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Original Article

A comparison of the effects of partial superficial parotidectomy and superficial parotidectomy on the postoperative parotid absorption and secretion functions in the treatment of pleomorphic adenoma

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Abstract: Objective: This study aimed to compare the effects of partial superficial parotidectomy (PSP) and superficial parotidectomy (SP) in the treatment of pleomorphic adenoma (PA). Methods: 75 PA patients admitted to our hospital from July 2018 to June 2019 were selected for a retrospective analysis based on their clinical data and randomly divided into a control group (CG), which included 37 patients treated with SP, and an observation group (OG), which included 38 patients treated with PSP, so as to compare the operative situations, postoperative parotid absorption, secretion functions, incidences of complications, recurrence rates (RR), and satisfaction with the operative results in the two groups. Results: (1) The operative durations (OD) of the OG were much shorter than they were in the CG ($P<0.05$); the number of dissected facial nerve branches in the OG was much lower than it was in the CG ($P<0.05$); the excision lengths (IL) of the OG were much shorter than they were in the CG ($P<0.05$); and there was no statistical difference in the intraoperative blood loss (IBL) in the two groups ($P>0.05$). (2) The parotid absorption rates (PAR) of the OG were much higher than they were in the CG at 3, 6, and 12 months after the operations ($P<0.05$). (3) The parotid secretion index (PSI) of the OG was much higher than it was in the CG 3 at 6 and 12 months after the operations ($P<0.05$). (4) The complication incidence of the OG was 18.42% within 2 years after the operations, lower than the 40.54% in the CG ($P<0.05$). (5) The RR was 0.00% in the OG and 2.70% in the CG during the 2-year follow-up period ($P>0.05$). (6) The OG's satisfaction with their postoperative facial appearances was 92.11%, higher than the 72.97% of the CG ($P<0.05$). Conclusion: Compared with SP, PSP can achieve a better therapeutic effect in the treatment of PA, with a faster recovery of the postoperative parotid absorption and secretion functions and higher satisfaction with the postoperative facial appearance.

Keywords: Pleomorphic adenoma, partial superficial parotidectomy, superficial parotidectomy, parotid absorption, secretion function, treatment

Introduction

Most benign parotid tumors, which have a relatively high incidence rate, are salivary gland tumors, myoepithelioma, adenolymphoma, and PA. Of these, PA has a higher incidence and occurs more frequently in superficial lobe of the parotid gland [1]. Many treatment methods have been proposed for PA, but postoperative RR is common in the cases of enucleation or extracapsular dissection (ECD) due to the lack of a complete capsule and the complex pathobiological characteristics of multiple nodes and tumor budding [2, 3]. Statistical data show that the 5-year postoperative RR rate exceeds 40% after enucleation or ECD [4].

Researchers have found that a parotidectomy can effectively reduce the RR. But the parotid gland is closely connected with the facial nerve, so parotidectomy increases the risk of facial paralysis (FP) and leads to severe facial depression, which seriously affects patients' facial appearance [5, 6]. SP has always been a standard method for PA. The whole superficial lobe is excised to reduce RR and avoid severe facial

deformity. But the risk of facial nerve injury is relatively high due to the five dissected facial nerve branches in SP [7]. Now, PSP has been gradually applied in clinical practice. With no need of complete facial nerve dissection (FND), the risk of facial nerve injury and RR are reduced and the normal tissues in the superficial lobe of the parotid gland are excised in small amounts, so it is widely used in clinical practice [8].

However, there are few studies on this and no unified conclusion about the difference in the preservation of parotid absorption and the secretion function between PSP and SP. 75 PA patients were selected as our study cohort to compare and analyze the therapeutic effects of the two operative methods, aiming to seek a safer treatment for PA.

Materials and methods

Materials

75 PA patients admitted to our hospital from July 2018 to June 2019 were selected for this retrospective analysis based on their clinical data and randomly divided into the CG, which included 37 patients aged 21-75 years old, and the OG, which included 38 patients aged 19-72 years old. This study was approved by the Ethics Committee of Shanghai Huangpu District Second Center for Dental Disease Prevention and Control. (1) Inclusion criteria: This study included patients diagnosed with parotid gland masses in our hospital; those treated for the first time; those who could tolerate an operation based on their physical examinations; and those who were informed of the research protocol and willingly signed the informed consent form. The pathological type and gender were not limited. (2) Exclusion criteria: This study excluded patients who planned to get pregnant; those with the lesion adhered to the adjacent tissues and fixed; those with the lesion on both sides of the parotid gland; those with the lesion in an accessory parotid gland or in the whole lobe or the deep lobe of the parotid gland; those without PA; and those with renal dysfunction.

