

Original Article

Clinical Outcome of Hypoglossal-Facial Nerve Anastomosis in Severe Facial Nerve Paralysis: An Experience from Khyber Pakhtunkhwa (KPK)

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ABSTRACT

Objectives: Facial nerve injury is one of the most devastating complications occurring as a result of any chemical, mechanical or ischemic insult. This study aimed to determine the surgical outcomes of limited experience in lower motor neuron facial palsy in the last decade.

Materials and Methods: A Prospective case series was done at Neurosurgery Department, Prime Teaching Hospital, MTI Lady Reading Hospital, and Irfan General Hospital Peshawar Khyber Pakhtunkhwa Pakistan. Patients were diagnosed after thorough clinical examination and radiological findings; conduction studies these as severe facial paralysis (House and Brackmann 4 – 6). Surgical treatment is done with end-to-end hypoglossal-facial nerve anastomosis. Outcomes and complications were documented. Entered data into specifically designed proforma.

Results: Out of 13 patients, who underwent a surgical procedure, 8 were male (61.5%) and 5 patients were female (38.5%). The mean age of presentation was 46 years. Patients were labeled on House and Brackmann scale. Improvement was defined as ≥ 1 grade improvement on the H&B scale, after 1 year of follow-up, 11 patients improved (84.6%) while 2 (15.4%) remained static. The complication was observed as hemiatrophy of the tongue without physiological weakness.

Conclusion: Hypoglossal-Facial nerve anastomosis is recommended treatment for severe facial paralysis, during the first year of insult.

Keywords: Facial Nerve Paralysis, Hypoglossal-facial nerve, House & Brackmann.

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INTRODUCTION

Facial nerve injury is one of the most devastating complications occurring as a result of any

chemical, mechanical or ischemic insult caused either by CPA tumors like vestibular schwannoma, meningiomas, epidermoid-like lesions, trauma, or any iatrogenic injury.¹ The most common cause is Bell's palsy accounting for almost 60 – 75% of patients in which the patient presents with one side of facial weakness.² Facial nerve injury is a well-known complication occurring as a result of skull base surgeries like temporal bone fracture or injury to the internal auditory canal, with transaction rates of almost about 6%.³ It has a serious impact on quality of life leading to severe psychological, cosmetic and functional problems.⁴ Over 10 decades various efforts have been employed for the repair of the facial nerve.⁵ To overcome this, it was suggested to anastomose one functional nerve with another non-functional nerve so as revive the damaged nerve. The anastomosis described includes facial-hypoglossal, masseter-facial, spino-facial, and phrenico-facial.⁶ Facial-hypoglossal anastomosis is the most commonly used which was proposed by Werner Korte in 1903.⁷ Facial-hypoglossal anastomosis has success rates however it is most commonly associated with hemiglossal atrophy without physiological prominent functional abnormality and also could not be employed in patients with deglutition problems.⁸ Masseter-facial anastomosis have been suggested as a substitute to reduce the morbidity associated with facial hypoglossal anastomosis which is now being employed with successful clinical outcome.⁹ Reanimation of the facial nerve can aid in the restoration of facial nerve function in patients having proximal nerve injury or in those patients having CPA tumors in which facial nerve damage is likely to happen and should be done as early as possible to avoid muscle atrophy associated with long-term denervation.¹¹ The current study was conducted to document the techniques that are being employed in the repair of facial nerve injury its efficacy, safety, and outcome of facial hypoglossal nerve anastomosis to improve the quality of life of the affected patients.

MATERIALS AND METHOD

Study Design & Setting

A Prospective case series was carried out from June 2011 to June 2020 (10 years) at the Neurosurgery Department Prime Teaching Hospital, MTI Lady Reading Hospital, and Irfan General Hospital Peshawar, Pakistan.

Inclusion Criteria

All those patients included in the study having post-CPA lesions or any trauma and with symptoms of less than 1-year duration

Exclusion Criteria

Patients suffering from Bell's palsy, upper motor neuron lesions, and children less than 10 years were excluded from our study.

