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Risk of Facial Paralysis Following Parotidectomy

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Abstract

Background The facial nerve should be sacrificed only if there is strong indication. Sometimes it is possible to sacrifice only part of the facial nerve and this termed "semiconservative parotidectomy". The commonest operation performed is superficial conservative parotidectomy, which is removal of the parotid superficial to the facial nerve with nerve preservation. A total conservative parotidectomy was performed only if clearly indicated by the pathological condition, since the complete freeing of the facial nerve in this operation increases the incidence of nerve paralysis.

Objective To demonstrate under what circumstances is the surgeon likely to be called upon to sacrifice the facial nerve deliberately, and mentioning what be done to reduce the risk of functional facial paralysis following conservative parotidectomy.

Methods The material comprises 30 cases of parotidectomy of all types. We analysed the incidence and degree of functional facial paralysis following conservative parotidectomy and also we reported some experimental work attempting to elucidate its etiology. We classify the degree of facial nerve paralysis to grade I, absent or slight, grade II moderate, grade III complete.

Results We did superficial parotidectomies for 22 cases, 19 had grade I, two had grade II and only one had grade III facial nerve paralysis. Conservative total parotidectomies done for 2 cases, one had grade I and one had grade III facial nerve paralysis. Semiconservative parotidectomies done for 4 cases all had grade I facial nerve paralysis and lastly radical parotidectomies done for 2 cases, the results had grade III for two cases facial nerve paralysis.

Conclusion To reduce the incidence of facial paralysis after conservative parotidectomy: carrying total parotidectomy only when clearly demanded by pathological condition by avoiding washing out the wound, and by measures designed to preserve the blood supply of the trunk of the facial nerve. The present study support that ischemia is the principal factor in post-parotidectomy functional facial paralysis.

Key words Parotidectomy, Facial nerve, Mixed tumor

Introduction

The thought that they may wake up with a paralyzed face is probably the chief anxiety of most patients who have been advised to undergo operations on the parotid. Such paralysis may theoretically occur in three ways. First, the surgeon may inadvertently cut or otherwise grossly interrupt the anatomical continuity of the facial nerve. Secondly he may deliberately sacrifice the nerve as a necessary step in removing the pathological process. Thirdly, although the surgeon preserves the nerve anatomically, the patient may develop a functional facial paralysis after operation, which is fortunately almost always temporary - [1-6].

The modern operation of conservative parotidectomy, that is parotidectomy with conservation of the facial nerve, is so well worked out that an advertent major

anatomical interruption of the nerve should be and experience shows is rare. The principal questions thus remaining are; first, under what circumstances is the surgeon likely to be called upon to sacrifice the facial nerve deliberately? And secondly can anything be done to reduce the risk of functional facial nerve paralysis following conservative parotidectomy? [7-11].

So an obvious principle of parotid surgery is that the facial nerve should be sacrificed only if clearly demanded by the conditions. In some cases it is possible to sacrifice only part of the facial nerve and this termed "semi-conservative parotidectomy" [12-17].

Misplacement of the suction drains may also lead to neurapraxia. The suction drains should be placed in such way that they do not overlie the trunk or any branch of the facial nerve and secured to the bed of the wound with 4:0 catgut sutures. In parotidectomy due to chronic parotitis, the duct is best tied as it may contain muco-purulent saliva [18-20].

Finally, there was a small modification in the technique of exposure of the trunk of the facial nerve based on the work of Blunt who found that the main blood supply of the trunk of the nerve in its extra cranial course came from two small branches of the stylomastoid artery which entered the nerve close to the stylomastoid foramen. In an attempt to preserve this blood supply it is better to identify the trunk of the facial nerve nearer to its main division rather than near stylomastoid foramen. Of purely surgical factors ischemia was thought to be the most important with edema and stretching, particularly of the finer branches of the nerve as possible subsidiary factors [20-24].

Methods

Total number of patients was 30 (13 males and 17 females; the age range was 13-75 years) whom diagnosed clinically, histopathology and treated surgically by parotidectomy of all types at Al-Kadhimiya Teaching Hospital from 2006 till 2010.

