Original Article

Surgical Management of Traumatic Facial Paralysis: A Case Review Study

YI Hai-jin[1], LIU Pi-Nan[2], YANG Shi-ming[1]

[1]*Department of Otolaryngology, Head and Neck Surgery, Institute of Otolaryngology, Chinese PLA General Hospital, Beijing, China*

[2]*Department of neurosurgery division 9 and otolaryngeal-head and neck surgery, Beijing Tiantan Hospital ,Capital University of Medical Science, Beijing ,China*

AbstractObjective To evaluate efficacy of surgical treatment in traumatic facial paralysis. **Methods**: Thirty-three cases were reviewed, including temporal bone fracture and iatrogenic facial nerve injury. All the patients were treated with various surgical methods according to their pathogeny. **Results** The mean percentage facial function improvement (House-Brackmann Grade Ⅰ-Ⅱ) was 86% in temporal bone fracture and function was improved after proper operation to iatrogenic facial nerve injury. **Conclusions** Patients with traumatic facial paralysis receive proved outcomes itreaed with proper surgical methods according to their particular condition of nerve injury.

Key words traumatic facial paralysis; temporal bone fracture; surgical therapy ;iatrogenic facial nerve injury

Facial paralysis (FP) as a disease of serious impact on patient´s lives has currently aroused increasing attention. FP can be divided into two types, central and peripheral, with the latter being more common. Many factors, including inflammation, trauma, tumors and congenital factors can cause FP. With the increase of traffic accidents, traumatic facial paralysis (TFP) has also increased and iatrogenic facial nerve injuries (IFI) are increasingly common too. This paper summarizes the data of 33 patients with TFP treated in our department, including TBF and IFI, and evaluates the outcomes of surgical treatment in these patients.

Clinicaldata

From January, 2007 to March, 2011 ,33 patients with TFP were treated in our department, including 17 males and 16 females, aged from 1 to 65 years (average 33 years). The injury was on left in 15 cases and right in 18 cases. Temporal bone fracture was involved in 28 cases, including longitudinal fracture in 14 cases, transverse fractures in 7 cases, and mixed fractures in 7 cases as shown by high resolution CT scan. IFI was found in 5 cases, including postoperative FP after removal of acoustic neuroma in 4 cases and of the parotid gland in 1 case. House-Brackman (H-B facial nerve function, time from injury to treatment and other data of the 33 cases are shown in table 1. All the patients received routine preoperative tests, including pure tone audiometry, taste test, lacrimal gland secretion test, facial nerve electroneuronography (ENOG) and electromyography (EMG) to determine the injury site and severity. Patients were followed up for 3 months to 3 years.

Corresponding author: Yang ShiMing Yi HJ1, MD, postdoctor, 18601032722, no fax number, dl7599@sohu.com, expert in otology & neurotology and lateral skull base surgery.

Methods

Different surgical techniques were useddepending onthespecificTFPcondition.

For temporal bone fracture facial nerve decompression was approached via a mastoid-epitypanum approach. The surface of the damaged nerve tissue was exposed, bone chips and blood clots were removed, the facial nerve sheath was incised and the decompression was finished. When the injured site was around the geniculate ganglion and the auditory ossicles hindered exposure, dislocation of the incudomalleolar joint and anterior–inferior displacement of the incus were done for decompression of the geniculate ganglion and the distal labyrinthine segment through the supralabyrinthine recess, followed by restoration of the incudomalleolar joint. In the 1 case of transverse temporal bone fractures with totally deafness, the translabyrinthine approach was used to expose the entire facial nerve to the cerebellar pontine angle. The injury site in the labyrinthine segment was repaired and the internal auditory canal was tamped with muscle tissue graft to prevent postoperative cerebrospinal fluid leakage. In a case of tympanic segment transection, end–to–end anastomosis with about 1 cm great auricular nerve graft was performed as direct anastomosis with tension was difficult. The nerve graft was embedded in bone slots milled specially for nerve transplantation. Four cases of postoperative FP underwent facial – hypoglossal nerve anastomosis. Decompression of facial nerve in the 1 case of parotid gland excision was achieved by excision of the scar in the stylomastoid foramenas as it comppressed the facial nerve trunk.

