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Comprehensive Approach to Speech and Language Assessment in Recurrent Meningioma: A Case Study

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ABSTRACT

Meningioma is a tumor that arises from the meninges - the membranes that surround the brain and spinal cord. It compresses the adjacent brain tissues, nerves and vessels, leading to changes in vision, loss of smell, headaches, hearing loss or ringing in the ears, memory loss, seizure and most importantly communication difficulty. It affects mainly the elderly above the age of 60, at a female: male ratio of 3:2. Recurrence and progression are well known and are frequent characteristics of meningiomas. The present study aimed to perform a comprehensive approach to speech and language assessment in a case with recurrent meningioma. A case reported following postsurgical recurrent meningioma in the left parietal temporal area, exhibiting symptoms of language, speech and swallowing difficulty associated with a weakness in the left upper and lower limb. The evaluation process from a speech and language perspective involved perceptual and instrumental assessment of cognition, communication and swallowing using tests and tools. The case was found to have comorbid disorders of nonfluent aphasia associated with neuro cognitive deficit, mild dysphagia, mild dementia and dysarthria of speech. Though the presence of language and speech disorders in case of recurrent meningioma is not common, the severity of the disorder may lead to severe communication deficit. Assessing and interpreting an individual's communication ability involves the integration of a variety of information collected in the evaluation process.

Keywords: Recurrent meningioma, dysphagia, aphasia, dysarthria

INTRODUCTION

Tumors of the central nervous system are a set of neoplasms originating from support cells of the nervous tissue. They include tumors of the brain, cranial meninges, and intracranial nerve (Gasparini, 2010). Among the primary intracranial neoplasms, meningiomas are considered as the most frequent (Pieri & Giriko, 2011). A meningioma is a primary central nervous system tumor. It is a tumour that forms on membranes specifically on the three layers of membranes (meninges) that cover the brain and spinal cord. Meningioma forms along the dura mater, the outermost layer of tissue that covers and protects the brain and spinal cord (Buerki, 2018). This is the most common benign tumor, accounting for 13%–26% of intracranial tumors; most of them are slow growing, and many are found incidentally (Yakhmi, 2015). The clinical symptoms are usually dependent on the anatomic site involved (Gupta, 2004). Meningiomas account for about 1.5% of brain tumours in childhood and adolescence (Wiemels, 2010).

In elderly population (patients aged 60 years or older) meningiomas are the most incidentally detected benign primary brain tumour. As a patient ages, the rate of growth of the meningioma decreases, while comorbidities increase (Eseonu, 2020). Females are reported to be more commonly affected with meningiomas than males (Wiemels, 2010).

Recurrence and progression are well known and frequent characteristics of meningiomas. Symptoms of meningioma vary by the site and size of the tumour. The most common symptoms reported are swellings and headaches, memory loss, seizures, blurred vision, swallowing difficulty, hearing loss or balance problem, language and speech deficits. Basso et al., (2021) reported of progressive language deficits in a case with meningioma. The study attributed this result to the fact that meningiomas can compress major cerebral arteries, resulting in transient neurologic symptoms. Some international studies point to aphasia and dysphagia as complications of meningeal neoplasms (Nakamura et al., 2003; Tella et al., 2006). Tracheal aspiration resulting from difficulty of swallowing is an important symptom that should be considered, potentially leading to compromised pulmonary status, nutritional problems, dehydration, weight loss, pneumonia, and death.

Communication deficits can lead to negative effects, as when language is affected it can interfere in the related processes (Padovani, 2007). Language impairments may coincide with speech impairments, such as dysarthria or apraxia of speech, and/or with nonverbal cognitive impairments. When an individual with recurrent meningioma has signs and symptoms of both dysarthria and aphasia, a speech language pathologist needs to differentially diagnose the problem as motor or language based or a combination. Differential diagnosis is a systematic process used to identify the proper diagnosis from a set of possible competing diagnoses. (Cook & Décary, 2020). However, there is limited literature regarding speech and language characteristics occurring in individuals with recurrent meningiomas. A thorough evaluation analysis and better understanding of speech and language characteristics are of crucial importance for better, treatment and prognosis. Early rehabilitation is important to prevent complications, maximize the patients' functional capacity and in improving their quality of life (Costa, 2018). The present study aimed to highlight the role of speech language pathologist in comprehensive assessment and differential diagnosis of a case with recurrent meningioma.