In all cases of parotidectomy, preauricular incision "Modified Blur incision" was used and the operation was classified into:

1. Superficial conservative Parotidectomy which include removal of the parotid superficial to the facial nerve with complete anatomical preservation of the nerve.
2. Total Conservative Parotidectomy involves sub-facial dissection. The sub facial tumors are those lying deep to the facial nerve which may arise in either the superficial or deep lobes and occasionally involve both lobes. It was performed only if clearly indicated by the pathological condition, since the complete freeing of the facial nerve and its branches has been shown to increase the incidence of functional facial paralysis.
3. Semi-conservative Parotidectomy in which an important part of the facial nerve was involved in the growth and was deliberately sacrificed.
4. Radical Parotidectomy in which the whole facial nerve was deliberately sacrificed

Regarding the facial nerve identification, the nerve lies at a point midway between the tip of the mastoid process and the lower bony auditory meatus, and these points of anatomy are identified with the index finger. The main trunk of the facial nerve is readily distinguished from surrounding tissues by its texture, color, position and direction.

The dissection proceeds forward and with minimal flanking movements, using gentle retraction and fine curved artery forceps. The technique involves laying the artery forceps immediately above the nerve and then opening it and carefully dividing the bridging tissue over the nerve. Avoid repeated heavy pressure on the dissected facial nerve by way of a dry swab, the assistant's sleeve or an excessively hot pack used in the interest of hemostasis.

We analyzed the incidence and degree of functional facial paralysis following conservative parotidectomy and also we reported some experimental work attempting

to elucidate its etiology. In our cases we have tried to eliminate the factors which seemed to predispose to functional facial paralysis from the previous studies.

We classify the degree of facial nerve paralysis:

1. Grade I (absent or slight) Recovery from any grade I functional paralysis is usually complete within a few months.
2. Grade II (moderate) Recovery from a grade II functional paralysis does not usually begin for three months and may take six months to complete
3. Grade III (complete) resulting from anatomical interruption of the nerve and is permanent unless anatomical continuity is in some way restored.

All the data were analyzed using SPSS version 15 (2006) computer program.

Results

A total of 30 patients who had undergone parotidectomy at Al-Kadhimiya Teaching Hospital were studied prospectively from November 2006 till November 2010 with a mean period of follow-up of 1.65 years. The study comprised 13 (43.3%) males and 17 (56.7%) females. Their ages ranged from 13 to 75 years with a mean of 47 years. The demographic features of the patients was shown in table 1.

Table 1. Demographic features of the studied patients

Case	Age (years)	Gender	Histopathology	Procedure	Grade
1	75	♂	Adenoid cystic carcinoma	Radical	III
2	45	♀	Pleomorphic adenoma	=	III
3	54	♂	=	Semi-conservative	I
4	43	♂	=	=	I
5	65	♀	Adenoid cystic carcinoma	=	I
6	56	♀	Muco-epidermoid carcinoma	=	I
7	40	♀	Pleomorphic adenoma	Superficial conservative	I
8	50	♂	=	Total conservative	I
9	54	♀	Muco-epidermoid carcinoma	=	III
10	43	♀	Pleomorphic adenoma	Superficial conservative	I
11	47	♀	=	=	I
12	53	♀	=	=	I
13	37	♀	=	=	I
14	29	♀	=	=	I
15	37	♀	=	=	I
16	41	♀	=	=	I
17	50	♀	=	=	I
18	35	♀	=	=	I
19	28	♂	=	=	I
20	33	♂	=	=	I
21	48	♂	Warthin's tumor	=	I
22	13	♂	Vascular malformation	=	I
23	54	♀	Myo-epithelioma	=	I
24	27	♀	Calculus	=	I
25	55	♂	Warthin's tumor	=	I
26	63	♂	=	=	I
27	68	♂	=	=	I
28	54	♂	Muco-epidermoid carcinoma	=	II
29	52	♀	Adenoid cystic carcinoma	=	II
30	60	♂	=	=	III
Mean age :47 years			SD : (13.51946)		
Malignancy 7 cases (23.3%)			Benign 23 cases (76.7%)		
(♂:♀) (13:17)		♂ 43.3%		♀ 56.7%	