Postoperative treatment and rehabilitation

All patients were given similar treatments including antibiotics and support treatments. Stitches were removed after a week and acial function rehabilitation exercises began.

Table 1 Case data

Etiology	Total No.	Pre-op H-B	Duration Before Surgery	Injury Site	Surgical Technique	Post-op H-B
TBF	28	III (n=5 IV (n=16) V (n=7)	1-3 m (n=13) 4-6 m (n=12 7-9 m (n=3)	VS (n=8) AGG (n=18 LS (n=1) NTP (n=1)	MEA (n=26 TLA (n=1) NTP (n=1)	I (n=15) II (n=8) III (n=1) IV (n=2)
IFI	5	V (n=5)	12-18 m (n=5)	PFPAN (n=4) PGE (n=1)	FHNA (n=4) SED (n=1)	III (n=3) IV (n=2)

VS = vertical segment, LS = labyrinthine segment, NT = nerve transection, AGG = around the geniculate ganglion, IS = injury situation, PFPAN = postoperative FP of acoustic neuroma, PGE = parotid gland excision, mastoid–epitypanum approaches = MEA, translabyrinthine approach = TLA, nerve transplantation = NTP, facial–hypoglossal nerve anastomosis = FHNA, scar excision+decompression = SED,, m = months

Journal of Otology 2011 Vol.6 No.2

Results

Treatment outcomes of the 33 cases are in Table 1.

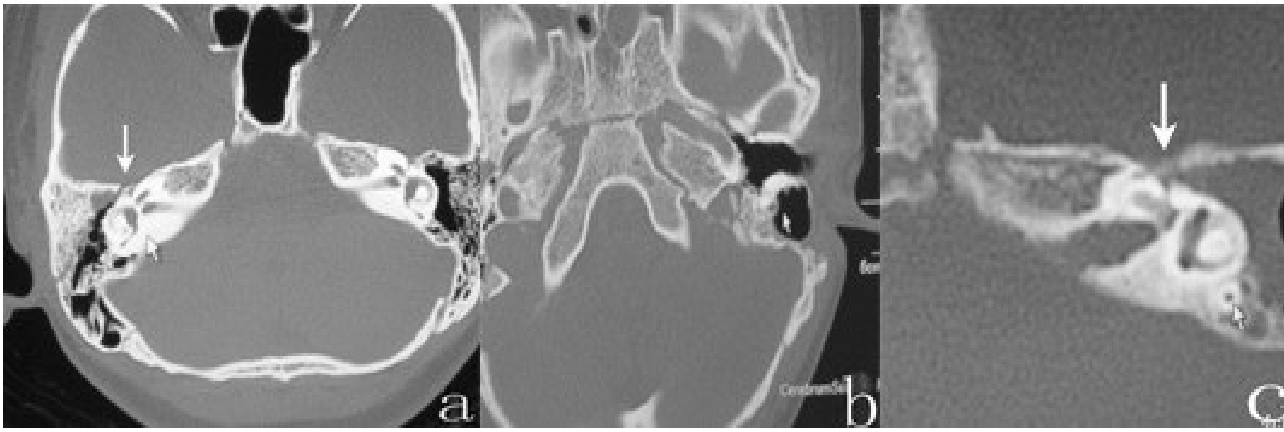

Figure 1 a. injury site around the geniculate ganglion in a case of right temporal bone fracture (arrowhead). b. postoperative HRCT showing vertical segment facial nerve decompression for traumatic FP. c. postoperative HRCT showing nerve decompression in the left geniculate ganglion and distal labyrinthine segments via a mastoid–epitypanum approach (arrowhead).

