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Case Report

Rehabilitation of pharyngeal dysphagia and spastic dysarthria following acute ischemic stroke: a case study

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ABSTRACT

We present the case of a 49-year-old female with a history of coronary artery disease, hypothyroidism, and prior coronary artery bypass grafting, who presented with slurred speech, left-sided mouth deviation, and difficulty swallowing. Imaging confirmed acute ischemic stroke affecting the left precentral gyrus and left corona radiata. The patient was diagnosed with spastic dysarthria and pharyngeal dysphagia, with severe swallowing difficulties and aspiration. A comprehensive swallowing therapy plan was developed, focusing on both rehabilitative and compensatory techniques. Rehabilitative therapy included exercises like the chin-down posture to improve tongue control and laryngeal closure, the tongue anchor exercise to increase pharyngeal wall pressure, and the Valsalva maneuver to promote safer swallowing. The supraglottic swallow and effortful swallow techniques were introduced to improve bolus clearance and reduce residue. Compensatory strategies such as thermal tactile stimulation, the sour bolus strategy, and the dry gargle technique were applied to improve sensory awareness and swallowing safety. The patient was gradually introduced to different food consistencies, progressing from thickened liquids to a regular diet. After two weeks of therapy, swallowing function significantly improved, with increased oral intake, improved dysphagia severity scores, and a transition to a regular diet. This case emphasizes the importance of targeted swallowing therapy in post-stroke rehabilitation.

Keywords: Acute ischemic stroke, Pharyngeal dysphagia, Supraglottic swallow, Lee Silvermann voice therapy, Thermal tactile stimulation, Chin-down posture

INTRODUCTION

Acute stroke is typically characterized by the sudden onset of a focal neurologic deficit, though some patients have a stepwise or gradual progression of symptoms. The common deficits are aphasia, dysarthria, weakness, ataxia, sensory loss, and neglect.[1] Among the various sequelae that can arise following stroke, dysphagia and dysarthria are particularly debilitating conditions that significantly impact a patient's overall well-being quality of life. Dysphagia, especially pharyngeal dysphagia, is often associated with issues related to swallowing, which can lead to complications such as aspiration pneumonia and malnutrition. Swallowing, a highly complex neuromuscular activity essential to health and survival, is one of the most intricate functions in the human body, playing a crucial role in maintaining health.[3] Swallowing requires food passage from the mouth through the esophagus and into the stomach without compromising the adjacent structures: nasal passages, larynx and the lower respiratory tract. The process starts after food ingestion and can be divided into four stages defined by the location of the bolus. Oral preparatory phase prepares bolus for propulsion into pharynx. In the oral propulsive phase, the tongue pushes bolus through the fauces into the pharynx. Oral phase is the only voluntary phase in swallowing,

where the bolus (food or liquid) is chewed, mixed with saliva, and moved to the back of the mouth by the tongue, ready for swallowing. In the pharyngeal phase the bolus reaches the throat, triggering a reflex that elevates the soft palate to block the nasal cavity, closes the airway with the epiglottis and vocal cords, and pushes the bolus down the pharynx. The upper esophageal sphincter opens to allow passage into the esophagus. Last, the esophageal phase involves peristalsis which are muscular contractions that moves the bolus down the esophagus toward the stomach. The lower esophageal sphincter relaxes to allow entry into the stomach.

For swallowing to be controlled properly, several brain areas must work together. These include the brainstem, basal ganglia, thalamus, limbic system, cerebellum, and both the motor and sensory cortices. These systems manage the various processes involved in swallowing, including both voluntary and involuntary actions, as well as anticipatory and preparatory functions. Without the proper coordination of these systems, swallowing can become difficult, leading to dysphagia and its associated complications.

Swallowing involves various muscles that work together, coordinated by a complex neural network. This network is mainly controlled by five cranial nerves: the trigeminal (V), facial (VII), glossopharyngeal (IX), vagus (X), and hypoglossal (XII).[2] When it comes to diagnosing pharyngeal dysphagia, a thorough clinical evaluation is usually conducted. Additionally, instrumental techniques, such as fiberoptic endoscopic evaluation of swallowing (FEES), are often used. In FEES, a flexible endoscope is inserted through the nose to observe the swallowing process in real-time, providing valuable insights into how the muscles and structures involved in swallowing are functioning.