Type of Operation and Histopathogic Results
Superficial conservative parotidectomy was the most commonly done operation (22 cases, 73.3% of cases). With regard to the pathology, twelve cases were pleomorphic adenoma, four cases were Warthin's tumor, two were adenoid cystic carcinoma, one was inflamed parotid due to calculus, one was myo-epithelioma, one case was a muco-epidermoid carcinoma and one vascular malformation.
Semi-conservative parotidectomy done in 4 cases (14%). The pathology examination showed that one cases was muco-epidermoid tumor, another case was adenoid cystic carcinoma, while the remaining two cases were of pleomorphic adenoma.
Total conservative parotidectomy done in 2 (7%) cases; one case was a muco-epidermoid tumor and the other was a recurrent pleomorphic adenoma. Radical parotidectomy done in 2 (7%) cases; one case with carcinoma and the second case of pleomorphic adenoma (Figure 1 and Table 2).

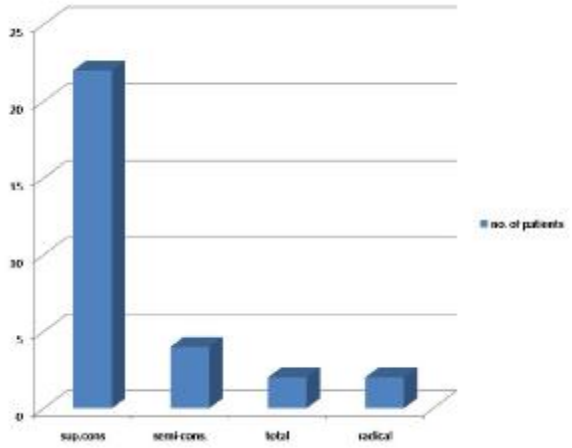

Figure 1. Type of surgery

Out of the total 30 patients, 7 patients (23.3%) had malignant diseases and 23 patients (76.7%) had benign diseases.
Grade of facial paralysis
In our series, most of the cases (24 cases 80%) was classified as grade I in which no facial paralysis results, 2 (7%) patients with grade II, 4 (13%) patients with grade III. The mean grade = 1.3%

Table 2. Histopathology Results of the entire group

Histopathology	patients	
	No.	%
pleomorphic adenoma	16	53.40%
adenoid cystic carcinoma	4	13.30%
mucoepidermoid carcinoma	3	10%
warthins tumor	4	13.30%
vascular malformation	1	3.30%
Calculus	1	3.30%
Myoepithelioma	1	3.30%

Radical Parotidectomy was done in 2 cases and both of them had grade III facial paralysis. Semi-conservative Parotidectomy done in 4 cases and all of them had grade I facial paralysis. Total Conservative Parotidectomy done in 2 cases; one case had grade I and the other had grade III. Superficial Conservative Parotidectomy done in 22 cases, 19 case (86.5%) showed grade I, 2 cases (9%) grade II and 1 case (4.5%) grade III facial paralysis (Table 3).

Discussion

Superficial Conservative Parotidectomy: 19 of the 22 cases of this group showed little or no functional facial paralysis (grade I). There was one case (adenoid cystic carcinoma) of grade III paralysis and 2 cases of grade II (one was adenoid cystic carcinoma and one was a muco-epidermoid carcinoma with adhesion to both skin and masseter).
Total Conservative Parotidectomy: One case had grade III, it was muco-epidermoid tumor was arise in the sub-facial parotid and it presented retro-pharyngeally. The superficial parotid was merely reflected for access but not resected, but since the facial nerve had to be mobilized on both superficial and deep aspects, we have considered the operation as equivalent to a total parotidectomy. The other

case of this group (recurrent pleomorphic adenoma) had grade I, here, although the sub-facial parotid was not resected, the facial nerve was completely freed on both aspects under the impression subsequently proved false, that there was a secondary primary tumor in the sub facial parotid.

