PHRENICOFACIAL NERVE ANASTOMOSIS FOR FACIAL PARALYSIS

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Attempts to correct facial paralysis by anastomosing the distal portion of the facial nerve with a donor nerve began with the turn of the century. The first anastomosis of the spinal accessory to the facial nerve was performed by Faure in 1898, and in 1903 Ballance and his associates reported good results in similar anastomoses. Use of the hypoglossal nerve as the donor implant was reported almost simultaneously by Körtc, Kennedy and Cushing were among the first to report successful results of spinofacial anastomosis. The operative technic progressed from an end-to-side anastomosis to the correct end-to-end procedure. The glossopharyngeal nerve has also been used successfully by Watson-Williams.

Recent reports of anastomosis of the facial nerve with the spinal accessory and hypoglossal nerves have emphasized the inherent disadvantages of both procedures, including the undesirable mass movements, the failure of return of emotional and reflex responses, and the sometimes serious deficits secondary to surgical interruption of the donor nerve. Plastic procedures designed to restore facial symmetry have been helpful in cases in which repair of the nerve was not feasible.

The facial nerve is so bound within the capsule of an acoustic neurinoma that removal of the intracranial portion of the nerve usually occurs with the total removal of the tumor. The use of either the spinal accessory or the hypoglossal nerve may not be warranted for anastomosis as a result of its involvement by the tumor or damage incidental to removal of the tumor. Our first case is that of a patient with facial paralysis following the total removal of an acoustic neurinoma treated by an anastomosis of the phrenic nerve with the facial nerve.

CASE REPORT

SUI #54-12720. The patient was a 44-year-old widow who complained of hearing roaring noises, deafness, diminished vision, difficulty in walking, nausea and vomiting. She had been aware of diminished hearing on the right side for many years, and she recalled that several years ago she had heard an almost continuous roaring noise for several months. For about 9 months she had noticed increasing difficulty in walking. For 3 months she had been bothered with episodes of nausea and vomiting of increasing frequency and severity. For 2 months she had had spells consisting

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of blindness and a strange sensation of numbness of the entire body lasting several minutes. For several weeks there had been increasing impairment of distant and near vision.

Examination. The patient walked with a wide-based unsteady gait. On Romberg testing she would fall to the right. There was drifting of the outstretched left upper extremity. The right eye could not be sustained in right lateral gaze. Papilledema was marked bilaterally. Moderate weakness of the right side of the face was evident. There was pronounced hypalgesia of the right side of the face, and scarcely any corneal sensation was present on this side. Bone conduction of the right ear was markedly diminished. The right heel-to-left knee performance was poorly executed.

Roentgenograms of the skull revealed pronounced enlargement of the right internal auditory meatus. Loss of function of both components of the right acoustic nerve was shown by audiometric and caloric tests.

Operation. On Oct. 29, 1954, a right suboccipital craniectomy was carried out and an encapsulated spherical tumor, approximately 3 cm. in diameter, was completely removed from the cerebellopontine angle. The inferolateral one-third of the cerebellar hemisphere was sacrificed to provide greater exposure. The clinical impression of acoustic neurinoma was confirmed microscopically.

Postoperative course was complicated by a B. coli meningitis, but after several days of intramuscular streptomycin and intravenous Terramycin therapy, the cerebrospinal fluid cultures were negative and the protein and sugar values approached normal limits. Gastric-tube feedings were necessary following operation, but after 4 weeks she was able to swallow adequately. The hoarse quality of speech also slowly improved. Her vision continued to deteriorate for 2 months, at the end of which time it was 2/60. There was no further loss of vision. She had a disfiguring facial palsy, and in addition there was wasting of the right side of the tongue, weakness in elevation of the right shoulder, and wasting of the corresponding trapezius and sternomastoid muscles.

A facial nerve anastomosis was desired, and in view of the significant damage to the spinal accessory and hypoglossal nerves, it was decided to use the phrenic nerve.

2nd Operation. A right phrenicofacial anastomosis was carried out on Dec. 30, 1954. The phrenic nerve was exposed through a transverse incision just above the clavicle. The nerve was followed as far inferiorly as possible before it was cut. It was transposed deep to the sternomastoid muscle to a wound near the angle of the jaw, where the trunk of the facial nerve was exposed. A small incision between the two wounds was made to facilitate the transposition. In order to gain necessary length, the contribution from the 5th cervical nerve was sacrificed. The phrenicofacial anastomosis was accomplished with epineural sutures of #00000 silk. Rotation of the head to the left of midposition was avoided by the use of a chin-shoulder adhesive strap for 4 weeks.

Course. On Mar. 13, 1955, 5 months after the craniectomy and 3 months after the phrenicofacial anastomosis, the patient’s gait was improved, she swallowed more easily and her voice was normal. An iridocyclitis had developed, which responded favorably to treatment. There was marked flaccidity of the facial musculature of the right side.

Three months later, June 22, 1955, a return of muscle tone of the right side of the face was evident. In repose, a barely perceptible movement of the right side of the mouth was observed to coincide with each inspiration. With a deep inspiration the face was pulled to the right side and the right lid would close (Fig. 1B).
The patient and her family had been unaware of the significance of these changes. After only a few minutes' instruction, she was able to correlate the depth of inspiration with the extent of the smile to result in a symmetrical facies (Fig. 1C).

