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COMPREHENSIVE ASSESSMENT OF DYSARTHRIA IN POST COVID –19 INFECTION: A CASE REPORT

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ABSTRACT Adults with COVID-19 infection frequently present with neurological conditions that leads to dysphagia and dysarthria. Respiratory compromise associated with COVID-19 infection can alter respiratory swallowing coordination and can limit breath support for speech and voice production. Identification of the presence and nature of motor speech disorders in adults is useful for differential diagnosis and planning of intervention. The present study aimed towards a comprehensive assessment of dysarthria post-COVID-19 infection in a 45years old female with report of slurring of speech. Objective and subjective assessments were carried out in speech, language, cognition and swallowing parameters. Detailed subjective evaluation of speech subsystems namely; respiratory, phonatory, articulatory, resonatory and prosody was carried out using VHI, GRBAS, Frenchay Dysarthria Assessment (FDA), Speech intelligibility rating scale. Objective evaluation included Multi-Dimensional Voice Profile (MDVP) software program for phonatory-respiratory system. Result of assessment of speech subsystems indicated client having dysarthria (classified as mixed type) associated with slight dysphagia with aspiration risk. Comprehensive evaluation and monitoring of Dysarthria post-COVID-19 infection will benefit in management goals resulting in improved quality of life.

KEYWORDS : Dysarthria, Dysphagia, FDA, MDVP

INTRODUCTION

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus (WHO,2023). Health have been affected globally by the corona virus pandemic. Although COVID-19 is primarily presented with respiratory symptoms, neurological manifestations of this disease are being increasingly recognized (Benjamin et al., 2020). Neurological manifestations include intracranial haemorrhage, cerebrovascular disease, parkinson's disease and parkinsonism, neuromuscular diseases, peripheral neuropathy, myoneural junction and muscle disease encephalitis, dementia, fatigue, gustatory and olfactory disturbances (Marshall, 2020). Davis et. al (2020) reported 48.6% of individuals to have speech and language issues post-COVID-19 and almost 1 in 3 individuals tend to develop neurological problems. Studies have shown that neurological post-COVID-19 symptoms can persist for even a year after the initial infection although symptoms display an improvement in patient outcomes (Rass et al., 2022).

Dysarthria is one of the reported post-COVID-19 conditions. ASHA refers to dysarthria as “a group of neurogenic speech disorders characterized by "abnormalities in the strength, speed, range, steadiness, tone, or accuracy of movements required for breathing, phonatory, resonatory, articulatory, or prosodic aspects of speech production"(Duffy, 2019). Dysarthria following COVID-19 infection is predominantly caused either due to stroke (Mehboob et al., 2020; Bhagat et al., 2020) or due to infections of nervous systems like meningitis and encephalitis (Huo et al., 2021). The present case study aimed to report a comprehensive assessment of dysarthria post-COVID-19 infection.

MATERIAL AND METHOD

A 45years old right-handed Hindi-speaking female reported to speech language pathology department after 10 months of COVID-19 infection. The client reported of slurring of speech which was progressive in nature and shortness of breath during verbal communication post COVID-19. Objective and subjective assessment were carried out in speech, language, cognition and swallowing parameters. MRI results suggested of tiny cortical calcification with surrounding mild gliosis in left inferior parietal lobule and right pre-central gyrus.

The client underwent detailed subjective evaluation in speech subsystems namely; respiratory, phonatory, articulatory, resonatory and prosody. Respiratory subsystem was assessed by observing the client's breathing pattern at rest as well as during speech. To assess respiration the client was instructed to take a deep breath via the mouth and exhale out slowly. Conversation was used to evaluate the function of respiration in speech. The tasks assessed the client's breathing pattern, effort and capacity subjectively. Phonatory subsystem was assessed by measuring the maximum phonation duration (phonate /a/, /i/, /u/) and s/z ratio. Auditory perceptual procedures of Voice handicap Index – Hindi (VHI) and GRBAS was used to measure the severity of voice handicapness and quality of voice respectively. Resonatory system was assessed subjectively using Buffalo voice rating scale. Assessment of the articulatory subsystem considered contextual speech and picture description tasks. Diadochokinetic rates (AMR, SMR) assessed coordination and control of the articulators through a hierarchy of productions of increasing length and complexity. The articulatory errors were recorded, noted and analysed based on the SODA (substitution, omission, distortion addition) analysis. Overall speech intelligibility was checked using speech intelligibility rating scale. Assessment of prosody included the reading of contrastive stress words and informal evaluation of rhythm and intonation during conversation instances.

Frenchay Dysarthria Assessment was administered for rating the overall severity of dysarthria and for the classification of dysarthria based on nature and patterns of oro-motor movements. Dysphagia evaluation was carried out subjectively by assessing of saliva swallowing, direct assessment of swallowing (with food) and severity of aspiration risk was screened using Gugging swallowing screening (GUSS) measures. Subjective assessment of cognitive functioning (executive functioning, attention, language, visuospatial and orientation) was checked using the Montreal Cognitive Assessment-Hindi version (MoCA-H) scores. Language skills (spontaneous speech, auditory verbal comprehension, naming, repetition) were screened using Hindi version of Western Aphasia Battery screener. Objective evaluation included Multi-Dimensional Voice Profile (MDVP) software program for phonatory-respiratory system. Fundamental frequency, jitter, shimmer, amplitude tremor during phonation were recorded and noted.

