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ORIGINAL RESEARCH

Histopathological and Demographic Profiling of Salivary Gland Pathologies: Insights from a 3-Year cross-sectional Study

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ABSTRACT

Background: This study aimed to analyze the demographic distribution, histopathological spectrum, and regional trends of salivary gland lesions in a tertiary care setting, comparing findings with global data to enhance diagnostic and therapeutic strategies. **Methods:** A retrospective, cross-sectional analysis of 102 salivary gland specimens (November 2018– October 2021) was conducted. Specimens were processed using hematoxylin-eosin staining, supplemented with periodic acid–Schiff (PAS) where required. Diagnoses were validated by two pathologists for malignancies. Data on age, gender, lesion type, and site were analyzed descriptively using SPSS v26.0 and Excel. **Results:** Salivary gland lesions constituted 0.45% (102/22,587) of histopathology specimens. Peak incidence occurred in the 3rd–4th decades (48.04%), with male predominance (M:F = 1.24:1). Non-neoplastic lesions (56.86%) were most common, notably mucous retention cysts (32.35%) and chronic sialadenitis (13.72%). Benign neoplasms (33.33%) included pleomorphic adenoma (28.43%), showing female preponderance. Malignancies (9.81%) comprised mucoepidermoid carcinoma (1.96%) and acinic cell carcinoma (1.96%). The parotid gland was the primary site (45.10%), with 18.92% of parotid tumors being malignant. Submandibular lesions exhibited higher malignancy rates (42.85%). **Conclusion:** Histopathology remains pivotal for diagnosing salivary gland lesions, with non-neoplastic pathologies dominating in younger cohorts and parotid malignancies aligning with global averages. Regional variations, such as delayed malignancy onset and female predominance in benign tumors, highlight the need for population-specific diagnostic protocols. Future studies integrating molecular markers are warranted to refine management.

Keywords: Salivary gland lesions, histopathology, pleomorphic adenoma, mucoepidermoid carcinoma, diagnostic accuracy.

INTRODUCTION

As exocrine organs, salivary glands play a crucial role in generating saliva. This important fluid serves multiple functions, including lubricating the oral cavity, assisting with digestion, and offering antimicrobial defense. [1]. Humans possess three major paired glands—parotid (serous secretions), submandibular (mixed seromucous), and sublingual (mucinous)—alongside minor salivary glands distributed throughout the upper aerodigestive tract. Saliva production averages 0.5 liters daily, with composition and flow rates varying across glands. Dysregulation, as seen in xerostomia or autoimmune disorders like Sjögren's syndrome, leads to complications such as dental caries and impaired swallowing [2].

Salivary gland pathologies span inflammatory, cystic, and neoplastic lesions. Non-neoplastic conditions, including sialadenitis and sialolithiasis (accounting for >50% of major gland diseases), often stem from infections or ductal obstructions [3]. Autoimmune infiltrations further disrupt glandular function. Neoplastic lesions, though rare (<2% of all tumors), exhibit marked histological diversity [4].

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Approximately 65–80% arise in the parotid, with malignancy rates inversely correlating to gland size: 15–30% in parotid, 40% in submandibular, and 50–90% in sublingual/minor glands [5]. Pleomorphic adenoma (50% of all tumors) and mucoepidermoid carcinoma (35% of malignancies) dominate benign and malignant categories, respectively [6].

Histopathology remains pivotal for diagnosis and prognostication, as over 30 distinct neoplasms exhibit overlapping clinical-radiological features but divergent outcomes [5]. For example, low-grade tumors may require conservative excision, while high-grade malignancies necessitate aggressive therapies [2]. Despite advancements, regional epidemiological variations and diagnostic challenges persist, particularly in differentiating cystic lesions or rare malignancies [7].

Aim of the Study

This study aims to:

1. Analyze the age and gender distribution of salivary gland lesions.
2. Characterize their histopathological spectrum.
3. Compare findings with existing literature to identify diagnostic and regional trends.

By elucidating clinicopathological correlations, this research seeks to refine diagnostic accuracy and therapeutic strategies.

MATERIALS AND METHODS

Study Design and Setting

Present descriptive cross-sectional study was carried out in the Histopathology Section of the Pathology Department at a tertiary care teaching hospital affiliatedto GMERS Medical College, Gujarat, India.Surgically resected specimens and biopsies of salivary gland lesions received between November 2018 and October 2021 were retrospectively analyzed after ethical clearance and waiver of informed consent due to the study's retrospective nature.