The patient was re-examined on Mar. 20, 1956 and again on Oct. 3, 1956, 15 and 23 months respectively following anastomosis. She had manifestly held the gains recorded previously. In repose her facies appeared nearly symmetrical and thus suggested progressive improvement in muscle tonus. However, she had not yet learned regularly to correlate the movements of self-directed breathing with the play of facial movements. On some occasions she succeeded and on others failed (forgot?) to activate the right side of the face with the left.

Whether this irregular performance was because of lack of sufficient

motivation or more basic shortcomings of the patient's capacity to learn new patterns of behaviour can only be speculated upon.

During fluoroscopy and radiographic studies of the chest on Mar. 20, 1956 both leaves of the diaphragm moved synchronously through approximately the same ranges of excursion. This unanticipated finding has been noted in other connections. Thus, Klein\(^8\) asserted that failure to obtain hemidiaphragmatic paralysis following phrenicotomy appeared in 20 to 30 per cent of his cases, a figure that agrees closely with Hegner's\(^6\) earlier statement on the subject. The explanation proffered is that accessory contributions from sources in the thorax join the phrenic nerve below the cervico-brachial level.

Since our initial experience we have successfully accomplished phrenicofacial neurorrhaphy in 4 additional patients. As in the first case, 2 of these operations were performed after extirpations of acoustic neurinoma. In another patient, the operation followed removal of a meningioma from the
cerebellopontine angle and in a fourth, it was performed for hemifacial paralysis following a gunshot wound which had shattered the left facial nerve and styloid process.

A brief synopsis of the status of the 4 patients follows: In the case of meningioma of the cerebellopontine angle, left phrenicofacial neurorrhaphy was accomplished on Nov. 7, 1955, and 5 months later "voluntary" contractions were seen about the left mouth and cheek but not in the frontalis region. However, 7 months postoperatively, a return of movements in the left frontalis and musculature of the eyelid was noted. Fluoroscopic examination revealed the left diaphragm higher than its fellow, moving through a small arc of excursion and in unison with the leaf of the right side. Our second case of phrenicofacial neurorrhaphy following acoustic neurinoma was carried out on the right side on Dec. 6, 1955. At checkup examination 6 months later the patient already exhibited some "voluntary" motion around the right eye and corner of the mouth. One year later there was good, though incomplete, recovery of facial motion. At fluoroscopy this patient exhibited a paradoxical movement of the right leaf of the diaphragm. In our third case of acoustic neurinoma, phrenicofacial neurorrhaphy was performed on Nov. 27, 1956. As only 2½ months have passed since this operation, we are not prepared to report meaningfully on the case. Finally, in the instance of the individual who suffered the gunshot wound, the first evidence of facial function was seen 6 months after the operation. He has continued to improve for several weeks thereafter.

We desire to report, in addition to the above cases, an unsuccessful attempt to accomplish phrenicofacial neurorrhaphy in 1 patient following removal of an acoustic neurinoma. In this instance it was not possible to accomplish suture of the nerves because we were unable to mobilize a sufficient portion of the phrenic nerve to permit approximation of its proximal end to the distal end of the facial nerve. The phrenic nerve in this case appeared upon anatomic dissection to arise completely from the 5th cervical nerve, in contrast to the usual circumstance in which it arises from the 3rd and/or 4th cervical nerves. It is likely that whenever this particular anatomic variation obtains it will compromise the surgeon's attempt to accomplish phrenicofacial anastomosis, unless he is prepared to pursue the trunk well into the mediastinum.

DISCUSSION

Although Cushing suggested in 1903 that a motor branch of the cervical plexus might be used in facial nerve anastomosis and Lurje mentioned the phrenic nerve as a potentially suitable implant into the peripheral ends of severed components of the brachial plexus, to our knowledge these are the first reported cases of phrenicofacial anastomosis.

The present data suggest that clinical evidence of regeneration of fibres within the facial nerve is as satisfactory following phrenicofacial as that following spinofacial and hypoglossofacial neurorrhaphy. If our impression in this regard should be supported as additional cases are accumulated in this
and other clinics, there would appear to be reasons for preferring the phrenicofacial to the more conventional procedures. In the instance of spinofacial neurorrhaphy, an asymmetry of the musculature of neck and shoulder must be accepted regularly and aching discomfort of the upper limb is a not infrequent consequence of the partial paralysis. In the instance of hypoglossofacial neurorrhaphy, a bothersome dysarthria and some disability in manipulating food within the mouth often attend hemiparalysis of the intrinsic muscles of the tongue. Phrenicofacial anastomosis avoids such consequences of visible atrophy, dysarthria and impairment of motor power. Even if it is likely, as apparently obtains in about 70 to 80 per cent of cases, that hemidiaphragmatic paralysis supervenes after such an operation, the patient’s presenting appearance would in no way be compromised. Finally, the physiologic disability resulting from section of one phrenic nerve is virtually nil.

SUMMARY

A case is reported in which a phrenicofacial anastomosis was carried out for facial paralysis which followed the total removal of an acoustic neuroma. The result 23 months later is considered fairly satisfactory. More recent experience with 5 additional cases is briefly presented.

REFERENCES