Discussion

Electrophysiology and imaging of the facial nerve

Facial nerve electrophysiology diagnostic techniques include nerve excitability test (NET), electroneuronography (ENOG), electromyography (EMG), maximum stimulation test (MST) and nerve conduction velocity test. NET is to stimulate the facial nerve trunk with a square wave electrical pulse and to measure facial nerve excitement. MST is to stimulate the facial nerve with a supercurrent to enable excitement of all residual functioning facial nerve fibers in order to accurately compare the reaction of the nerve on the diseased and healthy sides. ENOG is to record induced compound action potential of facial muscle and compare its amplitude with the contralateral side to estimate the percentage of degeneration of nerve fibers. Electrophysiology diagnosis requires appropriate timing and clinicians must choose appropriate electrophysiology methods according to the particular injury condition in a case. Comprehensive analysis of all electrophysiology results should be done in order to draw the right conclusions. It is generally believed that surgical exploration should be considered if ENOG shows a bilateral amplitude ratio of > 90% or NET shows a difference of > 3.5mA or MST shows no reaction, especially when combined with EMG examination revealing fibrillation potentials indicating complete loss of nerve function with no recovery. High Resolution CT (HRCT) plays an important role in the diagnosis of TFP [1]. Multi–slice spiral CT that can find 0.5 mm wide fracture lines is the useful instrument to locate the injury site of facial nerve. When dealing with delayed post–traumatic facial nerve palsy without evidence of TBF on CT, MR is essential for diagnosing nerve impairment [2].

Surgical indication , technique and timing in TFP

Approximately 15–25% of the longitudinal and 50% of the transverse TBF result in FP. Facial nerve decompression in TFP can significantly improve clinical outcomes. Saraiya PV, Aygun N [1] and others reported that HRCT in the diagnosis of TBF was important. Ulug T, Arif Ulubil S [3] reported that facial nerve decompression led to good results within 3 months after injury. Yetiser S, Hidir Y, Gonul E [4] reported that 54% of TFP was due to traffic accidents, of which 31.58% involved vertical segment injury, and facial nerve decompression was effective treatment. Sanu? GZ, Tanri?ver N [5] thought that if early decompression of TFP was missed, late decompression could still be applied with certain efficacy. We think that surgical intervention in TFP should be based on facial nerve electromyography and HRCT findings. If surgery is indicated by facial nerve electrophysiology, then surgery should be done as soon as possible. If the patients has missed the chance of early intervention, surgery should be done when EMG shows fibrillation potentials.

On the surgical approach, the mastoid approach is used for tympanic and vertical segment injury, the external ear canal approach for horizontal segment injury with combined ossicular chain disruption in longitudinal TBF, the middle cranial fossa approach for geniculate ganglion and labyrinthine segment or the internal auditory canal segment injury with good hearing and vestibular function; and the mastoid-middle cranial fossa approach for decompression of the entire course. When there is complete hearing and the injury site is above the geniculate ganglion, translabyrinthine approach is usually recommend. In this paper, mastoid – epitypanum approach was adopted in 26 patients. When the injury site was around the geniculate ganglion and the ossicles obscured exposure, dislocation of the incudomalleolar joint and anterior and inferior displacement of the incus were done for decompression of the geniculate ganglion and distal labyrinthine segments through the supralabyrinthine recess. The incudomalleolar joint was restored after decompression. We feel that this approach is simple, safe and effective and can achieve a similar result as the middle cranial fossa approach with little postoperative hearing change as there is minimal disruption to the ossicular chain. In our series, facial function in 23 of the 26 cases was restored to H-B Ⅰ–Ⅱ. Translabyrinthine approach was used in one case with total deafness and resulted in function restoration from H-B Ⅴ to H-B Ⅱ. Greater auricular nerve transplantation was used in one case of nerve transection with a function restoration from H-B Ⅴ to H-B Ⅲ.