Methods

The CG was treated with SP, with the operative procedures shown below. A Blair S-shape incision was made after successful routine anesthesia. The skin, subcutaneous tissues and parotid fascia were excised and sharply separated along the deep side of the parotid fascia to form the cutaneous flap and fully expose the tumor. The flap was reversed forward to dissect the facial nerve branches, excise the tumor and superficial lobe, ligature the parotid duct, suture the nub of gland, and suture the parotid fascia, subcutaneous tissues and the skin layer by layer. After the negative pressure drainage, the operation was completed.

The OG was treated with PSP, with operative procedures shown below. An incision was made after the successful routine anesthesia. If the tumor was located at the posterioinferior portion of the parotid gland, an arc incision was made from the position between the postauricular region and the earlobe down to a position 1-2 cm below the angle of the mandible. If the tumor was located in the preauricular region, an incision was made from the horizontal plane of the tragus down to the plan position of the angle of the mandible. The skin, subcutaneous tissues and parotid fascia were excised in sequence and sharply separated along the deep side of parotid fascia to form the cutaneous flap and to fully expose the tumor. The facial nerve branches were dissected according to the actual situation of the tumor after the flap was reversed forward. If the tumor was located in the preauricular region, the zygomatic and temporal branches of the facial nerve were dissected. If the tumor was located at the front edge of the parotid gland, the buccal and zygomatic branches of the facial nerve were dissected. If the tumor was located in the subauricular region, the marginal mandibular branch of the facial nerve was dissected. The great auricular nerve was dissected by excising the branch of the great auricular nerve that extended into the gland. Next, the tumor and its adjacent normal gland tissues with a width of 0.5-1.0 cm were excised, the parotid master duct was reserved, the branch parotid duct was ligatured, and the nub of the gland was sutured. The parotid fascia, subcutaneous tissues, and skin were sutured in sequence. After the negative pressure drainage, the operation was completed.

Observation targets

Operative situation: The two groups were compared in terms of OD, IBL, number of dissected facial nerve branches, and IL.

Table 1. Comparison of the general information in the two groups ($\bar{x}$±s)/[n (%)]

Material		OG (n = 38)	CG (n = 37)	t/X^2	*P*
Gender	Male	23 (60.53)	20 (54.05)	0.321	0.571
	Female	15 (39.47)	17 (45.95)		
Age (years old)		50.27±13.62	52.29±13.38	0.648	0.519
GTD (cm)		3.26±1.16	3.28±1.14	0.075	0.940
BMI (kg/^{2})		22.13±2.16	22.18±2.19	0.010	0.921
Unaffected side	PAR	7.82±0.95	7.86±0.96	0.181	0.857
	PSI	60.86±5.13	60.72±5.19	0.117	0.907

Postoperative PAR: The PAR was measured and compared between the two groups before the operation and at 3, 6, and 12 months after the operation. Salivary gland imaging was performed at each time point after the oral administration of vitamin C. Then, senior physicians drew the roughly circular region of interest (ROI) and the time-activity curve (TAC) for both sides of the parotid gland based on the baseline of the tempus on the left side. Absorption rate = (maximum value before vitamin C stimulation-minimum value after vitamin C stimulation)/maximum value before vitamin C stimulation.

Postoperative PSI: The two groups were compared in terms of their parotid secretions before the operation and at 3, 6, and 12 months after the operation. The salivary gland imaging was performed at each time point after the oral administration of vitamin C. Then, senior physicians drew the roughly circular ROI and the TAC for both sides of the parotid gland based on the baseline of the tempus on the left side. Secretion index = (maximum value before vitamin C stimulation-mean value of base number)/(maximum value before vitamin C stimulation-minimum value after vitamin C stimulation) * 100.

