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Factors associated with facial nerve palsy in patients undergoing superficial parotidectomy for pleiomorphic adenoma: our experience of eight and half years

Dheer S. Kalwaniya¹*, Goutam Kothathi Chowdegowda¹, Monish Raj¹, Jaspreet S. Bajwa¹, Satya V. Arya¹, Ranjith Mahadevan¹, Rohit Choudhary¹, Ashok Kumar², Nipun Singla¹

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*Correspondence: Dr. Dheer S. Kalwaniya, E-mail: drdsk85@gmail.com

*Correspondence

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ABSTRACT

Background: The pleomorphic adenoma comprises 45-60% of all salivary gland tumors most often in parotid gland up to 80%. The association between the facial nerve and the gland is responsible for most of the technical difficulties and complications of the surgical approaches.

Methods: This is a retrospective observational study performed in a unit of General Surgery, Safdarjung Hospital, New Delhi from May 2011 to October 2019 of all patients who underwent superficial parotidectomy for pleomorphic adenoma of parotid gland. The data was tabulated and results made using SPSS 21.0 system.

Results: Male:female ratios are 29:33. Average age was 47.1 years (31-61). Average duration of disease was 2.2 years (0.3-5). 4 were operated for recurrence. Facial paresis occurred in 7 out of 62 patients (11.3%), 4 females and 3 males. 11 patients have tumor greater than 4 cm, out of these 11 patients 2 patients had pre-op facial paresis. Out of 51 patients (size <4 cm), 2 suffered facial paresis and out of 11 patients (size >4 cm), 5 suffered same. Out of 59 patients with depth of tumor <2 cm, 4 patients had post-op facial paresis. All the three patients having tumor depth >2 cm suffered post op facial paresis. Patients with pre-op facial nerve paresis had mean duration of tumor 3.35 year (±0.92) while with post-op facial nerve paresis had mean duration of tumor 2.99 year (±1.35).

Conclusions: Meticulous separation of facial nerve from parotid tissue is key to preservation of the facial nerve. But factors like size of tumor, depth of invasion, previous surgery do affect the outcome in parotid surgery.

Keywords: Pleiomorphic adenoma, Superficial parotidectomy, Facial nerve injury

INTRODUCTION

Salivary gland tumors represent 3-10% of all head and neck tumors. These neoplasms occur predominantly in major salivary glands. The parotid gland is the most commonly affected salivary gland. The most common benign and malignant tumors are pleomorphic adenoma and mucoepidermoid carcinoma respectively. The pleomorphic adenoma comprises 45-60% of all salivary

gland tumors most often in parotid gland up to 80%, usually in the inferior pole of superficial lobe; however less frequently it can occur in deep lobe or accessory tissue. In earlier literature parotid tumors were histologically classified into more than 30 types, but now the current literature estimates that approximately 80% of them are benign, with pleomorphic adenoma being the most common and occurring between the fourth and sixth decades of life.

¹Department of General Surgery, ²Department of Social and Preventive medicine, V.M.M.C. and S.J.H., New Delhi, India

Clinically, the most common manifestation of pleomorphic adenoma is the presence of a solitary, solid, firm, lobulated, mobile nodular lesion with well-defined margins, which is painless, to palpation, and of long evolution. It has the capacity to grow to a large proportion and invariably spares the function of the facial musculature. The second most common benign tumor is Warthin's tumor, which affects mostly men after the fifth decade of life and may be bilateral. The most prevalent malignant tumor is the mucoepidermoid carcinoma, followed by adenoid cystic carcinoma. The presence of pain, facial paralysis, rapid growth, ill-defined margins, and skin infiltration are characteristics that are suspicious for malignancy.⁸

The first diagnostic imaging for assessing parotid tumors is usually ultrasonography, but it does not determine the definitive indication for surgical treatment. Computed tomography and magnetic resonance imaging assessment is not essential, but may be indicated in selected cases to plan appropriate treatment.⁸ Fine-needle aspiration (FNA), whether or not guided by ultrasound, can be used as a complementary diagnostic test, in case of a noncharacteristic manifestation of pleomorphic adenoma is suspected. The purpose of FNA is to differentiate benign from malignant tumors, as it usually does not establish the definitive histological diagnosis.⁷⁻⁹ Incisional biopsy is contraindicated, as it is often the cause of neo-plastic implantation and consequently, recurrences pleomorphic adenomas and malignant neoplasms. It is established that multiple recurrence of pleomorphic adenoma increase the possibility of malignant transformation of the tumor (carcinoma in a pleomorphic adenoma) and patients with these tumors often had undergone a biopsy or in adequate surgical excision in the past.

