



Factors of perioperative depressive and anxiety symptoms in patients with parotid gland tumor and its influence on postoperative complication and quality of life: a cohort study

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Background: Parotid gland tumors (PGTs) are the most common benign neoplasms of salivary gland tumor. Due to its tendency to affect the aesthetic appearance of the face, patients with PGTs are often prone to negative emotions, which seriously affects their recovery. However, there are fewer studies on risk factors associated with the development of anxiety and depression in patients. This study aimed to analyze the risk factors for negative emotions in the perioperative period of PGT patients and their effects on postoperative complication and quality of life and provide a reference basis for improving patient prognosis.

Methods: We retrospectively analyzed 186 patients with PGT admitted to our hospital from August 2017 to August 2021. We evaluated and compiled the general clinical characteristics of the patients. The *t*-test and chi-square test were used to analyze the relationship between patients' negative emotions and prognosis. Multiple linear regression was used to analyze the independent risk factors for negative emotions and poor prognosis of patients in the perioperative period. Patients were followed up 6 months after discharge by outpatient or telephone follow-up.

Results: Among 186 patients with PGT, a total of 43 (23.1%) patients showed symptoms of anxiety and 46 (24.7%) patients showed depression. Multiple linear regression analysis showed that the patients' education ($P=0.001$), with or without hypertension ($P=0.048$), tumor characteristics ($P=0.001$), postoperative complications of transient or permanent facial palsy ($P=0.008$, $P=0.027$), and recurrence ($P=0.018$) were independent risk factors for anxiety among patients, while the patients' educational level ($P=0.018$), tumor metastasis ($P=0.044$), and postoperative Frey syndrome ($P=0.011$) were independent risk factors for depression among patients. In addition, we found that the patients' negative emotions ($P=0.000$), educational level ($P=0.015$), residency ($P=0.027$), with or without hyperlipidemia ($P=0.042$), tumor characteristics ($P=0.000$), surgery time ($P=0.037$), and postoperative complications ($P=0.041$) were independent risk factors for patient prognosis.

Conclusions: PGT patients are prone to various postoperative complications and have a high likelihood of having negative emotions and seriously affects the prognosis. Clinical efforts should pay attention to patients' emotions and demeanor, the identification of relevant risk factors, the adoption of targeted measures to alleviate patients' anxiety and depression, and improve the prognosis.

Keywords: Parotid gland tumor (PGT); negative emotions; anxiety; depression; prognosis

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Introduction

Parotid gland tumors (PGTs) account for 80% of salivary gland tumors and 2% to 3% of head and neck tumors. Among them, 80% are benign, with the most common being the Warthin tumor and pleomorphic adenoma (1). Malignant tumors of the parotid gland account for about 15% of parotid tumors, with mucinous epidermoid carcinoma being the most common and most highly differentiated type (2). The majority of patients with parotid tumors have no obvious conscious symptoms in the early stage of development, and only some of them experience local pain or enlargement in the parotid area, so the optimal time for diagnosis and treatment is easily missed. Different types of parotid tumors exhibit divergent morbidity characteristics, and the benignity and malignancy of tumors cannot be judged by clinical manifestations and medical history alone but must be combined with ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and other ancillary examinations to make a clear diagnosis (3). In addition, Fine Needle Aspiration Biopsy (FNAB) is the basis of diagnosing salivary gland tumors. In a study by Park *et al.* (4), a total of 302 patients were diagnosed with parotid cancer after surgery, and 85 of them had no evidence of malignancy before surgery but were confirmed to be malignant by pathology postoperatively. According to the nature, size, location, relationship with facial nerve and patients' requirements for aesthetics and

other different factors of parotid benign tumor, on the premise of ensuring surgical treatment effect, the surgeon should try to make the incision more hidden on the basis of minimizing postoperative complications, such as the "V" incision with concealed postoperative bruises, in order to achieve the best treatment effect of both aesthetics and function. In view of the surgical effect and postoperative aesthetics, it is necessary to explore the balance between the two and develop as far as possible