Inclusion and Exclusion Criteria

All biopsy or resection specimens of salivary glands submitted for histopathological evaluation were included. Specimens showing normal salivary gland architecture without associated lesions, poorly fixed tissues, or autolyzed samples were excluded.

Sample Processing and Histopathological Analysis

Surgical specimens were fixed in 10% neutral buffered formalin. Gross examination documented size, shape, color, and consistency of lesions. Representative tissue sections (2–3 mm) were processed using an automated tissue processor, embedded in paraffin, and sectioned at 4–5 µm thickness with a rotary microtome. Sections were mounted on albumin-coated slides, stained with hematoxylin and eosin (H&E), and evaluated under light microscopy. Periodic acid–Schiff (PAS) staining was applied selectively to highlight mucinous or basement membrane components.

To ensure diagnostic agreement, slides showing malignancies were independently examined by two senior pathologists. Discrepancies were resolved through joint re-evaluation.

Data Collection and Statistical Analysis

Demographic and clinical data (age, sex, lesion location, clinical presentation) were retrieved from the hospital's Laboratory Information System (LIS). Histopathological findings, including tumor type and grade, were recorded. Data analysis employed descriptive statistics (percentages, means) using Microsoft Excel 2019 and SPSS v26.0.

Ethical Considerations

Ethical clearance for the study was acquired from the institutional ethics committee.Patient confidentiality was maintained by anonymizing data.

RESULTS

A total of 22,587 specimens were received for histopathological evaluation between November 2018 and October 2021, of which 102 (0.45%) were salivary gland lesions. The clinicopathological characteristics of these cases are summarized below.

Demographic Distribution

Age: The majority of patients (48.04%, 49/102) were aged 21–40 years, with the youngest patient being a 1-year-old male and the oldest a 76-year-old female (Table 1).

Gender: Males predominated (55.88%, 57/102), with a male-to-female ratio of 1.26:1 (Table 2).

Table 1 Age wise distribution of salivary gland lesions

Age (Years)	Number of cases	Percentage(%)
0-10	8	7.85
11-20	11	10.78
21-30	26	25.49
31-40	23	22.55
41-50	10	9.81
51-60	11	10.78
61-70	9	8.82
71-80	4	3.92
Total	**102**	**100**

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Table 2 Gender wise distribution of salivary gland lesions

Gender	Number of cases	Percentage (%)
Male	57	55.9
Female	45	44.1
Total	**102**	**100**

Lesion Classification

Non-neoplastic lesions constituted 56.86% (58/102), benign neoplasms 33.33% (34/102), and malignancies 9.81% (10/102) (Table 3).

- **Non-neoplastic lesions** (58 cases): Mucous retention cysts (32.35%, 33/102) (Figure 1a) and chronic sialadenitis (13.72%, 14/102)(Figure 1b) were most common. Rare cases included Sjögren's syndrome (0.98%) and benign lymphoepithelial cysts (1.96%).
- **Benign neoplasms** (34 cases): Pleomorphic adenoma (28.43%, 29/102) (Figure 2a) predominated, showing female preponderance (20 females vs. 9 males). Two cases of warthintumor (Figure 2b) were observed.
- Malignancies (10 cases): Mucoepidermoid carcinoma (Figure 3a) and Acinic cell carcinoma (1.96% each) (Figure 3b) were the most frequent. A rare case of Hodgkin's lymphoma (0.98%) was also observed (Table 4).

Table 3 Neoplastic property and gender-wise distribution of salivary gland lesions

Lesions	Male	Female	Total	Percentage(%)
Non Neoplastic lesions	37	21	58	56.86
Neoplastic lesions-Benign	13	21	34	33.33
Neoplastic lesions-Malignant	7	3	10	9.81
Total	**57**	**45**	**102**	**100**

