



## RESEARCH ARTICLE

## PREVALENCE OF PAROTID TUMORS AMONG YEMENI PATIENTS IN SANA'A CITY, YEMEN

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### Abstract

**Background and aims:** Parotid gland tumors (PGT) are a moderately scarce group of tumors with a broad range of histopathological manifestations and clinical characteristics. To date, most epidemiological studies on salivary gland tumors including PGT are limited in Yemen and this is one of the first studies, so the aim of the study was to determine the prevalence of different tumors affecting the parotid glands and the effect of age and sex on their distribution.

**Methods:** Epidemiological information as well as demographic data, anatomical site, and histological analysis of PGT were analyzed. The data analyzed included age, sex, site, and histological diagnosis. Data were collected from all histopathological centers covering the majority of Sana'a city between 2019 and 2023.

**Results:** A total of 284 cases- 69% benign and 31% malignant tumors were examined. Both benign and malignant tumors showed a little male inclination (52.5%) and a peak occurrence between the third and fifth decade. Mucoepidermoid carcinoma (36.4%) and adenoid cystic carcinoma (11.4%) are two common malignant tumor types. Benign parotid tumors include pleomorphic adenoma (71.4%) and Warthin tumors (11.2%) of benigns. Other malignants and benigns are less frequent.

**Conclusions:** This study presents the first retrospective study to date to analyze PGT data from health centers spread across Sana'a city. These results should serve the same as the basis for prospect studies assessing the epidemiological geography of these tumors in Sana'a in particular and Yemen in general.

**Keywords:** Demographics, epidemiology, parotid gland neoplasms, parotid gland tumours.

## INTRODUCTION

The parotid gland is an important salivary gland found in many species, including humans. In humans, the two parotid glands are situated on either side of the mouth and in front of both ears. Among the salivary glands, they are the biggest. Each parotid is surrounded by the mandibular ramus and secretes saliva into the mouth through the parotid duct. This process starts the breakdown of carbohydrates and facilitates swallowing and mastication. The submandibular and sublingual glands are the other two varieties of salivary glands<sup>1</sup>. Auxiliary parotid glands can occasionally be found adjacent to the primary parotid glands<sup>2</sup>. Eighty percent of parotid gland tumors are benign<sup>3</sup>. The most prevalent of these are Warthin tumors (also known as adenolymphoma, which is more common in males than in females) and pleomorphic adenoma, which accounts

for 70% of tumors<sup>3</sup>, of which 60% occur in women. Their anatomical location and propensity to expand over time are related to their significance. In addition, the tumorous growth may produce pain on the affected side of the face and alter the gland's consistency<sup>4</sup>. Approximately 20% of parotid tumors are malignant; mucoepidermoid carcinoma and adenoid cystic carcinoma are the most common types of tumors. Adenocarcinoma (originating from the parotid gland's ductal epithelium), squamous cell carcinoma (originating from the parenchyma of the parotid gland), acinic cell carcinoma, and undifferentiated carcinoma are among the other malignant tumors of the parotid gland. There have also been reports of metastases from other locations, such as phyllodes tumors of the breast that manifest as parotid edema<sup>5</sup>. Determining the tumor's relationship to the facial nerve's branches (CN VII) is crucial since removing the tumor could harm

the nerves and paralyze the face's expression muscles. Benign or malignant neoplastic tumors can affect the parotid salivary gland. Approximately 80% of tumors in the parotid gland are benign<sup>6</sup>. Benign lesions often grow slowly, cause little discomfort, and show no symptoms. The three most common salivary gland neoplasms in children are pleomorphic adenomas, lymphatic malformations, and hemangiomas<sup>7</sup>. Benign lesions must be diagnosed with an aspiration biopsy that resembles a fine needle. There is a chance that some benign tumors, including pleomorphic adenomas, will eventually turn malignant. These lesions are therefore usually resected<sup>7</sup>. Pleomorphic adenoma, with an incidence of 54–68% overall, is considered a frequent benign tumor of the salivary gland<sup>7</sup>. The Warthin tumor, which is more frequent in elderly males and has a lower incidence of 6–10%, is linked to smoking. The incidence of benign parotid gland lesions is substantially higher than that of malignant lesions<sup>7</sup>. Rarely, salivary gland lesions are malignant. On the other hand, tumors that spread to small salivary glands, the sublingual and submandibular are typically malignant. Since both benign and malignant tumors appear as painless lesions, differentiating between them can be challenging. A biopsy is an essential tool for diagnosis. There are typical indicators that indicate a malignant lesion is present. These include ulceration of the skin's mucosa, sudden growth of the mass in size, and weakening of the facial nerve<sup>7</sup>. With a low prevalence of 4–13%, mucoepidermoid carcinoma is a common malignant tumor of the salivary glands. With a prevalence of 4–8%, adenoid cystic carcinoma is another frequent malignant salivary gland tumor. This carcinoma can recur after treatment and has a tendency to infiltrate nerves<sup>7</sup>.