Surgery is the main treatment method for PGT (5). In recent years, as a new surgical method, endoscopy-assisted resection of benign parotid tumors not only provides sufficient surgical field of view, but also has the advantages of highly aesthetic incision, rapid postoperative recovery and few complications (6). In addition to the surgical resection of malignant tumors, fast neutron radiation is often used in radiation therapy, which is now ranked as the first choice for the radiotherapy of salivary gland malignancies (7). Both benign and malignant PGTs are prone to postoperative complications, such as facial nerve injury, salivary fistula, periauricular sensory abnormalities, Frey syndrome, recurrence, hematoma in the wound, wound infection and First Bite Syndrome (FBS). One study (8) found that the incidence of salivary fistula after parotidectomy can be as high as 14%. In parotid tumor resection surgery, intraoperative injury to the greater auricular nerve is the main cause of abnormal discomfort of peri-auricular and earlobe sensation among patients (9). FBS is a recognized complication after upper neck surgery involving deep lobe of parotid gland (DLP), parapharyngeal space (PPS), or subtemporal fossa (ITF), and its diagnosis is purely clinical and patient history (10). It is typically characterized by the first bite of each meal experiencing sharp pain in the ipsilateral parotid gland region, which in severe cases may affect an individual's ability to tolerate oral eating. According to the results of Xu *et al.* (11), the incidence of FBS is about 2%. Frey syndrome, also known as auriculotemporal syndrome, refers to symptoms such as transient sweating, flushing, and abnormal sensation of the ipsilateral temporal and anterior ear skin when eating after parotid tumor surgery. Helmus (12) reported that the incidence of Frey syndrome was 1.4% in 146 cases of partial parotidectomy with 10-year follow-up. Another study showed that Frey syndrome occurred in 4–62% of parotidectomized patients between 6 and 18 months after surgery (13–15). It has been suggested that this is due to the regeneration of misaligned postganglionic fibers of the parasympathetic secretory nerve that innervates the parotid gland, causing facial flushing and

Highlight box

Key findings

- Negative emotions have a significant impact on the postoperative complication and quality of life of patients with PGT. According to individual differences, targeted nursing intervention should be supplemented to stabilize the patient's emotions, improve compliance, and enhance their quality of life.

What is known and what is new?

- Negative emotions have a significant impact on the postoperative complication and quality of life of patients with PGT.
- Apart from negative emotions, there are many independent risk factors for the postoperative quality of life of patients with PGT.

What are the implications, and what should change now?

- During surgical treatment of PGT, clinical efforts should pay attention to patients' emotions and demeanor, the identification of relevant risk factors as early as possible, the adoption of targeted measures to alleviate the anxiety and depression of patients, and the prevention of complications, so as to improve their prognosis.

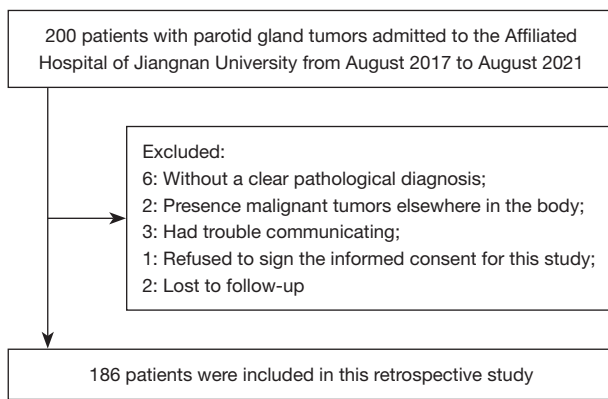


Figure 1 Patient selection flow chart.

sweating when the patient eats (16). Poutoglidis *et al.* showed that the recurrence rate of parotid tumors is as high as 5.7% (17). Inadequate intraoperative resection and rupture during removal are the main causes of the recurrence of benign parotid tumors. Therefore, during the treatment of parotid tumors, we should try to prevent the occurrence of complications intraoperatively, according to different factors such as the nature, size, location, and relationship with the facial nerve of the tumor, and if they occur after surgery, we should intervene as early as possible to achieve early detection and treatment (18).

Benign PGTs generally have a better prognosis, and despite the longer postoperative recovery period, careful care and improved patient compliance can significantly improve patient prognosis. In the process, however, there has been a growing recognition that mental health issues are a growing part of the unmet needs of cancer survivors, including in the form of anxiety and depression, and that mental health can have a significant impact on patient outcomes (19). Because of the special location of parotid gland tumor surgery, postoperative aesthetics often become the focus of attention of patients, and some patients may even have negative emotions. In addition, a study has shown that age, gender, tumor malignancy and other factors are risk factors for negative emotions in cancer patients (20). However, there are few studies on the risk factors for negative emotions in patients with PGTs. The present study aims to analyze the risk factors for negative emotions in the perioperative period and their impact on the prognosis of patients with PGT to provide a reference for improving the prognosis of patients. We present the following article in accordance with the STROBE reporting checklist (available at <https://gs.amegroups.com/>

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Methods

Research participants

In total, 200 PGT patients admitted to the Affiliated Hospital of Jiangnan University from August 2017 to August 2021 were included in this study. The pathological classification of this study referred to the 2005 histopathological classification of salivary gland tumors (21).

