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HISTOPATHOLOGICAL STUDY OF NEOPLASTIC SALIVARY GLAND LESIONS - AN INSTITUTIONAL STUDY

Pathology

Dr. Amreen Fatima Aamer Quadri
Department of Pathology Government Medical College Miraj.

ABSTRACT

This study was conducted for 10 years in Government Medical College Miraj during the period of August 2003 to July 2013. Total number of salivary gland lesions included were 82. Pleomorphic adenoma (59.6%) was the commonest benign tumor. Whereas commonest malignant tumor was adenoid cystic carcinoma constituted 38.5 % .

KEYWORDS

pleomorphic adenoma , histopathology, adenoid cystic carcinoma.

Salivary glands are exocrine organs responsible for the production and secretion of saliva. They comprise of three paired major glands, the parotid, submandibular and sublingual, and the minor glands.

Salivary gland lesions encompass a heterogenous group of disorder and are broadly classified as neoplastic and non-neoplastic. Between 64- 80% of all primary epithelial salivary gland tumours occur in parotid gland; 7-11% occur in the submandibular glands; fewer than 1% occur in the sublingual glands; and 9-23% occur in minor glands. Benign tumours represent 54-79% and 21-46% are malignant.[1]

Salivary gland tumours can show striking range of morphological diversity between different tumour types and sometimes within an individual tumour mass.

MATERIAL AND METHOD:

The present was undertaken in Histopathology section of Department of Pathology, GMC Miraj over a duration of 10 years, i.e. August 2003 to July 2013. This included a retrospective period from August 2003 to July 2011 and a prospective period from August 2011 to July 2013.

The data was collected from 82 cases of surgically resected salivary gland lesions including neoplastic and non-neoplastic lesions.

I. Retrospective Study:
1) The glass slides of histopathological sections and paraffin blocks were retrieved from the Department of Pathology.
3) The relevant clinical details were taken from the case files of the patients and were recorded in the proforma.

II. Prospective Study:
A detailed study of the salivary gland specimens was done, with respect to size and external and cut surfaces.

The findings were noted down. The specimens were fixed in 10% formalin solution.Routine processing and paraffin embedding of the sections was done. The sections were cut at 3-4 microns thickness and stained with hematoxylin and eosin (H & E). The slides were studied under light microscope.

RESULTS:

In this study out of 82 salivary gland lesions, we observe 39 benign tumors, 13 malignant tumors and 30 were inflammatory and obstructive lesions.

Major salivary glands were involved in 88.5% of salivary gland tumors. Pleomorphic adenoma (59.6%) was the commonest benign tumor. Whereas commonest malignant tumor was adenoid cystic carcinoma constituted 38.5 % of all malignant salivary gland tumors The maximum frequency of benign and malignant salivary gland tumor was observed in the 5th decade. Benign are common in females, and malignant in males.

Table 1 Age Wise Distribution Of Various Salivary Gland Lesions

Type of lesion	11-20	21-30	31-40	41-50	51-60	61-70	71and above	Total
Benign tumours								
Pleomorphic adenoma	-	8	6	9	4	3	1	31
Warthin tumour	-	-	-	-	2	-	-	2
Basal cell adenoma	-	-	1	-	1	1	-	3
Oncocytoma	-	-	-	-	1	-	-	1
Myoepithelioma	-	-	1	-	-	-	-	1
Cystic lymphangioma	-	-	-	1	-	-	-	1
Total	-	8	8	10	8	4	1	39
Malignant tumours								
Adenoid Cystic Ca.	-	-	1	2	1	1	-	5
Mucoepidermoid Ca.	-	-	-	2	-	2	-	4
Ca. ex pleom. Adenoma	-	-	-	3	-	-	-	3
Acinic Cell carcinoma	-	-	-	-	1	-	-	1
Total	-	-	1	7	2	3	-	13
Grand total	0	8	9	17	10	7	1	52

In the present study benign salivary gland tumours were most commonly found in 4th decade. Malignant salivary gland tumours were also most frequent in 4th decade.

