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Review Article

Etiology, evaluation, and management of facial nerve trauma

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ABSTRACT

A typical presenting concern in general practitioners' offices, emergency rooms, otolaryngology, and neurology departments are facial nerve paralysis. Penetrating injury to the facial nerve, especially iatrogenic damage, is one of the most frequent traumatic reasons of facial paralysis. The facial paralysis that results from blunt trauma that crushes the nerve frequently appears as an incomplete or delayed paralysis. The affected part of the nerve will determine how the injury manifests clinically. For adequate patient counseling with respect to prognosis and management, accurate diagnosis of facial nerve palsy must be achieved. The most often employed standardized instrument for determining the level of facial weakness is the House-Brackmann 6-grade instrument for facial nerve activity. The greatest success chances for reanimation occur in cases of a recent, sudden nerve transection i.e., less than 72 hours, where the nerve is quickly identified and repaired using direct coaptation or interposition grafts. The primary strategy of care is surveillance in situations with facial nerve paralysis where it is known that the nerve is physically intact such as blunt force trauma with incomplete or delayed complete paralysis. Neurological, muscular, static, and facial plastic treatments are some examples of facial reanimation approaches.

Keywords: Facial nerve trauma, Facial nerve paralysis, Nerve repair

INTRODUCTION

A typical presenting concern in general practitioners' offices, emergency rooms, otolaryngology, and neurology departments are facial nerve paralysis. Based on whether or not planned iatrogenic traumas (such radical parotidectomy for oncological resection) are deemed "trauma," trauma contributes to 6-27% of all facial nerve palsies.[1] Surgical removal of malignancies, temporal bone fractures, and penetrating injury to the facial nerve, especially iatrogenic damage, are the most frequent traumatic reasons of facial paralysis.[1,2] Because the facial nerve is involved in so many everyday activities, facial paralysis has an impact on patients' quality of life.[3] Facial nerve palsy can result in ophthalmologic, otologic, rhinologic, gustatory, and speech ramifications in

addition to the psychological impact of decreased facial expression.

Keratopathy is one of the ophthalmologic effects of poor lacrimation, ectropion, and epiphora, and if it is not identified and treated promptly, it might inevitably lead to blindness. Hyperacusis and partial external auditory canal numbness are otologic outcomes. Nasal blockage can result from inadequate muscle support for the nasal valve. Injury to the chorda tympani branch of the facial nerve can cause dysgeusia, whereas effect on the perioral muscles can cause changed articulation and oral incapacity.[4]

METHODOLOGY

This study is based on a comprehensive literature search conducted on 04 December 2022, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed the information about etiology, evaluation, and management of facial nerve trauma There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

The most common secondary cause of penetrating trauma to the extratemporal side of the facial nerve is transection of the facial nerve following soft tissue injury to the face (such as a knife and gunshot wounds). The facial paralysis that results from blunt trauma that crushes the nerve frequently appears as an incomplete or delayed paralysis. The affected part of the nerve will determine how the injury manifests clinically. Upper and lower facial paralysis results from injury to the face nerve's primary trunk. The capacity to move that part of the face will be impaired by trauma to the muscles or the pes anserinus itself. There have been several cases reported of facial nerve trauma leading to facial paralysis.[2,4] In addition to penetrating trauma to the extratemporal aspect of the facial nerve, these consist of basilar cranial fracture (temporal bone, predominantly), birth injury (most often with forceps delivery), pathological reasons (typically while tumor excision but also while facial or mastoid surgery), bariatric trauma (typically from scuba diving or airplane travel) and lightning bolt.

For adequate patient counseling with respect to prognosis and management, accurate diagnosis of facial nerve palsy must be achieved. The most often employed standardized instrument for determining the level of facial weakness is the House-Brackmann 6-grade instrument for facial nerve activity.[5,6] However, this scale falls short when it comes to describing facial paralysis that is restricted to a certain facial distribution. The Terzis-Noah, Burres-Fisch, Nottingham, and Sunnybrook scales are additional types of scales.[7-10] The state of the upper, middle, and lower face's movements should be carefully assessed and documented, along with facial nerve activity. Eyelid closure, lower lid laxity, brow height, as well as visual acuity, the occurrence of the Bell phenomenon, and corneal irritation, should all receive special attention. In addition to general symmetry, nasal valve collapse and oral competence are significant functional factors. Dysgeusia and total facial paralysis are possible outcomes of injury to the intratemporal section of the facial nerve. Due to trauma to the preganglionic parasympathetic fibers which supply the lacrimal gland and are conveyed in the greater superficial petrosal nerve, injury to the geniculate and close to this area might cause a reduction in lacrimation. Hyperacusis in the impacted ear may come from injury to the nerve close to where it leaves the brain to travel to the stapedius.

