in an Eastern Caribbean nation: A retrospective study. *Ann Med Surg (Lond)*. 2018; 36:148–151.
 8. Reinheimer A, Vieira DSC, Cordeiro MMR, Rivero ERC. Retrospective study of 124 cases of salivary gland tumors and literature review. *J Clin Exp Dent*. 2019; 11(11):e1025-32.
 9. Ammar AS, Khalid R, Naqi SA, Khattak S, Inayat F, Asghar S. Histopathological spectrum and outcome of surgery for salivary gland tumors presented in tertiary care hospital of Pakistan. *Professional Med J* 2021; 28(10):1422-1427.
 10. Raza SH, Ahmed S, Zafar M. Spectrum of biopsied oral and maxillofacial lesions in a tertiary care hospital of Karachi, Pakistan. *J Fatima Jinnah Med Univ*. 2021; 15(2): 81-86
 11. Sandhu VK, Sharma U, Singh N, Puri A. Cytological spectrum of salivary gland lesions and their correlation with epidemiological parameters. *J Oral Maxillofac Pathol*. 2017; 21:203- 210.
 12. Rauf A, Ejaz A. Cytological Pattern of Salivary Gland Lesions. *J Rawalpindi Med Coll*. 2017; 21(3):276-280.
 13. Ugga L, Ravanelli M, Pallottino AA, Farina D, Maroldi R. Diagnostic work-up in obstructive and inflammatory salivary gland disorders. *Acta Otorhinolaryngol Ital*. 2017; 37(2):83-93
 14. Khan H, Khalid K, Sajjad E, Yousuf I. Spectrum of Salivary Gland Disorders at a Tertiary Care Hospital in Central Lahore. *J Fatima Jinnah Med Univ*. 2017; 11(3) 7-13.
 15. Singareddy R, Bajwa HK, Reddy MM, Alluri KR, Raju KVVN, Rao TS, Rao LMC. Mucoepidermoid Carcinoma of the Salivary Gland: Long Term Outcomes from a Tertiary Cancer Center in India. *Indian J Otolaryngol Head Neck Surg*. 2020;02: 1-5.
 16. Mahmood HN, Haseeb AA, Riaz N, Firdous S, Hanif S, Khan SR. A Clinicopathological analysis of 75 Salivary Gland Tumors at Mayo Hospital, Lahore. *Pak J Med Sci*.2022; 16(02):223-225.
 17. Da Silva LP, Serpa MS, Viveiros SK, Sena DAC, de Carvalho Pinho RF, et al. Salivary gland tumors in a Brazilian population: A 20-year retrospective and multicentric study of 2292 cases. *J Craniomaxillofac Surg*. 2018; 46(12):2227-2233.
 18. Mishra J, Seth S, Nayak S, Agrawal KC. Spectrum of Salivary Gland Lesions in Western Odisha with the Diagnostic Value of F.N.A.C. Correlating with Histomorphology. *Ann Int Med Dent Res*. 2018; 4(4):PT06-PT10.
 19. Valstar MH, de Ridder M, van den Broek EC, Stuiver MM, van Dijk BAC, van Velthuysen MLF, et al. Salivary gland pleomorphic adenoma in the Netherlands: A nationwide observational study of primary tumor incidence, malignant transformation, recurrence, and risk factors for recurrence. *Oral Oncol*. 2017; 66:93-99.
 20. Aliyu D, Iseh KR, Sahabi SM, Amutta SB, Abdullahi M, Inoh, MI. Pattern of Salivary Gland Tumour in Sokoto, North-Western Nigeria. *Int J Clin Med*. 2016; 7(5):347-352.
 21. Kadletz L, Grasl S, Perisanidis C, Grasl MC, Erovic BM. Rising incidences of Warthin's tumors may be linked to obesity: a single-institutional experience. *Eur Arch Otorhinolaryngol*. 2019; 276(4):1191-1196.
 22. Ahmed S, Yousif OY, Abuzeid M. Tumours of Salivary Glands in Sudan. *Int J Otorhinolaryngol*. 2018; 5(1):1-5.
 23. Shafique K, Zhang PJ, Montone KT, Song S, Livolsi VA, Baloch Z. Pathologic grading of mucoepidermoid carcinomas of the salivary gland and its effect on clinicopathologic follow-up: an institutional experience. *Hum Pathol*. 2020; 98:89-97.
 24. Chavda AB, Bhalara RV, Dhruva GA. Histopathological study of Salivary gland lesions. *Int J Clin Diagn Pathol*. 2019; 2(1):325-328.
 25. Huang AT, Tang C, Bell D, Yener M, Izquierdo L, Frank SJ, et al. Prognostic factors in adenocarcinoma of the salivary glands. *Oral Oncol*. 2015; 51(6):610-615.
 26. Arrangoiz R, Papavasiliou P, Sarcu D, Galloway TJ, Ridge JA, Lango M. Current Thinking on Malignant Salivary Gland Neoplasms. *J Cancer Treat Res*. 2013; 1(1):8-24.
 27. Mejía-Velázquez CP, Durán-Padilla MA, Gómez-Apo E, Quezada-Rivera D, Gaitán-Cepeda LA. Tumors of the salivary gland in Mexicans: A re-trospective study of 360 cases. *Med Oral Patol Oral Cir Bucal*. 2012; 17(2):e183-189.
 28. Ko JJ, Siever JE, Hao D, Simpson R, Lau HY. Adenoid cystic carcinoma of head and neck: clinical predictors of outcome from a Canadian centre. *Curr Oncol*. 2016; 23(1):26-33.
 29. Nizam GS, Awan SA, Shah SM, Bano S, Naushad H, Kundi JA. Pattern of minor salivary glands tumours in Khyber Pakhtunkhwa. *Pak Oral Dent J*. 2013; (33)3:464-467.
 30. Tilakaratne WM, Jayasooriya PR, Tennakoon TM, Saku T. Epithelial salivary tumors in Sri Lanka: a retrospective study of 713 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2009; 108:90–8.