MATERIAL AND METHOD

A Hindi speaking male aged 63yrs, reported to speech and language department with complaint of inability to speak clearly with a medical diagnosis of recurrent meningioma associated with a right sided weakness. Data on sociodemographic factors and present condition of tumor location were collected from radiological, surgical history and also from the patients' interview. Surgical history revealed presence of a posterior left frontal meningioma for which a parietal craniotomy with gross excision of the tumour was done. Following this a duroplasty surgery was performed due the reoccurrence of dural based tumour convexity meningioma. Postsurgical MRI results suggested of large irregular gliosis in left high front parietal regions. Presence of two more small benign lesions with smooth margins and uniformly intense contrast enhancement was noted in the left anterior temporal lobe and the other outside skull vault in left temporal scalp.

Communication deficit was reported by the case post second surgery of recurrent meningioma. Limb weakness (both fore and hind limb) in right side, a slow - staggered gait and dependency in activities of daily living was evident. Speech-language assessment was performed focusing on cognition, speech, language and swallowing aspects. Perceptual tests included assessment of level of consciousness using Glassgow Coma Scale (GCS), cognitive functioning (executive functioning, attention, language, visuospatial and orientation) based on

Montreal Cognitive Assessment-Hindi version (MoCA-H) scores, cognitive functioning to assess dementia using Hindi version of Clinical Dementia Rating scale (CDR-H) and linguistic skills (spontaneous speech, auditory verbal comprehension, naming, repetition) using Hindi version of Western Aphasia Battery- (WAB-H). Additional assessment for the functions of reading, writing and praxis were also conducted. Frenchay Dysarthria Assessment (FDA) was assessed for the identification of the nature and patterns of oromotor movements associated with different types of dysarthria. Assessment of saliva swallowing, direct assessment of swallowing (with food) and severity of aspiration risk was screened using Gugging swallowing screening (GUSS) measures. Speech intelligibility rating scale assessed the overall intelligibility of speech followed by the assessment of voice quality and articulation using perceptual procedure of Voice handicap Index (VHI) and Picture articulation test - Hindi version (PAT-H) respectively. Furthermore, instrumental analysis of voice quality was also performed using Multi-Dimensional Voice Profile (MDVP) software program on continuous phonation of vowel /a/. The collected results of perceptual and instrumental tests were tabulated, analysed and interpreted.

RESULTS

The obtained scores of Glassgow Coma Scale (GCS) were indicative of adequate level of alertness and awareness. Assessment of speech, language and cognition was done using perceptual and instrumental tests and the accumulated results assisted in differential diagnosis. Montreal Cognitive Assessment-Hindi (MoCA-H) evaluated cognitive skills in domains of visuoconstructional skills, naming, memory, attention, language, abstraction, delayed recall and orientation. The obtained score of 19 out of a maximum score of 30 suggested of a mild cognitive decline in the case (Table 1).

Table 1: Scores obtained in Montreal Cognitive Assessment-Hindi (MoCA-H)

Domain	Obtained score	Maximum score
Visuoconstructional Skills	4	5
Naming	1	3
Memory	-	-
Attention	5	6
Language	0	3
Abstraction	1	2
Delayed Recall	3	5
Orientation	5	6
Total score	19	30

The CDR-H scale consisted of six domains (memory, orientation, judgement and problem solving, community affairs, home and hobbies, personal care) and the rating indicated presence of mild dementia. The language skills were assessed using diagnostic Western Aphasia Battery (Hindi) which consisted of spontaneous speech, auditory verbal comprehension, naming, repetition, reading, writing and praxis. The results reported of significantly poor scores in verbal responses for repetition, naming and verbal fluency whereas auditory comprehension revealed a comparatively better score as demonstrated in tasks of comprehension of simple commands through verbal and written modalities (Table 2).