Table No.2 Gender Wise Distribution Of Various Salivary Gland Lesions:

Type of lesion	Male		Female		Total	M:F
	No.	[%]	No.	[%]		
Benign tumours	15	[38.5%]	24	[61.5%]	39	1:1.6
Pleomorphic adenoma	11	[35.5%]	20	[64.51%]	31	
Warthin tumour	1	[50%]	1	[50%]	2	
Basal cell adenoma	1	[33.3%]	2	[66.66%]	3	
Oncocytoma	1	[100%]	-	-	1	
Myoepithelioma	1	[100%]	-	-	1	
Cystic lymphangioma	-	-	1	[100%]	1	
Malignant tumours	09	[69.24%]	4	[30.76%]	13	2.2:1
Adenoid cystic. Ca	5	[100%]	-	-	5	
Mucoepidermoid ca.	1	[25%]	3	[75%]	4	
Ca. ex pleom. Adenoma	2	[66.66%]	1	[33.33%]	3	
Acinic cell carcinoma	1	[100%]	-	—	1	
Total	24		28		52	

It can be noted from table 2 that, in the present study benign tumours were much more common in females, whereas malignant tumours were much more common in males

Table No.3 Frequency Of Individual Salivary Gland Lesions In Different Salivary Glands.

Location of the Salivary gland	Benign Tumors		Malignant tumours		Total	
	No. of Cases	%of BT	No. of Cases	%of MT	No. of Cases	%of total cases
Major salivary Glands						
Parotid	28	71.8%	09	69.2%	37	51.2%
Submandibular	06	15.3%	2	15.4%	8	26.8%
Sublingual	-	—	1	7.7%	1	1.2%
Minor salivary Glands						
Cheek	1`	2.6%	1	7.7%	2	3.8%
Lip	2	5.1%	—	—	2	12.2%

Palate	1	2.6%	—	—	1	1.2%
Tongue	1	2.6%	—	—	1	1.2%
BOM	-	-			0	1.2%
Total	39	100%	13	100%	52	100%

It can be noted from table 3 that most of tumours were located in major salivary glands. Among the major salivary glands, parotid was the commonest site for both benign tumours (71.8%) and malignant tumours (69.2%) Among the minor salivary glands lip was the commonest site for benign tumours (5.1%).Only one case of malignant tumour of minor salivary gland was present in cheek.

Table No.4 Site Wise Distribution Of Various Salivary Gland Lesions:

Types of lesion	Site wise distribution								Total cases
	Major glands			Minor glands					
	P	SM	SL	C	L	PL	T	BOM	
Benign tumours									
Pleomorphic adenoma	20	6	—	1	2	1	1	—	31
Warthin tumour	2	—	—	—	—	—	—	—	2
Basal cell adenoma	3	—	__	—	—	—	—	—	3
Oncocytoma	1	—	—	—	—	—	—	—	1
Myoepithelioma	1	—	—	—	—	—	—	—	1
Cystic lymphangioma	1	—	—	—	—	—	—	—	1
Malignant tumours									
Adenoid cystic ca.	3	—	1	1	—	—	—	—	5
Mucoepidermoid ca.	4	—	—	—	—	—	—	—	4
Ca.ex pleom.adenoma	1	2	—	—	—	—	—	—	3
Acinic cell carcinoma	1	—	—	—	—	—	—	—	1
Total	37	8	1	2	2	1	1	0	52

It is obvious from table 4 that, the parotid gland was the most common site for all tumours except for carcinoma ex pleomorphic adenoma.

DISCUSSION

Frequency Of Non Neoplastic Lesions Of Salivary Gland

The total number of biopsies received in our department during the study period was 18116. Out of these, 82 were salivary gland lesions out of which52 (63.5%) cases were of neoplastic lesions. The frequency of salivary gland lesions in our study was compared with that of other studies.

Table No. 5 Comparison Of Frequency Of Non Neoplastic And Neoplastic Lesions Of Salivary Glands:

Author	Total cases	Non neoplastic lesions (%)	Neoplastic lesions (%)
Ashraf et al.(2010)[1]	100	14	86
Mohan et al.(2011)[2]	393	55	45
Ghandhi et al.(2013)[6]	49	18.4	81.6
Jain C et al.(2013)[7]	30	54.3	45.7
Present study(2013)	82	36.5	63.5

It can be noted from table 5 that frequency of neoplastic and the non neoplastic salivary gland lesions in different studies was variable.

The frequency of neoplastic lesions of salivary gland was found to be high in the series of Ashraf et al[1], Ghandhi et al[3]and present study. However, Mohan et al[2] and Jain et al[6] report much higher frequency of non neoplastic lesions of salivary gland.

