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REHABILITATION OF SWALLOWING AND VOICE IN MEDIAL MEDULLARY INFARCT – A CASE STUDY

Clinical Research

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ABSTRACT

Cerebral infarction leads to necrosis as a result of occlusion in cerebral artery. Based on the lesion site, infract is classified as i) Total Anterior, ii) Partial Anterior Circulation Infarcts, iii) Lacunar Infarcts, iv) Lateral and v) Medial Medullary Infarct. Among the types, Lacunar and Lateral Medullary Infarcts are the common causes for speech and swallowing problems. Medial Medullary Infarct (MMI) is a rare syndrome which causes speech and swallowing problem in less than 1% of the clinical population. Major characteristics of Medial Medullary Infarct include 1) Ipsilateral Hypoglossal nerve palsy (deviation toward the side of the lesion) 2) Contralateral Hemiparesis and 3) Lemniscal sensory loss (proprioception and position sense). The major symptom of patients with MMI exhibit respiratory distress for whichtracheostomy tube would be inserted in order to protect the airway and supports for prolonged ventilation. This case study mainly focuses on a patient who has MMI and fitted with Tracheostomy tube. The client presented with Speech and swallowing difficulty. Management of Swallowing, Voice and the prognosis were documented.

KEYWORDS

Medullary infarct, Hypoglossal nerve palsy, Hemiparesis

INTRODUCTION

Medial Medullary Syndrome/ Infarct is a rare condition which occludessmall branches of vertebral or basilar artery supplying the medial aspect of medulla oblongata. The syndrome was first described by Joseph Jules Déjerine, a French neurologist, in 1915. Medial medullary infarct (MMI) is presented with triad clinicalsymptoms such as, ipsilateral hypoglossal nerve palsy, contralateral hemiparesis, and contralateral lemniscal sensory loss. Patients with MMI also exhibit breathing difficulties due to lesion in the corticospinal nerve tract, which controls the muscles of respiration. Patient who experience respiratory distress are usually intubated with Tracheostomy tube (TT). There are various mechanical and physiological impact on insertion of TT. Mechanical impactwould result in: Reduced laryngeal excursion; Saliva and secretion issues. Physiological impact results in: Disruption of airway pressures and Reduction of airflow through the glottis. Immediately after tracheostomy, the air does not pass through the vocal folds which results in aphonia (Shikani & Burns, 2012).

Conlan and Kopec (2000) reported that individuals intubated for greater than seven to ten days may develop upper airway injury which impacts the voice and swallowing function.A tracheostomy tube decreases the ability of the patient to communicate effectively. The ability to speak improves the quality of life for a patient with a tracheostomy. The complex interrelationships between respiration, swallowing and voicing in patients with tracheostomy are treated by experienced Speech- Language Pathologists. Cuff-down technique with finger occlusion of the proximal tracheostomy tube and Speaking valve facilitates voice production for those patients who underwent tracheostomy.

The Speech-Language Pathologist assesses the patient's cognitive and language abilities to determine the effectiveness of communication, evaluates oral-motor and swallowing functions, and assesses the patient's ability to produce voice with the help of speaking valve. Multidisciplinary teamwork can result in effective restoration of speech in many patients with a long-term tracheostomy.

CASE STUDY

A 55 year old male was diagnosed with Bilateral Medial Medullary Infarct using MRI by the Neurologist. The client was alert and oriented during the assessment session. Breathing was initially supported by the mechanical Ventilation through TT and feeding was aided through Naso Gastric tube (NG) Tube. Language Profile and Cognition was observed to be adequate.

Cranial Nerve Examination

Cranial Nerve	Examination	Findings
V Trigeminal	**Sensory task** -Cold sensation, -cotton swab -pinprick - light touch. -Touch anterior tongue on both sides - Observe contours of masseter at rest. **Motor task** -Observe chewing. "Bite down" and palpate masseter muscles - Opening& closing mouth against resistance - Observe soft palate upon phonation. -Palpate laryngeal elevation	Sensory Functions are adequate. Motor functions are adequate
VII Facial	-Observe at rest and during facial expressions -Wrinkle & Rise the eyebrows - Tight closure of eyes - Smile, Pout, Blow - IOBP -Cotton swab with different taste (lemon juice/sugar/salt) was given to elicit taste sensat ion(anterior part of the tongue)	No significant dysfunction observed
IX Glossophary ngeal	-Contributes to cough reflex (test cough) -Cotton swab vs tongue depressor touching posterior tongue elicits gag reflex -Cotton swab with different taste (lemon juice/sugar/salt) was given to elicit taste sens ati on(posterior part of the tongue) - Evaluate salivation	-Absence of cough reflex (Due to TT) - Reduce gag due to reduced sensation
X Vagus	-Observe soft palate and test gag, as in CN IX - "Cough hard" and test for glottis closure - Listen for problems in the voice: gurgly, wet, breathy, hoarse, stridor, monopitch, diplophonia, tremors - Test /k, g/ sounds (for soft palate movement)	- Loss of gag reflex. - Loss of cough reflex -Reduced taste sensation, - unable to identify texture and temperature -Aphonia

	-Observe swallowing, and palate for reduced laryngeal elevation and delay in the swallow response	-Difficulty swallowing (Dysphagia)
XII Hypoglossal	-Observe tongue (atrophy, tremor, fasiculations) -Use tongue depressor to resist movement. against retraction - Check lateral resistance. - Test range of motion. Side to side.	Reduced range of motion of the tongue and weakness observed predominantly in left side.