Inclusion criteria: (I) all case data were diagnosed by clear pathological diagnosis, tumor onset site in the parotid area, and complete case data; (II) patients who voluntarily signed the informed consent; (III) parotid tumors were the primary tumors (*Figure 1*).

Exclusion criteria: (I) patients who were treated after surgery without a clear pathological diagnosis or incomplete information; (II) patients with malignant tumors elsewhere in the body; (III) those with consciousness and communication disorders; (IV) those with psychiatric disorders and patients who were unable to follow medical advice (*Figure 1*).

The number of patients to be included in this study combined the findings of the previous study group on the incidence of PGTs and the work experience of our researcher, and included all patients with PGTs in the department of stomatology of Affiliated Hospital of Jiangnan University during 5 years. Based on the inclusion and exclusion criteria, a total of 200 cases were proposed to be included. A total of 14 cases were lost due to lost visits, and 186 patients were finally included in this study. All patients received Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) scores 3 days prior to discharge. Patients were followed up 6 months after discharge by outpatient or telephone follow-up, and World Health Organization Quality of Life Scale (WHOQOL) were used to assess the postoperative and quality of life of patients at the last follow-up.

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by Ethics Committee of Affiliated Hospital of Jiangnan University (No. LCKY2021132) and informed consent was taken from all the patients.

General information questionnaire

The general information questionnaire included demographic

data (gender, age, education level, residency, children or not, spouse or not, etc.) and clinical data (hypertension history, hyperlipidemia history, diabetes history, tumor characteristics, tumor metastasis, intraoperative bleeding, surgery time, hospitalization time, postoperative complications, etc.).

Negative emotion assessment

The SAS was used to reflect the existence and degree of anxiety. This scale consists of 20 items, each rated from 1 to 4. The scores of each item were added together to obtain a crude score and then multiplied by 1.25 to obtain a standard score. The evaluation criteria are SAS score >50 , 50–59 for mild anxiety, 60–69 for moderate anxiety, and ≤ 70 for severe anxiety. The scale has good reliability and validity, and Cronbach's α coefficients were above 0.75.

The SDS was used to reflect the existence and degree of depression. This scale consists of 20 items, and an SDS score >52 was used as the evaluation criterion. An SDS ≥ 53 was classified as depression, 53–62 as mild depression, 63–72 as moderate depression, and >72 as severe depression. The SDS has good reliability and validity, and Cronbach's α coefficients were above 0.75.

Prognostic evaluation

Quality of life evaluation

The quality of life of patients was assessed according to the World Health Organization Quality of Life Scale (WHOQOL) at 6 months after surgery, which includes four dimensions to evaluate patients' postoperative quality of life, including social domain (SOCIL), environmental domain (ENVIR), psychological domain (PSYCH), and physiological domain (PHYS). The higher the score, the better the quality of life.

The last follow-up visit occurred in February 2022.

Postoperative recurrence

Tumor recurrence was defined as the re-growth of the tumor as primary cancer at or near the same site during the follow-up period. All enrolled patients were followed up for 1 year by telephone, internet, or outpatient service to determine whether the tumor had recurred.

The last follow-up occurred in August 2022.

Statistical analysis

The results of each scale were entered into a computer for

score conversion, and statistical analysis was performed using SPSS 26 (IBM SPSS, USA), with measured data expressed as the mean and standard deviation and count data expressed as frequencies and percentages. Statistical analysis between the groups was performed using the *t*-test and chi-square test, and multiple linear regression analysis was conducted to determine the independent risk factors for negative mood and poor prognosis in patients during the perioperative period. Two-sided $P < 0.05$ was considered statistically significant.

Results

Baseline data

The baseline characteristics of the patients are shown in *Table 1*. A total of 189 patients with parotid tumors were included in this study, among which 91 (48.92%) were males and 95 (51.08%) were females. Also, 22 patients (11.83%) had malignant tumors and 164 patients (88.17%) had benign tumors. The SAS scores were 50.68 ± 7.45 and 44.27 ± 8.07 in these two groups, respectively, and the SDS scores were 51.95 ± 6.73 and 46.46 ± 7.90 , respectively. The patients' anxiety and depression scores differed significantly between the two groups ($P < 0.05$). A total of 178 patients (95.70%) had spouses and 8 patients (4.30%) had no spouse, while the SAS scores were 44.76 ± 8.10 and 51.13 ± 9.67 in these two groups, respectively, which were statistically different ($P < 0.05$). In addition, a total of 89 patients (47.85%) had high school or higher education and 97 patients (52.15%) had less than high school education. Their SAS scores were 46.96 ± 8.89 and 43.27 ± 7.23 , respectively, and their SDS scores were 48.46 ± 7.89 and 45.88 ± 7.84 , respectively.