Table No.6 Frequency Of Benign And Malignant Salivary Gland Tumours:

Author(Year)	Total cases	Benign tumours(%)	Malignant tumours (%)
Davies et al [8] (1964)	129	62.0	38.0
Sengupta et al[9](1973)	111	76	24
Budhraja et al[10](1974)	56	62.5	37.5
Dandapat et al[11] (1991)	42	71.4	28.6
Pinkston and Cole[12] (1999)	248	84.3	15.7
Gill et al [13] (2001)	379	73.0	26.9
Morais et al [14] (2011)	303	71	29
Oti et al[15] (2013)	109	60.5	39.5
Present study(2013)	52	(39)75 %	(13)25%

In our study we came across 39 (75%) benign tumours and 13 (25%) malignant tumours. Thus benign tumours were much more frequent than malignant ones. It can be noted from table 6 that, the frequency of benign tumours was significantly more than that of malignant tumours in all the studies.

Table No.7 Age Wise Distribution Of Salivary Gland Tumours (In Percent):

Age group in years	Budhraja et al [10] [%] (1973)	Fenn et Al[16] [%] (1982)	Verma et al[17][%] (1988)	Gill et al[13] [%] (2001)	Present study [%] (2013)
0-10	--	—	3.7	1.8	—
11-20	7.1	12.2	11.7	13.7	—
21-30	32.1	15.8	16.1	23.2	15.4
31-40	19.6	19.3	9.1	19.8	17.3
41-50	26.8	21	14.2	19.5	32.7
51-60	10.8	14.1	23.4	12.9	19.2
61-70	3.6	14.1	14.8	6.0	13.5
71 and above	-	-	-	1.0	1.9

It is obvious from table 7 that the maximum frequency of salivary gland tumours in 4th decade in our study is consistent with the observations of Fenn et al.[16] But Gill et al[13] recorded the highest frequency of salivary gland tumours in 3rd decade. While Verma et al[17] recorded the highest frequency in 3rd and 6th decade. In most of studies the frequency of salivary gland tumours was low in 1st decade and beyond 7th decade.

Table No.8 Age Wise Distribution Of Benign Tumours Of Salivary Glands (in percent)

Age Group In Years	Budhraja et al [10] [%](1973)	Gill et al[13] [%] (2001)	Present study [%] (2013)
0-10	-	2.2	-
11-20	11.4	12.6	-
21-30	34.3	26.3	20.5
31-40	17.1	22.7	20.5
41-50	25.7	19.1	25.6
51-60	11.4	10.4	20.5
61-70	-	3.9	10.3
71 and above	-	1.0	2.6

It is obvious from table 8 that the maximum frequency of benign tumours of salivary gland in 4th decade in our study is consistent with the observations of Budhraja et al.[10] But Gill et al[13] recorded the highest frequency of salivary gland tumours in 3rd decade. In all the studies the frequency of salivary gland tumours was low in 1st decade and beyond 7th decade.

Table No.9 Age Wise Distribution Of Malignant Tumours Of Salivary Glands (in percent):

Age Group In Years	Budhraja et al [10] [%] (1973)	Gill et al [13] [%] (2001)	Present study [%] (2013)
0-10	-	2.2	-
11-20	11.4	12.6	-
21-30	34.3	26.3	7.7
31-40	17.1	22.7	53.8
41-50	25.7	19.1	15.4
51-60	11.4	10.4	23.1
61-70	-	3.9	-
71 and above	-	1.0	-

It is obvious from table 9 that the maximum frequency of malignant tumours of salivary gland was in 4th decade in our study. But Budhraja et al[97] and Gill et al[13] recorded the highest frequency of malignant tumours of salivary gland in 3rd decade.

Table No.10 Gender Wise Distribution Of Salivary Gland Tumours:

Author	Male: Female
Davies et al [8] (1964)	1 : 1.1
Sengupta et al [9](1973)	1 : 1.3
Fenn et al [16](1982)	1.2 : 1
Verma et al[17] (1988)	1.8 : 1
Dandapatetal [11] (1991)	1.2 : 1
Gill et al[13] (2001)	1.2 : 1
Morais et al[14](2011)	1 : 1.7
Oti et al[15] (2013)	1.7 : 1
Present study(2013)	1 : 1.2

Slight female predominance with M**:** F ratio of 1**:**1.2 observed in the

present study is comparable with the same observed by Davies et al[8], Sengupta et al[9] and Morais e al.[14] Other studies found male predominance.

Table No.11 Gender Wise Distribution Of Benign Tumours Of Salivary Gland:

Author	Male: Female
Sengupta et al [9] (1973)	1 : 1.7
Budhraja et al[10](1974)	1 : 1
Morais et al[14] (2011)	1 : 1.8
Oti et al[15](2013)	1.6 : 1
Present study (2013)	1 : 1.6

Slight female predominance with M**:** F ratio of 1**:**1.6 observed in the present study is comparable with the same observed by Sengupta et al[18] and Morais et al.[14]However,Budhraja et al[10]observed equal distribution of benign tumours in men and women. Oti et al[15] observed marked male predominance with M**:** F ratio of 1.6**:**1.

