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ORIGINAL ARTICLE

Results of 301 Parotidectomies: A Twenty-Year Experience of One Single Institution

Harun Gür[1] · Onur İsmi[1] · Yusuf Vayısoğlu[1] · Kemal Görür[1] · Murat Ünal[1] · Onurhan Güven[1] · Cengiz Özcan[1]

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Abstract To evaluate demographic, clinical, surgical and histopathological results and complications of 301 parotidectomies performed in southern part of Turkey. The results of 297 patients undergoing 301 parotidectomies between 2000 and 2019 were retrospectively reviewed. Four patients underwent bilateral parotidectomy. Age, gender, side and size of lesion, postoperative facial nerve function (FNF) for benign tumors and types of surgery were evaluated. There were 172 male and 125 female patients. The mean age was 52.53 ± 16.67 years (range 11–90 years). Patients with malignant tumor had higher mean age than the patients with benign diseases ($p < 0.001$) and the mean age of Warthin tumor (WT) patients was significantly higher than pleomorphic adenoma (PA) ($p < 0.001$). There was a significant male dominancy in WTs than the PAs ($p < 0.001$). The mean size of the malignant tumors was significantly higher than the benign tumors ($p = 0.012$). The mean of cigarette smoking value (pack/year) was higher in WTs than the PAs ($p < 0.001$). WT incidence was slightly higher than PA in between years 2010 and 2019 ($p = 0.272$) compared to between years 2000 and 2009. Fine needle aspiration biopsy had a sensitivity of 96% and specificity of 78% for the benign tumors. Tumor location ($p < 0.001$) and tumor size ($p = 0.034$) had negative effect on the postoperative FNF. The incidence of WT had a significant rise in the last decade. Deep lobe tumors and increased tumor size had effect postoperative FNF. Experience of surgeon is more important than nerve monitoring to prevent facial paralysis. Partial superficial parotidectomy was available methods for small benign tumors in tail of the parotid gland.

Keywords Parotid gland · Warthin tumor · Pleomorphic adenoma · Malignant neoplasms · Facial paralysis

✉ Harun Gür
hrngur@hotmail.com

Onur İsmi
dronurismi@gmail.com

Yusuf Vayısoğlu
yvayisoglu@gmail.com

Kemal Görür
kgorur@gmail.com

Murat Ünal
drmunal@gmail.com

Onurhan Güven
onurhanguven@gmail.com

Cengiz Özcan
cengizozcan@hotmail.com

[1] Department of Otorhinolaryngology, University of Mersin School of Medicine, Çiftlikköy Kampüsü, Çiftlikköy/Yenişehir, Mersin, Turkey

Introduction

The parotid glands (PGs) have a variety of diseases including infectious, inflammatory diseases, and benign or malignant tumors [1]. Primary PG tumors constitute approximately 1–3% of all head and neck tumors. Benign tumors account for approximately 75% of all parotid tumors [2]. The most common benign PG tumor is pleomorphic adenoma (PA) and malignant counterpart is mucoepidermoid carcinoma [2, 3]. But some new reports have suggested Warthin tumor (WT) is the most common benign tumor of the PG [4, 5]. Malignancies of the tissues surrounding the PG and distant metastasis to PG can also cause a mass in the parotid glands.

Clinical assessment of PG lesions involves a complete history and physical examination. Benign tumors generally present with a solid, mobile, slow-growing and painless mass whereas malignant tumors can manifest with immobile mass, rapid growth pattern, pain, facial paralysis and regional lymphadenopathy [6].

Ultrasonography (USG), computed tomography (CT), magnetic resonance imaging (MRI) and fine needle aspiration biopsy (FNAB) are diagnostic methods for differential diagnosis of PG masses. FNAB could be performed quickly as a relatively painless procedure with low complication rates in the outpatient setting [7, 8]. Fine needle aspiration biopsy for differentiating benign versus malignant lesions has a sensitivity of 80% and specificity of 97% [9].

Management of PG tumors includes parotidectomy and adjuvant radiotherapy (RT) and/or chemotherapy. Parotidectomy types for PG tumors are extracapsular dissection, partial or complete superficial and radical parotidectomy with or without neck dissection.

Facial nerve paralysis is the most important complication of parotidectomy, however, Frey's syndrome, wound infection, hematoma/hemorrhage, salivary fistula and seroma/sialocele may occur as less serious complications of parotidectomy.