RESULTS

The assessment findings of speech, language, cognition and swallowing were recorded and documented which assisted in differential diagnosis. The client obtained a MoCA-H total score of 28 out of a maximum score of 30 suggestive of no neuro-cognitive decline. Western Aphasia Battery Screener in Hindi (WAB - H) results reported of significantly better scores for spontaneous speech, auditory verbal comprehension, naming and repetition indicating no linguistic deficit.

Assessment of the speech skills included cranial nerve examination, which is an integral and important part of a complete neurological examination. Clinical evaluation of cranial nerve assessment revealed affected functioning of trigeminal (V) facial (VII) and vagus nerve (X). Reduced diadochokinetic (DDK) rates of 4.5, 4.3, and 4.1 were noted for /pʌ/, /tʌ/, and /kʌ/, respectively. Productions during the DDK

tasks were affected in terms of slowness, rhythmicity and precision. Oral peripheral structure and function examination revealed deviated lips towards the right side, reduced range of movements and a decreased strength of the lips and tongue in speech and non-speech tasks. The articulatory errors included imprecise distorted consonants (fricatives affricates and blends) in all position of word and sentence level. Speech intelligibility rating of spontaneous conversation was indicative of unintelligible sentence production that required understanding with difficulty and concentration even by family members. The VHI and GRBAS findings when analyzed indicated moderate voice handicapness with hoarse voice quality. Maximum phonation duration and s/z ratio was reduced when compared to the normative values (Table 1).

Fig 1. FDA assessment data

Note: This table depicts FDA rating of the client. The domains assessed include reflex, respiration, lip movements, jaw, palate, voice, tongue and intelligibility. *FDA score sheet indicates dysarthria of speech.

The client scored 19 out of a maximum score of 20 in Gugging swallowing screen (GUSS) of indirect and direct swallowing test. This was suggestive of slight dysphagia with aspiration risk indicating that the client was successful in swallowing semisolids but occasionally slightly deficient in swallowing liquids and solid.

Table 1. Results of subjective evaluation

Subjective evaluation		Results
Evaluation of subsystem	**Articulation**	Distortion of fricatives, affricates and blends Diadochokinetic rate: /pʌ/- 4.5, /tʌ/- 4.3, /kʌ/- 4.1
	Phonation	MPD: /a:/- 10s, /i:/- 9s, /u:/- 9s. s/z- 0.8s VHI: Moderate voice handicapness GRBAS: Hoarse voice quality
	Respiration	Slight inadequacy of respiratory support
	Resonation	Adequate
	Prosody	Inadequate stress and longer interword pauses. Reduced rate of speech
Swallowing screening		Slight dysphagia with aspiration risk
Speech intelligibility		Understanding with difficulty and concentration even by family members

Objective evaluation of voice (MDVP) indicated a altered voice quality with significant variability in fundamental frequency, variability of amplitude and presence of noise. (Table 2).

Table 2. MDVP data

Parameter	Symbol	Obtained value
Average fundamental frequency	F_0	280.510 Hz
Pitch Period Pertubation Quotient	PPQ	1.052%
Fundamental frequency variation	vF_0	1.835%
Peak to Peak Amplitude Variation	vAm	14.907%
Shimmer in dB	ShdB	.231Db
Amplitude Pertubation Quotient	APQ	1.553%

Note: This table depicts the acoustic analysis of voice of client. The acoustic correlates of pitch and intensity are analyzed through the MDVP program. The parameters with values not within normal limits are tabulated.

On accumulating the evidences and results of subjective and objective speech and language parameters along with MRI report, the present case was conveyed as having dysarthria classified as mixed type.

DISCUSSION:

Through a comprehensive evaluation, the client was provisionally diagnosed with mixed dysarthria associated with slight dysphagia with aspiration risk. Usually dysarthria in a post COVID-19 patient is clustered with many neurological deficits (D'Anna,2020). Bhagat et al. (2020) reported a rare case of isolated dysarthria in COVID-19 infected stroke patient. In the present study the comprehensive assessment included screening tests (WAB screener, GUSS), subjective tests (MPD, Speech intelligibility rating scale, VHI, GRBAS), Standardized tests (FDA) and objective tests (MDVP). Altaher (2019) stated that dysarthria can be assessed by various subjective and objective assessment tools among which Frenchay Dysarthria Assessment is a standardized tool commonly used by speech-language pathologist.

The present case study evaluated the subsystems of speech production and the findings conveyed a definite severity and classification of dysarthria. Bhagat et al. (2020) also reported that in a case of isolated dysarthria strength, rate of movement, vocal quality, tone, breath control, pitch, range of motion, and steadiness of speech are assessed. These functions relate to articulation, phonation, respiration, resonation and prosody, and affects intelligibility, audibility, and efficiency of spoken communication. Based on these assessments dysarthria is then classified as flaccid, spastic, ataxic, hypo- or hyperkinetic, or the mixed type.

The client of the present study revealed a moderate voice handicapness which was associated with respiratory and articulation deficits. Several COVID-19 variants cause significant respiratory symptoms, and thus a voice signal may be a potential biomarker for COVID-19 infection. Lichen et. al (2021) found correlation between dysphonia and coughing cases of post COVID-19 syndrome.

CONCLUSION

Comprehensive assessment of speech and language deficits can enhance diagnostic accuracy. Identification and measurement of motor speech impairment is an important part of the diagnostic pathway in dysarthria. This case study emphasizes the importance of dynamic speech and language assessment for new-onset of neurologic symptoms post COVID-19.

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