Table No.12 Gender Wise Distribution Of Malignant Salivary Gland Tumours:

Author	Male: Female
Sengupta et al[9](1973)	1 : 2
Budhraja et al[10] (1974)	1 : 2
Morais et al[14] (2011)	1 : 1.5
Oti et al[15] (2013)	1.8 : 1
Present study (2013)	2.2: 1

Marked male predominance with M**:** F ratio of 2.2**:**1 observed in the present study is comparable with the same observed by Oti et al[15]. However, Sengupta et al[9], Budhraja et al[10] and Morais et al[14] observed female predominance.

Site

In the present study of salivary gland lesions, parotid gland was the most frequently involved site with 42 cases (51.2%). Parotid was also the most common site for tumours of salivary gland with 37 out of 52 cases (71.1%) which was followed by submandibular gland with 8 cases (15.4 %).

Among the minor salivary glands, lip was common site for benign salivary gland tumours with 2 cases (3.8%) and cheek was the site for the single case of malignant tumour.

Table No.13 Percent Of Frequency Of Salivary Gland Tumours At Different Sites

Author	Total Cases	P (%)	SM (%)	SL (%)	Palate (%)	Other MSG (%)
Davies et al[8] (1964)	129	52.7	19.4	—	19.4	8.5
Sengupta et al[9] (1973)	111	62.1	17.1	—	11.7	9.1
Fenn et al[16]\(1982)	57	70.2	22.8	—	1.8	5.2
Verma et al[104] (1988)	162	67.9	17.3	—	—	14.8
Dandapat et al[98] (1991)	42	71.4	19.0	—	—	9.6
Morais et al[14] (2011)	303	72.6	15.2	-	-	12.2
Oti et al[15] (2013)	109	50.4	29.4	-	11.9	8.3
Present study (2013)	52	71.1	15.4	1.9	1.9	9.7

It is evident from table 13 that parotid gland was the most common site of salivary gland tumours as observed by all authors. We also recorded similar observation.

In all studies, Major salivary glands were the common site, parotid gland being most common.

Among the minor salivary glands cheek was the common site.

Table No.14 Comparative Frequency Of Histological Types Of Salivary Gland Tumours:

Histological type of tumours	Davies et al[8] cases [%] (1964)	Fenn et al [15] cases [%] (1982)	Verma et al[17] cases [%] (1988)	Dandapat et al[19] cases [%] (1991)	Gill et al [13] cases [%] (2001)	Morais et al [14] cases [%] (2011)	Oti et al[15] cases [%] (2013)	Present study Cases [%] (2013)
Pleomorphic adenoma	80 [62%]	25 [45.6%]	42 [26.0%]	28 [66.6%]	234 [61.7%]	171 [56.4%]	62 [56.9%]	31 [59.6%]
Basal cell adenoma	—	—	—	—	4 [1.0%]	24 [7.9%]	-	3 [5.7%]
Oncocytoma	—	—	—	—	-	3 [1%]	-	1[1.9%]
Warthin tumour	—	1[1.7%]	5[3.0%]	1[2.4%]	17[4.5%]	16[5.3%]	4[3.7%]	2[3.8%]
Myoepithelioma	-	--	--	--	1[0.2%]	--	9[8.3%]	1[1.9%]
Acinic cell Carcinoma	1 [0.7%]	1[1.7%]	7[4.3%]	—	4[1.0%]	9[3%]	-	1[1.9%]
Mucoepidermoid carcinoma	1 [10.1%]	7 [12.3%]	26 [16.1%]	2 [4.8%]	58 [15.3%]	42 [13.9%]	6 [5.5%]	4 [7.6%]
Adenoid cystic carcinoma	15 [11.6%]	4 [7.0%]	23 [14.2%]	1 [2.4%]	20 [5.3%]	16 [5.3%]	16 [14.7%]	5 [9.6%]
Carcinoma ex pleomorphic adenoma	2 [1.6%]	1 [1.8%]	12 [7.4%]	1 [2.4%]	-	2 [0.7%]	-	3 [5.7%]
Squamous cell Carcinoma	—	5 [8.8%]	12 [7.4%]	2 [4.8%]	-	-	8 [7.3%]	—
Undifferentiated Carcinoma	5 [3.9%]	4 [7.0%]	20 [12.4%]	3 [7.1%]	5 [1.3%]	-	-	—
Adenocarcinoma	13 [10.1%]	6 [10.5%]	8 [4.9%]	2 [4.8%]	2 [0.5%]	10 [3.3%]	-	—
Haemangiomas	—	—	-	-	8[2.1%]	-	-	—
Cystic lymphangioma	—	—	—	—	-	-	-	1[1.9%]
Lipoma	—	—	—	1 [2.4%]	4 [1.0%]	-	-	—
Other tumours	—	2 [3.5%]	7 [4.3%]	1 [2.4%]	17 [4.5%]	9 [3.0%]	4 [3.6%]	—
TOTAL	129	57	162	42	379	303	109	52