The aim of this study was to present demographic features, the surgical, clinical and histopathological results and complications of 297 patients (301 parotidectomies) undergoing parotidectomy at our tertiary otorhinolaryngology department and to evaluate Frey's syndrome and frequency of other complications. The risk factors for facial nerve paralysis after resection of benign tumors and the increasing rates of WT were also analyzed.

Methods

This study was approved by our University Local Ethical Committee. A total 297 of 350 patients undergoing parotidectomy were enrolled to this retrospective study. Fifty-three patients were excluded from our study because these patients' data were not available. Clinical, radiological and histopathological results of 297 patients undergoing 301 parotidectomies at our Otorhinolaryngology Department between 2000 and 2019 years were retrospectively reviewed from medical charts of the patients.

Study group inclusion criteria were as follows:

I. Patients undergoing parotidectomy for the parotid mass, inflammatory diseases or elective parotidectomy for the malignant skin tumors,
II. Patients whose the histopathological results were available.

Demographic features of the patients (age, gender), side and size of the lesions, facial nerve function and types of surgery were evaluated. Tumor size, the longest dimension, was obtained from the histopathologic results of the surgical specimens. Inflammatory diseases such as Sjögren syndrome and chronic sialadenitis were not evaluated in tumor size. Tumor sizes were also classified as three subgroups, including ≤ 20 mm, 20 mm < or ≤ 40 mm and 40 mm < according to the recent World Health Organization (WHO) TNM classification of malignant tumors [10]. Patients' smoking rates (pack/year) were evaluated in both patients with WT and patients with PA. Distribution of the benign tumors was investigated in two separate decades in which they were from 2000 to 2009 and from 2010 to 2019. Facial nerve function before and after surgery was assessed by using House-Brackmann grading scale.

Patients' USG, CT and MRI results were also evaluated (Fig. 1). According to these imaging methods and the tumor location during surgical procedure, the tumor location was grouped as superficial or deep lobe tumors. Fine needle aspiration biopsy was performed in vast majority of the patients. Results of the FNABs were classified as three subgroups including benign, malignant and non-diagnostic cytology. Frozen section was also performed for patients with malignant FNAB report and/or a clinical suspicion of malignancy. Results of the FNAB were compared with the final histopathological reports of the surgical specimens. Thus, the sensitivity, specificity, positive predictive value (PPV) and negative predictive values (NPV) of FNAB were also calculated for both benign and malignant diseases.

Postoperative facial nerve function after benign tumor removal was evaluated in the tumor size and side, tumor location (superficial vs deep lobe), parotidectomy type and presence/absence of the use of intraoperative facial nerve monitoring for patients with benign diseases.

Extracapsular dissection, partial superficial (lower segment), complete superficial, total or radical parotidectomy with or without neck dissection was performed for patients with parotid mass, with facial nerve monitoring. Facial nerve monitoring was started to be increasingly used after year 2010 at our department. Extracapsular dissection was performed for small, limited and well-circumscribed masses superficial to the facial nerve. Lower segment partial superficial parotidectomy was performed for masses which were only restricted to the tail of the PG. The facial nerve was identified routinely in the vast majority of the patients except for three patients performed extracapsular dissection. All of the parotidectomies were performed by or under the supervision of the experienced surgeons. Parotidectomy complications from patients' charts were enrolled. The greater auricular nerve has been preserved since year 2015 but it was sacrificed in the patients who underwent neck dissection for malignant parotid gland tumors and who have the greater auricular nerve grossly infiltrated by malignant tumor. For the patients whose frozen section results reported as malignant

