RISK OF FACIAL PARALYSIS AFTER PAROTIDECTOMY

BY

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The thought that they may wake up with a paralysed 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 fortunately is almost always temporary. The modern operation of conservative parotidectomy—that is, parotidectomy with conservation of the facial nerve—is so well worked out that inadvertent 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 paralysis following conservative parotidectomy? The present paper aims at answering these two questions.

Material

The material comprises 60 consecutive cases of parotidectomy of all types which we have performed subsequent to those reported by Patey and Moffat (1961). In that paper Moffat and I analysed the incidence and degree of functional facial paralysis following conservative parotidectomy, and also reported some experimental work attempting to elucidate its aetiology. In the cases reported in the present paper I have tried to eliminate the factors which from the previous study seemed to predispose to functional facial paralysis. Of purely surgical factors, ischaemia was thought to be the most important, with oedema and stretching, particularly of the finer branches of the nerve, as possible subsidiary factors.

General Principles

An obvious principle of parotid surgery is that the facial nerve should be sacrificed only if clearly demanded by the conditions. In some such cases it is possible to sacrifice only part of the facial nerve, and this I have termed "semi-conservative parotidectomy." In the present series the commonest operation performed was superficial conservative parotidectomy—that is, removal of the parotid superficial to the facial nerve with complete anatomical preservation of the nerve. A total conservative parotidectomy was performed only if clearly indicated by the pathological condition, since the complete freeing of the facial nerve and its branches necessary for this operation has been shown to increase the incidence of functional facial paralysis (Patey and Moffat, 1961). In a few peripheral tumours a partial superficial parotidectomy was performed when this could be done without encroaching on the region of the tumour. Following the conclusion of Patey and Moffat (1961) that washing out the wound with perchloride of mercury after parotidectomy predisposed to facial paralysis, no type of washout has been used in the present series. The experimental studies of Woodhall *et al.* (1962) suggest that the other common tumour chemotherapeutic agents would have a similar effect.

Finally, it was decided to adopt a small modification in the technique of exposure of the trunk of the facial nerve based on the work of Blunt (1954). In detailed anatomical studies of the blood supply of the facial nerve Blunt found that the main blood supply of the trunk of the nerve in its extracranial 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 we have, whenever possible, tried to identify the trunk of the facial nerve nearer to its two main divisions than to the stylomastoid foramen.

Results

Table I gives the incidence and degree of facial paralysis in the main types of parotidectomy. The degrees of facial paralysis are classified in the same way as in the previous paper (Patey and Moffat, 1961): grade I, absent or slight;

TABLE I

Type of Parotidectomy	No. of Cases	Degree of Facial Paralysis		
		Grade I	Grade II	Grade III
Conservative—superficial ..	44	38	4	2
—total ..	5	2	1	2
Semi-conservative ..	7	7	0	0
Radical ..	4	—	—	4
Total ..	60	47	5	8

grade II, moderate; grade III, complete. In most of the cases classified as grade I in this series there was no facial paralysis. Recovery from any grade I functional paralysis is usually complete within a few weeks and from grade II within a few months. Recovery from a grade III functional paralysis does not usually begin for three months and may take six months to be complete, while a grade III paralysis resulting from anatomical interruption of the nerve is, of course, permanent unless anatomical continuity is in some way restored. In the following paragraphs some of the principal features of the cases falling into the different groups are given.

Radical Parotidectomy

Three of the four cases in which the whole facial nerve was deliberately sacrificed were cases of carcinoma. The fourth was a case of mixed parotid tumour twice recurrent. The recurrences involved both skin and masseter, portions of both of which were removed in continuity with multiple adherent tumour masses.

Semi-conservative Parotidectomy

In the seven cases of this group an important part of the facial nerve was involved in the growth and was deliberately sacrificed. In four cases the lower main division of the nerve was resected and in one the upper main division. In the remaining two cases growth had infiltrated in the region between the two main branches, and a leash of intermediate branches was involved and resected. As regards pathology, one case was a recurrent muco-epidermoid tumour, one a case of sarcoma reactive after being initially controlled by radiotherapy, while the remaining five were cases of recurrent mixed tumour. The results confirmed our previous experience (Patey and Thackray, 1958) that the facial movements after these

partial resections may be surprisingly good. In the case of resection of the upper main division the only movements lost were those of the forehead, and in the four cases of resection of the lower main division those of the angle of the mouth. In the two cases of intermediate facial nerve resections 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 in Table I as grade I.