The parotid gland has a superficial lobe, lateral to the facial nerve, which comprises 4/5 of the glandular parenchyma, and a smaller deep lobe. Superficial parotidectomy with facial nerve preservation is the most often indicated surgical procedure, as 90% of the tumors are located in the glandular superficial lobe and, thus, do not affect the facial nerve. 8,10,11 Although tumors more often affect the superficial lobe, the term subtotal parotidectomy seems more appropriate than superficial parotidectomy. The association between the facial nerve and the gland is responsible for most of the technical difficulties and complications of the surgical approaches. Because of a particular tumor histological type or extension, a decision to perform a parotidectomy with deliberate sacrifice of the facial nerve trunk or branches, possibly with an associated neck dissection, is sometimes made during surgery. Therefore, the pathologist's contribution of frozen section examination during surgery is essential. In extrcapsular dissection, facial nerve dissection is not performed. 12-16 The treatment of malignant tumors of the parotid can be supplemented with adjuvant radiotherapy, but chemotherapy is rarely indicated. The prognosis is determined according to the histological type and the pre- and post-surgical staging.⁸

Lesion of the facial nerve is one of the most serious complications that can occur, it is estimated that 30-65% of all patients experience some transient facial weakness and 3-6% develop permanent dysfunction. ¹⁶ The goal of this investigation was to survey the 62 parotidectomies performed by a similar specialist from May 2011 to October 2019 to determine predictive factors related to occurrence of peripheral facial paralysis after superficial parotidectomy for pleomorphic adenoma of parotid gland.

METHODS

This is a retrospective observational study performed in a unit of General Surgery, Safdarjung Hospital, New Delhi from May 2011 to October 2019 of all patients who underwent superficial parotidectomy for pleomorphic adenoma of parotid gland (Figure 1). This diagnosis was made on the basis of fine needle aspiration cytology of parotid swelling along with radiological investigation in the form of contrast-enhanced computed tomography head and neck (Figure 2). The analyzed events on the basis of histopathological examination were: tumor length, depth, duration of disease, primary or secondary surgical approach (Figure 3). Facial paralysis was classified and graduated according to House-Brackmann's scale.

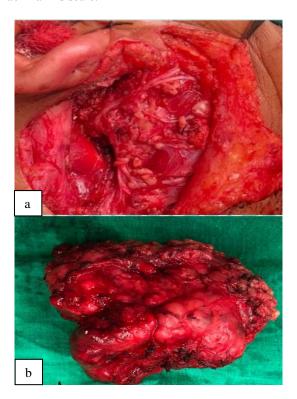


Figure 1: (a) Post superficial parotidectomy of all branches of facial nerve preserved, (b) resected parotid specimen macroscopic view.

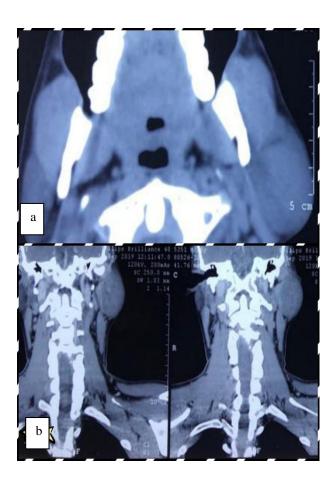


Figure 2: (a) Transverse section of head and neck CT of left parotid mass extending into prestyloid space with maintained fascial planes, (b) saggital section of CT head and neck of left parotid mass which is isodense with few areas of hypodensity.

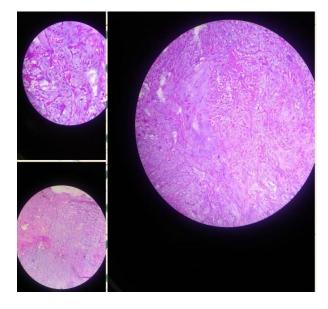


Figure 3: Histopathology specimen of biphasic appearance comprising of epithelial components.

There is formation of tubules and glands.

Mesenchymal component shows myxoid changes along with focal calcification. No atypical mitosis, necrosis or hemorrhage is seen.