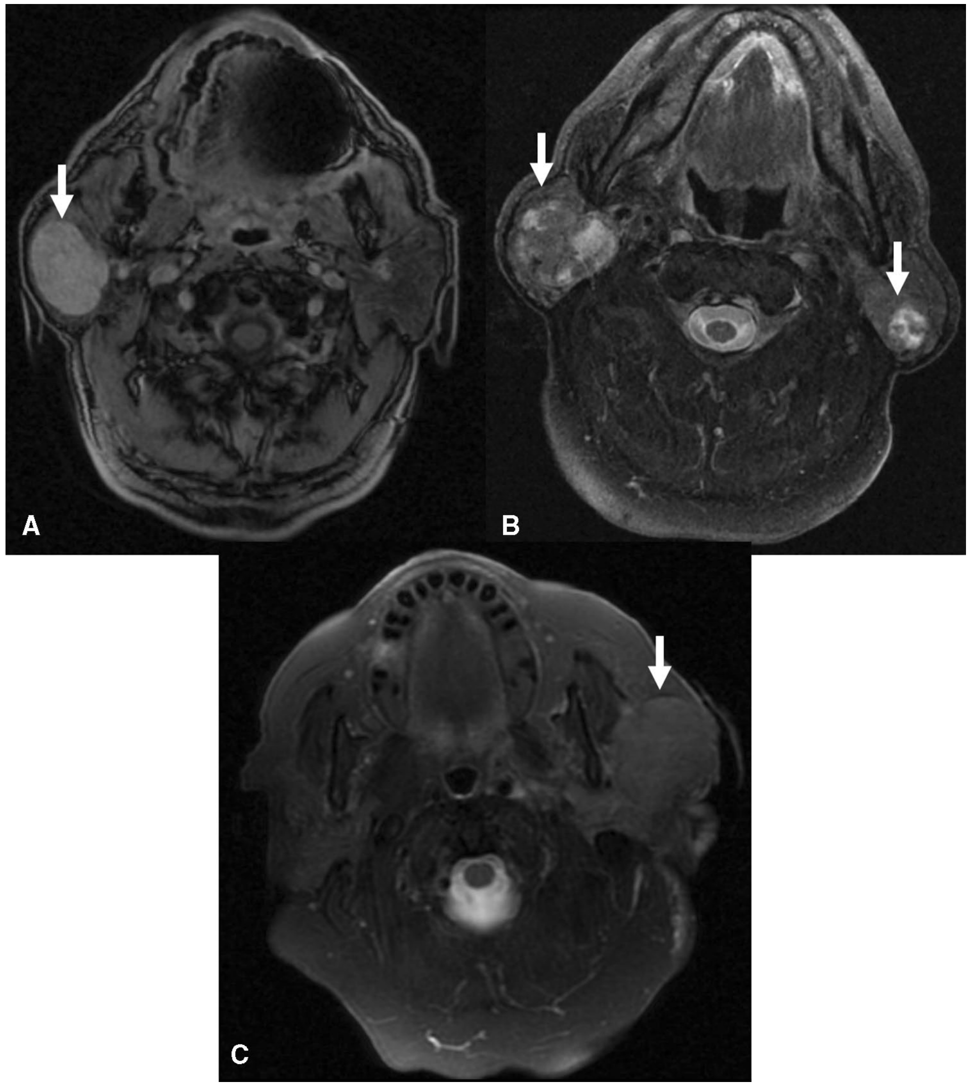

Fig. 1 The views of axial section of MRI of patients with pleomorphic adenoma (**A**), with Warthin tumor (**B**) and with malignant tumor (**C**) (White arrows: tumors within the parotid gland)

neoplasia or high-grade malignancy and patients who had clinically malignant mass findings, a neck dissection was additionally performed. If patients had any clinical and/or radiological regional nodal metastasis, or if any suspicious lymph node was encountered at the level II during parotidectomy, the lymph node was excised and sent to the frozen section analysis. Comprehensive neck dissection (radical or modified radical) was performed if the result of the frozen section was reported as metastasis of the PG tumor. Adjuvant RT was indicated for high-grade malignant neoplasms, deep lobe cancers, positive surgical margin, infiltration with tumor of the surrounding tissues, the condition of nodal metastasis or neural and vascular structures invaded by tumor and chemotherapy was applied for patients in case of distant metastasis, the extra nodal extension and positive surgical margin.

Histopathological results of the surgical specimens were reviewed and classified according to the latest WHO classification for salivary gland tumors [10].

Statistical Analysis

Statistical analysis was performed using SPSS version 24.0 (IBM SPSS, New York, USA, 2016). Data were shown as mean ± standard deviation for continuous variables and number of cases was given for categorical ones. Data were controlled for normal distribution using the Shapiro–Wilk test. Chi-square test was employed for the comparison of sex differences, tumor site frequencies, T classification frequency of the tumors, cigarette-smoking patient frequencies between the benign-malignant tumors and PA-Warthin tumors. Chi-square test was also used to compare the tumor site frequencies, tumor location (superficial or deep lobe) frequencies and FN monitoring absence/presence status between patients having normal FN motor function and patients having FN paresis after surgical removal of the benign tumors. Z-test was used to compare the proportions of PA and Warthin tumors among all of the benign tumors. In addition, Mann–Whitney *U* test was used to compare the age differences, mean cigarette smoking values (pack/year) and mean tumor size values between the studied groups. Multivariate logistic regression with enter method was performed to assess the relative effect of independent variables (site, size and location the tumor, parotidectomy type and intraoperative facial nerve monitorization status) on facial nerve function outcome after removal of the benign PG tumors.

