

ORIGINAL ARTICLE

Comparative Evaluation of Various Types of Surgical Treatment of Peripheral Paresis of The Facial Nerve of Different Genesis

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ABSTRACT

The results of surgical treatment of facial nerve palsy (FNP) of various origins in 82 patients in the period 2015-2022 were analyzed. There were 48 (58.5%) women and 34 (41.5%) men. Combined neurotization by masticatory branches with simultaneous control-lateral (Cross) neurotization of the FN improved the function of the facial nerve to level II-III on the House-Brackmann scale in 86.6% of patients. Neurotization of the FN by the branches of the masticatory nerve or the descending branch of the hypoglossal and the branch of the accessory nerve in most cases improves the function of the FN to clinical grade III according to House-Brackmann. The choice of surgical treatment tactics should be chosen individually, taking into account factors such as the degree of damage to the mimic muscles, the age of the patient, the duration of the disease and the prevailing clinical symptom.

Keywords: neurotization, facial nerve, donor nerve, electroneuromyography, surgical treatment

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INTRODUCTION

Facial nerve palsy (FNP) is a polyetiological pathological condition characterized by predominantly unilateral paresis and/or paralysis of the facial and other muscles innervated by the facial nerve, often with a remitting course, which is accompanied by a decrease in the tone and activity of the facial muscles, a violation of the parasympathetic innervation of the eye, a gross aesthetic defect, a secondary decrease in the quality of life, an increased high probability of developing a depressive or anxious state, and a decrease in behavioral activity [4]. The annual incidence of FNP, according to various sources, is 1.2-5.3 cases per 10,000 population [1, 3]. Among the causes of FNP, it is especially important to note mechanical damage to the facial nerve (FN) or its trunks during craniocerebral and craniofacial trauma, as well as a wide range of iatrogenic injuries associated with the removal of tumors of the posterior cranial fossa (most often, acoustic neuromas), the retroauricular region, as well as with surgical interventions for various diseases of the peripheral part of the auditory analyzer [1, 2, 3]. FN damage is typical for 7-10% of cases of temporal bone fracture [5]. Pathognomonic for FNP are aesthetically significant peripheral flaccid paresis of the facial muscles (ptosis, gross asymmetry against the background of activation of the opposite part of the facial muscles), secondary neurotic disorders of the affective sphere and social maladjustment [1, 2, 3, 4], as well as ophthalmological disorders such as lagophthalmos, deficiency of parasympathetic innervation of the eye and xerophthalmia, secondary damage to the cornea [6].

Treatment of the most common form of FNP - Bell's palsy in the acute period requires a differentiated therapeutic approach, the elimination of irreversible consequences includes a number of conservative and surgical methods. In most cases of lack of effect from 2-3 courses of conservative treatment of FNP, first-line treatment measures are surgical interventions aimed at reinnervation of the facial muscles [8].

The use of a differentiated approach and a combination of several treatment methods generally improves the quality of life of patients. Among the problems associated with FNP, the choice of an effective type of FN neurotization when conservative treatment is ineffective over a certain period is relevant. This study is devoted to solving this issue.

Purpose of the research

To evaluate the effectiveness of various types of surgical correction in patients with FNP of various genesis.

MATERIAL AND METHODS

The results of surgical treatment of FNP of various genesis in 82 patients were analyzed in the period 2015-2022. There were 48 women (58.5%), 34 men (41.5%). The median duration of the period from the moment of FN injury to surgical treatment was 12 months. The duration of the postoperative observation period was 12-36 months. Patients with facial nerve injury underwent correction of facial muscle dysfunctions, in particular: neurotization with various donor nerves, free muscle grafting of the facial muscles, static secondary cosmetic corrections of the facial muscles (canthopexy, elevation of the corner of the mouth). The most common cause of facial nerve injury was removal of posterior cranial fossa tumors - 43 patients (52.3%). Various types of reconstructive interventions were used: neurotization by the branch of the masseteric nerve innervating the sternocleidomastoid muscle with one-stage "cross" neurotization of patients, neurotization of the facial nerve by the branch of the accessory nerve to the sternocleidomastoid muscle and the descending branch of the hypoglossal nerve - 18 descending branch of the hypoglossal and branch of the accessory nerve - 49 patients, the immediate and remote treatment results were studied.

Patients underwent a control examination and ENMG study no earlier than 4 months after surgery. Remote results were studied at a time of no earlier than 12 months and up to 24 months after surgery by repeated neurological examinations and additional electrophysiological research methods.

Inclusion criteria: persistent FN function deficiency, ineffectiveness of conservative treatment against the background of ENMG signs of complete conduction disorder. The causes of FNP are listed in Table 1, the most common etiologic form due to the removal of tumors of the posterior cranial fossa.