Semi-conservative Parotidectomy: In 2 cases the lower main divisions of the nerve was resected and in one case the upper main division. In the remaining one case, growth had infiltrated in the region between the two main branches, and a leash of intermediate branches was involved and resected. In the case of resection of the upper main division the only movements lost were those of the forehead, and in the 2 cases of resection of the lower main division those of the angle of the mouth. In the case of intermediate facial nerve resection there was slight weakness of the cheek and upper lip. In all cases in this group the good facial function was present immediately after operation and the functional paralysis has therefore been classified as grade I.

Radical parotidectomy One of the two cases was a case of carcinoma. The second was a case of mixed parotid tumor (pleomorphic adenoma) twice recurrent. The recurrences involved both skin and masseter, portions of both of which were removed in continuity with multiple adherent tumor masses (both of them located in the deep lobe of the parotid gland).

The discussion will be limited to the question of facial paralysis following parotidectomy. The first point worthy of comment is that sacrifice of the facial nerve, complete or partial was thought necessary in no fewer than 5 out of the 30 cases. Two points in this connection may be made, firstly; that the only primary tumor requiring major sacrifice of the facial nerve were highly malignant tumors, secondly, that of the recurrent tumors [25- 28].

A recurrent pleomorphic tumors does not necessarily demand partial or complete sacrifice of the facial nerve, but recurrence clearly increase the danger of some sacrifice of the facial nerve being necessary. In grade II and III cases in this group the operations involved some technical difficulty. The problem is not only that a recurrent tumor may show infiltrative characters but also that, even if it does not do so, if the original operation has been in the neighborhood of nerve, tumor and nerve may be so bound together by fibrous adhesions that separation is impossible. Resection of the nerve in these cases may fairly be regarded as the price that had to be paid for an inadequate primary operation [29-30].

Never assume that a centrally placed tumor is entirely superficial simply because it seems so on palpation. In some apparently fairly superficial and movable tumors the growth may be found to extend beneath the seventh nerve. In case of superficial tumors much of the superficial parotidectomy is achieved as possible before the nerve is gently mobilized from the surface of the tumor. Once mobilization is completed we place fine vascular slings beneath the nerve and very gently lift it away from the tumor and continue dissection.

The surgeon should resist the impulse to stimulate the nerve repeatedly to confirm movements of the mimetic musculature. The nerve stimulator and bipolar diathermy is good servant and bad masters and we should never forget the advice of Hughes et al "that repetitive direct stimulation both at one site and multiple sites of the same nerve produced significant myelin and axon degeneration" [10].

Never use also unipolar diathermy because this will lead to damage to the nerve. A striking feature in our study was slight degree of facial paralysis which followed sacrifice of up to half of the facial nerve particularly of the lower half. The terminal branches of the facial nerve have inter-communicating branches and it is presumably on the preservation of all these that the good result depends.

There is a striking reduction in the incidence and severity of functional facial paralysis in our

study as compared with the Patey and Moffat series (the same type of surgery). Thus if we group together the grade II and grade III paralysis and regard them as major functional facial paralysis, there were 44 such paralysis in 95 cases in the Patey and Moffat series as compared with 4 in 24 cases in our study [22 superficial parotidectomies and 2 total parotidectomies] [and 4=2 grade II and 2 grade III] (P = 0.002).

Our percentage of post-operative facial weakness therefore was 16% and that of Maynard 2000 21%. Maynard compares the complications rate of primary parotidectomy for mixed tumors (number = 155) with parotidectomy for chronic and obstructive parotitis (number = 94), he indicate 21% of postoperative facial weakness. Norman found 26% (number = 100) postoperative weakness with duration of between 24 hours and 9 months. The indications for surgery include obstruction parotitis, benign and malignant tumors [11-12].