Results

In this study, there were a total of 297 patients undergoing 301 parotidectomies, four of whom underwent bilateral parotidectomy due to bilateral WT. There was no statistically significant difference between benign disease and malignant tumor group patients regarding gender differences ($p = 0.88$), and tumor side ($p = 0.594$). Patients with malignant tumor had higher mean age than those with benign diseases ($p < 0.001$). Additionally, the mean size of the malignant tumors was observed to be significantly higher compared to the benign tumors ($p = 0.012$). Comparison of demographic and clinical features of the patients with benign and malignant tumors was shown in Table 1.

There was a significant male predilection in WT group patients as compared to the PA group patients. ($p < 0.001$). Similarly, the mean age of the patients was higher in WT than PA ($p < 0.001$). In addition; the mean of cigarette smoking value (pack/year) was observed to be higher in WT as compared to the PA group patients ($p < 0.001$). However, there was no statistically significant difference between WT and PA patients regarding the mean tumor size ($p = 0.37$) and the side of the tumor ($p = 0.069$) When the proportion of PA and WT among all of the benign tumors was compared,

Table 1 Comparison of demographic, clinical and surgical features of the patients with benign or malignant tumors

Characteristic	Benign tumors	Malignant tumors	Total	p value
Number of patients	242	55	297	
Gender				0.88
Men	141	31	172	
Women	101	24	125	
Mean age, SD	49.59 ± 15.34	65.69 ± 16.14	52.53 ± 16.67	0.001*
Side				0.594
Right	115	28	143	
Left	123	27	150	
Bilateral	4	0	4	
Size				0.055
≤ 20 mm	73	15	88	
20 mm < or ≤ 40 mm	135	26	161	
> 40 mm	30	14	44	
Mean (mm)	28.66 ± 12.90	35.29 ± 17.73	29.90 ± 14.14	0.012*
FNAB				
Number	182	29	211	
Diagnosis				
Benign	152	5	157	
Malign	6	18	24	
Non-diagnostic	24	6	30	
Parotidectomy type				
Extracapsular dissection	3	–	3	
Partial superficial	109	–	109	
Complete superficial	94	26	120	
Total	39	12	51	
Radical	1	17	18	
Neck dissection	2	34	36	
Facial nerve examination				
Preoperative paralysis	0	6	6	
Postoperative paresis or paralysis	26	17	18	

SD standard deviation, *FNAB* fine needle aspiration biopsy

*Statistically significant

there was a PA predominance between the years 2000–2009 (Z score: 4.8446, $p < 0.001$). On the other hand, WT proportion was slightly higher than PA between years 2010–2019, however, this difference was not statistically significant ($p = 0.272$) (Table 2).

There were 211 FNABs which classified as benign in 157, malignant in 24 and non-diagnostic in 30 samples. Results of FNABs in patients with benign histopathology were reported as benign in 152, malignant in 6 and non-diagnostic in 24 samples. Those with final histopathology reported as malignant diseases were benign in 5, malignant in 18 and non-diagnostic in 6 samples. Of patients with benign histopathology, results of FNAB have revealed a sensitivity of 96.2%, specificity of 78.2%, PPV of 96.8% and NPV of 75%. Of patients with malignant histopathology, results of FNAB have revealed a sensitivity of 78.2%, specificity of 96.2%, PPV of 75% and NPV of 96.8%. Diagnostic odds ratio and accuracy were 91.2% and 93%, respectively (Table 3).

Surgical approaches to the parotid gland were three extracapsular dissections, 229 superficial (109 lower segment partial superficial and 120 complete superficial), 51 total and 18 radical parotidectomies. Extracapsular dissection and partial superficial parotidectomies were performed only for patients with benign FNAB results. Superficial parotidectomies were performed for 203 benign lesion and complete superficial parotidectomy was performed for 26 malignant tumors. Total parotidectomy was performed in 39 benign deep lobe tumors and in 12 malignant tumors. Facial nerve paralysis complication was observed in one patient with benign tumor (facial

Table 3 Accuracy rates of FNAB in benign and malignant diseases

	Benign diseases (%)	Malignant diseases (%)
Sensitivity	96.2	78.2
Specificity	78.2	96.2
Positive predictive value	96.8	75
Negative predictive value	75	96.8
Diagnostic odds ratio	91.2	91.2
Accuracy	93	93