The FN function index was expressed in points that corresponded to the digital index of the clinical degree according to the House-Brackmann scale. All patients demonstrated a clinical FN function index of 3-6 points at the time of surgery. ENMG was used in individual clinical cases to verify the depth of facial muscle paresis, the absence of positive functional dynamics and the formation of indications for surgical treatment of FNP. ENMG included an assessment of spontaneous and evoked activity of the facial muscles during stimulation of the extracranial part of the trunk or branches of the facial nerve [14].

Table 1: Distribution of patients with persistent facial nerve neuropathy by etiology

Causes of FNP	Number (abs.)	No (%)
Consequences of posterior fossa tumor removal	43	52,3
Inflammatory (osteomyelitis, otogenic)	5	6,1
Consequences of parotid gland tumor removal	8	9,8
Open FN injury (injury to soft tissues of the face)	3	3,7
Fracture of the temporal bone pyramid	4	4,9
Birth injury FN	3	3,7
Neuritis FN	16	19,5

Stimulation was performed by an electroneuromyograph (neurosoft), with simultaneous recording of the maximum amplitude of the total action potential (AP) of the nerve and the M-response of the muscle.

The signs of muscle fiber reinnervation were spontaneous or caused by stimulation of the trunk of the damaged FN low-amplitude polyphasic potentials of motor units, fibrillation potentials, low-amplitude M-responses.

Indications for surgical treatment: persistent deficiency of FN function - grade V according to House-Brackmann (6 months) against the background of conservative treatment, no ENMG signs of innervation of paretic facial muscles.

The method of surgical treatment was neurotization of the extracranial part of the common trunk of the FN, in group 1 - a branch of the masseteric nerve innervating the sternocleidomastoid muscle with one-stage "cross" neurotization (n = 18); in group 2 - descending branch of the hypoglossal and branch of the accessory nerve (n=49); in group 3 - Free muscle plastic surgery of the facial muscles (n=8); in group 4 - Plastic surgeries aimed at correcting the facial muscles and protecting the cornea (n=15).

Criteria for inclusion in the first group: Disease duration of at least 24 months, age under 60;

Criteria for inclusion in the second group: Age at least 40, disease duration of no more than 12 months,

Criteria for inclusion in the third group: Persistent paralysis of the facial muscles with gross atrophy, disease duration of more than 24-36 months, patient age no more than 35 years;

Criteria for inclusion in the fourth group: gross dysfunction of the facial muscles with secondary ophthalmological disorders, patient age over 50 years, presence of concomitant diseases.

Table 2: Types of surgical intervention aimed at compensating the functions of facial muscles

Types of surgical intervention	Number (abs.)	No (%)
Neurotization by chewing branches of the V-pair with one-stage "cross" neurotization	18	22
Neurotization by the hypoglossal nerve	40	48,8
Free muscle plastic surgery of the facial muscles with m. gracilis	8	9,8
	16	19,4

The choice of the neurotization option was made during the intervention after mobilization of the distal part of the LN, guided by surgical and operative considerations - accessibility, mobilizability and thickness of the donor trunks. Also, in the choice of surgical tactics, the decisive importance was given to the age of the patients, the duration of the disease and the prevailing clinical complaint.

The immediate and remote results of treatment were studied. Patients underwent a control examination and ENMG study no earlier than 5 months after surgical treatment. Given the peculiarities of the long-term restoration of the lost function of the FN and facial muscles, the remote results of the performed surgical treatment were studied in periods of no earlier than 15 months and up to 24 months after the operation by repeated neurological examinations and additional electrophysiological research methods.

Due to organizational features, it was not possible to achieve full compliance with the recommendations for rehabilitation physiotherapeutic treatment of operated patients.

RESULTS AND DISCUSSION

In all groups, the average clinical index of FN function at the time of surgical treatment corresponded to 4-5 points. The treatment results 12-24 months after surgery are presented in Table 3.

As can be seen from Table 3, in Group 1, positive treatment results (restoration of FN function to II-III according to the House-Brackmann scale) were achieved in 81.2% of patients; in Group 2, positive results were achieved in 76.8% of patients; in Group 3, in 70% of patients; in Group 4, in 20% of patients.