Complications: The two groups were followed up for 2 years after their operations to record the incidences of FP, Frey syndrome, salivary fistulas, cumulative salivation, and periotic skin numbness during the follow-up period.

Recurrence: The two groups were followed up for 2 years after their operations to record the recurrence situation during the follow-up period.

Satisfaction with facial appearance: The patients' satisfaction with their facial appearance was evaluated at discharge using the Visual Analogue Scale (VAS) by selecting a number from 0 to 10 on a scale plate, with 10 representing complete satisfaction and 0 representing complete dissatisfaction. A score of 10 meant full satisfaction, scores from 6-9 meant partial satisfaction, and scores from 0-5 meant dissatisfaction. Satisfaction = full satisfaction rate + partial satisfaction rate.

Statistical methods

SPSS 22.0 was used for the statistical analysis. The measurement data were represented as the mean ± standard deviation, and the results between groups were compared using independent-samples *t* tests. The enumeration data were represented by [n (%)], and the results between groups were compared using X^2 tests. The multi-point comparisons in the groups were performed using ANVOA and F tests. $P<0.05$ meant that a difference was statistically significant.

Results

Comparison of the general information in the two groups

The two groups showed no significant differences in terms of their gender ratio, average age, greatest tumor diameter (GTD), average body mass index (BMI), or PAR and PSI on the unaffected side ($P>0.05$) (**Table 1**).

Comparison of the operative situation in the two groups

The OD, number of dissected facial nerve branches and IL in the OG were much lower than they were in the CG ($P<0.05$), and there was no statistical difference in the IBL between the two groups ($P>0.05$) (**Table 2**).

Comparison of the PAR in the two groups

The PAR of the OG and the CG were (8.39± 1.23) and (8.42±1.26) before the operations, (7.21±1.12) and (6.32±1.01) at 3 months after the operations, (7.53±1.16) and (6.38±1.12) at 6 months after the operations, and (8.02±1.21) and (6.32±1.15) at 12 months after the operations. There was no statistical difference in PAR between the two groups before the operations

Table 2. Comparison of the operative situations between the two groups ($\bar{x}\pm s$)

Group	Number of cases	OD	IBL	Number of dissected facial nerve branches	IL
OG	38	82.45±20.39	45.52±9.38	1.66±0.95	6.68±1.52
CG	37	120.13±36.92	48.13±12.35	3.86±1.02	10.78±1.71
t		5.490	1.032	9.670	10.982
P		0.000	0.305	0.000	0.000

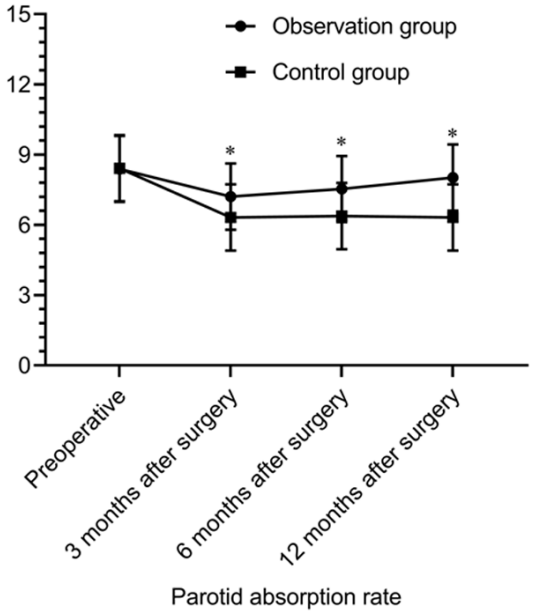

Figure 1. Comparison of the PAR between the two groups. The two groups showed little difference in PAR before the operations ($P>0.05$) and the PAR of the OG was much higher than it was in the CG at 3, 6, and 12 months after operations ($P<0.05$). * meant $P<0.05$ when the two groups were compared at the same time point.