Management

Principles of management

The greatest success chances for reanimation occur in cases of a recent, sudden nerve transection (less than 72 hours), where the nerve is quickly identified and repaired using direct coaptation or interposition grafts. Finding the cut ends for a delayed surgery is advised if the patient's condition prevents reanastomosis, for instance an infected field. It is preferable to use a nerve crossover graft (such as the hypoglossal nerve) or cross-face graft when the proximal terminus of the nerve is inaccessible. Neural procedures are less probable to be successful in achieving facial movement if the distal nerve is unavailable and/or if there has been a prolonged denervation trauma. In these cases, muscle transposition approaches will be required. Muscle that receives no cerebral stimulation experiences denervation atrophy, which typically reaches its peak at three years of age. The primary strategy of care is surveillance in situations with facial nerve paralysis where it is known that the nerve is physically intact (such as blunt force trauma with incomplete or delayed complete paralysis). A baseline of six months but no more than two years should be allowed for the observation period. By 12 months, most patients should start to show symptoms of reinnervation if healing is to take place. EMG might be helpful in this situation. After two years, there is a higher likelihood that denervation atrophy will occur, obviating the possibility of using neural procedures. Neurological (e.g., direct anastomosis, crossover grafts, free tissue transfer), muscular (e.g., temporalis tendon transfer, temporalis transposition, masseter transposition), static (e.g., slings, upper eyelid gold weight), and facial plastic treatments are some examples of facial reanimation approaches (e.g., brow-lift, face-lift). The biggest likelihood of mobility and alignment comes from neural approaches. Movement and alignment can be achieved via muscular procedures; however, they do not produce as good of outcomes as neural approaches. Improved symmetry and corneal protection are achieved through static and face plastic treatments. As an emergency management strategy for maintaining vision and lessen

ocular problems such epiphora, dryness, ectropion, corneal eroding, and loss of vision, these operations are frequently carried out in tandem with other procedures. Mentioned below are neural techniques to consider in the acute management of facial nerve injury.

Neural techniques

Direct anastomosis

The greatest chance for nerve functionality to restore is with direct end-to-end ligation of the distal and proximal parts of the transected facial nerve. Procedures for coapting the terminals of the nerve employing 9-0 or 10-0 nylon sutures have been documented for both epineurial and perineurial suture repairs. An epineurial repair is simpler to carry out and has had positive outcomes. Although surgery takes longer and is more challenging to complete, perineurial restoration of the specific fascicles has the ability to decrease synkinesis and mass facial movement. Given that these nerve branches only have a small number of fascicles, it may be helpful in cases of more proximal injury. Any procedure used must be tension-free in order to avoid scar tissue formation and fibrosis at the anastomotic site. Numerous alternative and supplemental approaches have been devised in an attempt to enhance facial nerve surgery and healing. In the healing of neural gaps, nerve conduits provide an alternate solution to nerve transplants. These synthetic grafts give the anastomotic site protection and structural support while directing axon regrowth.[11-13] Technically, conduits prevent fibrosis, the development of neuromas, and responses to foreign bodies by segregating the nerve terminals during regeneration.[14] Conduits are now designed thanks to technical advancements to enable the diffusion of several neurotrophic and neuroprotective substances.[11,12] There are no linked donor site complications with neural conduits, in contrast to nerve grafts.[15] A fibrin glue may be used to restore the facial nerve without the need of sutures. Particularly in small surgical spaces like the internal auditory canal and the cerebellopontine angle, it is simpler and takes less time.[16,17] A fibrin adhesive might also reduce the occurrence of a foreign body reaction.[17,18] According to studies, fibrin glue performs equally well in surgical procedures on the cerebellopontine angle and the temporal bone as suture does.[16,17] Despite the paucity of research on fibrin adhesive for distal anastomoses, fibrin adhesive may in some circumstances be a viable choice for facial nerve restoration. According to a new analysis by Cho et al in an animal model, suture repair combined with neural generated mesenchymal stem cells and platelet-rich plasma facilitates a quicker and more thorough recovery of facial motion than suture anastomosis itself.[19]