Table 4 Histopathology wise distribution of salivary gland lesions

Type of Lesions	Male	Female	Total No of cases	Percentage(%)
Non-neoplastic				
Mucous retention cyst	24	9	33	**32.35**
Chronic Sialadenitis	6	8	14	13.72
Benign cystic swelling - Ranula	1	0	1	0.98
Lymphocytic infiltration(Sjogren's syndrome)	0	1	1	0.98
Benign lymphoepithelial cyst	2	0	2	1.96
Salivary gland Abscess	4	3	7	6.86
Neoplastic lesion-Benign				
Pleomorphic adenoma	9	20	29	**28.43**
Warthin tumor	2	0	2	1.96
Oncocytoma	1	0	1	0.98
Basal Cell Adenoma	0	1	1	0.98
Lipoma	1	0	1	0.98
Neoplastic lesion-Malignant				
Mucoepidermoid carcinoma	1	1	2	1.96
Acinic Cell Carcinoma.	1	1	2	1.96
Adenoid Cystic Carcinoma	1	0	1	0.98
Carcinoma ex pleomorphic adenoma	1	0	1	0.98
Salivary Duct Carcinoma- High Grade	1	0	1	0.98
Hodgkin's lymphoma	1	0	1	0.98
Metastatic SCC	1	1	2	1.96
Total	**57**	**45**	**102**	**100**

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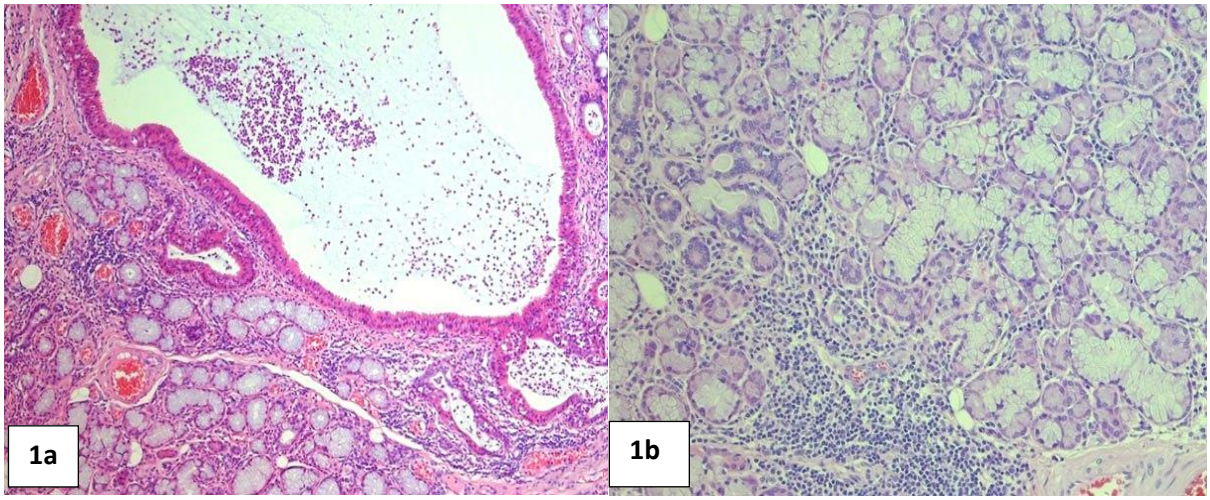

Figure 1: Non-neaoplastic lesions in salivary gland [1a:Mucous retention cyst-shows chronic inflammatory infiltrate but no acinar atrophy or fibrosis (H & E,20x), **1b:Chronic Sialadenitis-**shows the epithelium consists of 1–2 layers of cuboidal/columnar cells (H & E,10x)]