In groups 1-4, neurotization improved the FN function, with most patients (n=71; 86.6%) showing improvement in clinical status to grade II-III according to the House-Brackmann scale, which corresponds to satisfactory restoration of the function of the muscle that raises the angle of the mouth (m. levator anguli oris), the orbicularis oris muscle, significant leveling of facial asymmetry, restoration of the function of complete or partial eyelid closure and, as a consequence, regression of inflammatory phenomena of the cornea. The first signs of restoration of function after FN reinnervation were observed 4-6 months after the intervention, the maximum clinical effect - within 18-24 months. In 8 cases (~9%), restoration of the function of all three main branches of the FN was observed. When analyzing the value of the clinical indicator of the FN function in the groups, a relationship was found between the achieved result and the method of surgical treatment. When comparing the effectiveness of treatment with the five surgical methods, statistically significant differences (Dunn index, p<0.05) in the parameters of the FN function after treatment were revealed between Group 1 and Groups 4 and 5, and between Group 2 and Groups 4 and 5. The figure

Shows an estimate of the proportion of patients whose House-Brackmann score was greater than III in each group (treatment is ineffective). In particular, neurotization of the FN by the branches of the hypoglossal nerve (Group 4) is less effective (the House-Brackmann score was greater than III for 80% of patients than the neurotization options used in Groups 1 and 2.

Table 3: Results of surgical treatment of FNP

Clinical groups	Number of patients (% share of the total number of patients in the group)				Significance level of difference between groups, p
	II	III	IV	V	
1 18	9 (50,0)	7 (38,9)	2 (11,1)	0(0,0)	0,336
2 40	19 (47,5)	18 (45,0)	2(3,2)	1 (2,5)	
3 8	3 (37,5)	4 (50,0)	1 (12,5)	0 (0,0)	
4 16	3 (18,75)	8 (50,0)	4 (25,0)	1 (6,25)	
Total 82	34 (41,5)	37 (45,1)	9 (11)	2(2,4)	

Against the background of each of the tested surgical methods, an improvement in the clinical condition was observed at the specified time of the postoperative period. Since the effectiveness of treatment with both most frequently used methods (group 1 and group 2) does not demonstrate any significant differences, their use in each clinical case should be justified by technical considerations. It was previously believed [17] that isolated neurotization by one donor nerve limits the restoration of the FN function. Our observations refute these assumptions. Considering the fact that one-stage neurotization of the LN by branches of the masticatory nerves (group 1) requires less time and procedural efforts of the personnel, this method should be considered basic and creates optimal conditions for the restoration of facial muscle dysfunctions that have been proven experimentally. The use of other neurotization methods is indicated in the case of a pronounced discrepancy between the cross-sectional area of the reinnervated part of the FN and the branch of the accessory nerve, with individual anatomical features of the course of the accessory nerve or its branches, comorbidity of the accessory nerve, or may be due to a number of other situational considerations. Based on the literature data [17], secondary deficit resulting from segregation of the branches of n. accessorius from the innervated muscles is manifested by motor or static deviation of the scapula, asymmetry of the muscles of the shoulder girdle, limitation of shoulder abduction, including against the background of pain in the shoulder joint. At the same time, no significant effect on the performance of the main functions of the upper limb was noted; in most cases, the described symptoms regress due to reinnervation of the trapezius muscle by fibers of the descending branch of the hypoglossal nerve. Productive motor disorders in the specified variant of neurotization of the FN (group 2) are synergies of the facial muscles and the muscles of the shoulder girdle. When using branches of the hypoglossal nerve as donors, secondary complications depend on the volume of reinnervation and include impaired motor function of the tongue, chewing and swallowing food, atrophy of half of the tongue, which against the background of prosoparesis significantly worsens the patient's quality of life. In general, in case of extracranial injuries of the FN in the acute period, for obvious reasons, it is indicated to use direct neurorrhaphy without tension or autoplasty in case of diastasis of the distal and proximal sections. The method of choice for reinnervation of the distal part of the FN when it is technically impossible to mobilize a section of its proximal stump sufficient for performing neurorrhaphy is neurotization by the common trunk or branches of the accessory nerve. In cases where the duration of the period between the onset of FNP and the patient's visit is more than 18-24 months, and also when it is impossible to follow the instructions for physical rehabilitation of the facial muscles, in our opinion, preference should be given to conservative methods of choice, as well as electrical stimulation treatment and static methods of facial correction.

CONCLUSION

1. Combined neurotization by the masticatory branches with simultaneous contralateral (Cross) neurotization of the FN to level II-III according to the House-Brackmann scale in 86.6% of patients.
2. Neurotization of the FN by the sternocleidomastoid branches of the accessory nerve or the descending branch of the hypoglossal and the branch of the accessory nerve in most cases allows improving the function of the FN to clinical grade III according to House-Brackmann.
3. The choice of surgical treatment tactics should be selected individually, taking into account factors such as the degree of damage to the facial muscles, the patient's age, the duration of the disease and the prevailing clinical symptom.

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