From above table 14, it can be concluded that pleomorphic adenoma was the commonest tumour according to all authors. The frequency of pleomorphic adenoma in the present study (59.6%) is similar to Davies et al[8], Dandapat et al[11], Gill et al[13], Morais et al[14]and Oti et al.[15]

In the present series, the most common malignancy was adenoid cystic carcinoma followed by mucoepidermoid carcinoma similar to Devis et al[8] and Oti et al.[15] However all other authors found mucoepidermoid carcinoma more common than adenoid cystic carcinoma

INDIVIDUAL TUMOURS

Pleomorphic Adenoma

Frequency And Sites

In the present study, pleomorphic adenoma constituted the most common tumour with frequency of 59.6% of all salivary gland neoplasms and 79.5% of all benign salivary gland tumours. Parotid was the most common site of involvement of pleomorphic adenoma (64.5%).

Table No.15 Frequency And Site Wise Distribution Of Pleomorphic Adenoma:

Author	Total No. of cases	Frequency of pleomorphic adenoma cases	Site of involvement [%]			
			P	SM	SL	MSG
Sengupta et al[9] (1973)	111	72[64.0]	60.0	19.0	—	21.0
Fenn et al[16] (1982)	57	26[45.6%]	61.5	26.0	—	11.5
Kalra et al[20](1982)	150	100[66.6%]	55	19.0	1.0	25.0
Morais et al[14](2011)	303	129[56.4%]	75.43	19.29	-	5.26
Oti et al[15](2013)	109	62 [56.9%]	50	27.4	-	22.6
Present study (2013)	82	31[59.6%]	64.5	19.3	—	16.1

It is evident from table 15 that the frequency in our series is comparable to other studies.[9,16]

According to all the studies including present study, parotid is the most favored site for pleomorphic adenoma followed by submandibular gland and minor salivary gland. Sublingual gland is a very rare site for pleomorphic adenoma.

Age And Sex Distribution

In the present study maximum frequency was observed at mean age is 43.8 years. A female predominance with M**:** F ratio of 1**:**1.75 was observed.

Table No.16 Comparison Of Age And Sex Distribution Of Pleomorphic Adenoma:

Author	Age range (in years) decade	Mean age (in years)	M: F ratio
Potdar et al[21] (1973)	13-74	39	1.3:1
Kalra etal[20] (1982)	12-80	37.2	1.9:1
Gurung et al[18] (2010)	15-85	37	1:1.1
Present study (2013)	22-72	43.8	1:1.2

It can be noted from table 16 that the mean age in our study was slightly higher as compared to other studies.

In our study, a female predominance was observed in pleomorphic adenoma which is consistent with that observed by Gurung et al[22]

Gross Features

The majority of pleomorphic adenomas found in the present study were well circumscribed, solitary nodular masses within the substance of the salivary glands. Similar features were described by others.[20,19,23]

Microscopic Features

In the present study, most of the pleomorphic adenomas showed biphasic pattern composed of epithelial and stromal elements. The epithelial component was arranged in the form of tubular structures in 54.8% of our cases. Sengupta et al[9] observed well formed tubular structures in 56% of their cases.

The frequency of various stromal components observed in the different series is shown in table 17.

Table No.17 Frequency Of Mesenchymal Components In Pleomorphic Adenoma:

Stromal Component	Panda and Agarwal et al[24] (1969)	Sengupta et al [9] (1973)	Margaritescu et al [25] (2005)	Present study (2013)
Myxoid	42.3%	56.00%	51%	87.0%
Pseudo cartilaginous	59.6%	40.00%	33%	64.5%
Hyaline	19.2%	14.00%	15%	25.8%

The most frequent stromal component in the present study was myxoid (87.0%) which is in agreement with Sengupta et al.[9]

Squamous metaplasia was observed in 19.4% of the cases, which is slightly more than that reported by Sengupta et al[9](14.1%). However, Panda and Agrawal[24] observed higher frequency of squamous metaplasia (34.6%).