Inclusion criteria

All the patients presenting with parotid gland tumors with clinical, cytological and imaging features suggestive of pleomorphic adenoma

Exclusion criteria

Patients who have had any kind of facial motricity impairment previous to surgery, those who were having any neurological deficit and patients with any collagen and vascular diseases.

The corrected data was entered into microsoft excel after preparing a master-chart. Data analysis was done using licensed statistical package for social sciences (SPSS) software version 21.0 (Chicago, Illinois). Outcome variable facial nerve paresis was analyzed with following: tumor length, which grouped in <4 cm and >4 cm; tumor depth, which grouped in <2 cm and >2 cm; primary or secondary surgical approach; duration of disease.

Descriptive statistics were used to calculate frequencies of categorical variables, and measures of central tendencies and dispersion were used to describe continuous variables. Chi square/fishers exact test for qualitative and t test for quantitative variable were applied. Parameteric and non-parametric test were used appropriately. P value of <0.05 was considered statistically significant.

RESULTS

During the study period 62 patients underwent superficial parotidectomy for pleomorphic adenoma of parotid gland during the study period from May 2011 till October 2019.

Males were 29 patients and females 33 patients. The average age was 47.1 years (31-61). Average duration of disease was 2.2 years (0.3-5).

Table 1: Distribution of patients according primary or secondary surgical approach and pre-operation facial nerve paresis.

Previous surgery	Pre-operation facial nerve paresis		D 1
	Yes	No	P value
	N (%)	N (%)	
No (primary)	0 (0)	58 (100)	0.003
Yes (secondary)	2 (50)	2 (50)	0.003

In Table 1, primary means those patients who were operated for pleomorphic adenoma for first time (58 patients) and 4 patients were undergoing surgery for recurrence. None of the primary adenoma patients had pre-operative paresis of facial nerve whereas, 2/4 patients of recurrent pleomorphic adenoma had the same. P value is 0.03 showing this finding to be significant.

Table 2: Distribution of patients according primary or secondary surgical approach and post-op facial nerve paresis.

Previous surgery	Post-operation facial nerve paresis		Doubles
	Yes	No	P value
	N (%)	N (%)	
No (primary)	3 (5.2)	55 (94.8)	0.001
Yes (secondary)	4 (100)	0 (0)	0.001

Facial paresis occurred in 7 out of 62 patients (11.3%), 4 females and 3 males. Facial paresis was graded according to House-Brackmann's scale. 4 patients had grade II, 2 patients had grade III and 1 patient had grade IV. None had grade V and VI. Out of 62 patients, 4 patients were operated outside (secondary) and referred to our center in view of recurrence in which 2 patients already had facial paresis and after surgery all 4 patients developed facial paresis. P value is less than 0.05, hence showing significance of facial nerve palsy in previously operated patients. This is in view of distorted anatomy at previous surgery site.

Table 3: Association of pre-operative and post-operative facial nerve paresis with tumor length.

Tumor length	Pre-operative facial nerve paresis (yes/no)	Post-operative facial nerve paresis (yes/no)
<4 cm	0/51	2/49
>4 cm	2/9	5/6
P value	0.029	0.001

Out of 62 patients, 51 patients had tumor of less than 4 cm and 11 patients have tumor greater than 4 cm, out of these 11 patients 2 patients had pre-operative facial paresis. P value came out to be 0.029, hence this association was found to be statistically significant. Out of 51 patients 2 patients suffered facial paresis and out of 11 patients 5 patients suffered post-operative facial paresis. And this association was found to be significant (p value 0.001).

Table 4: Association of pre-operative facial nerve paresis with tumor depth.

Tumor depth	Pre-operative facial nerve paresis		
	Yes	No	P value
	N (%)	N (%)	
<2 cm	2 (3.4)	57 (96.6)	- 0.905
>2 cm	0 (0)	3 (100)	0.903

Among 59 patients who had tumor depth less than 2 cm, 2 patients suffered from pre-operative facial nerve paresis. This association was not found to be statistically significant.

Table 5: Association of post-operative facial nerve paresis with tumor depth.

Tumor depth	Post-operative facial nerve paresis		Darelan
	Yes	No	P value
	N (%)	N (%)	
<2 cm (n=59)	4 (6.8)	55 (93.2)	0.001
>2 cm (n=3)	3 (100)	0 (0)	

In 62 patients, 59 patients were having tumor of depth <2 cm and 3 patients had tumor of depth > 2 cm. Out of 59 patients 4 patients had post- operative facial paresis. All the three patients having tumor depth >2 cm suffered post op facial paresis. This association was found to be statistically significant means more is the depth of tumor, more are chances of facial nerve injury and hence, more are the chances of facial nerve palsy.