Table 2. Scores obtained in Western Aphasic Battery- Hindi

Domain	Obtained scores	Maximum score
Spontaneous speech	03	06
Auditory verbal comprehension	86	200
Naming	26	100
Repetition	24	100
Reading	23	100
Writing	33.5	100
Praxis	58	60

Aphasia quotient calculated from the obtained scores of WAB was 30.6 which indicated a severe category of aphasia. Differential diagnosis of aphasia is usually the distinction between fluent and non-fluent aphasia (Ardila and Roselli,2007). Hence a differential diagnosis performed based on the WAB scores suggested of a classification of non-fluent aphasia of Broca's type. The interpretation of the test scores noted reading and writing deficits however apraxia was not present in the case.

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 facial nerve (VII), accessory nerve (XI) and hypoglossal nerve (XII). Diadochokinetic (DDK) rates assess coordination and control of the articulators through a hierarchy of productions of increasing length and complexity. Reduced DDK rates of 4.4, 4.2, and 3.1 for /pʌ/, /tʌ/, and /kʌ/, respectively were noted. Productions during the DDK tasks were affected in terms of slowness, rhythmicity and precision.

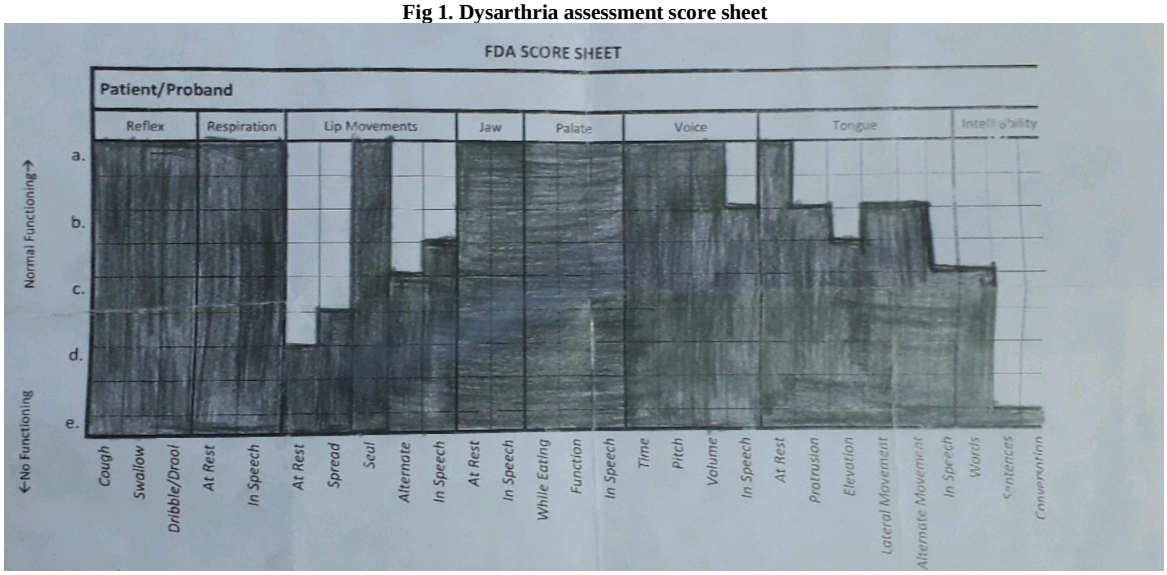
Oral peripheral structure and function examination reported of deviated lips with slight droop on the right side and a noted overall weakness of the tongue at rest. As for strength and mobility of orofacial structures (lips, tongue and jaw) during speech and nonspeech tasks the case presented with slow alternating movements, reduced range of movements and a decreased strength.