A more comprehensive definition is that dysarthria is the impaired production of speech because of disturbances in the muscular control of the speech mechanism. The concept of dysarthria is not just someone with slurred speech, it involves a range of speech difficulties that can affect various components of communication, including respiration, pitch, tone, resonance, and phonation. One of the most prevalent forms of dysarthria in stroke patients is spastic dysarthria, which is caused by spasticity, or abnormal muscle tightness, in the muscles responsible for speech.

This type of dysarthria occurs when there is bilateral damage to the upper motor neurons, which are the nerve cells that transmit signals from the brain to muscles. Spastic dysarthria is characterized by imprecise speech articulation, a monotonous or flat vocal tone, and reduced loudness variation, all of which contribute to diminished prosody. Affected individuals typically exhibit muscle tightness, causing restricted and slowed movements of the speech muscles. Consequently, their speech often appears effortful, with words sounding stretched or prolonged.[4]

This case study presents the rehabilitation journey of a 49-year-old female patient who experienced an ischemic stroke in the left precentral gyrus, which was followed by both pharyngeal dysphagia and spastic dysarthria. The patient underwent a comprehensive assessment and an individualized rehabilitation plan that included both speech and swallowing interventions. This paper discusses the patient's clinical presentation, diagnostic findings, rehabilitation treatment strategies, and the significant improvements observed during therapy.

CASE REPORT

The patient, a 49-year-old female, presented with the primary complaints of slurred speech and deviation of the mouth to the left side. She also reported difficulty in swallowing. Her medical history included coronary artery disease (CAD), hypothyroidism, and a previous coronary artery bypass grafting (CABG) surgery in 2018.

Diagnosis

Neurological examination and radiological findings

Initially the patient underwent a neurological examination. The national institutes of health stroke scale (NIHSS) score were 5. The rapid arterial occlusion evaluation scale (RACE) score was 2. The Alberta stroke program early CT score (ASPECTS) score was 10. Radiological findings confirmed the presence of ischemic damage. Computed topography (CT) brain scan revealed hypodensity in the left external capsule. The Magnetic Resonance Imaging (MRI) brain scan revealed an acute infarct in the left precentral gyrus and left corona radiata. The MRI also showed a left internal watershed zone infarct and a left choroidal fissure cyst.

The patient was diagnosed with an acute ischemic stroke that caused right sided Fascio branchial Mono paresis and lingual spastic dysarthria. Neurological findings indicated right upper motor neuron (UMN) facial nerve palsy. The patient underwent thrombolysis with alteplase (50 mg) as part of acute stroke management.

ENT evaluation

The patient underwent Videolaryngoscopy (VDL) as a part of the ENT assessment, which revealed normal findings of base of tongue, B/L valleculae, epiglottis, B/L arytenoid folds, false vocal folds, pyriform sinus and the true vocal folds were normal & mobile.

In addition to the neurological and ENT assessment, the patient underwent a thorough speech and language evaluation.

Speech evaluation

The following speech assessments were conducted. Frenchay's dysarthria assessment (FDA) revealed a speech

type of Spastic dysarthria of speech, characterized by muscle spasticity affecting articulation, prosody, and speech intelligibility. The diadochokinetic rates were measured at 1 syllable per second for the Alternate Motion Rate (AMR) and 2 syllables per second for the sequential motion rate (SMR), indicating a slow rate of speech movement. The speech intelligibility test, using the perceptual speech intelligibility rating scale (AYJNISHD, 2022), resulted in a "Score 2-the speech is intelligible, though it is perceived as not entirely normal. The listener can understand it without difficulty, but the speech has atypical features." The rate of speech is slow, with the patient producing 70 words per minute. Resonance is normal, with no signs of hypernasality. The patient exhibits reduced stress in prosody, suggesting limited variation in pitch and loudness. Articulation is characterized by distortion of the sounds /f/, /r/, and /l/ in multisyllabic words, which is a typical finding in spastic dysarthria, reflecting difficulties in precise speech production. The oral-peripheral motor examination (OPME) reveals that all structures, including the tongue, teeth, and jaw, appear normal, and their functions are adequate. However, there is lip deviation noted during retraction. The patient is currently being fed via a Ryle's tube, indicating a need for assisted feeding.

Voice assessment

A voice evaluation was conducted. The client's voice profile reveals hoarseness in voice quality, normal pitch with reduced loudness and reduced maximum phonation duration (MPD) as in Table 1. The acoustic analysis of voice was conducted using PRAAT software. The results are shown in Table 2.