Furthermore, the patients' anxiety and depression scores were likewise significantly different in both groups ($P < 0.05$). Sixty-eight patients (36.56%) with concurrent hypertension had a SAS score of 46.75 ± 8.93 , while 118 patients (63.44%) with no hypertension had a SAS score of 44.04 ± 7.70 , which was significantly lower than that in the group with concurrent hypertension ($P < 0.05$). The SAS scores were 53.75 ± 6.13 and 44.84 ± 8.20 , respectively, and the SDS scores were 59.50 ± 7.19 and 46.84 ± 7.77 in the two groups, respectively. The anxiety and depression scores were significantly higher in those with distant metastases than in the non-metastatic group ($P < 0.05$). In conclusion, the nature of the tumor, education level, and whether distant metastasis occurred significantly influenced the SAS and SDS scores of patients. In addition, the presence

Table 1 SAS and SDS scores in patients with parotid gland tumors

Item	N (%)	SAS			SDS		
		Mean ± SD	t/F	P	Mean ± SD	t/F	P
Age (years)			0.491	0.624		1.679	0.095
≤40	29 (15.59)	45.72±8.18			49.38±7.14		
>40	157 (84.41)	44.90±8.28			46.69±8.04		
Gender			0.212	0.833		0.529	0.597
Male	91 (48.92)	44.90±8.78			47.43±8.24		
Female	95 (51.08)	45.16±7.75			46.81±7.69		
Benignity or malignancy tumor			3.748	0.001		3.112	0.002
Benign	164 (88.17)	44.27±8.07			46.46±7.90		
Malignant	22 (11.83)	50.68±7.45			51.95±6.73		
Fertility or not			0.060	0.952		1.430	0.154
Have children	180 (96.77)	45.04±8.24			46.96±7.98		
No children	6 (3.23)	44.83±9.48			51.67±5.99		
Spouse or not			2.156	0.032		1.510	0.133
Have spouse	178 (95.70)	44.76±8.10			46.93±7.76		
No spouse	8 (4.30)	51.13±9.67			51.25±11.22		
Education level			3.116	0.002		2.238	0.026
High school and above	89 (47.85)	46.96±8.89			48.46±7.89		
Below high school	97 (52.15)	43.27±7.23			45.88±7.84		
Residence			1.391	0.166		1.082	0.281
Countryside	94 (50.54)	44.20±8.73			46.49±8.03		
City	92 (49.46)	45.88±7.68			47.75±7.86		
Hypertension or not			2.177	0.031		0.560	0.576
Yes	68 (36.56)	46.75±8.93			47.54±8.27		
No	118 (63.44)	44.04±7.70			46.86±7.78		
Hyperlipidemia or not			0.928	0.355		0.837	0.404
Yes	78 (41.94)	44.37±7.49			46.54±7.53		
No	108 (58.06)	45.51±8.76			47.53±8.25		
Diabetes or not			1.286	0.200		0.344	0.732
Yes	69 (37.10)	46.04±7.95			46.86±7.70		
No	117 (62.90)	44.44±8.40			47.26±8.13		
Presence of distant metastases or not			2.158	0.032		3.229	0.001
Yes	4 (2.15)	53.75±6.13			59.50±7.19		
No	182 (97.85)	44.84±8.20			46.84±7.77		

SAS, Self-Rating Anxiety Scale; SDS, Self-Rating Depression Scale; SD, standard deviation.

Table 2 Multiple linear regression analysis of SAS scores

Related factor	B	SE	t	P
Malignant tumor	-6.060	1.841	-3.291	0.001
No spouse	-3.797	2.738	-1.387	0.167
High school and above	3.552	1.086	3.271	0.001
Presence of distant metastases or not	0.600	4.158	0.144	0.885
Hypertension	2.275	1.140	1.996	0.048
Salivary fistula	-2.562	2.250	-1.139	0.256
Skewed corners of the mouth	0.904	2.487	0.364	0.717
Bleeding	-3.143	2.820	-1.114	0.267
Facial paresis or transient paralysis	6.476	2.432	2.663	0.008
Frey syndrome	2.725	1.946	1.401	0.163
Permanent facial palsy	5.425	2.437	2.226	0.027
Relapse during 1 year of follow-up	5.498	2.311	2.379	0.018

SAS, Self-Rating Anxiety Scale; SE, standard error.