Data Collection

After approval from the ethical committee, Patients were diagnosed through clinical examination and radiological findings, and nerve conduction studies, these patients were diagnosed with severe facial paralysis (House and Brackmann 4 – 6). Surgical treatment was done with end-to-end facial-hypoglossal nerve anastomosis. House and Brackmann Grading System were used as an outcome measure.¹¹ Clinical results of outcome and complications were recorded. Data was entered into designed Performa and analyzed through SPSS version 26.

RESULTS

Demographic Variables

A total of 13 patients were enrolled in the study. Out of 13 patients, 8 were male (61.5%) and 5 were female (38.5%). The House-Brackmann Grading System was used to categorize patients, and all patients ranged from grade IV to grade VI. Out of all, 6 patients (46.1%) were treated for CPA

acoustic neuroma, 4 patients (30.7%) had CPA meningioma and 2 patients (15.3%) were post-traumatic 1 patient (7.6%) had facial neuroma. The retromastoid suboccipital approach was used in all 9 patients for the removal of the tumor.

Surgical Outcomes and Complications

Improvement was defined as ≥ 1 grade improvement on the H&B scale. 11 patients showed improvement (84.6%) while 2 (15.4%) remained static. The complication was observed as hemiatrophy of the tongue without physiological weakness. All patients underwent regular physiotherapy following end-to-end facial hypoglossal anastomosis surgery.

Table 1: Distribution based on gender.

Gender	Frequency	Percentages
Male	08	61.5%
Female	05	38.5%

Table 2: Distribution based on Etiology.

Etiology	Frequency	Percentages
Acoustic Neuroma	06	46.1%
Meningioma	04	30.7%
Post Trauma	02	15.3%
Facial Neuroma	01	7.6%

Paired Samples test was used on Pre-Op and Post Op House and Brackmann grading and a significant difference was noted in improvement after intervention (Facial Hypoglossal Nerve anastomosis) with a p-value of 0.001

SURGICAL TECHNIQUE

General Anaesthesia, the patient was cleaned and draped and was put in a supine position with 45°. A retro auricular incision(Modified Blair's incision) was made to the angle of the mandible. The greater auricular nerve is explored, dissected, and preserved. The facial nerve is pointed out near the

stylomastoid and the styloid process is used as an anatomical reference to locate the facial trunk which was exposed. Hypoglossal nerve lies deep under the digastric muscle. It was identified and was isolated, partial mastoidectomy if needed, and the facial nerve was exposed to the geniculate ganglion facial nerve was released and was brought distally to the isolated hypoglossal nerve. The proximal part of the facial nerve was anastomosed with a lateral portion of the hypoglossal nerve and tied with suture prolene 6/0, Hemostasis was secured. In many patients, we performed Tarsoraphy to avoid exposure to keratitis.

Table 3a: Surgical outcome (House and Brackmann Grading System).

