



## EARLY INTERVENTION IN VOICE AND SWALLOWING REHABILITATION FOR UNILATERAL VOCAL FOLD PARALYSIS POST-CARDIOTHORACIC SURGERY: A CASE REPORT

### Speech & Hearing

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| <b>Ramanadham Thejesh*</b> | Assistant Professor, Audiology And Speech Pathology, Department Of Otorhinolaryngology, Christian Medical College & Hospital, Vellore, Tamil Nadu, India.<br>*Corresponding author |
| <b>Paul Jasper</b>         | Lecturer, Audiology And Speech Pathology, Department Of Otorhinolaryngology, Christian Medical College & Hospital, Vellore, Tamil Nadu, India.                                     |
| <b>Philip Thomas</b>       | Assistant Professor, Audiology And Speech Pathology, Department Of Otorhinolaryngology, Christian Medical College & Hospital, Vellore, Tamil Nadu, India.                          |
| <b>Dr Swapna Sebastian</b> | Professor, Audiology And Speech Pathology, Department Of Otorhinolaryngology, Christian Medical College & Hospital, Vellore, Tamil Nadu, India-632004.                             |
| <b>M. P. Oviya</b>         | Lecturer, Audiology And Speech Pathology, Department Of Otorhinolaryngology, Christian Medical College & Hospital, Vellore, Tamil Nadu, India.                                     |

### ABSTRACT

Unilateral vocal fold paralysis (UVFP) is a common complication of cardiothoracic surgery, leading to significant voice and swallowing dysfunction. This case report demonstrates the efficacy of intensive voice and swallowing therapy in improving outcomes in a 49-year-old female patient with iatrogenic UVFP following mitral valve replacement surgery. Comprehensive assessments of voice and swallowing, including acoustic, aerodynamic, FEES, perceptual, and self-rating scales, were conducted pre- and post-therapy. Following eight sessions of therapy, significant improvements were observed in voice quality, swallowing function, and patient-reported quality of life. The patient's nasogastric tube was removed, and she regained oral feeding ability. This case highlights the importance of early detection and intervention in achieving optimal outcomes for individuals with UVFP, underscoring the critical role of speech-language pathologists in the assessment and treatment of voice and swallowing disorders.

### KEYWORDS

unilateral vocal fold paralysis, cardiothoracic surgery, voice therapy, swallowing therapy, early intervention, quality of life.

### INTRODUCTION

The vocal cords play a key role in producing sound, as well as protecting the airway during breathing and swallowing. When one vocal cord is paralyzed ( unilateral vocal fold paralysis, or UVFP), it causes insufficient closure of the glottis, leading to voice changes and additional issues like swallowing difficulty and aspiration risks. (1) The most frequent cause, accounting for 29.8–88% of cases, is iatrogenic injury, specifically from cardiothoracic surgery. (2) Unilateral vocal fold paralysis (UVFP) is a known consequence of many cardiothoracic surgeries that cause recurrent laryngeal nerve (RLN) injury. (3) According to the literature, non-thyroid procedures, such as cardiothoracic surgeries, are now more common iatrogenic causes of UVFP than thyroid surgeries. (3,4) After cardiothoracic surgery, swallowing difficulty and voice change are frequently disregarded as a minor side effect. Vocal fold paralysis, however, adversely impacts the quality of life and prevents the patient from improving physically and psychologically once acute postoperative problems and other medical and surgical issues are treated. (5) Prompt and comprehensive intervention addressing both swallowing and voice aspects is vital to prevent complications, improve quality of life, and enhance overall outcomes. Hence the role of early detection will help in providing intervention that will improve the quality of life.

The literature reported that the shortest time to recovery of UVFP was 4 months in iatrogenic cases. (5) This case report highlights the significance of early diagnosis and treatment to enhance voice and swallowing outcomes, thereby reducing the risk of persistent voice and swallowing issues and improving overall quality of life.

**Aim:** " This case aims to demonstrate the efficacy of intensive voice and swallowing therapy in a patient with iatrogenic unilateral vocal fold paralysis (UVFP) following a cardiothoracic procedure, emphasizing the importance of early detection and appropriate management in significantly improving the patient's overall quality of life."