Table 3 Multiple linear regression analysis of SDS scores

Related factor	B	SE	t	P
Malignant tumor	-3.236	1.862	-1.737	0.084
No spouse	-2.308	2.769	-0.834	0.406
High school and above	2.616	1.098	2.382	0.018
Presence of distant metastases or not	8.530	4.205	2.028	0.044
Salivary fistula	-0.059	2.170	-0.027	0.978
Skewed corners of the mouth	4.500	2.432	1.850	0.066
Bleeding	-2.775	2.688	-1.033	0.303
Facial paresis or transient paralysis	0.697	2.349	0.297	0.767
Frey syndrome	4.814	1.869	2.576	0.011
Permanent facial palsy	2.436	2.327	1.047	0.296
Relapse during the 1 year of follow-up	3.875	2.240	1.730	0.085

SDS, Self-Rating Depression Scale; SE, standard error.

of concurrent hypertension and a spouse also significantly influenced the SAS scores of patients.

Risk factors of patients' anxiety and depression analyzed by multiple linear regression

Patient's higher education, those with hypertension, malignant tumors, facial paresis or transient paralysis, and relapse during 1 year of follow-up were independent risk

factors for patient anxiety, as shown in *Table 2*. Meanwhile, high education, tumor metastasis, and Frey syndrome in patients after surgery were independent risk factors for patient depression, as shown in *Table 3*.

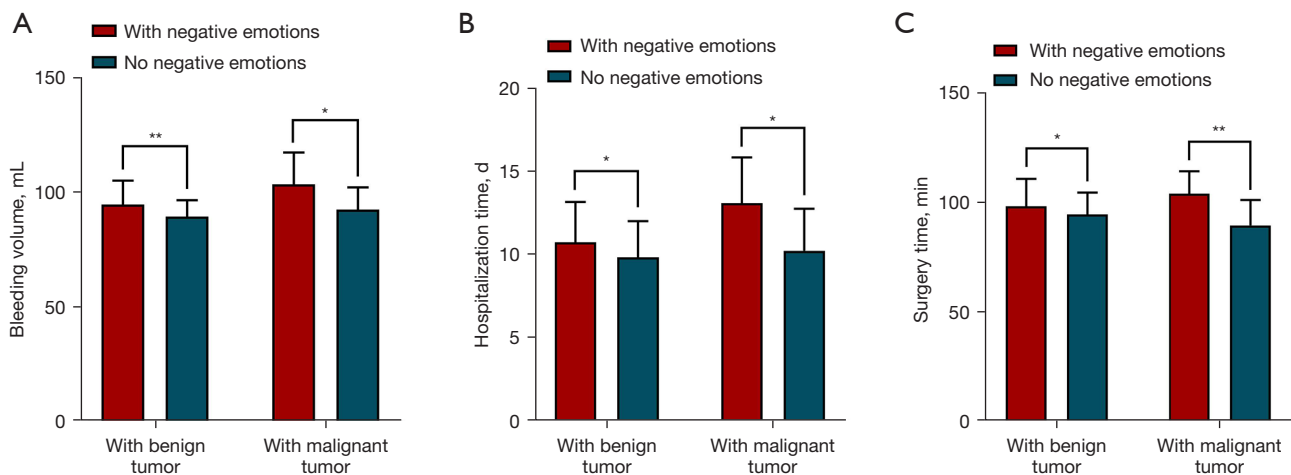
Prognostic indicators of patients with parotid tumors

Among the prognostic indicators of patients with benign parotid tumors, there were 45 patients (27.44%) with

Table 4 Comparison of the prognostic indicators for patients with parotid gland tumors

Item	N (%)	Bleeding volume, mL (mean ± SD)	Hospitalization time, d (mean ± SD)	Surgery time, min (mean ± SD)
Patients with benign tumors				
With negative emotions	45 (27.44)	94.69±10.33	10.73±2.42	98.27±12.44
No negative emotions	119 (72.56)	89.43±7.07	9.83±2.18	94.48±10.04
t		-3.148	-2.293	-2.014
P		0.003	0.023	0.046
Patients with malignant tumors				
With negative emotions	9 (40.91)	103.33±14.00	13.008±2.74	104.00±10.24
No negative emotions	13 (59.09)	92.46±9.61	10.23±2.52	89.54±11.61
t		-2.168	-2.408	-3.083
P		0.042	0.028	0.006

SD, standard deviation.

**Figure 2** Comparison of bleeding volume (A), hospitalization time (B), and surgery time (C) of patients with parotid gland tumors. *, $P < 0.05$; **, $P < 0.01$.

negative emotions, whose mean bleeding volume was 94.69 ± 10.33 mL, mean hospitalization time was 10.73 ± 2.42 d, and mean operative time was 98.27 ± 12.44 min. Meanwhile, there were 119 patients (72.56%) without negative emotions, whose mean bleeding volume was 89.43 ± 7.07 mL, mean hospitalization time was 9.83 ± 2.18 d, and mean operative time was 94.48 ± 10.04 min, all of which were significantly lower than those in the negative emotion group ($P < 0.05$).