Total Conservative Parotidectomy

All five cases in this group were examples of mixed parotid tumour, one being recurrent. Four were tumours arising in the subfacial parotid and two of these presented retropharyngeally. In one of the retropharyngeal tumours 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. Similarly, we have regarded the fifth case of this group as equivalent to a total parotidectomy, since, although the subfacial parotid was not resected, the facial nerve was completely freed on both aspects under the impression, subsequently proved false, that there was a second primary tumour in the subfacial parotid. A high incidence of severe functional facial paralysis will be noted in this group—two of the five cases showing grade III and one grade II paralysis.

Superficial Conservative Parotidectomy

Most of the 44 cases in this group were examples of primary mixed tumour, though there were three recurrent mixed tumours. There were three examples of cyst, but only one of adenolymphoma. The biggest group after the primary mixed tumours was that of chronic parotitis, which comprised nine cases, three being secondary to calculus and most of the remainder being due to the obscure condition of chronic sialectatic parotitis. There was one case of secondary deposits of malignant melanoma in the lymph nodes of the parotid, which was treated by superficial conservative parotidectomy combined with block dissection of the neck; incidentally no facial paralysis occurred.

As will be seen from Table I, 38 of the 44 cases of this group showed little or no functional facial paralysis. There were two cases of grade III paralysis and four of grade II. One of the grade III paralysees was a case of chronic sialectatic parotitis of long standing in which the operation was difficult owing to fibrosis; the other was a simple case of mixed parotid tumour which presented no technical difficulty. Of the four cases classified as grade II, one was another long-standing case of chronic sialectatic parotitis, one a recurrent mixed tumour with adhesion to both skin and masseter, one a primary mixed tumour arising so close to the stylomastoid foramen that the mastoid process had to be resected to obtain access to the trunk of the facial nerve, and one a primary mixed tumour arising between the two main branches of the facial nerve which were stretched over the tumour. Thus in five of the six cases showing grade II or grade III paralysis after superficial conservative parotidectomy the operation involved some technical difficulty. In the remaining case, however, the operation was, as noted, easy and uneventful.

Discussion

The discussion will be limited to the question of facial paralysis following parotidectomy. The pathological justifi-

cation for the policy adopted towards parotid tumours has been considered elsewhere, particularly the limitation of total parotidectomy to cases in which the tumour lies deep to the facial nerve in the subfacial parotid (Patey and Thackray, 1958). The first point worthy of comment is that sacrifice of the facial nerve, complete or partial, was thought necessary in no fewer than 11 out of the 60 cases. This is almost certainly an artificially high incidence resulting from the number of recurrent cases selectively sent for treatment. Two further points in this connexion may be made: first, that the only primary tumours needing major sacrifice of the facial nerve were highly malignant tumours—three carcinomata and one sarcoma; secondly, that of the seven recurrent tumours, no fewer than six were recurrent mixed tumours. A recurrent mixed tumour does not necessarily demand sacrifice, partial or complete, of the facial nerve, and there were three such cases in the present series in which the facial nerve was completely preserved; but recurrence clearly increases the danger of some sacrifice of the facial nerve being necessary. The problem is not only that a recurrent mixed tumour may show infiltrative characters but also that, even if it does not do so, if the original operation has been in the neighbourhood of the nerve, tumour 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.

A striking feature in the present series was the 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 intercommunicating branches, and it is presumably on the preservation of all these that the good result depends.

Nerve-grafting was performed in two patients using the great auricular nerve as recommended by Redon (1955). One was a case of carcinoma in which the facial nerve was widely resected. The patient was elderly and lived in the country and has not been seen since her operation 18 months ago; her doctor, however, informed us that there has been only slight recovery of facial movement. The other was a case in which the lower main division of the facial nerve only was resected. This patient showed almost full facial movements immediately after operation, so that we have been unable to judge whether there has been any regeneration through the graft. Our feeling is that facial-nerve grafting has not a big position in parotid surgery. With partial sacrifice of the nerve it is probably unnecessary, and, under most conditions in which complete sacrifice of the nerve is indicated, grafting is rarely feasible technically owing to the wide resection usually necessary and the difficulty of joining the graft, at one end to the nerve, trunk, at or even proximal to the stylomastoid foramen, and at the other to a large number of tiny peripheral branches.