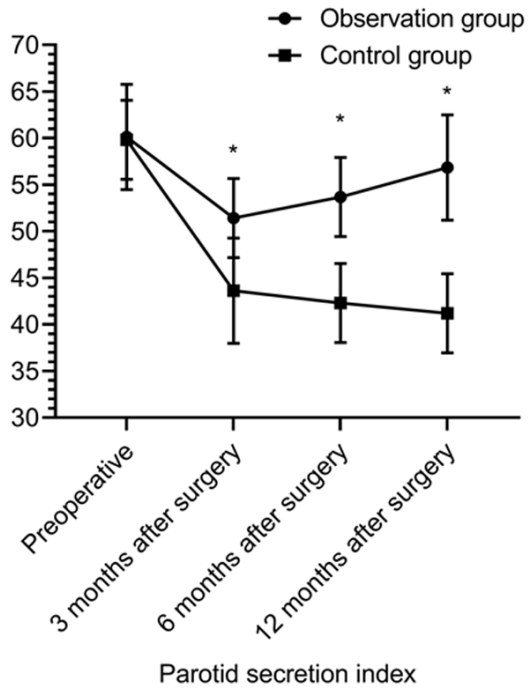

Figure 2. Comparison of the PSI in the two groups. The two groups showed little difference in their PSI before the operations ($P>0.05$) and the PSI of the OG was much higher than it was in the CG at 3, 6, and 12 months after the operations ($P<0.05$). * meant $P<0.05$ when the two groups were compared at the same time point.

($P>0.05$). The PAR of both groups was reduced slightly at 3, 6, and 12 months after the operations and that of OG was much higher than that of CG ($P<0.05$) (**Figure 1**).

Comparison of the PSI between two groups

The PSI of the OG and the CG were respectively (60.12±4.49) and (59.83±3.95) before the operations, (51.42±3.26) and (43.62±4.21) at 3 months after the operations, (53.69±3.85) and (42.31±3.86) at 6 months after the operations, and (56.85±4.12) and (41.19±3.64) at 12 months after the operations. There was no statistical difference in the PSI in the two groups before the operations ($P>0.05$). The PSI of both groups was reduced slightly at 3, 6, and 12 months after the operations, and the PSI of the OG was much higher than it was in the CG ($P<0.05$) (**Figure 2**).

Comparison of the postoperative complications in the two groups

The incidence of postoperative complications among the 38 patients in the OG was 18.42%, while the incidence of postoperative complications among the 37 patients in the CG was 40.54%, between which the difference was statistically significant ($P<0.05$) (**Table 3**).

Table 3. Comparison of the postoperative complications in the two groups [n (%)]

Group	Number of cases	FP	Frey syndrome	Salivary fistula and cumulative salivation	Periotic skin numbness	Incidence
OG	38	2 (5.26)	1 (2.63)	1 (2.63)	3 (7.89)	7 (18.42)
CG	37	5 (13.51)	2 (5.41)	3 (8.11)	5 (13.51)	15 (40.54)
X^2						4.425
P						0.035

Table 4. Comparison of the postoperative RR in the two groups [n (%)]

Group	Number of cases	Recurrence	No recurrence
OG	38	0 (0.00)	38 (100.00)
CG	37	1 (2.70)	36 (97.30)
X^2		1.041	
P		0.308	

Comparison of the postoperative RR in the two groups

During the 2-year follow-up period, RR was 0.00% in the OG and 2.70% in the CG, which showed no statistical difference between the two groups ($P>0.05$) (**Table 4**).

Comparison of the satisfaction with facial appearance in the two groups

In the OG, the satisfaction of 38 patients with their postoperative facial appearance was 92.11%, while in the CG, the satisfaction of 37 patients with their postoperative facial appearance was 72.97%, which showed a statistical difference ($P<0.05$) (**Table 5**).

Discussion

SP has a significant therapeutic effect on benign tumors in the superficial lobe of the gland and critical tumors by excising the tumor and gland tissues on the superficial surface of the facial nerve and ligaturing the parotid duct [9]. This operation is also applicable to some low-grade malignant tumors due to a large excision extension [10]. PSP is more applicable to benign parotid tumors by simultaneously excising the tumor and its adjacent gland tissues 0.5-1.0 cm away [11]. Kim et al. [12] found little difference in postoperative RR between PSP and SP in the treatment of benign parotid tumors, but the latter had a higher incidence of FP and Frey syndrome after the operations. Li et al. [13] found no patient suffering from recurrence after the excision of the benign parotid tumors using PSP, and the postoperative complication incidence of PSP was lower than that of SP.