Because of the anatomy of the facial nerve parotid lodge and the higher risk of postoperative relapse, surgical treatment of parotid gland tumors might be challenging at times. For this reason, early parotid tumor diagnosis is critical to the prognosis following surgery. Operative method is time-consuming due to incomplete prior treatment in other border specialties and relapses<sup>3</sup>. With the advent of facial nerve neuromonitoring in recent years, surgical methods for parotid surgery have improved and become less intrusive and safer<sup>8</sup>. The auriculotemporal nerve is susceptible to injury following surgical parotidectomy excision, and after recovery it merges with sweat glands. Sweating may result on the affected gland's cheek on the side of the face. Frey's syndrome is the name given to this illness<sup>9</sup>. Pathologists find it difficult to diagnose salivary gland tumours (SGTs) due to their heterogeneous grouping of neoplasms with a wide variety of histological subtypes. Mercifully, they are quite uncommon, with an estimated yearly prevalence in the Western world of 2.5–3.0 per 100,000 individuals<sup>10</sup>.

To date, there is no report of epidemiological data for SGT and/or PGT in Yemen, and only one study in Aden discusses the adenoma of the Intra-Oral Minor Salivary Glands Clinicopathological Study have been conducted<sup>11</sup>. However, they somewhat reflect a relatively small group of patients (60 patients) from a

single center (Al Gumhoria Teaching Hospital- Aden, Yemen) during the period of October 2003–July 2010). These shortcomings necessitate the need for epidemiological evaluation of parotid tumors from multiple centers across the city of Sana'a with a view to analyzing the distribution of different types of parotid tumors as well as identifying associations with sexes and age groups in the Sana'a populations.

## MATERIALS AND METHODS

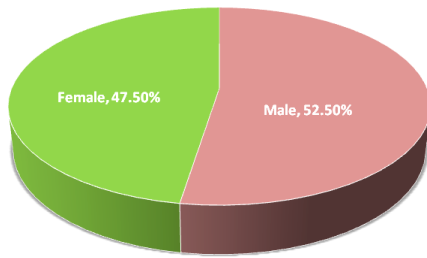
From 2019 to 2023, all diagnoses for parotid gland tumors were obtained from the pathology databases of Sana'a city's laboratories. Included were all primary tumors in the parotid glands, both benign and malignant. Lymphomas and other mesenchymal neoplasms were not included. It was also possible to gather clinical data regarding the patient's age, gender, and anatomical site of presentation (left or right). Before the data was shared for analysis, it was locally anonymized. Following an initial assessment, cases with missing information were eliminated, and duplicates and recurrences were also eliminated. The cases' histology diagnoses were examined wherever feasible. The WHO's 2017 classification of salivary gland tumors was used to categorize the tumors. Within the observed instances, sixteen benign SGT types and sixteen malignant PGT types were found. These included common entities like pleomorphic adenoma, Warthin tumour, basal cell adenoma, and canalicular adenoma, among others. Sixteen distinct tumor forms were found for malignant PGT, including spindle cell carcinoma (SCC), acinic cell carcinoma (ACC), polymorphous adenocarcinoma (PAC), mucoepidermoid carcinoma (MEC), and adenoid cystic carcinoma (AdCC).

**Statistical Analysis:** Descriptive statistical analysis of the data was performed using frequencies and percentages of the variables in Epi-inf version 6.

**Ethical Consideration:** The Contract No. 400 project received ethical authorization on January 1, 2022, from the Medical Ethics and Research Committee of Sana'a University's Faculty of Dentistry. The review committee's established ethical guidelines were constantly adhered to. The selected individuals gave their written and informed consent.