FNAB fine needle aspiration biopsy

Table 2 Distribution of characteristics of pleomorphic adenoma and Warthin tumor

	Pleomorphic adenoma	Warthin tumor	*p* value
Number of patients	114	88	
Between 2000 and 2009	55 (of 82benign tumors)	21 (24WT)	< 0.001*
Between 2010 and 2019	59 (of 135 benign tumors)	67 (68WT)	0.272
Gender			< 0.001*
Male	45	79	
Female	69	9	
M:F ratio	1:1.53	8.77:1	
Mean age, SD (Range)	43.41 ± 15.67 (11 to 76)	57.42 ± 9.42 (38 to 88)	< 0.001*
Side			0.069
R	55	39	
L	59	45	
Bilateral	–	4 (4.5%)	
R:L ratio	1:1.07	1:1.15	
Size (mm)	27.17 ± 11.70	29.01 ± 12.34	0.37
FNAB			
n	86	71	
Pleomorphic adenoma	75	3	
Warthin	1	53	
Smoking history	28 (24.5%)	62 (70.4%)	< 0.001*
Mean Smoking (pack/year)	16.67 ± 13.48	42.01 ± 24.15	< 0.001*
Parotidectomy type			
Partial SP	47	54	
Complete SP	45	29	
Total parotidectomy	22	9	

WT Warthin tumor, *M* male, *F* female, *SD* standard deviation, *R* right, *L* left, *FNAB* fine needle aspiration biopsy, *SP* superficial parotidectomy

*Statistically significant

nerve schwannoma), since facial nerve main truncus and branches could not be identified during parotidectomy. Radical parotidectomy was performed in 17 patients with malignant lesion. Recurrence of the benign tumor was determined in two patients with WT after the first complete superficial parotidectomy. These patients underwent revision parotidectomy and second recurrence was not encountered during two years' follow-up.

Neck dissection was performed in 36 patients. Superficial parotidectomy along with neck dissection was performed in two patients for squamosa cell carcinoma in skin of malar region and in skin of parietal region. The remaining neck dissections were performed in 34 patients with malignant lesion.

Thirteen patients with skin cancer of the face or scalp (squamous cell carcinoma in 11 and malignant melanoma in 2 patients) were performed an elective or therapeutic neck dissection with parotidectomy according to nodal involvement. So, normal parotid gland tissue on histopathological examination occurred in three patients performed parotidectomy and elective neck dissection for skin cancers of the face and scalp. Distribution of all PG lesions was summarized in Table 4.

Facial nerve monitoring was used in 96 (32%) patients, with 61 benign tumors and 35 malignant tumors. When postoperative facial nerve functions after parotidectomy for benign PG tumors were analyzed: none of them had preoperative facial paresis or paralysis. Univariate analysis of the independent factors demonstrated that tumor location and parotidectomy type had a statistically significant effect on postoperative facial paresis ($p < 0.001$). On the other hand, when multivariate logistic regression with enter method was performed to assess the relative effect of independent variables (tumor side, tumor size, tumor location, parotidectomy type and intraoperative facial nerve monitorization status) on facial nerve function results; tumor location (deep lobe tumors) ($p < 0.001$) and tumor size ($p = 0.036$) were observed to effect the postoperative facial nerve function significantly (Tables 5, 6).

Six patients (10.9%) with malignant parotid lesion presented with facial nerve paralysis at admission. Nevertheless, 18 patients undergoing the radical parotidectomy, for one facial nerve schwannoma and 17 malignancies, had permanent facial nerve paralysis in the postoperative period. Whenever facial nerve was seen to apparently infiltrated by the tumor and it could not be dissected adjacent to the tumor tissue, it was sacrificed after confirmation of the malignant tumor by frozen section.

Considering other complications, salivary fistula in 21 (6.9%), sialocele/seroma in 17 (5.5%), wound infection in 16 (5.3%), hematoma in 13 (4.3%) and Frey's syndrome in 10 patients (3.3%) occurred.