Language assessment

The language assessment reveals that the patient is oriented to space and time, demonstrating awareness of her surroundings and the current time. She is emotionally stable and can respond appropriately to simple yes/no questions. The patient comprehends both simple and complex commands, indicating good understanding and cognitive processing. She can read and comprehend written material, showcasing functional literacy. Additionally, the patient can perform automatized sequences, repetition, naming, and oral reading without difficulty, which reflects the preserved language and memory function. Her speech is fluent, with no signs of disfluency such as stuttering or hesitation. Overall, there are no cognitive issues, suggesting intact memory, attention, and executive functions. This assessment indicates that the patient demonstrates no cognitive or language deficits.

Swallowing assessment

A comprehensive clinical swallowing examination revealed that the gag reflex was diminished, though it was present while dry swallowing, it was weak. The patient exhibited weak voluntary cough and throat clearing, indicating reduced airway protection during swallowing. Aspiration and choking were observed during the swallowing assessment, though nasal regurgitation was absent. The patient reported no pain or numbness during swallowing but had difficulty with food bolus clearance. A trial feeding with thickened liquids (5 ml) in an upright position was conducted to assess swallowing safety.

Manipal manual for swallowing assessment

The patient's swallowing function was further evaluated using the Manipal manual for swallowing assessment. In Subscale 1, the structural assessment revealed that the lips, tongue, palate, jaw, teeth, and cheeks were all normal. Subscale 2, which evaluates function, showed that sensory and motor assessments were within functional limits, with some exceptions-reduced soft palate elevation and sensation, and lip deviation observed during retraction. In Subscale 3, which assesses the phases of swallowing, the patient was found to have severe impairment in the pharyngeal phase (Table 3). Finally, subscale 4 evaluated the patient's tolerance of different food consistencies, revealing that while the patient could tolerate thick consistencies during the oral phase, she had difficulty in the pharyngeal phase, where thicker consistencies posed a challenge.

The patient was further assessed using the functional oral intake scale (FOIS), dysphagia outcome and severity scale (DOSS) and eating assessment tool (EAT-10). FOIS is a validated tool for evaluating the daily functional oral intake of food and liquids in individuals with dysphagia. This scale, which ranges from 1 (nothing by mouth) to 7 (total oral diet with no restrictions), provides an objective measure of dysphagia severity. The patient received a score of 1, indicating that the patient could not take anything by mouth. DOSS is a simple, easy-to-use, 7-point scale designed to systematically evaluate the functional severity of dysphagia, ranging from severe impairment to normal swallowing function. It provides guidance on diet recommendations, level of independence, and nutritional needs based on objective assessment. The patient received a score of 1, indicating severe dysphagia.

EAT-10 is a self-administered questionnaire designed to assess concerns related to swallowing. It serves as a symptom-specific outcome tool for evaluating dysphagia severity and monitoring treatment response in individuals with swallowing disorders. This 10-item scale features five levels of difficulty for each item, ranging from "no problem" to "serious problem," with a total score ranging from 0 to 40. According to normative data, a score of 3 or higher is considered abnormal. The patient obtained a score of 25, categorizing the patient's dysphagia as severe. Based on the evaluation, the patient was diagnosed with pharyngeal dysphagia and spastic dysarthria.

Therapy and rehabilitation

A comprehensive and individualized treatment plan was developed for the patient, focusing on both speech and swallowing rehabilitation.

Treatment for dysarthric component

Speech therapy targeted the dysarthric components of the patient's speech. Rate modification techniques are used to the slow rate of speech, with visual and auditory feedback helping the patient become more aware of their pace. The Lee Silvermann voice therapy (LSVT) was implemented to increase phonatory loudness and improve vocal quality. Exercises focused on improving vocal fold closure and respiratory support for better loudness.

Strengthening and stretching exercises for the articulators (lips, tongue, and jaw) were introduced. The patient was also instructed to exaggerate consonant articulation during speech to improve intelligibility. Intelligibility drills, such as exaggerated speech and visual feedback techniques, were employed to enhance the clarity of speech.

Treatment for pharyngeal phase of dysphagia

Swallowing therapy was tailor made to address the pharyngeal dysphagia, focusing on both rehabilitative and compensatory techniques. Therapy sessions were scheduled 45 minutes per day, daily for 2 weeks.