## RESULTS

The sex distribution of patients in Sana'a, Yemen who have parotid gland tumors is displayed in Figure 1. Male patients make up 52.5% of the total, while female patients make up 47.5%. The age distribution of Sana'a city patients with parotid gland tumors is displayed in Table 1. Patients' ages ranged from 1 to 96 years old, with a mean age of 43.3 years and a standard deviation of 18.9 years. The age group of 26–35 years old accounted for 25.5% of all patients, followed by the age group of >50 years old (24.7%) and the age group of 36–45 years old (18.3%). The remaining age categories were less common.



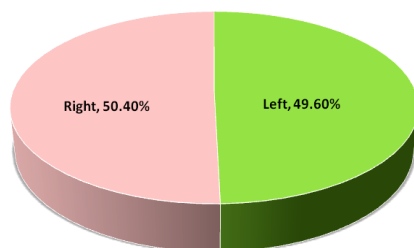
**Figure 1: Sex distribution of parotid tumors patients in Sana'a city.**

The types of parotid tumors in the research subjects are displayed in Table 2. The most frequent tumor in our analysis, accounting for 49.3% of all cases, was pleomorphic adenocarcinoma. Wharthin tumors, or lymphomatousms, were less prevalent, occurring in 7.7% of all cases, as was less frequently, mucoepidermoid carcinoma accounted for 11.3% of the total cases. At 2.8% of the total, adenoid cystic carcinoma was extremely uncommon. Table 2 displays the percentage of other tumors, which came to 28.2% of the total. Table 3 displays the frequency of various benign and malignant parotid tumors among Sana'a City tumor patients. Warthin tumors accounted for 11.2% of all benign parotid tumors.

**Table 1: Age distribution of parotid tumors patients in Sana'a city.**

Age groups	N (%)
≤15 years	13 (4.5)
16-25 years	33 (11.6)
26-35 years	72 (25.5)
36-45 years	52 (18.3)
46-55 years	43 (15.4)
>55 years	71 (24.7)
Total	284
Mean age	43.3 years
SD	18.9
Median	41
Mode	45
Range	1-96 years

Three percent of patients have malignant tumors, whereas the majority of patients (69%) have benign tumors. Mucoepidermoid carcinoma accounted for 36.4% of all malignant tumors, making it one of the most prevalent malignant tumors; adenoid cystic carcinoma accounted for 11.4% of all malignant tumors. Table 3 illustrates the decreased frequency of various malignants. Pleomorphic adenoma accounted for 71.4% of all benign parotid tumors, making it the most prevalent type.



**Figure 2: The side of parotid Tumors in studied patients in Sana'a city.**

Figure 2 presents the aspect of parotid gland tumors among the Sana'a research participants. The incidence of parotid gland tumors was 50.4% on the right side of the jaw and 49.6% on the left, indicating that they were roughly equally common on both sides of the face. Table 4 lists the year when Yemeni patients in Sana'a experienced parotid gland tumors. With 27.1% of the total, 2023 had the highest rate, followed by 2021 with 20.1%. The rate then reached 18.3% for the years 2019 and 2020 and 16.2% for the year 2022. The rate of recurrent was 9.9%.

**DISCUSSION**

In the current study 284 cases of parotid were diagnosed in Sana'a city during 5 years periods with estimated incidence for the five year period equal to 284/2,000,000/5 years equivalent to 56/2,000,000/anum. The highest rate occurred in 2023, at 27.1% of the total, followed by 2021 at 20.1%. Then for the years 2019 and 2020, the rate reached 18.3%, while for the year 2022, it reached 16.2%. PGTs are uncommon, and our study is among the first comprehensive studies to look into the incidence and characteristics of these tumors from several histopathology centers in Sana'a, as well as most of the laboratories that Tumor patients use in Sana'a and the surrounding areas. We collected 280 cases from pathology centers across the Sana'a city and found that benign tumors accounted for the majority of PGT (69%) compared to malignant tumors (31%). This finding is consistent with the existing data from Eastern Chinese<sup>12</sup>, Hiroshima Japan<sup>13</sup>, and from other previous literature<sup>14-16</sup>.