Table 4 Distribution of the histopathological results obtained from parotidectomy samples [10]

Histopathology	n	Histopathology	n
Benign tumors		Malignant tumors	
Pleomorphic adenoma	114	Mucoepidermoid carcinoma	11
Warthin tumor	92	Adenoid cystic carcinoma	5
Basal cell adenoma	6	Squamous cell carcinoma	5
Oncocytoma	2	CEPA	3
Myoepithelioma	1	Salivary duct carcinoma	3
Cystadenoma	1	Acinic cell carcinoma	1
Canalicular adenoma	1	PLGA	1
		Adenocarcinoma NOS	1
		Undifferentiated carcinoma	1
		Sebaceous adenocarcinoma	1
		Malignant epithelial tumor	1
Benign lesions		Other malignant neoplasms	
Lipoma	6	Squamous cell carcinoma[1]	11
Lymphoepithelial cyst	4	Lymphoma	8
Sialadenitis	4	Malignant melanoma[1]	2
Normal parotid tissue	3	MPNST	1
Hemangioma	3		
Lymphangioma	2		
Schwannoma	1		
Cyst hydatid	1		
Sjogren syndrome	1		
Aneurismal bone cyst	1		
Branchial cleft cyst	1		
Tuberculosis	1		
Inflammatory pseudotumor	1		
Total	246		55

[1]Tumors arising from scalp or face skin, CEPA: Carcinoma ex pleomorphic adenoma, PLGA: Polymorphous low-grade adenocarcinoma, NOS: not otherwise specified, MPNST: malignant peripheral nerve sheath tumors

Discussion

In the present study, we have demonstrated that pleomorphic adenoma and mucoepidermoid carcinoma were the most common benign and malignant neoplasms of the PG. However, WT was the most common benign tumor for the last ten years' period with a slight predominance as compared to PA. Patients with malignant tumors and WT were observed to have a higher age than other benign tumors and PA, respectively. In addition, there was a male gender predominance for patients with WTs as compared to PA. It was also found that the FNAB have higher sensitivity for detection of the benign tumors and higher specificity for detection of malignant tumors of the PG. Larger tumor sizes and

Table 5 Univariate analysis of the factors with respect to the facial nerve paresis outcome after parotidectomy performed for benign lesions

Facial paresis	Present	Not present	*p* value
Monitoring			0.633
Monitoring (+)	5 (8.7%)	52	
Monitoring (−)	21 (11.3%)	164	
Surgical side			0.307
Right	10 (8.5%)	107	
Left	16 (12.8%)	109	
Location of the tumor			< 0.001*
Superficial lobe	13 (6.3%)	193	
Deep lobe	13 (32.5%)	27	
Mean size of the tumor	34.13 ± 13.77	27.30 ± 12.59	0.333
Parotidectomy type			
Partial superficial	6 (5.5%)	103	< 0.001 (for all)*
Complete superficial	7 (7.4%)	87	0.573(partial vs complete)
Total	13**	27	

*Statistically significant

**One patient (with schwannoma of the facial nerve trunk) had facial nerve paralysis after radical parotidectomy and it was also regarded as total parotidectomy

Table 6 Multivariate logistic regression analysis of the predictive factors on the facial nerve paresis status

Factor	β	SE	Sig	Odds ratio	95% CI
Tumor site (Right sided tumor)	− 0.186	0.461	0.752	0.864	0.348–2.143
Tumor location (Deep lobe tumor)	− 2.341	0.498	< 0.001*	13.51	3.91–45.45
No facial nerve monitoring	0.809	0.573	0.142	2.326	0.754–7.173
Tumor size	− 0.041	0.019	0.036*	1.04	1.003–1.079
Parotidectomy type (Total parotidectomy)	0.435	0.599	0.468	1.544	0.478–4.992
Constant	− 0.014	0.759	0.985	0.986	

B beta-coefficient, *SE* standard error, *Sig* significance, *CI* confidential interval

*Statistically significant

deep lobe tumors were significantly higher associated with postoperative facial nerve paresis after parotidectomy for benign tumors.

Many studies have revealed that WT is associated with a higher age than PA and the other benign tumors [4, 11]. Additionally, salivary gland cancers occur more often in the patients with an advanced age compared to the benign ones [2, 12]. On the other hand, some studies reported that there was no statistically difference in terms of sex and age between benign and malignant diseases of the PG [13]. According to our study, WT presented with a higher age than PA and malignant tumors were encountered in older population than benign diseases.

Most of the previous reports have suggested that WT is frequently seen in male patients and PA in female patients. [4, 5, 11]. A male: female ratio in patients with WT ranges from 11.16:1 to 1.1:1 [5, 14]. Similarly, we found an 8.77:1 ratio (a male: female) in WT and a 1:1.53 ratio in PA. Malignant neoplasms of the PG were more common in male patients [15, 16]. However; in our study, we found that there was no difference between benign and malignant PG tumors regarding the gender differences. Male predominance in benign tumors may arise from the increasing number of WT in our study.