The complete excision of tumors and the preservation of relevant functions shall be considered in excision of PA [14]. There are few studies on the preservation of parotid function in PSP and SP, and the salivary gland imaging method was used for the concrete analysis on it in this study. Parotid function is related to the amount of parotid tissues. The more the tissues are excised, the more severe the damage to the parotid function [15]. In addition, Kadletz et al. [16] found the influence of duct ligation on parotid function and indicated that the saliva secreted by the deep lobe could not be excreted in a timely manner because the duct was ligatured in SP, which led to the gradual atrophy of acini and the loss of secretion function. Furthermore, the nerve endings are damaged during SP, so the secretion of acini cannot be controlled by nervous impulse, so the parotid function is affected [17]. Generally, the influence on functions cannot be avoided in operative treatment, but patients basically understand and accept this in the case of successful postoperative recovery. This study showed that PAR and PSI were reduced after the operations in both groups, but the PAR and PSI of the OG gradually recovered 3 months after the operation and recovered to the preoperative level 12 months after operation, but the PAR and PSI of the CG were still lower than they were before the operation without a significant recovery at 3 and 12 months after the operation. Huang et al. [18] indicated that the postoperative salivary gland function recovered to about 70% of the PAR and PSI preoperative level in PSP and only 20% in SP. Patel et al. [19] found that the parotid duct was located on the deep side of the facial nerve branches in the sense of anatomic relationship, so only the branch parotid

Table 5. Comparison of the satisfaction with facial appearance in the two groups [n (%)]

Group	Number of cases	Fully satisfied	Partially satisfied	Dissatisfied	Satisfaction
OG	38	15 (39.47)	20 (52.63)	3 (7.89)	(92.11)
CG	37	12 (32.43)	15 (40.54)	10 (27.03)	(72.97)
X^2					4.789
P					0.029

duct was ligatured with the master duct reserved in PSP to preserve the gland function to a larger extent.

According to this study, the OD, the number of dissected facial nerve branches, and the IL of OG were better than they were in the CG ($P<0.05$) even if the IBL was similar between them ($P>0.05$). The complication incidence of the OG was 18.42% within 2 years after the operations, which was much lower than the 40.54% of the CG ($P<0.05$), but the RR was similar within 2 years after the operations. Compared with SP, PSP had a better effect on PA, with fewer postoperative complications and faster postoperative recovery due to smaller incisions and fewer dissected facial nerve branches. Salivary fistula and cumulative salivation have a higher incidence at 1 month after the operation [20]. The tissues are excised extensively and the parotid master duct is ligatured in SP, so the salivation of the deep lobe is obstructed, which leads to a risk of salivary fistula and cumulative salivation [21]. A small range of tissues are excised and only the branch parotid duct is ligatured in PSP to prevent saliva from flowing into the wound. And the saliva is excreted through the parotid duct due to the preservation of the parotid master duct, so the risk of salivary fistula and cumulative salivation is low [22, 23]. Patients will suffer from the obvious deformity of facial depression after SP due to the large incision and obvious facial scarring. Also, more tissues are excised after the operation, so the face will become asymmetrical and the postoperative facial appearance will be affected seriously [24]. By contrast, PSP can achieve a lower asymmetry and a higher aesthetic degree because only a small amount of tissue is excised. This study showed that the OG's satisfaction with postoperative facial appearance was 92.11%, much higher than the 72.97% of the CG ($P<0.05$). Emodi et al. [25] also indicated that patients treated with PSP had a higher satisfaction with their facial appearance. This implied that compared with SP, PSP had less impact on facial appearance, so the patients were more satisfied with their facial appearance after PSP and could accept it more easily.

In conclusion, PSP has a better therapeutic effect on PA compared with SP, with a faster recovery of postoperative parotid absorption and secretion function, fewer postoperative complications and a faster postoperative recovery. But this study was a retrospective study with a small cohort, so the analysis was not comprehensive enough, and the results are biased to a certain extent. More intensive studies with larger samples in more aspects should be conducted focusing on prospective studies in the future so as to obtain more scientific and representative conclusions and thus provide more references for the operative methods of PA.

Disclosure of conflict of interest

None.

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