**Table 2: The types of parotid tumors patients in Sana'a city.**

Types	N (%)
Pleomorphic adenoma	140 (49.3)
Wharthin tumor (lymphomatousm)	22 (7.7)
Mucoepidermoid carcinoma	32 (11.3)
Adenoid cytic carcinoma	10 (2.8)
Other tumors	80 (28.2)
	284 (100)

In the current study, male PGT constitute 52.5% of the total patients, while females constitute a slightly lower rate of 47.5% of the total patients. Our study revealed a slight preference for males, in contrast to reports from Jones AV *et al.*<sup>17</sup>, in the UK, Bello IO *et al.*<sup>18</sup>, in Fenland, and Fonseca FP *et al.*<sup>19</sup>, in Southern Brazil, which also revealed a slight preference for females. These findings have been confirmed by a few other studies<sup>16,20</sup>. On the other hand, a few single-center investigations have found that males are equally affected by salivary gland tumors, including PGT, or that their incidence is higher in them<sup>12,21,22</sup>. Furthermore, in the current study, most patients were in the age group of 26-35 years, 25.5% (peak of the incidence), followed by the age group >50 years, 24.7% (second peak of the incidence), which is different from that reported by Alsanie *et al.*<sup>23</sup>, for international incidence, Jones AV *et al.*<sup>17</sup>, in the UK,

Tian Z *et al.* among the Chinese population<sup>12</sup>, Bello IO *et al.* in Finland<sup>18</sup>, and Ito FA *et al.*<sup>20</sup>, in the Brazilian population, in which the peak of incidence of SGT was in the fourth to seventh decades of life. In the current study, the malignant tumors are counting 31% of the total, while benign tumors are counting the majority of the patients (69%) of the total (Table 4). This result consists of that reported elsewhere<sup>16,19,20,25</sup>. Pleomorphic adenocarcinoma was the most common benign tumor in our study in 49.3% of the total cases; this is consistent with prevalence rates reported by Jones *et al.* in the UK<sup>17</sup>, Sardar *et al.*<sup>26</sup>, in international bases, Fiorella R *et al.*<sup>27</sup>, in an international study,

Girdler R *et al.* in London, UK<sup>28</sup>, and Sentani K *et al.*, in Japan<sup>13</sup>. Pleomorphic adenoma was the most prevalent benign tumor across all research areas, with rates ranging from 64% in Europe to 87% in South America, according to a comparison of incidence between centers. In the current study, Warthin tumor (lymphomatous) was a less common benign tumor in 7.7% of the total, which is also similar to earlier demographical studies by Fiorella R *et al.*<sup>27</sup>, in an international study, Girdler R *et al.*, in London-UK<sup>28</sup>, Sentani K *et al.*, in Japan<sup>13</sup>, Ito FA *et al.* in Brazil<sup>20</sup>, Satko I *et al.*, in Bratislava<sup>24</sup>, and Neville BW *et al.*, in Amsterdam Holand<sup>25</sup>.

**Table 3: The prevalence of malignant and benign parotid tumors among tumor patients in Sana'a city.**

Malignant, n= 88		Benign n=196	
	N (%)		N (%)
Pleomorphic adenocarcinoma	1 (1.3)	Lipoma	5 (2.6)
Basal cell carcinoma	4 (4.5)	Hematoma	1 (0.5)
Spindle cell carcinoma	2 (2.6)	Hemangioma	1 (1.02)
Oncocytic carcinoma	2 (2.6)	Lymphoid cells	4 (4.1)
Rhabdomyoma sarcoma	2 (2.6)	Basal cell adenoma	1 (1.02)
Myoepithelial carcinoma	1 (1.3)	Adenomatous nodule	1 (0.5)
Acinic cell carcinoma	1 (1.3)	Lymphangioma	1 (1.02)
Squamous cell carcinoma	12 (13.6)	Benign neutofibromatous	1 (0.5)
Non-Hodgkin lymphoma	4 (4.5)	Fibrosis	1 (0.5)
Hodgkin lymphoma	4 (4.5)	Myocetoma	1 (0.5)
*Carcinoma	9 (10.2)	Neoplastic	10 (5.1)
Lymphoepithelial carcinoma	3 (3.9)	Schwannoma	1 (1.02)
Osteosarcoma with chondroid	1 (1.3)	Lymphoma	1 (1.02)
		Oncocytoma	1 (0.5)
Mucoepidermoid carcinoma	32 (36.4)	Pleomorphic adenoma	140 (71.4)
Adenoid cystic carcinoma	10 (11.4)	Warthin tumor	22 (11.2)
Total	88 (31)	Total	196 (69)

The results of this study contrast from those of Waldron CA *et al.*<sup>29</sup>, and Al Sheddi MA in Saudi Arabia<sup>30</sup>, who identified basal cell adenoma as the third most common benign tumor. Instead, lipoma was the third most common benign tumor (2.6%). Strangely, there were no reports of basal cell adenomas in Asia or South America, while in our analysis they made up 1.02% of benign SGT, which is less than that reported in the UK (5%) and 3% in centers in both Europe and Africa<sup>25,28</sup>. Previous research has demonstrated that basal cell adenoma is not among the five most common benign tumors in these areas, suggesting that this may be due to the lower incidence or the lesser number of cases collected from these sites<sup>19,20,31</sup>.