Rehabilitative swallow therapy

The rehabilitative swallowing exercises to improve various aspects of swallowing and reduce the risk of aspiration were included in the therapy plan. The chin-down posture was utilized to improve control of the back of the tongue and facilitate better laryngeal closure. The tongue anchor exercise was implemented to increase pharyngeal wall pressure and enhance tongue base control and strength. The Valsalva maneuver was performed to improve laryngeal closure and promote a safer swallow. The supraglottic swallow technique was incorporated to improve laryngeal elevation and reduce bolus residue in the valleculae. The effortful swallow technique was practiced to increase the posterior movement of the tongue base and improve bolus clearance.

Compensatory swallow therapy

In addition to these exercises, compensatory swallowing strategies were also included to enhance swallowing function. Thermal tactile stimulation was applied with cold stimulation to the anterior faucial pillars to increase sensory awareness and trigger the swallow reflex. The sour bolus strategy, using citrus extracts like lemon and orange, was introduced to increase oral sensory awareness and trigger the pharyngeal swallow.

The dry gargle technique was used to reduce residue in the valleculae and enhance tongue base control. Finally, the /k/ tongue production exercise was incorporated to strengthen and improve tongue control, helping to prevent bolus retention in the throat. These combined exercises and strategies were aimed at optimizing the patient's swallowing function and safety.

Different consistencies of food during the time of therapy

During the course of therapy, the patient was gradually introduced to different food consistencies based on the international dysphagia diet standardization initiative (IDDSI) to improve swallowing function and ensure safety. The therapy began with biscuit water (medium-thick, IDDSI Level 2), followed by vegetable soup (Medium-thick, IDDSI Level 2). The patient then progressed to Ragi conjee (Liquidized, IDDSI Level 3), followed by Rice conjee (Extremely soft, IDDSI Level 4). Idli with rice conjee (Pureed, IDDSI Level 4) and minced and steamed carrot (Minced and moist, IDDSI Level 5) was introduced next.

The patient was then given Pongal (Easy to chew, IDDSI Level 7), followed by Idli with sambar (Soft and bite-sized, IDDSI Level 6). Apple juice (Slightly thick, IDDSI Level 1) and water (Thin, IDDSI Level 0) were also included in the diet, and the patient eventually transitioned to a normal diet (Regular, IDDSI Level 7). These varying food consistencies were gradually introduced to help the patient adapt to different textures and enhance swallowing safety and efficiency.

Table 1: MPD during voice evaluation.

MPD	
Syllable	**Time (in seconds)**
/a/	10
/i/	7
/u/	7
/s/	6
/z/	6

Table 2: Acoustic analysis of voice using PRAAT.

Parameter	Phonation /A/	Spontaneous speech
Fundamental frequency	196.99 Hz	170.088 Hz
Minimum intensity	60.5 dB	42.7 dB
Maximum intensity	61.76 dB	44.23 dB
Jitter	0.135%	0.642%
Shimmer	2.302%	4.503%
HNR	33.31 dB	17.89 dB

Outcomes

After 2 weeks of therapy, the patient demonstrated significant improvement in both speech and swallowing functions. The maximum phonation duration (MPD) increased, showing an improvement in the patient's ability to sustain phonation. Her speech intelligibility also improved, and her articulation became more accurate with fewer distortions in consonants.

Table 3: Subscale 3-assessment of phase of swallowing, MMSA.

	Observation	Upright posture	Chin down posture
Dry swallow	laryngeal elevation	0	0
Thick liquid (Trial feed:10 ml of thick liquid)	lip seal	0	0
	managing secretion	0	0
	oral transit	1	1
	nasal regurgitation	0	0
	laryngeal elevation	1	1
	post swallow voice	1	0
	cough	1	0

Table 4: Outcome progress table for rating scales like FOIS, EAT-10, and DOSS.

Assessment	Pre-therapy assessment	Post-therapy assessment
FOIS	1	7
EAT-10	25	2
DOSS	1	7

In terms of swallowing, significant improvement was documented using FOIS, DOSS and EAT-10 (Table 4). The patient successfully transitioned from thickened liquids to a regular diet, demonstrating the effectiveness of the rehabilitative and compensatory techniques used in her treatment.

DISCUSSION

This case study illustrates the effectiveness of a comprehensive, multidisciplinary approach to the rehabilitation of stroke patients with complex neurological deficits, such as pharyngeal dysphagia and spastic dysarthria. This study aligns with recent advancements in dysphagia and dysarthria management, especially following acute ischemic stroke.