Gunn reports a partial and temporary facial paresis occurred in 47% of primary parotidectomy and recovery usually took place in 3-6 months. Zan Mra et al in 1993 reported 9 cases out of 10 that the marginal mandibular branch shows weakness postoperatively. In general temporary facial nerve paresis involving all or just one or two branches of the facial nerve and permanent total paralysis have occurred respectively in 9.3% to 64% in the literatures [35, 36].

The cases of transient facial nerve paresis resolved within 6 months with 90% within 1 month. Temporary paresis usually resolves according to Laccourrey within the 18th post-operative month [8].

The incidence of facial nerve paralysis is higher with total than with superficial parotidectomy which may be related to stretch injury or as a result of surgical interference with the vasa nervosum.

In our study the avoidance of washing out the wound with powerful antiseptics combined with the limitations in the indications for total parotidectomies provide an obvious explanations for the reduced incidence for major functional paralysis.

Table 3. Types and numbers of cases classified according to facial nerve paralysis

Types of Parotidectomy		No. Of cases	Degree of Facial Paralysis					
			Grade I		Grade II		Grade III	
			No	%	No	%	No	%
Conservative	Superficial	22	19	64%	2	7%	1	3%
	Total	2	1	3%	0	0	1	3%
Semi-conservative		4	4	31%	0	0	0	0
Radical		2	0	0%	0	0	2	7%
Total		30	24	80%	2	2%	4	13%

Table 4 Gives the incidence of the different degrees of functional paralysis in the comparable superficial parotidectomies in three studies.

The reduction of the incidence of major functional paralysis from 18 in 49 cases (37%) in Patey and Moffat to 3 in 22 (14%) cases in our study is statistically significant (P-value:0.002).

In our study the trunk of the facial nerve was identified whenever possible some way in front of rather than at the stylomastoid foramen on the hypothesis that in this way the blood supply to the trunk of the facial nerve might be preserved. Our study thus provides evidence both for the value of this maneuver and to support Patey and Moffat's conclusion that

ischemia is the main factor in functional facial paralysis after conservative parotidectomy.

Detailed analysis of the cases of our study suggests however that ischemia may not be the only factor. Thus two superficial parotidectomies were followed by major functional paralysis though it was thought that the blood supply to the trunk of the facial nerve had not been interfered with, both were cases in which the gland was swollen and inflamed the time of operation and it is possible that edema played a part in the facial paralysis. Again, we formed the impression that functional paralysis was predisposed to in cases in which branches of the facial nerve were stretched around a tumor or cyst. In these circumstances the freeing of the nerve branches might stretch them still further and thus interfere with their conductivity. Finally, there was the grade III functional paralysis which has already been mentioned and which followed an uneventful superficial parotidectomy. In this case again it was thought that the blood supply to the trunk of the facial nerve had not been interfered. Whatever the cause of the functional paralysis, the case is important in emphasizing that in spite of all precautions the risk of major functional facial paralysis cannot be entirely eliminated [31-34].

Table 4. Types of tumors and their grading in the present study and those reported others

Tumor Type	Grading	David & Patey (1993)	Patey & Moffat (1995)	Present study
Mixed parotid tumor	Grade I	38	31	19
Mucoepidirmoide carcinoma & adenoid cystic carcinoma	Grade II	4	16	2
Sarcoma, mucoepidirmoid carcinoma, adenoide cystic carcinoma, recurrent mixed parotid tumor	Grade III	2	2	1

The results confirmed that of (Patey and Thackray) [11] that the facial movements after these partial resection may be surprisingly good, Most cases of nerve injuries occurred in adenoid cystic carcinoma [24].

As a conclusion, the incidence of major functional facial paralysis after conservative parotidectomy has been significantly reduced by carrying out total parotidectomy only when clearly demanded by the pathological condition, by avoiding washing out the wound, and by measures designed to preserve the blood supply of the trunk of the facial nerve. The present study support that ischemia is the principal factor in post-parotidectomy functional facial paralysis.

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