**Table 4: Year of occurrence of parotid gland tumors among Yemeni patients in the city of Sana'a.**

Years	N (%)
2019	52 (18.3)
2020	52 (18.3)
2021	57 (20.1)
2022	46 (16.2)
2023	77 (27.1)
Total	284 (100)

The possibility of variation in diagnostic criteria can also not be excluded. The most frequent malignancy in the current investigation was mucoepidermoid carcinoma; these findings are consistent with

prevalence rates that have been previously reported by Jones *et al.* in the UK<sup>17</sup>, Fiorella R *et al.*<sup>27</sup>, Spiro RH<sup>16</sup>, and Ito FA *et al.* in Brazile<sup>20</sup>. By looking into lever actions With the exception of oncology institutions in Africa, where adenoid cystic carcinoma was the most often diagnosed malignancy, we discovered that mucoepidermoid carcinoma was the most prevalent tumor worldwide. In the current study, adenoid cystic carcinoma was the second common malignant tumor, counting 2.8% of the total tumors and 4.5% of the malignant tumors. The current result is different from that reported by El-Naggar AK *et al.*<sup>32</sup>, in which 2012 adenoid cystic carcinoma was the most common malignant tumor in their study<sup>31</sup>. The second most common malignant diagnosis for most of the centers in our study was adenoid cystic carcinoma, accounting for 4.5% of all malignancies, similar to reports by Sardar MA *et al.*<sup>26</sup>, Fiorella R *et al.*<sup>27</sup>, Ito FA *et al.* in Brazil<sup>20</sup>, Spiro RH<sup>16</sup>, Bradley PJ *et al.*, in the UK<sup>33</sup>, and Girdler R *et al.* in London<sup>28</sup>, despite the fact that reports of differences in its prevalence exist. Molecular methods such FISH, PCR, and NGS can aid in the ultimate diagnosis of mucoepidermoid carcinoma and adenoid cystic carcinoma; however, these assays are not readily accessible or reasonably priced worldwide<sup>34</sup>. In the United Kingdom, routine testing for MAML2 rearrangement in mucoepidermoid carcinoma has just been commonplace since 2015–2016. The most accessible test for this condition is FISH, while MYB testing for adenoid cystic carcinoma is still limited to a

small number of specialized centers. With 13.6% of all malignant tumor cases, squamous cell carcinoma was the second most prevalent diagnosis. Indeed, there is a great deal of variation in the literature about the occurrence of this tumor, which may be caused by small and homogeneous cohorts.

Gaining insight into the distribution and epidemiological landscape of parotid gland tumor histological subtypes is essential to improving the diagnostic performance of this intricate and varied group of tumors. Future research with a wider geographic area and other ENT and H&N centers would be beneficial. To aid future researchers, it would be beneficial to create national and global datasets of these tumors (whole slide images or research archives) that include histological reevaluation and classification based on the most recent WHO guidelines.

## CONCLUSIONS

Although PGTs are uncommon, their occurrence has gradually increased in Yemen over the past five years. The majority of PGT cases are benign (69%), with a small preference for males (52.5%), according to the biggest multicenter analysis of PGT to date that we have reported. PGT affects patients in their third or fourth decade of life in about 55% of cases. Pleomorphic adenoma was the most common benign tumor and mucoepidermoid carcinoma was the most common malignant tumor. More comprehensive studies of PGT are needed to understand and update the epidemiological landscape of these tumors and correlate it with prognosis.

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## AUTHOR'S CONTRIBUTIONS

**Al-Kibsi TAM:** writing original draft as a part of M. Sc thesis, literature survey. **Al Qirshi HGMA:** data analysis, report drafting and review. **Al-Shamahy HA:** formal analysis, critical review. Final manuscript was checked and approved by all authors.

## DATA AVAILABILITY

The data will be available to anyone upon request from the corresponding author.

## CONFLICT OF INTEREST

There are no conflicts of interest in regard to this project.

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