As demonstrated by Chen et al, the international dysphagia diet standardisation initiative (IDDSI) framework has emerged as a critical tool in enhancing dysphagia management.[5] Their research showed that adhering to IDDSI guidelines significantly improved communication among healthcare providers, resulting in more accurate dietary recommendations and reducing aspiration risks. Our study also emphasizes the importance of a standardized approach to ensure patient safety, particularly in the early stages of stroke recovery.

Additionally, intensified post-stroke care has been linked to better long-term outcomes for stroke patients with dysphagia. Karisik et al highlighted that comprehensive rehabilitation programs, including early dysphagia assessments and individualized therapy, led to improved swallowing function.[7] These findings are consistent with our approach, were early and personalized interventions significantly enhanced recovery. As noted by Jones et al the co-occurrence of dysphagia and dysarthria in post-stroke patients complicates both assessment and rehabilitation.[6] In this case, a combined approach targeting both speech and swallowing was essential for recovery. Techniques such as the supraglottic swallow and rate modification for dysarthria, along with swallowing exercises like the chin-down posture, addressed the interdependent nature of these conditions. This integrated rehabilitation strategy supports the need for concurrent therapies, to enhance recovery outcomes and improve quality of life for stroke survivors.

The study "thermal tactile stimulation therapy and swallowing function among patients with acute stroke-induced dysphagia" supports our findings, showing that thermal tactile stimulation enhances swallowing efficiency in acute stroke patients with dysphagia.[11] Our research further highlights thermal tactile stimulation as an effective adjunct in early rehabilitation, improving both swallowing function and potentially speech clarity, underscoring its value in dual therapy for stroke patients with combined dysphagia and dysarthria. A multidisciplinary approach is crucial for managing dysphagia and dysarthria after stroke.[8] The study emphasized the need for tailored rehabilitation strategies to address the complex nature of stroke-related swallowing disorders. Our approach, which included rehabilitative techniques like the chin-down posture and compensatory strategies, is in line with these recommendations and helped ensure safe swallowing and effective recovery.

Moreover, Bath et al demonstrated the impact of early swallowing therapy, particularly in reducing the risk of aspiration pneumonia.[9] This is reflected in our case, where timely intervention allowed the patient to transition from tube feeding to a regular diet, highlighting the efficacy of early rehabilitation. Finally, our findings are consistent with Cock et al, who reported a high incidence of both dysphagia and dysarthria following acute ischemic stroke.[10] Their research affirmed the effectiveness of a multidisciplinary approach, combining both swallowing and speech rehabilitation. The inclusion of interventions like LSVT for spastic dysarthria in our study aligns with their results, where early intervention led to significant recovery in both swallowing and speech functions.

CONCLUSION

This case study underscores the critical importance of a comprehensive, individualized, and multidisciplinary approach in the rehabilitation of stroke patients with complex neurological deficits, such as pharyngeal dysphagia and spastic dysarthria. The patient's recovery demonstrated significant progress, not only in speech intelligibility and articulation but also in swallowing function, as evidenced by improvements in key clinical measures such as the functional oral intake scale (FOIS), dysphagia outcome and severity scale (DOSS), and eating assessment tool (EAT-10). The patient successfully transitioned from tube feeding to a regular diet, highlighting the effectiveness of both rehabilitative and compensatory strategies used in therapy.

Findings align with recent research emphasizing the benefits of standardized frameworks, such as the international dysphagia diet standardisation initiative (IDDSI), in improving communication among healthcare providers and enhancing patient safety. Additionally, the importance of early, intensive rehabilitation following stroke has been reinforced, as timely and personalized interventions significantly contributed to the patient's recovery.

This study also reinforces the need for a multidisciplinary approach, combining the expertise of speech-language pathologists, nutritionists, and other healthcare providers, to address the complex nature of stroke-related dysphagia and dysarthria. The inclusion of evidence-based strategies like LSVT for spastic dysarthria and techniques like the chin-down posture for swallowing has proven effective in improving both swallowing safety and speech function. These therapeutic interventions, supported by recent literature, highlight the potential for significant long-term recovery in stroke patients when appropriate, early interventions are implemented.

In conclusion, this case study illustrates the positive impact of a tailored, interdisciplinary rehabilitation program, emphasizing the importance of early intervention, individualized care, and the integration of standardized frameworks like IDDSI to ensure optimal outcomes for patients with dysphagia and dysarthria following acute ischemic stroke.

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