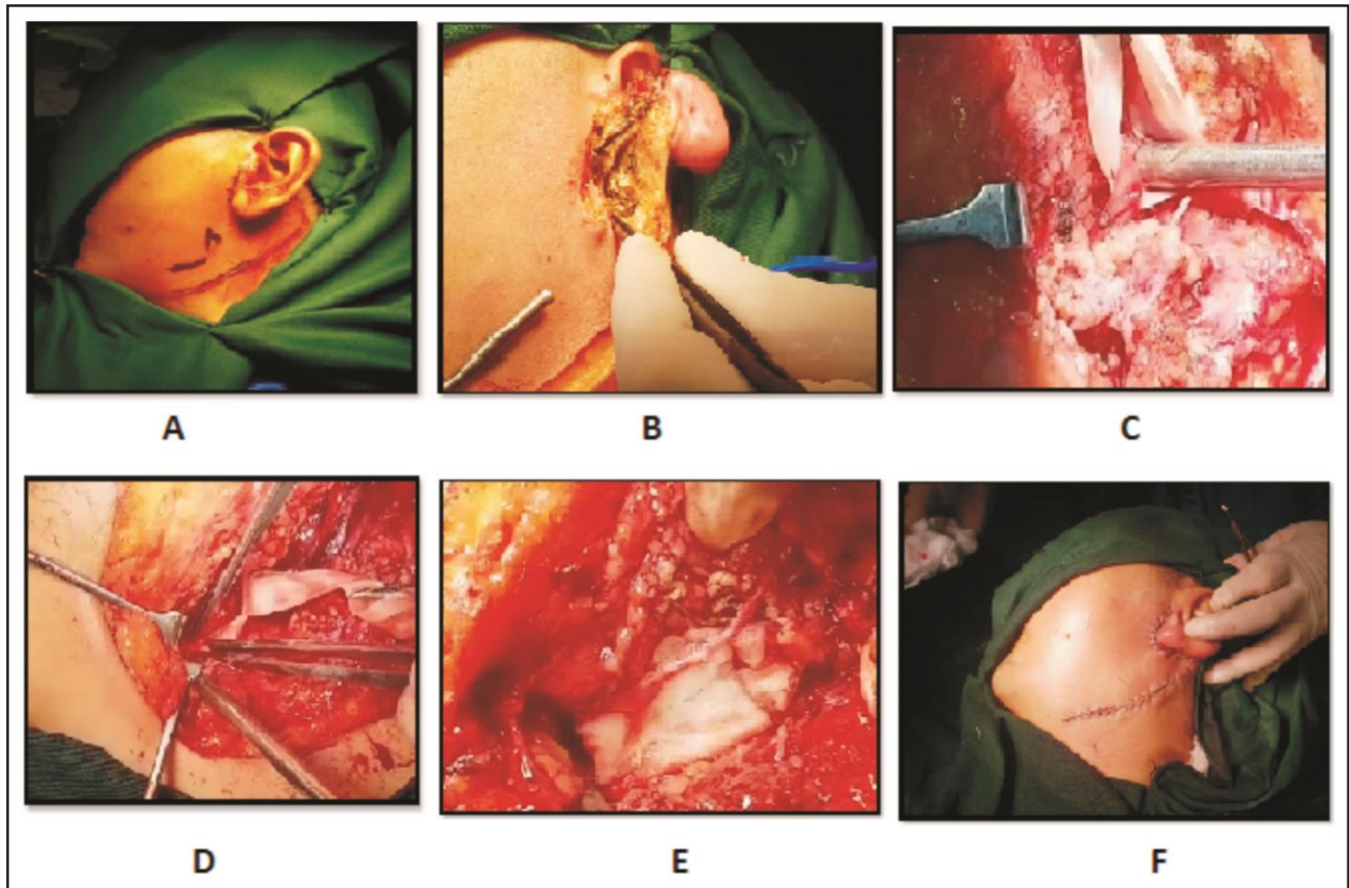
Etiology	Pre-Operative Grading (100%)	Post-Operative Grading
CPA Acoustic Neuroma	05	03 (40%)
CPA Acoustic Neuroma	04	03 (25%)
CPA Acoustic Neuroma	04	04 (0%)
CPA Acoustic Neuroma	05	03 (40%)
CPA Acoustic Neuroma	06	04 (35%)
CPA Acoustic Neuroma	06	04 (35%)
CPA Meningioma	04	03 (25%)
CPA Meningioma	05	03 (40%)
CPA Meningioma	04	03 (25%)
CPA Meningioma	04	02 (50%)
Post Traumatic	05	04 (20%)
Post Traumatic	06	06 (0%)
Facial Neuroma	04	03 (25%)

DISCUSSION

Facial nerve conservation is a prime challenge to surgeons involved in temporal bone and CPA surgery. Despite all the modern advances, intraoperative injury to the facial nerve is inevitable. Numerous surgical interventions have been introduced for the repair of the facial nerve

Table 3b: Difference in Pre and Post grading (House and Brackmann Grading System) after surgical procedure.

Grading	Mean	Paired sample test results		
		Number of Patients	Std. Deviation	P value
Pre-op grading	4.76	13	0.83	0.001 (significant result)
Post-op grading	3.46	13	0.96	



Picture 01: **A** – Shows modified Blair's incision, **B** – Shows subcutaneous dissection, **C** – Identification of Facial nerve, **D** – Shows identification of hypoglossal nerve, **E** – Shows final dissection and anastomosis of Facial-Hypoglossal nerve, **F** – Shows cosmetically skin closer (Patient permission was taken for images).