Warthin Tumour

Two cases of Warthin tumour were noted in the present study, which accounted for 3.8% of all salivary gland tumours and 5.1% of all benign salivary gland tumours.

Table No.18 Comparison Of Frequency Of Warthin Tumour:

Author	Frequency
Sengupta et al[9](1973)	2.0%
Verma et al[17] (1988)	3.0%
Dandapat et al[11] (1991)	2.4%
Morais et al[14](2011)	5.3%
Oti et al[15](2013)	3.3%
Present study (2013)	3.8%

It is obvious from table 18 that the frequency of Warthin tumour (3.8 %) in the present study is comparable with Sengupta et al[9], Verma et al[17], Dandapat et al[11] and Oti et al.[15] However, Morais et al[14] noted much higher frequency.

The patients in the present study were 60 and 56 year old female and male respectively.

The preference for the involvement of parotid gland in Warthin tumour is in agreement with Verma et al[17], Dandapat et al[10], Morais et al[14] and Oti et al.[15]

The Warthin tumours found in the present study were well circumscribed and solitary masses .The cut surface showed cystic areas. Similar features were described by others.[25,26]

Other Benign Tumours

Three basal cell adenomas were diagnosed in the present study. It accounted for 5.7 % of all salivary gland tumours and 7.7 % of all benign salivary gland tumours. The frequency observed in our study is similar to that reported by Morais et al.[14]

We encountered a single case of myoepithelioma in a 40 year old man involving parotid gland. Myoepithlioma accounts for less than 2 % of all salivary gland tumours. It equally affects men and women with a peak in 3rd to 4th decade of life. Parotid is affected in half of the cases followed by palate.[4]

There was a single case of Oncocytoma in a 52 year old man involving parotid gland. It accounts for less than 1 % of all salivary gland tumours. It commonly affects women in 6th decade of life. Parotid is most commonly involved.

There was a single case of cystic lymphangioma. Vascular tumours are the most common benign mesenchymal neoplasms representing 40% of all benign mesenchymal salivary gland tumours. Out of these lymphangiomas constitute approximately 20%. Most common age of occurrence of lymphangiomas is first decade.[27] Our patient was 50 years old.

Malignant Tumours

Adenoid Cystic Carcinoma

Frequency And Sites

We found five cases of adenoid cystic carcinoma which comprised 9.6% of all salivary gland tumours and 38.5% of all malignant salivary gland tumours. Of these five cases three (60 %) were located in the parotid gland and one case each (20%) was located in the sublingual gland and cheek.

Table No.19 Frequency And Sites Wise Distribution Of Adenoid Cystic Carcinoma:

Author	Frequency [%]	Site wise distribution [%]			
		P	SM	SL	MSG
Panda and Agarwal et al[24] (1969)	10.6	88.9	11.1	-	-
Perzin et al[27] (1978)	—	19.4	16.1	3.2	61.3
Nascimento et al[28] (1986)	14.5	13.1	13.1	1.7	72.1
Verma et al[17](1988)	14.2	13.0	34.8	—	52.2
Morais et al [14] (2011)	5.3	43.75	37.5	-	18.75
Oti et al [15](2013)	13.2	37.5	50	-	12.5
Present study (2013)	9.61	60.0	—	20	20

It can be interpreted from table 19 that the frequency observed in the present study is comparable with that of Panda and Agarwal[24]. Nascimento et al[28], Verma et al[17] and Oti et al[15] observed higher frequency than the present study.

It is also evident from table 25 that most of the authors reported a higher frequency in the minor salivary glands. However Panda and Agarwal[19] and Morais et al[14] reported a higher frequency in the parotid gland which is consistent with that of our study.

Age And Sex Distribution

In the present study the youngest patient was 40 year old and the oldest patient was 63 year old. All five patients were men.

Table No.20 Age And Gender Wise Distribution Of Adenoid Cystic Carcinoma:

Author	Age range (in years)	Mean age (in years)	M:F
Sengupta et al [9](1973)	-	42.8	1: 2.5
Sharkey [29](1977)	41 to 74	59.2	1:2
Seaver and Kuehn[30](1979)	16 to 58	55.0	1: 1.5
Nascimento et al[28](1986)	15 to 81	51.3	1:1.6
Rodrigucz et al [31](2011)	-	55.2	1:1.3
Ellington e al [32] (2012)	11 to 99	57.4	-
Present study (2013)	40 to 63	51	1:0

It is obvious from table 20 that the average age observed in our study correlates with that reported by Nascimento et al.[28]

Sengupta et al[9] reported lower mean age. Most of the other authors observed adenoid cystic carcinoma at considerably older age than in our study. All the authors reported female predominance, however in our study men are affected in all cases.