It is well known that WT usually occurs in smokers. Smoker rates among patients with WT were reported to be 70–89% [11, 17]. Additionally, the number of female smokers has almost caught the number of male smokers recently, thus WT has been increasingly seen in females as well [5]. In our study, 70.4% of patients with WT had smoking history and both smoker rate and cigarette use (pack/year) in patients with WT were significantly higher than PA.

Fine needle aspiration biopsy is the most important diagnostic modality for the preoperative diagnosis of PG tumors. However, there is a wide range of sensitivity and specificity rates of FNAB for distinguishing benign tumors from the malignant ones. According to the recent literature reviews, FNAB has a sensitivity of 75.0–82.4% and specificity of 90.4–98.0% in patients with malignant tumors [7, 8, 18]. In our study, we have demonstrated that FNAB has a sensitivity of 96.2% and specificity of 78.2% for benign tumors and has a sensitivity of 78.2% and specificity of 96.2% for malignant tumors.

Pleomorphic adenoma is generally known as the most common tumor of the PG [3] but recent studies have changed this opinion. WT (42.4–50%) was the most common PG benign tumor seen in Germany [4, 19]. Franzen et al. reported that PA occurrence rate decreased from 53.7% to 17.3% among the benign tumors when compared between the first (1975–1986 years) and last decades (2008–2017 years). Additionally, WT occurrence rate increased from 20.6% to 44.9% in the same time period [5]. Similarly, there was a PA predominance in the first decade, whereas WT rates were slightly higher than PA in the second decade, in our study. The increase in WT frequency among the benign tumors may be explained by the increasing the number of female smokers and the widespread use of positron emission tomography (PET-CT) for diagnosis of malignant diseases. Lee et al. showed that 10 patients have any cancer outside the head and neck region had positive 18 fluorodeoxyglucose-uptakes in the parotid region and WT diagnosis was confirmed by biopsy [20]. Incidentaloma in the parotid gland may be seen 0.3–0.4% of PET-CTs obtained from patients with another organ malignancy [21–23]. Warthin tumor accounts for 10.3% of these incidentalomas on PET-CT [21]. Standard uptake value (SUV_{max}) of WT is higher than other tumors, even malignant tumors [22]. Oncocytes use a great deal of glucose due to having profuse mitochondrial contents, this may explain WT has higher SUV_{max} values. In our study, an incidentaloma (WT) which was detected by PET-CT was seen in one patient (1.1%) undergoing parotidectomy. The low rate of malignant transformation in WT and poor general health status in patients both with one or more malignant tumor and with incidental WT need rarely parotidectomy, so true incidence of WT may be much less in patient confirmed by parotidectomy than by FNAB.

Recently, more limited surgeries such as enucleation and partial superficial parotidectomies have been performed instead of complete superficial parotidectomy for benign PG tumors to avoid the complications [24]. Both PA and WT commonly occur in the tail of the PG. Excision of these tumors with partial superficial parotidectomy by dissecting only the cervico-facial branches of the facial nerve is logical with respect to the prevention of complication about eyelid function. Long term follow-up periods demonstrated that the recurrence rates are also reasonable for benign tumors after partial superficial parotidectomy techniques [17]. In our study, recurrent tumor was not seen in patients who underwent partial superficial parotidectomy and only 2 (2.1%) recurrent tumors were seen after the complete superficial parotidectomy. According to our study, there was no significant difference between partial and complete superficial parotidectomy regarding the postoperative facial paresis rates and recurrence rates. Thus, partial superficial parotidectomy could be safely selected for benign PG tumors instead of complete superficial parotidectomy. Although selective deep lobe excision has been described for deep lobe benign tumors of the PG [25], total parotidectomy with preservation of the facial nerve is the surgical technique of choice in our institution. Since most of the patients (55%) with deep lobe tumors were diagnosed as PA, total parotidectomy was more commonly applied for PA than the WT in our study.