Cable (interposition) graft

The best method for restoring facial motion when a tension-free treatment is not a possibility is a cable nerve transplant. The two most frequently used nerves are the sural nerve and the great auricular nerve (C2, C3). Both have appropriate axon lengths, are easily accessible, and have little donor insufficiency. The great auricular nerve, which gives feeling to the skin of the posterior auricle, can be seen leaving the body at Erb's point, just beneath the sternocleidomastoid muscle. The nerve has a diameter and fascicular pattern similar to the facial nerve and has a harvestable length of 7 to 10 cm. The sural nerve runs posterior to the lesser saphenous vein at the lateral malleolus and is comprised of the medial branch of the sural cutaneous nerve and the peroneal communicating branch of the lateral sural cutaneous nerve. The harvestable length ranges from 35 to 70 cm and comprises a variety of branch sites that are perfect for anastomosing to different branches of the facial nerve.[20] Additionally classified as a donor nerve, the medial antebrachial cutaneous nerve is a good contender for an interposition graft due to its branching structure and width.[20,21]

Crossover grafting

It is feasible to use additional cranial nerves (crossover grafts) to supply the distal terminus of the face nerve when the proximal facial nerve is unavailable. To guarantee undamaged distal motor endplates, the best time to apply these techniques is between six months and two years. The benefit of crossover grafts is that they can reinstate facial motion by utilizing a motor nerve. Substantially more mass movement and synkinesis than direct anastomosis or interposition are disadvantages. In addition, the patient needs to develop the ability to move his or her face by sticking out their tongue (hypoglossal-facial crossover), clenching their jaw (trigeminal-facial crossover), or shifting their shoulder (spinal accessory-hypoglossal crossover). The necessity of weakening or sacrificing a functional cranial nerve is yet another significant drawback of crossover transplants. The most popular and effective crossover graft is the anastomosis of the hypoglossal-facial nerve (HFN). The nerve is the perfect nerve because of how closely tongue and facial motions are related to each other and how close the nerve is to the surgical area.[22] The biggest drawback is the accompanying donor handicap, which includes articulation and swallowing issues as well as tongue atrophy. The hypoglossal nerve was end-to-end anastomosed to the facial nerve in the traditional HFN anastomosis.[22] Consequently, tongue atrophy was widespread and had varying effects on articulation and swallowing. May et al discuss the application of an interposition graft with end-to-side and end-to-end anastomosis to the facial nerve in order to lessen these consequences.[23] In several situations, ipsilateral tongue atrophy was prevented with only selective hypoglossal nerve division. In contrast to the traditional approach, they observed a lower facial response and a prolonged recovery period. Other accounts of the HFN crossing comprise longitudinal division of the nerve, end-to-side intrapetrous anastomosis, end-to-side anastomosis with translocation of the infratemporal facial nerve, and hemihypoglossal-facial neurorrhaphy following mastoid resection.[24] The functional outcomes of these alterations have so far been encouraging. Owing to the degeneration of the trapezius