Among the patients with malignant parotid tumors, there were 9 patients (40.91%) with negative emotions, whose mean bleeding volume was 103.33 ± 14.00 mL, mean hospitalization time was 13.08 ± 2.74 d, and mean operative

time was 104.00 ± 10.24 min. Meanwhile, there were 13 patients (59.09%) without negative emotions, whose mean bleeding volume was 92.46 ± 9.61 mL, mean hospitalization time was 10.23 ± 2.52 d, and mean operative time was 89.54 ± 11.61 min, all of which were significantly lower than the negative emotion group ($P < 0.05$), as shown in *Table 4* and *Figure 2*.

Complications

In patients with benign PGTs, there were significant differences in the presence or absence of negative emotions

Table 5 Complications in patients with parotid gland tumors

Item	Salivary fistula, n (%)		Skewed corners of the mouth, n (%)		Bleeding, n (%)		Facial paresis or transient paralysis, n (%)		Frey syndrome, n (%)		Permanent facial palsy, n (%)		Relapse during 1 year of follow-up, n (%)			
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No		
Patients with benign tumor																
With negative emotions	45 (27.44)	1 (2.2)	44 (97.8)	6 (13.3)	39 (86.7)	1 (2.2)	44 (97.8)	6 (13.3)	39 (86.7)	6 (13.3)	37 (82.2)	8 (17.8)	6 (13.3)	39 (86.7)	7 (15.6)	38 (84.4)
No negative emotions	119 (72.56)	9 (7.6)	110 (92.4)	4 (3.4)	115 (96.6)	6 (5.0)	113 (95.0)	4 (3.4)	115 (96.6)	6 (5.0)	113 (95.0)	4 (3.4)	115 (96.6)	3 (2.5)	116 (97.5)	
χ^2	1.627			5.671		0.635		5.671		6.783		5.671		9.689		
P	0.202			0.017		0.425		0.017		0.009		0.017		0.002		
Patients with malignant tumor																
With negative emotions	9 (40.91)	2 (22.2)	7 (77.8)	1 (11.1)	8 (88.9)	0 (0.0)	9 (100.0)	2 (22.2)	7 (77.8)	2 (22.2)	7 (77.8)	2 (22.2)	7 (77.8)	2 (22.2)	7 (77.8)	
No negative emotions	13 (59.09)	1 (7.7)	12 (92.3)	0 (0.0)	13 (100.0)	1 (7.7)	12 (92.3)	0 (0.0)	13 (100.0)	2 (15.4)	11 (84.6)	0 (0.0)	13 (100.0)	1 (7.7)	12 (92.3)	
χ^2	0.953			1.513		0.725		3.178		0.167		3.178		0.953		
P	0.329			0.219		0.394		0.075		0.683		0.075		0.329		

($P < 0.05$) between the two groups of patients with skewed corners of the mouth, facial paresis or transient paralysis, Frey syndrome, permanent facial palsy, and relapse during the 1 year follow-up period, while there were no significant differences in postoperative salivary fistula and bleeding. In patients with malignant PGTs, none of the complications were significantly different between the groups with or without negative emotions, as shown in *Table 5*.

WHOQOL and its analysis by multiple linear regression for patients with parotid tumors

In patients with benign parotid tumors, the physical domain scores were 21.78 ± 6.12 versus 24.14 ± 5.28 for those with and without combined negative emotions; 17.22 ± 4.63 versus 19.33 ± 4.52 in the psychological domain; and 19.93 ± 5.98 versus 23.96 ± 7.25 in the environmental domain, and the differences in these three domains were significantly different ($P < 0.05$), as shown in *Table 6* and *Figure 3A*. In contrast, among patients with malignant PGTs, only the physical and psychological domains differed significantly between patients with and without negative emotions ($P < 0.05$). Their physical domain scores were 12.11 ± 4.01 versus 18.31 ± 5.65 , respectively, and their psychological domain scores were 12.22 ± 3.60 versus 16.38 ± 4.46 , respectively (*Table 6, Figure 3B*).

Multiple linear regression analysis showed that malignancy, higher literacy, living in an urban area, concurrent hyperlipidemia, prolonged surgery, having negative emotions, and the occurrence of complications were independent risk factors affecting the prognosis of patients (*Table 7*).