Facial nerve paralysis is a devastating complication of parotidectomy. Incidence of temporary facial paresis and permanent facial paralysis is 20–40% and 0–4% after parotidectomy, respectively [26]. Tumor size, location, revision surgery, surgeon's skill and inflammation in PG were reported to be the main factors contributing to the postoperative facial nerve paresis after parotidectomy [26]. Facial paresis after parotidectomy may be strongly associated with deep lobe tumors and larger tumor size [27]. The effect of facial nerve monitoring on facial nerve paresis outcome is controversial. Facial nerve monitoring can help the surgeon to distinguish the facial nerve and its branches from the sensory nerves, non-nerve tissues and fibrotic tissues. Additionally, nerve monitoring may help the surgeon in case of unexpected route of the nerve branches and nerve monitoring may prevent injury to the nerve by warning the surgeon. On the other hand, the main disadvantage of the facial nerve monitor is that; in case of a false negative stimuli, the surgeon may feel in safe condition and may damage the nerve or its branches. [26]. Some studies showed that the nerve-monitored patients had lower facial paralysis rates [28]. On the other hand, other studies could not find a statistically significant difference regarding the postoperative early facial paresis after parotidectomy between the monitored and non-monitored patients [29]. Permanent facial paralysis after parotidectomy performed for benign diseases is a rare condition in both the monitored patients and non-monitored patients [29]. If parotidectomy is performed by an experienced surgeon who has a thorough anatomy knowledge and experience of parotidectomy, facial nerve paresis or paralysis can be seen at much less rates. Facial nerve monitoring may help the surgeons to identify the nerve, but the most important point is almost always an accurate anatomy knowledge of the route of facial nerve trunk and its branches. In our study, all of the parotidectomies were performed by experienced surgeons. According to our study; facial nerve paresis after parotidectomy for benign PG tumors occurred more commonly for deep lobe and bigger tumors as similar to the previous literature [27]. Facial nerve monitoring had no significant effect on facial nerve function outcome for parotidectomies performed by experienced surgeons. Facial nerve monitoring should be used for the medicolegal purposes if available.

Parotidectomy complications other than facial paralysis may be more acceptable and these complications may be managed more easily with conservative approaches than facial nerve complications. Frey's syndrome may develop with reinnervation of sweat glands by parasympatic nerves as a result of raising a thin skin flap. In various series, occurrence rates of parotidectomy complications are 1.7–11.2% in Frey's syndrome, 3.8–12.9% in wound infection, 6.3–9.9% in salivary fistula and 3.8–6.8% in hematoma [30–32].

Lymphangiomas, which usually present at birth, are congenital neck masses especially located on posterior triangle of the neck but occurrence within the parotid gland is uncommon [33]. Diagnosis of these slow-growing masses is established with history, physical examination, FNAB and imaging methods (USG, MRI) [34, 35]. Residual disease may leave in the parotid gland during incomplete removal of lymphangiomas while preserving the facial nerve [34]. Two patients, 13 and 16 years old, had lymphangiomas in region of the parotid gland in this study. Superficial parotidectomy with preservation of the facial nerve for complete removal of cystic mass was performed both of patients. We did not use sclerosing agents such as OKT-3 and bleomycin for treatment of lymphangioma. Any relapsing was not seen long term follow-up of these patients.

Parotid hemangiomas were more commonly seen in children. Hemangiomas in size may regress over time, thus, it rarely occurs in adults [36]. Diagnosis may be made with MRI with contrast agent. Our patients were adults who had hemangiomas that were not seen any regression with age. Therefore, we did not use corticosteroids, beta blocker and some other medications. Management of hemangiomas was performed with superficial parotidectomy.

Sjögren syndrome is an autoimmune disease characterized by xeropthalmia, xerostomia and enlargement of the PG. Sjögren syndrome refractory to medical treatment and cosmetic concerns may necessitate parotidectomy [37]. We performed total parotidectomy to one patient because our patient had aesthetic concerns and recurrent parotitis with intractable pain despite medical treatment.

In conclusion, older age is more commonly associated with WT and malignant tumors. Warthin tumor occurred more often in smoker male patients. FNAB had a high sensitivity for benign tumors and high specificity for malignant tumors. Warthin tumor was the most commonly seen benign tumor in the last decade. Deep lobe tumors and greater tumor size had a significant effect on facial paresis after parotidectomy for benign tumors. The anatomy knowledge and experience of the surgeon seems to be more important than facial nerve monitoring to prevent the facial nerve paresis. Partial superficial parotidectomy is an available surgical method for a small and well-circumscribed benign tumor in tail of the PG.

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Declarations

Conflict of interest All the authors declare no conflict of interest.

Ethics Approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of University Mersin (Date: 04.03.2020/No: 2020/209).

Informed Consent Informed consent was obtained from all individual participants included in the study.

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