muscle and the less dynamic movement of the face, the application of the spinal accessory nerve has shown only modest success and has been generally discontinued in preference of the HFN transfer.[28] The sternocleidomastoid branching of the spinal accessory nerve can be detached for anastomosis, as Poe et al. showed, to retain trapezius activity.[29] With the use of this approach, patients were able to regain some voluntary mobility and facial toning, according to Griebie and Huff.[25] In an individual with preoperative hypoglossal dysfunction or numerous cranial nerve impairments, use of the sternocleidomastoid branch for a spinal accessory-facial transference can be taken into consideration as an alternate to the hypoglossal-facial transfer.[26,27] Due to its width, length, and position relative to the facial nerve, the masseteric offshoot of the trigeminal nerve is an additional choice for crossover grafts.[28,29] It can also be utilized as a basic anastomosis or in combination with other procedures like a cross-face nerve graft (also known as the "babysitter surgery").[30] The opposite undamaged facial nerve serves as the motor supply for the cross-face (facial-facial) nerve graft. The only method that theoretically allows for divisional control of the face muscles and the potential for spontaneous expression is this one.[27] Traditional cross-face nerve grafting is carried out in two stages. First, fascicular branches on the healthy side are severed, and various interposition grafts (such as the sural nerve) are anastomosed to these branches. These grafts are delivered to the face's paralytic side using subcutaneous channels. Before axon regeneration approaches the last interposition graft, the second phase is postponed. This is seen when the individual's healthy side of the face tingles when the paralyzed side is touched (Tinel sign). The extremities of the interposition grafts are now anastomosed to the paralyzed facial aspect, which typically occurs six to 12 months afterwards. While awaiting cross-face innervation, a "babysitter operation" utilizing the masseteric branch of the trigeminal nerve or the hypoglossal nerve can be carried out to avoid irreparable denervation degeneration.[30] Pure cross-face nerve grafts alone do not produce satisfactory esthetic effects for reanimation, but when paired with the babysitting operation or single-stage free tissue transfer (e.g., latissimus dorsi), symmetrical and coordinating motions can be obtained.[31,32]

CONCLUSION

Patients who suffer from facial nerve injuries can suffer greatly from mental trauma and disfigurement. Acute facial nerve damage must be easily diagnosed and treated by facial plastic surgeons. An appropriate physical assessment is the first step in the proper management of abrupt facial nerve injury. The best result will come through investigation and immediate correction if a full transection has happened. The capacity of the neural system and the vitality of the muscular motor endplates are key factors in care in situations where direct restoration is impossible, or the damage is persistent. Depending on this, either static or dynamic methods will be suggested. To avoid ocular consequences in individuals with a facial nerve damage, it is crucial to consider eye care in the short and long run.

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REFERENCES

1. Hohman MH, Hadlock TA. Etiology, diagnosis, and management of facial palsy: 2000 patients at a facial nerve center. The Laryngoscope. 2014;124(7):E283-93.
2. Hohman MH, Bhama PK, Hadlock TA. Epidemiology of iatrogenic facial nerve injury: a decade of experience. The Laryngoscope. 2014;124(1):260-5.
3. Kleiss IJ, Hohman MH, Susarla SM, Marres HA, Hadlock TA. Health-related quality of life in 794 patients with a peripheral facial palsy using the Fa CE Scale: a retrospective cohort study. Clin Otolaryngol. 2015;40(6):651-6.
4. Gordin E, Lee TS, Ducic Y, Arnaoutakis D. Facial nerve trauma: evaluation and considerations in management. Craniomaxillofac Trauma Reconstruction. 2015;8(1):1-13.
5. House JW. Facial nerve grading systems. The Laryngoscope. 1983;93(8):1056-69.
6. Brackmann DE, Barrs DM. Assessing recovery of facial function following acoustic neuroma surgery. Otolaryngol-Head Neck Surg. 1984;92(1):88-93.
7. Terzis JK, Noah ME. Analysis of 100 cases of free-muscle transplantation for facial paralysis. Plastic Reconstructive Surg. 1997;99(7):1905-21.
8. Burres S, Fisch U. The comparison of facial grading systems. Arch Otolaryngol–Head Neck Surg. 1986;112(7):755-8.
9. Murty GE, Diver JP, Kelly PJ, O'Donoghue G, Bradley PJ. The Nottingham System: objective assessment of facial nerve function in the clinic. Otolaryngol-Head Neck Surg. 1994;110(2):156-61.
10. Ross BG, Fradet G, Nedzelski JM. Development of a sensitive clinical facial grading system. Otolaryngol-Head Neck Surg. 1996;114(3):380-6.
11. Zhang H, Wei YT, Tsang KS, Sun CR, Li J, Huang H, Cui FZ, An YH. Implantation of neural stem cells embedded in hyaluronic acid and collagen composite conduit promotes regeneration in a rabbit facial nerve injury model. J Transl Med. 2008;6:67.
12. Vasconcelos BC, Gay-Escoda C. Facial nerve repair with expanded polytetrafluoroethylene and collagen conduits: an experimental study in the rabbit. J Oral Maxillofac Surg. 2000;58(11):1257-62.
13. Furth ME, Atala A, Van Dyke ME. Smart biomaterials design for tissue engineering and regenerative medicine. Biomaterials. 2007;28(34):5068-73.
14. Zhou L, Du H-D, Tian H-B, Li C, Tian J, Jiang JJ. Experimental study on repair of the facial nerve with Schwann cells transfected with GDNF genes and