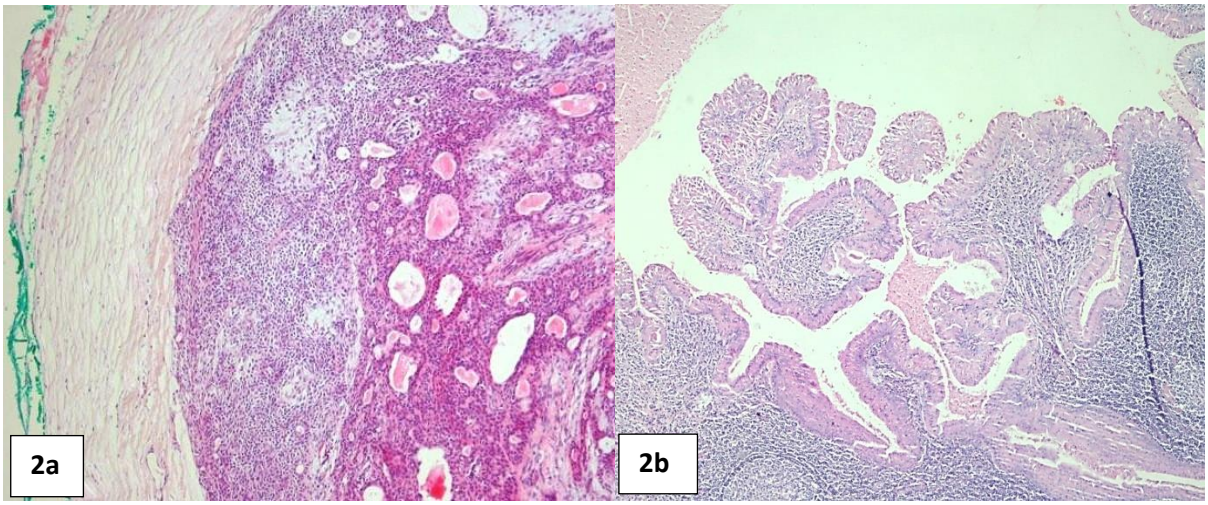

Figure 2: Benign lesions of salivary gland [2a: Pleomorphic adenoma- shows mixture of myoepithelial cells and ductal cells within a mesenchymal background (H & E,10x)**, 2b: Warthin tumor-**shows papillary epithelial projections in cystic spaces and lymphoid stroma (H & E,10x)

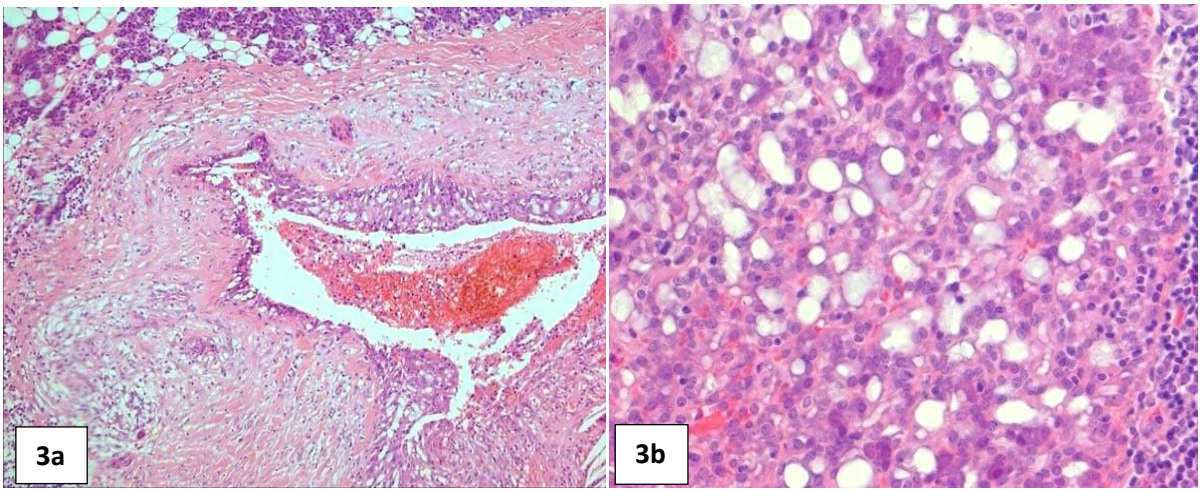

Figure 3: Malignant lesions of salivary gland [3a: Mucoepidermoid carcinoma-shows cyst lining with numerous mucous cells and interspersed basal intermediate cells (H & E,10x)**, 3b:Acinic cell carcinoma-** characterized by neoplastic cells displaying mild eosinophilic cytoplasm, organized into syncytial sheets and duct-like architectural patterns (H & E,10x)

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Age and Site Correlation

Age distribution: Benign tumors peaked in the 21–40 age group (61.76%, 21/34), while malignancies occurred predominantly in patients aged >50 years (Table 5). The youngest malignancy case was a 20-year-old female with mucoepidermoid carcinoma.

Anatomic site: The parotid gland was the most common site (45.10%, 46/102), followed by minor salivary glands (32.35%, 33/102). Malignancies were primarily parotid (70%, 7/10) (Table 6).

