Research Paper

The distribution of parotid gland neoplasms in a veteran population

Adnan S. Hussaini a,*, Navin R. Prasad b, Edina Paal c,d, Eshetu A. Tefera e, Sonya Malekzadeh a,c, Jessica H. Maxwell a,c

a MedStar Georgetown University Hospital, Department of Otolaryngology, Head and Neck Surgery, Washington, DC, USA
b Georgetown University School of Medicine, Washington, DC, USA
c Washington DC Veterans Affairs Medical Center, Washington, DC, USA
d The George Washington University, Department of Pathology, Washington DC, USA
e MedStar Health Research Institute - Department of Biostatistics and Biomedical Informatics, Hyattsville, MD, USA

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Abstract  Objective: Salivary gland tumors account for 6%–8% of head and neck neoplasms with the parotid gland as the most common primary site. Pleomorphic adenomas (PA) are considered the most common benign parotid gland neoplasms, followed by Warthin tumors (WT). The goal of this study was to investigate the distribution of parotid gland neoplasms among a United States veteran population.
Design: Retrospective chart review.
Setting: Washington DC Veterans Affairs Medical Center.
Participants: Veterans who underwent fine needle aspiration (FNA) for a parotid gland mass from 2000 to 2018 were included. Medical records were reviewed for gender, age, tobacco use, surgery date, and pathology results.
Main outcome measures: Changes in the distribution of parotid neoplasms and tobacco use over an 18-year period.
Results: Of 141 patients with parotid gland masses, 86.5% (n = 122) were benign, 9.9% (n = 14) were malignant, and 3.5% (n = 5) were indeterminate. Of benign tumors, WT accounted for the majority at 51.6%, followed by PA at 40.2%. When stratified by decade (2000–2009 and 2010–2018), the proportion of WT compared to all other benign and malignant
neoplasms increased from 31.6% to 53.6%, whereas the proportion of PA decreased from 36.8% to 33.3%. The rate of tobacco use was unchanged at approximately 32.0% among our cohort from 2000 to 2018.

**Conclusion:** Among our cohort of veteran patients, WT was the most common benign parotid tumor and has increased in incidence over the last two decades despite an unchanged smoking rate.

*Ethical considerations*

This study was approved by the Washington DC Veterans Affairs Medical Center (VAMC) Institutional Review Board (IRB).

*Statistical analyses*

Data aggregation was completed using Microsoft Excel 360 (Microsoft Corporation, Richmond, WA). All data were summarized using descriptive statistics. Means with standard deviations were used for continuous variables, and frequencies and percentages were used for categorical variables. Continuous variables were compared by two sample t-test and ANOVA tests as appropriate, while categorical variables were compared by Chi-square and Fisher exact tests. Multivariate logistic regression analysis was used to examine factors which were associated with tumor type controlling for the variables which were found significant in the bivariate analysis. Statistical significance was defined as $P < 0.05$ and analyses were performed with SAS 9.4 (SAS Institute Inc., Cary, NC).

**Results**

One hundred and ninety-seven patients who underwent parotid gland FNA and/or parotidectomy for a solitary parotid lesion were included in the analysis. Of these, 56 (28.4%) were excluded due to non-neoplastic pathology, including benign cysts ($n = 26$), sialadenitis ($n = 6$), non-
diagnostic/normal parotid tissue (n = 21), or due to metasta
tic nature (n = 3). Of the remaining 141 patients with
tumor neoplasms, 122 (86.5%) were benign, 14 (9.9%) were
malignant, and 5 (3.5%) were indeterminate (Table 2). Of
benign neoplasms, WT accounted for the majority at 51.6%
(63/122), followed by PA at 40.2% (49/122), lipoma at 5.7%
(7/122), basal cell adenoma at 1.6% (2/122), and myoepi-
thelioma at 0.8% (1/122).

Of the 141 patients who met the inclusion criteria, 98
(69.5%) underwent surgery and 43 (30.5%) had FNA only.
The discordance rate between FNA and surgical pathology
incidence of WT increased significantly over the last two
decades (P = 0.0422), whereas the incidence of other
neoplasms remained stable (Fig. 2). Malignant neoplasms
decreased in incidence over the same time period from
14.0% to 7.1% (Fig. 1).

The proportion of former, current, and never smokers
was also analyzed amongst all patients across four time
periods (Fig. 3). Of note, the former and current smoking
diff use and age were found to be statistically significant.
A greater proportion of WT patients were male, compared to
PA patients (93.7% vs. 77.6%, P = 0.0228). In addition, WT
patients were significantly older than those with PA (66.8 ± 9.4 vs. 60.0 ± 12.9, P = 0.0018). Of pa-
tients with WT, 82.5% were former or current smokers,
compared to 65.3% among patients with PA (P = 0.0106). Of
note, after controlling for co-variates, only current tobacco
use and age were found to be statistically significant. The
odds of WT for current smokers was 3.7 times higher
compared to never smokers after controlling for age and
gender (3.744, 95% CI = 1.27–11.02, P = 0.0162). The odds
of WT increased by 6.2% for a unit increase in age after
controlling for gender and smoking status (1.062, 95%
CI = 1.01–1.11, P = 0.0078).