**Case report:** A 49 year's old female patient diagnosed as having severe hoarse voice and dysphagia with left vocal cord paralysis secondary to cardiothoracic surgery (Mitral valve replacement) by team of Otolaryngologist and Speech-Language Pathologist (SLP), was considered for the study. The patient complained of breathy voice and

severe swallowing problem. The patient is currently taking feeds through Naso Gastric (NG) tube.

A detailed functional assessment of voice and swallowing function were carried out.

**Voice Evaluation:** A comprehensive voice evaluation was conducted by a team of experts, consisting of a speech-language pathologist (SLP) and otolaryngologist.

**Otolaryngologists Evaluation:** A Naso-Pharyngo-Laryngoscope (NPL) was utilized to examine the vocal tract and glottis, leading to a diagnosis of left vocal paralysis for the client.

### Evaluation by speech language pathologist (SLP):

A comprehensive voice assessment includes both qualitative and quantitative evaluations, incorporating self-rating tools such as the Voice Handicap Index (VHI-10) and the Voice-Related Quality of life (V-RQOL) measures, along with acoustic, aerodynamic, and perceptual analyses (using the GRBAS scale). Acoustic analysis was performed using Praat software version 6.4.12 in a sound-treated room, utilizing an Ahuja condenser microphone. Maximum Phonation Duration (MPD) and the s/z ratio were employed as aerodynamic measurements. The duration for both measures was recorded using a stopwatch, and among three trials, the longest phonation was selected for analysis. Perceptual voice evaluation was conducted using the GRBAS scale (Hirano, 1981), which was applied to assess both phonation and a spontaneous speech sample. The psychosocial aspect of voice was evaluated by using VHI-10 and V-RQOL questionnaire. It was described detail in below.

**Voice handicap Index 10:** The VHI-10 is a patient-reported self-assessment tool consisting 10 items that address the functional, physical, and emotional domains related to voice disorders. The patient rates on a scale 0-4, with 0-Never to 4-Always. VHI-10 > 10 is considered as abnormal. (6)

**Voice- Related quality of life (V-RQOL):** The V-RQOL is a self-administered patient-reported instrument designed to assess the subjective impact of a voice disorder. It consists of ten items, each addressing functional, physical, and emotional aspects of voice.

Patients rate each item based on its relevance to their situation, using a scale from 1 (not a problem) to 5 (the problem is "as bad as it can be") (7).

**GRBAS scale:** The GRBAS scale is an auditory perceptual rating scale used to evaluate voice quality, where an expert clinician assesses the voice sample and rates how much it deviates from the perceived normal range. The scale evaluates five parameters: Grade of hoarseness (G), Breathiness (B), Asthenia (A), and Strain (S). Each parameter is scored on a scale of 0 to 3, with 0 being normal, 1 indicating mild deviation, 2 representing moderate deviation, and 3 signifying severe deviation (Hirano, 1981).

**Swallow Function Assessment:** The evaluation of swallowing function included a variety of assessments such as the Eating Assessment Tool (EAT-10), the Functional Oral Intake Scale (FOIS), the Dysphagia Handicap Index (DHI), the Modified Water Swallowing Test (MWST), and Fiber-optic Endoscopic Evaluation of Swallowing (FEES).

**Eating Assessment Tool (EAT-10):** The Eat-10 is a self-administered, symptom-specific questionnaire designed for swallowing screening developed by Belafsky et al. It consists of 10 questions that the patients rate on a scale from 0 to 4, where 0 indicates no problem and 4 indicates a severe problem. A total score greater than 3 is considered abnormal. (8)

**Functional oral intake scale (FOIS):** The FOIS is used to evaluate the functional level of oral intake in individuals with swallowing difficulty. It consists of seven levels ranging from total dependence on non-oral feeding (level 1) to full independence with a regular oral diet without restrictions (level 7). The FOIS offers a standardized approach to assessing the severity of swallowing difficulty and guiding diet and swallowing/feeding recommendations. (9)