PLGA conduits. Acta Oto-laryngologica. 2008;128(11):1266-72.
15. Hadlock T, Elisseeff J, Langer R, Vacanti J, Cheney M. A tissue-engineered conduit for peripheral nerve repair. Arch Otolaryngol–Head Neck Surg. 1998;124(10):1081-6.
16. Bozorg Grayeli A, Mosnier I, Julien N, El Garem H, Bouccara D, Sterkers O. Long-term functional outcome in facial nerve graft by fibrin glue in the temporal bone and cerebellopontine angle. Eur Arch Oto-Rhino-Laryngol Head Neck. 2005;262(5):404-7.
17. Bacciu A, Falcioni M, Pasanisi E, Di Lella F, Lauda L, Flanagan S, et al. Intracranial facial nerve grafting after removal of vestibular schwannoma. Am J Otolaryngol. 2009;30(2):83-8.
18. Júnior EDP, Valmaseda-Castellón E, Gay-Escoda C. Facial nerve repair with epineural suture and anastomosis using fibrin adhesive: an experimental study in the rabbit. J Oral Maxillofac Surg. 2004;62(12):1524-9.
19. Cho HH, Jang S, Lee SC, Jeong HS, Park JS, Han JY, et al. Effect of neural-induced mesenchymal stem cells and platelet-rich plasma on facial nerve regeneration in an acute nerve injury model. The Laryngoscope. 2010;120(5):907-13.
20. Humphrey CD, Kriet JD. Nerve repair and cable grafting for facial paralysis. Fac Plast Surg. 2008;24(02):170-6.
21. Haller JR, Shelton C. Medial antebrachial cutaneous nerve: a new donor graft for repair of facial nerve defects at the skull base. The Laryngoscope. 1997;107(8):1048-52.
22. Conley J, Baker DC. Hypoglossal-facial nerve anastomosis for reinnervation of the paralyzed face. Plast Reconstructive Surg. 1979;63(1):63-72.
23. May M, Sobol SM, Mester SJ. Hypoglossal-facial nerve interpositional-jump graft for facial reanimation without tongue atrophy. Otolaryngol-Head Neck Surg. 1991;104(6):818-25.
24. Martins RS, Socolovsky M, Siqueira MG, Campero A. Hemihypoglossal–facial neurorrhaphy after mastoid dissection of the facial nerve: results in 24 patients and comparison with the classic technique. Neurosurgery. 2008;63(2):310-7.
25. Ebersold MJ, Quast LM. Long-term results of spinal accessory nerve-facial nerve anastomosis. J Neurosurg. 1992;77(1):51-4.
26. Griebie MS, Huff JS. Selective role of partial XI-VII anastomosis in facial reanimation. The Laryngoscope. 1998;108(11):1664-8.
27. Terzis JK, Konofaos P. Nerve transfers in facial palsy. Fac Plast Surg. 2008;24(02):177-93.
28. Brenner E, Schoeller T. Masseteric nerve: a possible donor for facial nerve anastomosis? Clin Anatomy. 1998;11(6):396-400.
29. Fournier H-D, Denis F, Papon X, Hentati N, Mercier P. An anatomical study of the motor distribution of the mandibular nerve for a masseteric-facial anastomosis to restore facial function. Surg Radiol Anatomy. 1997;19(4):241-4.
30. Faria JCM, Scopel GP, Ferreira MC. Facial reanimation with masseteric nerve: babysitter or permanent procedure? Preliminary results. Ann Plast Surg. 2010;64(1):31-4.
31. Yoleri L, Songür E, Mavioglu H, Yoleri Ö. Cross-facial nerve grafting as an adjunct to hypoglossal-facial nerve crossover in reanimation of early facial paralysis: clinical and electrophysiological evaluation. Ann Plast Surg. 2001;46(3):301-7.
32. Terzis JK, Tzafetta K. The “babysitter” procedure: minihypoglossal to facial nerve transfer and cross-facial nerve grafting. Plast Reconstructive Surg. 2009;123(3):865-76.

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