When stratified by decade (2000–2009 and 2010–2018),
differences in gender, age at diagnosis, race and BMI among
all comers undergoing FNA were not significant. Between
the two decades, the proportion of WT increased from
31.6% to 53.6%, whereas the proportion of PA slightly
decreased from 36.8% to 33.3%, respectively (Fig. 1). The
incidence of WT increased significantly over the last two
decades (P = 0.0422), whereas the incidence of other
neoplasms remained stable (Fig. 2). Malignant neoplasms
decreased in incidence over the same time period from
14.0% to 7.1% (Fig. 1).

The proportion of former, current, and never smokers
did not significantly change over time (P = 0.3460).
The overall rate of current smokers across all decades was
32.0%.

### Discussion

A number of European studies have suggested a shifting
paradigm in the once well-established epidemiology of
benign parotid tumors.
benign parotid neoplasms, with an increasing incidence of WT compared to PA.\(^2,6,8,9\) Franzen et al\(^8\) showed a higher frequency of WT compared to PA, seen in the final decade of a 42-year long analysis in a rural German population from 1975 to 2017. Various other European studies have reported similar trends. Luers et al\(^6\) reported an increase in WT from 24% to 48% from 1990 to 2014, while Kadletz et al\(^9\) reported an increased rate of 10%–60% from 1960 to 2015. Of note, the latter study described a six-fold increase in WT incidence discordant with relatively stable smoking rates - a known risk factor for the development of WT.\(^7,10\) To our knowledge, the present investigation is the first North American study to describe the incidence of benign salivary neoplasms in several decades, as well as the first to report an overall higher incidence of WT compared to PA, which is classically considered the most common benign parotid neoplasm.

Overall, several factors may explain this apparent increase in incidence of WT. Examining risk factors for the development of WT, such as tobacco exposure, may shed some light. Once a widespread habit in the United States in the 20th century, tobacco use reached its height in 1953, with a national smoking rate of 47%,\(^11\) and has since declined. Given that the median age of patients with WT in our cohort was 66.9, increased incidence may be an artifact of widespread smoking habits during the last several decades.

Although the national smoking rate has recently declined, the U.S. veteran population has historically maintained a higher than average smoking rate.\(^12\) This
observation is further corroborated by our results, which may partly account for a high incidence of WT in our cohort. However, the steady former and current smoking rate in our cohort does not explain the rising incidence of WT that we observed.

Obesity is another factor that has been implicated in the rising incidence of WT identified by European investigators. Among our cohort, however, there was no association between BMI and developing a WT. Furthermore, there was no difference in BMI among the two decades. It is possible that the effect of obesity on our cohort was not apparent due to the small sample size.

The rise in benign neoplasms which was observed in our cohort may be partly explained by the routine use of imaging modalities that identify small and asymptomatic parotid neoplasms. Recent studies have demonstrated a 60% overall increase in computed tomography (CT) scans utilized in the emergency room setting over the last decade, which may be responsible for incidentally noted parotid lesions, leading to further evaluation and subsequent FNA. However, this alone does not explain the rise in benign neoplasms and decline in malignant neoplasms in our veteran cohort.

Aside from its retrospective nature and limited sample size, a number of limitations must be considered. Of note, the percentage of patients undergoing FNA for parotid lesions is largely unknown. It is entirely possible, that the number of FNAs ordered or the compliance rate of patients completing FNAs has changed over the last two decades. An increase in the number of FNAs could explain a variance in frequencies of certain parotid pathologies. An investigation on the ordering practices of clinicians could be an avenue for future studies.

In addition, another limitation of our study is that limited data was available to compare the health of patient populations across decades. Although there was no difference among age, BMI, and smoking rates, overall cardiovascular and pulmonary status, as well as presence of diabetes may have influenced a patient’s ability to undergo parotidectomy, possibly alerting true incidence of certain parotid pathologies.

Finally, as with many other studies which examine epidemiologic data on incidence and distribution of benign parotid neoplasms, the majority of information is derived from single institutions, with population-based studies less common. As a result, our findings may not be relatable to the general US population. Nonetheless, our results suggest a shift in the distribution of parotid gland neoplasms in the veteran population of North America.

**Conclusion**

In our veteran cohort who underwent FNA for parotid gland masses, Warthin tumor was the most common benign neoplasm encountered, surpassing pleomorphic adenomas in incidence. Furthermore, our results suggest that the incidence of Warthin tumor is increasing, despite relatively stable smoking rates. It remains unclear whether this is due to a higher prevalence of tobacco use or male gender among the veteran population. However, a thorough understanding of the distribution of parotid gland neoplasms in this specific population is critical to patient counseling and surgical planning. This study contributes to the demographic epidemiology of salivary gland tumors and demonstrates the shifting distribution of parotid gland neoplasms.

**Data availability statement**

The data that support the findings of this study are available from the corresponding author upon reasonable request. Please contact the corresponding author, Adnan S. Hussaini, at adnan.s.hussaini@gunet.georgetown.edu to file a request.

**Authorship contributions**

Adnan S. Hussaini: Conceptualization, Methodology, Validation, Formal Analysis, Writing — Original Draft, Writing — Review & Editing, Visualization. Navin R. Prasad: Conceptualization, Methodology, Formal analysis, Investigation, Writing — Original Draft. Edina Paal: Methodology, Validation, Resources, Writing — Review & Editing. Eshetu A. Tefera: Validation, Formal Analysis, Writing — Review & Editing. Sonya Malekzadeh, MD. Conceptualization, Methodology, Writing — Review & Editing, Supervision. Jessica H. Maxwell: Conceptualization, Methodology, Writing — Review & Editing, Supervision.

**Declaration of Competing Interest**

None.

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