Discussion

Salivary gland tumors are a more complex type of head and neck tumor, among which approximately 60–80% are located in the parotid gland, which are known as parotid tumors (22,23). In our study, 88% of parotid tumors were benign and 12% were malignant, which is consistent with previous reports (24-26), highlighting that benign parotid tumors currently account for the vast majority of tumors. However, this does not mean that patients do not need to pay attention to them. Different pathological types have varying qualities. For example, the most common pleomorphic adenoma has the potential for malignant transformation and a tendency to recur even after treatment (27). Moreover, regardless of whether the

Table 6 WHOQOL of patients with parotid gland tumors

Item	N (%)	PHYS (mean ± SD)	PSYCH (mean ± SD)	SOCIL (mean ± SD)	ENVIR (mean ± SD)
Patients with benign tumor					
With negative emotions	45 (27.44)	21.78±6.12	17.22±4.63	8.51±2.93	19.93±5.98
No negative emotions	119 (72.56)	24.14±5.28	19.33±4.52	9.14±2.73	23.96±7.25
t		2.447	2.645	1.298	3.320
P		0.015	0.009	0.196	0.001
Patients with malignant tumor					
With negative emotions	9 (40.91)	12.11±4.01	12.22±3.60	6.33±2.12	14.78±4.79
No negative emotions	13 (59.09)	18.31±5.65	16.38±4.46	7.23±3.06	15.77±5.70
t		2.825	2.319	0.760	0.427
P		0.010	0.031	0.456	0.674

WHOQOL, The World Health Organization Quality of Life; PHYS, physiological domain; SD, standard deviation; PSYCH, psychological domain; SOCIL, social domain; ENVIR, environmental domain.

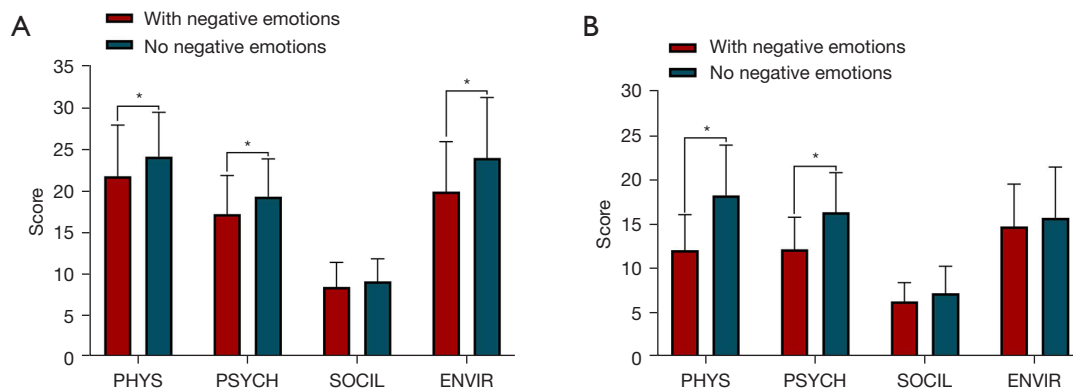


Figure 3 WHOQOL of patients with benign (A) versus malignant (B) parotid gland tumors. *, $P < 0.05$. PHYS, physiological domain; PSYCH, psychological domain; SOCIL, social domain; ENVIR, environmental domain; WHOQOL, The World Health Organization Quality of Life.

tumor is benign or malignant, it will affect the facial nerve function, facial appearance, and swallowing function, including through transient or permanent facial palsy, skin ulcers, and swallowing disorders, or worse, it will affect the symmetry and aesthetics of the patient's face. This can easily trigger a strong psychological stress response in patients, resulting in negative emotions such as anxiety and depression. The results of this study found that patients' education, hypertension, tumor malignancy, postoperative complications including transient or permanent facial palsy, and recurrence were independent risk factors for anxiety, while patients' education, tumor metastasis, and postoperative Frey syndrome were independent

risk factors for depression. The patient's educational level often determines his or her knowledge of medical science, and the more knowledgeable the patient is about medical science, the more worried he or she is about it, which greatly increases their psychological burden and contributes to negative emotions. Transient or permanent facial palsy and Frey's syndrome after surgery can mean a loss of physical integrity and reduced aesthetics for the patient. This can be psychologically difficult for patients, who often appear to be restless, fearful, and anxious, and even have a strong psychological stress response, which can have a negative impact on the body. Therefore, according to their psychological condition, medical staff should