There is a striking reduction in the incidence and severity of functional facial paralysis in the present series as compared with the Patey and Moffat series. Thus if we group together the grade II and grade III paralysees and regard them as major functional facial paralysees, there were 44 such paralysees in 95 cases in the Patey and Moffat series as compared with 9 in 49 cases in the present series. The reduction in incidence in the present series is highly significant statistically ($\chi^2=6.81$; $0.01>P>0.005$). Since Patey and Moffat found that total parotidectomy and washing out the wound with perchloride of mercury were the two principal factors predisposing to functional facial paralysis,

the avoidance of washing out the wound in the present series, combined with the limitation in the indications for total parotidectomy, provide an obvious explanation for the reduced incidence of major functional paralysis. In the few cases in which total parotidectomy was performed in the present series the incidence of major functional paralysis remained high (three out of five cases). But it is interesting that there is also an appreciable reduction in the incidence of major functional paralysis in the superficial parotidectomies of the present series.

Table II gives the incidence of the different degrees of functional paralysis in the comparable superficial parotidectomies in the two series. The reduction of the incidence of major functional paralysis from 18 in 49 cases in the Patey and Moffat series to 6 in 44 cases in the present series is statistically significant ($\chi^2=4.78$; $0.05>P>0.02$), a significance which is increased if the seven cases of semi-

TABLE II.—Comparison of Incidence of Functional Facial Paralysis in Superficial Parotidectomies

	Patey and Moffat	Present Series
Grade I	31	38
" II	16	4
" III	2	2
Total ..	49	44

The Patey and Moffat figures are derived from their material, though this particular table was not given in their paper.

conservative parotidectomy are added ($\chi^2=6.52$; $0.02>P>0.01$). The only factor known to be different in the two series is that in the present series 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. The present series thus provides evidence both for the value of this manoeuvre and to support Patey and Moffat's conclusion that ischaemia is the main factor in functional facial paralysis after conservative parotidectomy.

Detailed analysis of the cases of the present series suggests, however, that ischaemia may not be the only factor. Thus two superficial parotidectomies for chronic parotitis 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 at the time of operation, and it is possible that oedema 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 tumour 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 for mixed tumour. In this case again it was thought that the blood supply to the trunk of the facial nerve had not been interfered with. 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.

Finally, though not a question of facial paralysis, since the avoidance of unnecessary disability following parotidectomy is under discussion, mention may perhaps be made of conservation of the great auricular nerve. In the standard operation of conservative parotidectomy (Redon, 1955; Patey, 1957) this nerve is cut as it runs forwards

and upwards posterior to the external jugular vein, over the anterior border of the sternomastoid. By a small modification of technique, unless there is a tumour in the extreme lower and outer part of the parotid, it is usually possible to dissect out and preserve the posterior branches of this nerve and thus to avoid the annoyance of numbness of the lobule and lower part of the external ear, some degree of which tends to be permanent if the nerve is cut.

Summary

Sixty consecutive cases of parotidectomy have been analysed to determine the incidence of and the factors concerned in post-operative facial paralysis.

Sacrifice of the facial nerve was necessary in four cases, three being cases of carcinoma and one a case of mixed tumour which had recurred twice after previous operations.

Partial sacrifice of the facial nerve was necessary in seven cases, five being cases of recurrent mixed tumour, one a case of recurrent muco-epidermoid tumour, and one of sarcoma.

Gratifyingly little facial paralysis may result from sacrifice of up to half of the facial nerve provided that the terminal branches and their interconnecting nerve fibres are preserved (semi-conservative parotidectomy).

Little or no functional facial paralysis occurred in 45 out of 51 cases of conservative superficial or semi-conservative parotidectomy.

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 investigation furnishes support for the view that ischaemia is the principal factor in post-parotidectomy functional facial paralysis.

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"The Committee for the Advancement of Medicine and the Nuffield Committee for Medical Research and Postgraduate Training have also given attention to the question of library facilities on the Radcliffe and Churchill Hospital sites. No central library accommodation is at present available, and each department has its own separate collection, which results in inconvenience for readers and a certain amount of duplication. The two committees look forward to the establishment in the future of central comprehensive library facilities and the eventual disappearance of individual departmental libraries, and in the meantime have made grants in order to provide, as a nucleus of such a service, a minimum of library assistance and funds for the purchase of books and periodicals. On the Radcliffe site, the Neurology and Neurosurgery Departments have, as a temporary measure, generously offered their own existing library accommodation towards meeting the need for a central library, while on the Churchill site similar co-operation is being given by the Department of Plastic Surgery (in the Kilner Library)." (*Oxford University Gazette*, October 7: "Medical Studies.")