Gross Features

The majority of tumours in our study were solid, poorly circumscribed, with infiltrative margins. Cut sections revealed gray white appearance. Similar macroscopic features were reported by Nascimento et al.[28]

None of the tumour in the present study was encapsulated, which is in agreement with Seaver and Kuehn.[30]

Microscopic Features

In the present study cribriform pattern was the most common pattern of arrangement of neoplastic cells. This observation is consistent with that of Seaver and Kuehn[30], Nascimento et al[28] and Mehta et al.[33]

Perineural invasion was not noted in any case in the present study, while it was noted in 32% cases reported by Nascimento et al[33] and 20.4% cases reported by Seaver and Kuehn.[30]

Mucoepidermoid Carcinoma

Frequency And Sites

In the present study four cases of mucoepidermoid carcinoma were encountered making frequency of 7.6% of all salivary gland tumours and 30.7% of malignant salivary gland tumours. All the four tumours were located in the parotid gland.

Table No. 21 Frequency And Sites Wise Distribution Of Mucoepidermoid Carcinoma:

Author	Frequency [%]	Site of distribution [%]			
		P	SM	SL	MSG
Panda and Agarwal [24] (1969)	10.6	88.0	11.2	—	—
Fenn et al [16](1982)	12.3	85.7	14.3	—	—
Verma et al [17](1988)	16.1	61.5	26.9	—	11.6
Morais et al [14](2011)	13.9	50	9.5	-	40.4
Oti et al [15](2013)	4.9	33.3	33.3	-	33.3
Present study (2013)	7.6	100	—	—	—

It is evident from table 21 that the frequency observed in the present study matches with that reported by Panda and Agarwal.[19] However, Verma et al[17] and Morais et al[14] observed a higher frequency. Oti et al[15] observed lower frequency of mucoepidermoid carcinoma.

As evident from the table 21, parotid was the most frequent site. Panda and Agarwal et al[24], Fenn et al[16], Verma et al[17] and Morais et al[14] observed a relatively higher frequency of mucoepidermoid carcinoma in the parotid gland as we did.

Age And Sex Distribution

The maximum frequency of mucoepidermoid carcinoma was found in 7th decade. The average age was 54.5 years.

Table No.22 Comparison Of Mean Age And Sex Wise Distribution Of Mucoepidermoid Carcinoma:

Author	Age range (in years)	Mean age (in years)	M:F Ratio
Jacobson et al[34](1968)	5-79	40.5	1:1.3
Accetta et al [35] (1984)	3-69	43.2	1:2.1
Oti et al [15](2013)	-	51.3	1: 2
Present study (2013)	48-64	54.5	1:1

It can be observed from table 22 that, the mean age for mucoepidermoid carcinoma in our study is higher than that observed by all other authors. Female predominance was observed by all authors except present study in which the ratio was equal.

It can be concluded from the table no.25 and 27 that mean age for adenoid cystic carcinoma was higher than that for mucoepidermoid carcinoma.

Microscopic Features

In our study, out of four cases, one could not be graded as it was an incisional biopsy. Of the remaining four cases, three were low grade and one was intermediate grade mucoepidermoid carcinoma. All four tumours showed evidence of intra and extracellular mucin as also noticed by Accetta et al.[35]

The low grade tumour showed cystic spaces lined predominantly by mucin producing cells. The intermediate grade tumour showed almost equal amount of columnar cells, intermediate cells and squamous cells. The desmoplasia of the stroma was observed in single cases of the present study. Jakobson et al[34] noticed this feature in most of the tumours.

Carcinoma Ex Pleomorphic Adenoma

Three cases of carcinoma ex pleomorphic adenoma were reported in our study, which accounted for 5.7 % of all salivary gland tumours and 23% of all malignant salivary gland tumours.

Table No.23 Frequency And Site Wise Distribution Of Carcinoma Ex Pleomorphic Adenoma:

Author	Frequency [%]	Site wise distribution [%]			
		P	SM	SL	MSG
Munjal et al[36](1984)	10.9	100	—	—	—
Sharkey[37](1977)	1.4	100	—	—	—
Verma et al[17] (1988)	10.9	100	—	—	—
Dandapat etal[11] (1991)	2.4	—	—	—	—
Morais et al [14](2011)	0.7	50	50	—	—
Present study (2013)	5.7	33.33	66.67	—	—

From table 23, it is clear that the frequency of carcinoma ex pleomorphic adenoma than is different series was variable.