The quality of voice was perceptually rated as slight voice handicapness with reduced loudness during longer utterances. Instrumental evaluation of voice (MDVP) indicated a altered voice quality with significant variability in fundamental frequency, variability of amplitude and presence of noise. The articulatory errors reported of imprecise consonants, distortion of fricatives, affricates and blends at all position in isolation, word and sentence level. Speech intelligibility rating of spontaneous conversation was indicative of unintelligible sentence production (Fig 1). The FDA scores obtained confirmed the presence of dysarthria of speech in the present case study.

The result of Gugging swallowing screening (GUSS) of direct swallowing test found swallowing difficulties in solid textures with a score of 18 indicating a severity of slight dysphagia associated with low risk of aspiration.

On accumulating the evidences and results the present case was diagnosed from a speech language pathologist (SLP) perspective as having neuro cognitive deficit associated with mild dementia, Broca's aphasia, dysarthria of speech and slight dysphagia secondary to recurrent meningioma.

Fig 1. Dysarthria assessment score sheet



DISCUSSION

Meningioma is one of the most frequent primary brain tumors in adults and represents 15% of intracranial tumors and 30% of all tumors of the central nervous system originating from the meningeal coverings of the spinal cord and brain (Ohla & Scheiwe, 2015). Neurological deficits resulting from meningeal neoplasms are caused by compression of underlying structures (Kirshblum et al., 2001) shifting of brain structures, increased intracranial pressure, edema, and surgical manipulation (Miotto et al., 2003). The findings of the present study had an overall impression of cognitive, communication, swallowing and physical deficits in the case of recurrent meningioma. This is in line with previous studies (Costa et al., 2018) that stated speech-language disorders as common occurrences in brain tumors, with cognitive, communication, behavioral, and physical deficits that lowers the overall prognosis.

The present case of postsurgical recurrent meningioma had mild neurocognitive deficit as per the results of MoCA-H. This finding was supported by previous research studies that have widely cited postoperative cognitive and linguistic impairments in meningioma patients, especially in skills of memory, attention, and expression (Nayar et al., 2010; Miotto et al., 2003; Meskal et al., 2016). A mild neurocognitive deficit in MoCA also indicated a higher risk of developing dementia. Diagnostic test performed using CDR-H confirmed the presence of mild dementia. Presence of fluent aphasia (Broca's type) in the case was confirmed from the results of WAB-H and were similar to findings of research study by Collee et.al., (2022). Thie study concluded that error categories of linguistic modality or aphasia syndrome (comprehension, production, reading, Broca's aphasia and conduction aphasia) and linguistic level or other level (phonology, semantics, morpho-syntax, articulation, spontaneous speech, speech apraxia and word-finding) were related. It also stated that the most frequently observed postoperative deficits were production deficits (in terms of modality or aphasia syndrome) and spontaneous speech deficits (in terms of the linguistic or other levels).

The FDA findings of structural and functional errors on oromotor examination were widely documented in research studies (Nakamura, 2003; Gilbert et al., 2014; Bakar, 2010). Gilbert (2014) researched that surgical manipulation in meningioma cases often led to cranial nerve injuries and to frequent presence of postoperative dysarthria in recurrent meningioma. The present case also showed similar results and hence was in line with previous studies. Swallowing difficulties is one of the common symptoms of meningioma. In the present study the scores of GUSS revealed a successful swallow in semisolid and liquid textures however was unsuccessful in solid textures. Many research studies in literature are in the same line which confirmed the presence of dysphagia of varied severity in meningioma individuals (Tsao,2008; Shibao et al., 2022; Paglia & Giammattei, 2022). Speech-language assessment after surgical procedure of recurrent meningioma is essential for identifying functional alterations, allowing the necessary approaches to rehabilitation (Senior et al., 2015).

CONCLUSION

In conclusion, individuals with recurrent meningioma face a breakdown in communication during the course of the disease, which makes it challenging for SLP's to evaluate communication skills. A comprehensive assessment considering all the possibilities of comorbid conditions to recurrent meningioma should be considered, so that SLPs could meet the communicative needs and plan specialized therapeutic intervention. The case of the present research study can act as an example in upgradation of understanding for speech language pathologists working in multidisciplinary neuro rehabilitation set up.

Declaration by Authors

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