**Dysphagia Handicap Index (DHI):** The Dysphagia Handicap Index (DHI) is a self-assessment questionnaire designed to evaluate three aspects of the quality of life (QOL) in dysphagia patients: functional, physical, and emotional. It uses a three-point Likert scale, where 0 indicates "never", 2 represents "sometimes", and 4 signifies "always" allowing patients to respond to 25 statements about their condition. The highest possible score for a patient is 100 points. A patient who receives a score of 0 is fully satisfied with their capacity for swallowing. The patient is less satisfied with the quality or ability of their swallowing, the higher the DHI value. (10)

**Yale Pharyngeal Residue Severity Rating Scale (YPRSRS):** The YPRSRS Yale Pharyngeal Residue Severity Rating Scale is an ordinal scale used to assess the severity of residue in pyriform sinus observed during the post-swallow phase of swallowing using Fiber-Optic Endoscopic Evaluation of Swallowing (FEES). The scale evaluates pharyngeal residues in both the valleculae and the pyriform sinuses separately. It employs a five-point rating scale to categorize the severity of residue as "none, trace, mild, moderate, or severe". Each level is accompanied by an operational description, an anchor image, and a percentage of residue for both anatomical locations. (11)

**Penetration-Aspiration Scale:** The PAS (Penetration-Aspiration Scale) is an 8-point rating ordinal scale used to describe penetration and aspiration events during swallowing, where 1 represents no airway invasion and 8 indicates the most severe level of aspiration: (1) The depth of airway invasion (whether material is above, contacts, or passes below the vocal folds), (2) whether material is ejected or remains after the swallow, and (3) The patient's response to material in the airway (such as attempts to clear it). (12)

**Modified water swallowing Test (MWST):** Subjects are instructed to swallow 3 ml of water, and their swallowing performance is scored. If the individual is unable to swallow or experiences symptoms such as dyspnea, coughing, or a gurgly voice after swallowing, a score of 5 is recorded. If only one dry swallow is achieved, a score of 4 is given. (13,14)

**Fiber-optic endoscopic evaluation of swallowing (FEES):** FEES was performed by an experienced otolaryngologist in collaboration with speech-language pathologist. Patients with unilateral vocal fold paralysis (UVFP) tend to aspirate more frequently when swallowing liquids compared to other food consistencies. In addition to the

standard FEES protocol, a modified procedure was used, where varying fluid volumes and bolus consistencies were administered in the following order: 3 ml, then 5 ml. The test liquids and other food consistencies were dyed with 5% methylene green and followed IDDSI standards (IDDSI 0 (thin liquids), IDDSI 4 (Purees), and IDDSI 7 (solids)).(15,16) The patients were instructed to swallow. The PAS (Penetration-Aspiration Scale) was used to assess the severity of aspiration during the examination. If the patient shows signs of aspiration, the assessment was immediately discontinued. The pharyngeal residue both in vallecula and pyriform sinus was rated by using YPRSRS.

The voice and swallowing assessment were conducted on two consecutive days prior to the initiation of therapy.

**Voice and swallowing therapy Program:** A comprehensive review of recent evidence-based voice and swallowing therapy programs was done to systematically develop the therapy program for the patient. Voice therapy included diaphragmatic & abdominal breathing exercises, laryngeal valving exercises, and Head positioning exercises. Swallowing therapy included shaker's exercise, chin tuck, effortful swallow, and Masaka maneuver. The client initially attended 4 sessions of intensive voice and swallowing therapy for 40 min each session, and a reassessment was done on voice and swallowing assessment clinically, which revealed that the client had voicing which is quite audible, and clinical swallow assessment revealed that the client laryngeal elevation was good, cough strength is good and can tolerate purees (IDDSI 4) and liquids (IDDSI 0) orally without any cough and wet voice quality. The client was regularly monitored for voice and swallowing function over four additional sessions. After completing eight sessions of voice and swallowing therapy, post-therapy assessments were conducted across all domains, including acoustic, aerodynamic, perceptual, self-rating scales for voice and swallowing, FEES, and NPL. The pre-and post-therapy results for each domain were compared, as shown in the table below.