Iatrogenic facial paralysis

Possible causes of iatrogenic facial paralysis include: 1) neurosurgery and skull base surgery, including operations in the CPA area, translabyrinth approach and temporal bone surgery; 2) ear surgery, including operations for otitis media, otosclerosis, cochlear implants, etc; 3) head and neck surgery, such as parotid gland excision. This paper includes 5 cases of postoperative FP: 4 from acoustic neuroma removal and 1 from parotid gland excision. In acoustic neuroma removal, the surgeon cannot ensure the continuity of the facial nerve during the operation, so regular postoperative EMG observation is recommended until it is determined that restoration is impossible. Then facial – hypoglossal nerve anastomosis is usually performed before muscle atrophy. Why not sooner? It is because the efficacy of such operation is not great. Nerve function recovery in facial – hypoglossal nerve anastomosis can reach a H-B Ⅲ level at the most. If complete transection of the facial nerve were determined during the operation, first stage nerve anastomosis or transplantation should be done. Of the 5 cases of IFP in our series, facial function was restored from H-B Ⅴ to H-B Ⅲ in 3 cases, and from H-B Ⅴ to H-B Ⅳ in 1 case. In the 1 case of parotid gland excision with hemophilia, surgical scar formed above the stylomastoid foramen. Despite careful exploration and decompression, postoperative nerve function reached only H-B Ⅳ, probably due to the long duration of compression of 18 months before surgery. Yetiser S [6]uggested that facial – hypoglossal nerve anastomosis was a safe and effective surgical treatment, surgery as soon as possible (preferably 12 months or less) could lead to results, and improved variety of end-side anastomosis techniques might reduce complications such as tongue muscle weakness and paralysis. López Aguado D and Zieliński P [7,8] also supported a similar view. Donzelli R [9] reported that in three cases of facial nerve deficiency from removal of residual acoustic neuroma, first stage facial – hypoglossal nerve anastomosis led to good results. Matejcík V, Pénzesovά G [10] thought that facial – accessory nerve anastomosis was better than the facial – hypoglossal nerve anastomosis because of more acceptable concurrent deficiency of the nerve.

Conclusions

In short, timely surgical treatment chosen in accordance to the type of TFP, facial nerve electrophysiology and imaging guidance, and appropriate surgical approaches can result in good outcomes.

Reference

1 Saraiya PV, Aygun N.Temporal bone fractures.Emerg Radiol. 2009 Jul;16(4):255-65. Epub 2008 Nov 4.

2 Rotondo M, D´Avanzo R, Natale M.et,al.Post-traumatic peripheral facial nerve palsy: surgical and neuroradiological consideration in five cases of delayed onset.Acta Neurochir (Wien). 2010 Oct;152(10):1705-9. Epub 2010 Jul 27.

3 Ulug T, Arif Ulubil S.Management of facial paralysis in temporal bone fractures: a prospective study analyzing 11 operated fractures.Am J Otolaryngol. 2005 Jul-Aug;26(4):230-8.

4 Yetiser S, Hidir Y, Gonul E.Facial nerve problems and hearing loss in patients with temporal bone fractures: demographic data.J Trauma. 2008 Dec;65(6):1314-20.

5 Sanuş GZ, Tanriöver N, Tanriverdi T.et,al.Late decompression in patients with acute facial nerve paralysis after temporal bone fracture. Turk Neurosurg. 2007;17(1):7-12.

6 Yetiser S, Karapinar U.Hypoglossal-facial nerve anastomosis: a meta-analytic study.Ann Otol Rhinol Laryngol. 2007 Jul; 116(7):542-9.

7 López Aguado D, López Campos D, Campos Bañales ME. Hypoglossal facial anastomosis as a solution to a total peripheral facial palsy. Our experience Acta Otorrinolaringol Esp. 2006 May;57(5):223-7.

8 Zieliński P, Słoniewski P, Stempniewicz M. Neurol Neurochir Pol. Results of 13 hypoglosso-facial anastomoses.2006 May-Jun;40(3):194-6; discussion 197.

9 Donzelli R, Motta G, Cavallo LM.et,al.One-stage removal of residual intracanalicular acoustic neuroma and hemihypoglossal-intratemporal facial nerve anastomosis: technical note.Neurosurgery. 2003 Dec;53(6):1444-7; discussion 1447-8.

10 Matejcík V, Pénzesová G.Our experience with surgical treatment of lesions of nervus facialisNeurocirugia (Astur). 2008 Apr; 19(2):127-32.

(Received December 23, 2011)