Table 5 Age wise distribution of salivary gland lesions

Type of Lesions	Age Group (Years)								Total
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	
Non-neoplastic									
Mucous retention cyst	6	6	12	6	2		1		**33**
Chronic Sialadenitis		1	4	4	3	2			**14**
Ranula			1						**1**
Sjogren's syndrome							1		**1**
Benign lymphoepithelial cyst					1	1			**2**
Salivary gland Abscess	2	1	1	1			1	1	**7**
Neoplastic lesion-Benign									
Pleomorphic adenoma		2	7	10	4	4		2	**29**
Warthin tumor						2			**2**
Oncocytoma						1			**1**
Basal Cell Adenoma			1						**1**
Lipoma							1		**1**
Neoplastic lesion-Malignant									
Mucoepidermoid carcinoma		1					1		**2**
Acinic Cell Carcinoma.				1			1		**2**
Adenoid Cystic Carcinoma						1			**1**
Carcinoma ex pleomorphic adenoma				1					**1**
Salivary Duct Carcinoma								1	**1**
Hodgkin's lymphoma							1		**1**
Metastatic SCC							2		**2**
Total	**8**	**11**	**26**	**23**	**10**	**11**	**9**	**4**	**102**

Table 6 -Site wise distribution of salivary gland lesions

Site	Non-neoplastic	Benign	Malignant	Total Number of cases	Percentage(%)
Parotid	9	30	7	46	45.10
Submandibular	14	4	3	21	20.59
Sublingual	2	0	0	2	1.96
Minor salivary gland	33	0	0	33	32.35
Total	**58**	**34**	**10**	**102**	**100**

Parotid Gland Analysis

Among parotid lesions (46 cases), 81.08% (30/37 neoplastic cases) were benign, with a female predominance (51.35%, 19/37). Malignancies constituted 18.92% (7/37), occurring more frequently in males (Table 7).

Table 7 Gender wise distribution of neoplastic lesions of Parotid gland

Parotid Gland lesion	Male	Female	Total
Benign	11(29.73%)	19(51.35%)	**30(81.08%)**
Malignant	5(13.51%)	2(5.40%)	**7(18.92%)**
Total	**16(43.24%)**	**21(56.75%)**	**37(100%)**

Clinical Presentation

Swelling (mandibular angle, floor of the mouth, or lip) was the most common symptom. Pain, rapid mass enlargement, and cervical lymphadenopathy were also reported.

DISCUSSION

Salivary gland lesions encompass a diverse spectrum of pathologies, from inflammatory conditions to neoplasms, each with distinct demographic and anatomical patterns. This study, analyzing 102 cases, provides insights into these trends while highlighting

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regional variations through comparisons with published literature [8–11] (Table 8).

Demographic and Clinicopathological Trends

The peak incidence of salivary gland lesions occurred in the 3rd–4th decades (48.04%), aligning with Ajayi et al. [8] and Pachori et al. [10], who reported similar age distributions for benign tumors. However, malignancies in our cohort predominantly manifested in the 7th decade, contrasting with earlier peaks in other studies (Table 8). This delayed presentation may reflect regional differences in risk factors, such as environmental exposures or genetic predispositions [12].

A male predominance (M:F = 1.24:1) was observed, consistent with Pachori et al. [10] but diverging from Ali AL-Zamzami et al. [9] (M:F = 0.8:1). Such discrepancies underscore the influence of population-specific variables, including occupational hazards or diagnostic referral patterns [11].

Table 8: Comparative Analysis of Salivary Gland Lesions Across Studies

Parameter	Present Study	Ajayi et al.[8]	Ali AL-Zamzamiet al.[9]	Pachoriet al.[10]
Peak Decade (Benign)	3rd	3rd	3rd, 6th	3rd, 4th
Peak Decade (Malignant)	7th	3rd	6th	6th
M:F Ratio	1.24:1	1:1.05	0.8:1	1.12:1
Parotid Involvement	46%	19.6%	33.5%	51.2%
Submandibular Involvement	20.6%	21%	30.7%	32.3%
Non-Neoplastic Lesions	56.9%	37.8%	56.4%	43.8%
Malignancy Rate	9.8%	37.7%	27.1%	11.5%

Anatomic Distribution and Malignancy Risk

The parotid gland was the most frequent site (46%), consistent with its anatomical complexity and epithelial density [5]. Notably, 18.9% of parotid tumors were malignant, aligning with global averages (15–30%) [5]. In contrast, submandibular gland lesions exhibited a higher malignancy rate (42.9%), reinforcing the inverse correlation between gland size and cancer risk [5]. Minor salivary gland lesions (32.3%) were exclusively non-neoplastic, likely due to their submucosal location and susceptibility to obstructive pathologies [13].

Lesion Classification and Gender Disparities

Non-neoplastic lesions (56.9%) dominated, with mucous retention cysts (32.3%) and chronic sialadenitis (13.7%) as leading diagnoses, reflecting obstructive etiologies prevalent in the studied population [14]. Benign neoplasms (33.3%) were typified by pleomorphic adenoma (28.4%), which showed a striking female predominance (51.4% female vs. 29.7% male) in the parotid gland (Table 9). This contrasts with Venketesh et al. [14] and Sentani et al. [15], who reported male preponderance, suggesting regional hormonal or genetic influences.