**Table 1: Comparison of pre-therapy and post-therapy voice parameters.**

| S.no | Parameter                                                        | Pre therapy                                           | Post therapy                                                         |
|------|------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------|
| 1    | NPL findings                                                     | LVC Immobility                                        | LVC Hypomobility                                                     |
| 2    | VHI                                                              | 21                                                    | 3                                                                    |
| 3    | V- RQOL<br>Overall quality (as reported)                         | 38<br>Poor                                            | 13<br>Very good                                                      |
| 4    | Acoustic analysis<br>FO<br>Jitter<br>Shimmer<br>HNR              | Inadequate sample to analyse<br>Was unable to phonate | 180.898hz<br>0.333%<br>2.381%<br>20.425dB                            |
| 5    | Aerodynamic measure<br>MPD<br>/a/<br>/i/<br>/u/<br>s/z           | Was unable to phonate                                 | 5secs<br>6secs<br>5secs<br>S – 5secs, the client was unable to say z |
| 6    | GRBAS<br>Grade<br>Roughness<br>Breathiness<br>Asthenia<br>Strain | 3<br>1<br>3<br>0<br>3                                 | 2<br>1<br>2<br>0<br>1                                                |

**Table 2: Comparison of pre-therapy and post-therapy swallowing functions:**

| S.no | Parameter                                                                      | Pre therapy                                                                                     | Post therapy                                     |
|------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------|
| 1    | FEES<br>PAS score<br>YPRSRS<br>vallecula residue<br><br>Pyriform sinus residue | 7<br>Moderate 20-50%<br>Epiglottic ligament covered<br><br>Moderate 20-50% up wall to half full | 1<br>None 0% no residue<br><br>None % no residue |

|   |                                             |                                                                                 |                                                                                                           |
|---|---------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| 2 | FOIS                                        | Tube dependent<br>1 – no oral intake                                            | Total oral<br>intake<br>7 – Total oral<br>intake with no<br>restriction                                   |
| 3 | EAT -10                                     | 35                                                                              | 5                                                                                                         |
| 4 | DHI                                         | Severe                                                                          | Normal                                                                                                    |
| 5 | Modified water<br>swallowing test<br>(MWST) | Able to swallow but<br>choking/cough present<br>after few seconds. (score<br>3) | Swallowed<br>successfully<br>with ability of<br>additional dry<br>swallowing<br>twice in 30.<br>(score 5) |

## RESULTS AND DISCUSSION:

A reassessment was conducted to determine the effectiveness of voice and swallowing therapy for this client following eight sessions.

According to the EAT-10 and DHI, the clients self-perceived oropharyngeal dysphagia showed improvement in the current case study. Additionally, a significant reduction in the degree of penetration/aspiration and pharyngeal residue was observed on FEES across different consistencies.

There was a noticeable improvement in the VHI-10 and VRQOL ratings in this case study. After therapy, MPD lasted from 1 to 7 seconds. Every item in the G, R, B, A, and S categories showed a significant improvement from the severe to the moderate group. When compared to pre-therapy, the case showed a considerable improvement in overall voice quality. The client's voice and swallowing parameters improved significantly, which may have been a result of the voice and swallowing therapy. She was eventually discharged from the therapy, had her NG tube taken out, and was instructed to keep up her voice exercises. She was also able to eat orally without the need for an NG tube and could be heard by others.

According to existing literature, the least amount of time UVFP needed to recover from cardiotoracic procedures without intervention was four months (2). It is noteworthy, nonetheless, that our study achieved improved voice and swallowing outcomes in just eight sessions (40 minutes, alternate days), highlighting the efficacy of voice and swallowing therapy.

## CONCLUSION:

This case study demonstrates the efficacy of voice and swallowing therapy in improving both unilateral vocal fold paralysis and swallowing function. The findings highlight the importance of early intervention and therapy in achieving optimal outcomes for individuals with this condition. The study documents the therapy's impact by comparing pre-therapy and post-therapy parameters, reinforcing the critical role of speech-language pathologists in the assessment and treatment of voice and swallowing disorders. Additionally, the results underscore the necessity for ongoing research into the effects of voice and swallowing therapy on unilateral vocal fold paralysis and swallowing function.

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