Table 7 Multiple linear regression analysis of WHOQOL

Related factor	B	SE	t	P
Age (years)	-0.037	0.080	-0.464	0.643
Gender	-1.475	1.428	-1.033	0.303
Benign or malignant tumor	22.277	2.541	8.767	0.000
Fertility or not	0.090	4.320	0.021	0.983
Spouse or not	3.103	3.528	0.879	0.380
Education level	-3.537	1.443	-2.450	0.015
Residence	-3.197	1.434	-2.230	0.027
Hypertension or not	-0.780	1.472	-0.530	0.597
Hyperlipidemia or not	-2.959	1.443	-2.051	0.042
Diabetes or not	1.073	1.459	0.735	0.463
Presence of distant metastases or not	5.855	5.487	1.067	0.288
Bleeding volume	0.070	0.084	0.831	0.407
Hospitalization time	-0.159	0.313	-0.510	0.611
Surgery time	-0.139	0.066	-2.097	0.037
With negative emotions or not	-9.068	1.784	-5.084	0.000
With complications or not	3.237	1.571	2.061	0.041

WHOQOL, The World Health Organization Quality of Life; SE, standard error.

encourage patients to alleviate their fears and reduce their psychological burden and choose different ways to communicate with patients according to their different levels of understanding of the disease and their different psychological tolerance. This will help to enhance their confidence in treatment, guide them to treat the disease correctly, and actively cooperate with the treatment.

Currently, surgical resection is still the preferred treatment for PGT. Various surgical methods include superficial parotidectomy, partial superficial parotidectomy, total parotidectomy, and radical parotidectomy (28). It has been reported in the literature that the incidence of nerve palsy after superficial parotidectomy is 15–25% and 20–50% after total parotidectomy, while the incidence of permanent facial nerve palsy is 5–10%, and salivary fistula can occur in up to 14% of cases (10,29). McGurk *et al.* (30) reported incidence rates of 5% and 10% for Frey's syndrome and transient facial nerve palsy, respectively. A meta-analysis of nine studies (involving a total of 1,882 patients) by Albergotti *et al.* (31) showed transient facial nerve palsy in 8% of patients and Frey's syndrome in 4.5% of patients. Together, these findings suggest that complications after

parotid tumor surgery are relatively common, which can seriously affect the prognosis of patients. Our study found that the benignity of the tumor, whether the patient had negative emotions, the operative time, and whether there were postoperative complications were independent risk factors affecting the patient's prognosis. This requires medical staff to protect the important anatomical structures of the maxillofacial region intraoperatively and to avoid postoperative complications as much as possible. For example, the surgeon can adequately dissect and protect the parotid ducts, ligate and remove the branch ducts in the surgical area, and provide adequate postoperative negative pressure drainage to reduce or avoid postoperative salivary fistulae. In addition, they can also fill the defective surgical cavity with fillers to reduce the degree of depression in the surgical area, and establish a barrier between the parasympathetic nerve endings in the parotid gland and the skin and sweat glands to prevent misaligned nerve growth, thereby preventing Frey syndrome.

In addition, negative emotion is also an important factor affecting the patient's prognosis. According to different factors, such as characteristics of the parotid tumor, its size,

location, and relationship with the facial nerve, doctors should try to ensure a more concealed incision based on minimizing postoperative complications while ensuring the surgical treatment effect, so as to achieve the best treatment effect that takes into account both aesthetics and function, thus reducing patients' psychological burden and enabling them to better cooperate with the rehabilitation treatment.

Our study also found that the recurrence rate of benign parotid tumors was around 2.5–15.6% within 1 year after surgery, which is higher than the 1–5% recurrence rate reported in the literature (32), indicating that although the tumors are benign, they still have a high level of recurrence, probably due to incomplete resection, rupture of the envelope, or satellite lesions. Therefore, to prevent the recurrence of both benign and malignant tumors, physicians should carefully and comprehensively evaluate the size of the mass and confirm the extent of mass excision based on physical examination results and imaging data preoperatively, and also pay attention to the tumor-free principle intraoperatively to prevent tumor rupture and implantation, thereby avoiding tumor recurrence to the greatest extent, improving the postoperative quality of life of patients, and enhancing their prognosis.

The main drawback of this study is that due to limited manpower and time, the follow-up period was short and the prognosis of patients could not be followed up continuously and the postoperative survival rate of the two groups could not be studied. Therefore, we recommend that a longer follow-up period be applied in future studies.

Conclusions

PGT patients are prone to various postoperative complications and still have a high possibility of negative emotions. Clinical efforts should pay attention to patients' emotions and demeanor, the identification of relevant risk factors as early as possible, the adoption of targeted measures to alleviate patients' anxiety and depression, and the prevention of complications, so as to improve the prognosis of patients.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by Ethics Committee of Affiliated Hospital of Jiangnan University (No. LCKY2021132) and informed consent was taken from all the patients.

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