Table 9: Gender Distribution of Parotid Gland Neoplasms

Study	Benign Tumors		Malignant Tumors	
	Male	Female	Male	Female
Venketeshet al.[14]	45.8%	32.2%	11.9%	10.2%
Sentani et al. [15]	46.6%	39.5%	7.6%	6.3%
Present Study	29.7%	51.4%	13.5%	5.4%

Implications and Limitations

The high prevalence of non-neoplastic lesions supports conservative management in younger cohorts, while the parotid's neoplastic burden necessitates vigilant follow-up [16]. Limitations include the retrospective design and single-center sampling, which may limit generalizability [16]. Additionally, the small malignant cohort precludes subtype-specific analysis [12].

CONCLUSION

This study corroborates global trends in salivary gland pathology while highlighting unique regional patterns, such as delayed malignancy onset and female predominance in benign parotid tumors. Histopathology remains indispensable for accurate diagnosis, particularly in differentiating low-grade malignancies from benign mimics. Future multi-center studies integrating molecular markers could further refine diagnostic and therapeutic paradigms.

REFERENCES

1. Neville BW, Damm DD, Allen CM, Chi AC. Oral and Maxillofacial Pathology. 4th ed. St. Louis: Elsevier; 2016.
2. Scully C, Felix DH. Oral medicine—update for the dental practitioner: salivary gland disorders. Br Dent J. 2005;199(7):423-427.
3. Speight PM, Barrett AW. Salivary gland tumours. Oral Dis. 2002;8(5):229-240.
4. Ellis GL, Auclair PL. Tumors of the Salivary Glands. 4th ed. Washington, DC: ARP Press; 2008.
5. El-Naggar AK, Chan JKC, Grandis JR, Takata T, Slootweg PJ. WHO Classification of Head and Neck Tumours. 4th ed. Lyon: IARC Press; 2017.

DOI: 10.69605/ijlbpr_14.4.2025.176

6. Guzzo M, Locati LD, Prott FJ, et al. Major and minor salivary gland tumors. Crit Rev Oncol Hematol. 2010;74(2):134-148.
7. Tian Z, Li L, Wang L, et al. Salivary gland neoplasms in oral and maxillofacial regions: a 23-year retrospective study of 6982 cases in an eastern Chinese population. Int J Oral Maxillofac Surg. 2010;39(3):235-242.
8. Ajayi OF, Olawuyi A, Anunobi CC, Bamgbose BO, Adeyemo WL. Clinicopathologic Audit of Salivary Gland Lesions. Niger J Basic Clin Sci 2017; 14:101-104.
9. Ali Ali AL-Zamzami. Classification of Salivary Gland Diseases among Yemenis: (A Prospective Hospital-Based study). Am J Biomed Sci & Res. 2019 - 4(3).
10. Pachori, G., Chandra, S., Bihari, N. A., &Kasliwal, N. (2019). Histopathological spectrum of salivary gland lesions in Ajmer region, Rajasthan, India. International Journal of Research in Medical Sciences, *7*(7), 2708–2713.
11. Bray F, Ferlay J, Soerjomataram I, et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2018;68(6):394-424.
12. Bhattacharyya N, Fried MP. Determinants of survival in parotid gland carcinoma: a population-based study. Am J Otolaryngol. 2005 Jan-Feb;26(1):39-44.
13. Seethala RR. An update on grading of salivary gland carcinomas. Head Neck Pathol. 2009;3(1):69-77.
14. Venkatesh S, Srinivas T, Hariprasad S. Parotid gland tumors: 2-year prospective clinicopathological study. Ann Maxillofac Surg. 2019;9(1):103–109
15. Sentani K, Ogawa I, Ozasa K, Sadakane A, Utada M, Tsuya T, et al. Characteristics of 5015 Salivary Gland Neoplasms Registered in the Hiroshima Tumor Tissue Registry over a Period of 39 Years. J Clin Med. 2019; 8:566
16. Fonseca FP, Carvalho Mde V, de Almeida OP, et al. Clinicopathological analysis of 493 cases of salivary gland tumors in a Southern Brazilian population. Oral Surg Oral Med Oral Pathol Oral Radiol. 2012;114(2):230-239.