however anastomosing facial nerve with hypoglossal nerve has been the most popular, reliable, and effective technique with the most successful results. In our study a total of 13 patients were operated on for facial nerve repair, they were classified as grade IV to grade VI according to House and Brackmann scale.¹¹ They underwent end-to-end facial hypoglossal anastomosis for the repair of the facial nerve. 11 patients (84.6%) improved grades on the House

and Brackmann scale and 2 patients (15.4%) remained static due to delayed presentation and atrophy of facial nerve. The most common complication reported was hemiatrophy of the tongue. End-to-end anastomosis of the facial hypoglossal nerve was first proposed by Werner Korte in 1903 and is being employed to date.⁷ This can also be collated in a study done by Elkatatny et al. who carried facial nerve repair in 15 patients out of which 11 patients (73.3%) had



Picture 02: A, B Shows Post operative improvement in Facial palsy, C – Shows hemiatrophy of the tongue which is the main complication of facial-Hypoglossal nerve anastomosis. (Patient permission was taken for the study).

cerebellopontine angle surgery and 4 patients (26.6%) had traumatic petrous bone fracture outcomes were as follows 3 patients (20%) were improved to grade II of House and Brackmann, 11 patients (73.3%) improved to grade III of House and Brackmann, and one patient (6.66%) improved to House and Brackmann grade IV.¹¹ In another study conducted by Corrales et al. and end to end facial hypoglossal anastomosis was done, and after 12 months of follow up 75% of patients achieved House and Brackmann grade III/VI and 25% achieved House and Brackmann grade IV/VI.¹² In our study, end to end, anastomosis of the facial hypoglossal nerve was done however only complication that occurred in our study was hemiatrophy of the tongue which is the most commonly documented complication reported to date and is therefore contraindicated in patients with lower cranial neuropathies reported to date. To minimize this complication, another method was proposed by May et al. in which hemi hypoglossal nerve was used with interposing nerve graft to the anastomosis with facial nerve which drastically reduced tongue-related morbidity.¹³ This can also be seen in a study done by Slattery et al. in which a total of 19 patients were employed out of 7 patients (36.8%) improved to House and Brackmann grade III, 9 patients (47.4%) improved to House and

Brackmann grade IV and 3 patients (15.8%) had House and Brackmann grade V without any hypoglossal associated complications.¹⁴ A study conducted by Samii et al,¹⁶ in which a comparison was made between classic end-to-end hypoglossal-facial anastomosis and hemihypoglossal facial nerve anastomosis or jump anastomosis according to which a total of 26 patients underwent facial nerve repair. Out of 26 patients, 9 patients (34.6%) underwent classic end-to-end hypoglossal-facial nerve anastomosis and 17 patients (65.4%) underwent side-to-end hypoglossal-facial nerve anastomosis with interposing nerve graft. Although there were no differences between the two groups however patients with jump anastomosis had lower tongue-related complications namely swallowing difficulty→ 55% vs 11.7%, tongue hemiatrophy→ 100% vs 5.8%, and speech disorder→33% vs 0%.¹⁵

LIMITATIONS

This is a prospective study conducted at tertiary care hospitals in Peshawar KPK. Limitations of this study included delayed presentation when facial muscle had undergone atrophy, observer alteration is the term for facial nerve palsy grading varying surgical techniques, and the patient's negligence to exercise post-operative physiotherapy regularly. Also, a shortfall of surgical expertise and loss of follow-up should be taken into account while interpreting this research.

RECOMMENDATIONS

End-to-end hypoglossal-facial anastomosis has proven to be an effective means for the examination of the facial nerves. More studies are required to be conducted for the effectiveness and clinical outcome of hypoglossal-facial nerve anastomosis to get beneficial and successful results.

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Additional Information

Disclosures: Authors report no conflict of interest.

Ethical Review Board Approval: The study was conformed to the ethical review board requirements.

Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHOR CONTRIBUTIONS

Sr. No.	Author's Full Name	Intellectual Contribution to Paper in Terms of
1.	Arif Hussain	Study Design, Methodology, and Paper Writing.
2.	Sajid Khan	Data Calculation and Data Analysis.
3.	Ramzan Hussain	Interpretation of Results.
4.	Aleeha Ihsan	Statistical Analysis.
5.	Ikram Ullah	Literature Review.
6.	Mumtaz Ali, Muhammad Zubair	Literature Review and Quality Insurer.