Table 6: Association of pre-operative facial nerve paresis with duration of tumor.

Duration of	Pre-operative facial nerve paresis/paralysis		P value
tumor (year)	No	Yes	
Sample size	60	2	
Mean±SD	2.12±0.95	3.35 ± 0.92	
Median	1.95	3.35	0.076
Min-max	0.3-5	2.7-4	
Inter quartile Range	1.450-2.550	2.700-4	

Patients who suffered from pre- operative facial nerve paresis had mean duration of tumor 3.35 year with standard deviation of 0.92. This association was non-significant.

Table 7: Association of post-operative facial nerve paresis with duration of tumor.

Duration of	Post-operative facial nerve paresis/paralysis		P value
tumor (year)	No	Yes	
Sample size	55	7	
Mean±SD	2.05 ± 0.87	2.99±1.35	
Median	2	2.7	0.077
Min-max	0.3-4.5	1.5-5	
Inter quartile Range	1.400-2.500	1.825-4	

Patients who suffered from post- operative facial nerve paresis had mean duration of tumor 2.99 year with standard deviation of 1.35.

DISCUSSION

Pleomorphic adenoma is the most common benign tumor of parotid gland. ¹⁷ It occurs most frequently in women

than men between the ages of 40 and 50 years.¹⁸ It usually appears a slowly growing painless mass, with a variable progression, normally located in inferior pole of superficial lobe. In general terms, the demographic and clinical findings of our study confirm all these data widely reported in previous literature.

Facial nerve dysfunction is frequently encountered after parotid surgery, causing both cosmetic and functional disorder. Of the 62 patients treated in our study, patients with tumor size >4 cm, tumor depth >2 cm and reoperation had higher chances to develop immediate facial nerve paresis or paralysis. The rate of immediate postparotidectomy facial nerve paresis or paralysis was 11.3% which was lower than those reported in previous studies.¹⁹⁻²³ The exact mechanism of facial nerve dysfunction has not been elucidated, however mechanical trauma, such as nerve compression, crushing and stretching, and electrocoagulation heat damage are possible etiologies. Nerve stretching during surgery is the most probable cause.²⁴ Marginal mandibular branch of facial nerve is more prone to injury during parotidectomy. Possible reasons for this include the relatively fewer connecting anastomoses and thinner diameter and longer tracts of marginal mandibular nerve.²⁵ Some authors suggest that mechanical trauma to peripheral nerve requires 6 to 12 weeks for recovery. 24,26 Transient facial nerve paralysis remains the most common complication in parotid gland tumor 16 and permanent palsy is seen in 0-19% of the cases. In our study, 7 patients developed transient paresis and none had permanent paralysis.²⁷⁻³

Superficial parotidectomy remains the most efficient technique yet available allowing surgeons through complete facial nerve dissection with better chances of preserving its function.³⁴ It is quite intuitive to relate the increase of tumor dimensions to higher incidence of complications. In our study, we have demonstrated that tumors with 4.0 cm or more in length and 2.0 cm or more in depth have a significantly higher risk of developing facial paralysis. This should be taken into account in preoperative evaluation and much more care should be taken during nerve dissection. It is still inconclusive whether the incidence of facial nerve dysfunction is higher after malignant tumor resection due to more aggressive surgical approach, or after benign lesions of longer duration of disease associated with tumor adherence and adjacent inflammatory process. 31,35 In our study, we did not find any statistically significant correlation with higher risk of facial nerve injury.

In our study, facial nerve paresis was seen in all 4 patients operated for recurrence after surgery performed elsewhere. As seen in this study secondary surgery has much higher risk of facial nerve dysfunction, surely due to perilesional inflammation, fibrosis and lack of surgical landmarks. This should be recognized when performing the primary surgery.

In our study, there were no reported cases of Frey's syndrome or parotid fistula showing that meticulous surgery is the key to preventing these morbid complications.

CONCLUSION

Facial nerve injury during superficial parotidectomy remains common and feared complication. In this study, we have found that tumors with length >4.0 cms and depth >2.0 cms and secondary surgery to recurrent tumors have a significantly higher risk of developing facial palsy after superficial parotidectomy for pleomorphic adenoma.

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