Parotid gland was the most common site in all the series except for Morais et al[14] and present study in which submandibular gland was also found to be affected.

Age And Sex Distribution

In the present study, out of three patients of carcinoma ex pleomorphic adenoma, two were males and one was female. All the patients were in 5th decade with average age of 48.33 years.

Potdar et al[20] observed slight male predominance, whereas Livolski and Perzin[38] noticed a slight female predominance. The average age in present study was lower than that reported Livolski and Perzin[52] and Sharkey.[29]

Gross Features

All the three tumours in the present study were encapsulated firm nodular masses. The cut surface shows well circumscribed whitish translucent appearance with central ill circumscribed grey white and necrotic area. Many tumours described by other authors were larger than their benign counterparts and often were poorly circumscribed or frankly infiltrative.[2,39]

Microscopy

Malignant transformation in pleomorphic adenoma was in the form of acinic cell carcinoma in one case, malignant myoepithelioma in second case, and poorly differentiated clear cell carcinoma in third case. Boles et al[39] described five cases of carcinoma ex pleomorphic adenoma. Histologically, two of them were adenocarcinomas, one was adenosquamous carcinoma, one was anaplastic carcinoma and one was undifferentiated carcinoma. Malignancies encountered in pleomorphic adenoma included - polymorphous low-grade adenocarcinoma, salivary duct carcinoma, squamous cell carcinoma, mucoepidermoid carcinoma, malignant myoepithelioma, adenoid cystic carcinoma, adenocarcinoma NOS, adenosquamous carcinoma ,undifferentiated or sarcomatoid carcinoma.[2]

Acinic Cell Carcinoma

We encountered a single case of acinic cell carcinoma which accounted for 1.9% of all salivary gland tumours and 7.6% of all malignant salivary gland tumours.

Table No.24 Frequency Of Acinic Cell Carcinoma:

Author	Frequency
Sengupta et al [9](1973)	2.0
Verma et al [17]1988)	4.3
Morais et al [14](2011)	3.0
Present study(2013)	1.92

The frequency of acinic cell carcinoma in all the studies was much less as compared to adenoid cystic and mucoepidermoid carcinoma.

The frequency of acinic cell carcinoma (1.92%) in the present study is

close to that of Sengupta et al[9] and Morais et al.[14]

The tumour in the present study was situated in the parotid gland. Abrams et al[17], Verma et al[17]and Morais et al.[14] reported parotid as the most frequent site for this tumour.

The patient in the present study was 60 years old male. Female predominance is observed by various authors in acinic cell carcinoma. Average age was 57.1 years in the study by Sharkey et al[13].

Grossly, the tumour in our study was a nodular mass with cut section showing cystic areas. Microscopically, the tumour was encapsulated and was composed of round to oval cells with abundant basophilic cytoplasm arranged in microcystic pattern. Eneroth et al[121] observed acinic cell as the main cell type as in our case. Prominent microcystic pattern was also noted by Abrams et al[17].

CONCLUSION

1. Of the 82 salivary gland lesions, 39 were benign tumours, 13 were malignant tumours and 30 were inflammatory and obstructive lesions.
2. The maximum frequency of benign as well as malignant salivary gland tumours was observed in the 4th decade. Benign tumours were much more common in females, whereas malignant tumours were much more common in males.
3. Major salivary glands were involved in 88.5% of salivary gland tumors. Parotid gland was the commonest site. The minor salivary glands were involved in 11.5% of salivary gland tumors. Cheek and lips were the commonest sites.
4. Pleomorphic adenoma was the commonest benign tumor which constituted 59.6%(31 case) of all salivary gland tumors and 79.5% among all benign tumours encountered in the present study parotid was the most favoured site of pleomorphic adenoma. Other benign tumours were Basal cell adenoma (3 cases), Warthin tumour(2 cases), Oncocytoma(1case), Myoepithelioma(1case), and Cystic lymphangioma (1case).
5. The commonest malignant tumor in the present study was adenoid cystic carcinoma which constituted 9.6% (5 cases) of all salivary gland tumors and 38.5 % of all malignant salivary gland tumors. Parotid was the commonest site for this tumor. Other malignant tumours were Adenoid cystic carcinoma (5 cases), Mucoepidermoid carcinoma (4 cases), Carcinoma ex pleomorphic adenoma (3 cases) and Acinic cell carcinoma (1 case).

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