Oral Mechanism Examination, revealed

Lingual: Surface color : Normal
Size : Normal

Range of motion : Reduced
Protrusion : Present, only upto the level of teeth
Elevation of tip : Absent
Point to right side : Absent
Point to left side : Absent
Retraction : Absent
Strength : Reduced
Rapid repetitive lateral movements : Reduced speed
Rapid repetitive vertical movements : Reduced speed

Hard and Soft Palate:
Color : Normal
Arch height : Normal
Symmetry at rest and movement : Normal
Gag reflex : Reduced
***Dryness** was observed to be present due to reduced oral intake.

Speech Profile:
Respiration: Through TT
Voice Profile: Absence of voice (Aphonia)
Articulation: Articulatory gestures were observed to be present, however no voicing.
Fluency/ Prosody: Not able to assess

Swallowing Profile:
Screening for swallowing was done and the following were observed, **Dysphagia Severity Rating (DSR) (7 point rating scale) -** score of **3** was obtained which denotes water aspiration (Aspiration of thin liquid. Changes in food consistency will be effective)

Eating Status Scale (ESS) (5 point rating scale) - score of **1** was obtained, which denotes Tube feeding only.

The Modified Water Swallowing Test (MWST) (5 point rating scale) - score of **1** was noted which indicate no swallow.

Swallowing evaluation was done at bedside with the help of Manipal Manual of Swallowing Assessment (MMSA) and the following were observed, The client is under NG tube for feeding. Food trial was done for swallowing evaluation.

Swallowing therapy was given for 2 weeks, subsequently Oral Feed was initiated.

Reduced laryngeal elevation, Restricted tongue mobility. Aspiration (During swallow): Present

Symptoms	Food consistency	
	Thin liquids	Semi-solids
Complains of discomfort in throat	Absent	Absent
Nasal Regurgitation	Absent	Absent
Cough reflex	**Absent**	**Absent**
Delay in oral transit time	**Present**	**Present**
Gag reflux	**Absent**	**Absent**
Aspiration	**Present**	**Absent**

***Swallowing with solid food consistency could not be assessed as the client had difficulty in chewing.**

Impression: (?) Oropharyngeal Dysphagia with Aphonia.

Goals worked on
Goals for swallowing:
1. To facilitate normal inhalation and exhalation through nose (Breathing) by stoma occlusion.
2. Voluntary breath holding manuver was carried out by occlusion of tracheostomy cannula which indirectly improves Subglottic pressure and promote best airway closure.Voluntary cough was also initiated.
3. Tongue base resistance exercises and Masako manuver was carried out to improve Tongue retraction and improve Epiglottis excursion. During this phase, oral intake with Semisolid food consistency was initiated.
4. When administering Eating Status Scale (a five-point ordinal scale), score was improved from 1 to 3 in which Oral feed is better compared to tube feeding. Modified oral feed is facilitated using supraglottic swallow.

Progress: NG tube was removed and swallowing was observed to be adequate without anspiration.

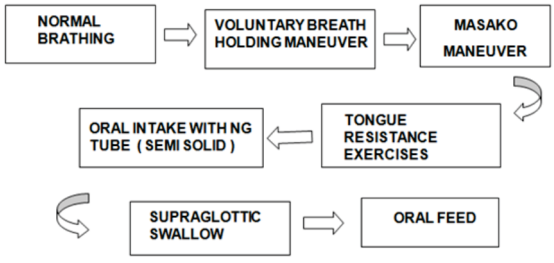

Fig 1 indicated the therapeutic plan for swallowing

During the course of treatment post Cuff deflation, One way Speaking valve were fitted. The speaking valve is a small device with a one-way valve that is placed on the hub of tracheostomy tube which helps in voice production.

Studies suggest that an inflated tracheostomy tube cuff excludes the larynx and upper airway from normal airflow patterns, and one of the best methods of facilitating communication is to deflate the cuff as soon as possible (Cameron et al, 2009). Cuff deflation can add a significant work of breathing to the patient however, especially if upper airway gas flow is augmented by the use of one-way speaking valves (Sutt & Fraser, 2015; Sutt et al, 2015).

Goals for Voicing:
1. Worked on normal inhalation (Breathing) through one way speech valve. The physiology of one way speech valve opens on inhalation to allow the inspiratory breath, but closes on exhalation. This allows the exhaled air to be re-directed up to the vocal cords, to provide the opportunity for voicing.
2. The cough reflex was also facilitated with tactile feedback.
3. Phonation of / a/, / i /, / u / were initiated through one way speech valve.
4. Establishment of easy onset of voicing while production of words starting with / h /sound .
5. Production of phrases and sentences.

PROGRESS
The following Progress were documented after Rehabilitation of Voice and Swallowing functions

Pre-Therapy Status (After Tracheotomy)	Post Therapy-Progress (Using One way Speaking valve)
• Respiration : Inadequate • Phonation : Aphonia • Swallowing : via NG tube	• Respiration : Adequate • Phonation : • Pitch : Low pitch • Loudness : Reduced • Quality : Hoarse voice • MPD : 3-4 seconds • Swallowing: Normal Swallowing through Oral feed.

Through the usage of **one way speaking valve**, initiation of voice with increased loudness was observed. It also facilitates normal passage of air, improves sense of smell and taste with reduced secretions at the stoma.

CONCLUSION:

Medial medullary infarct (MMI) is associated with clinical triad of ipsilateral hypoglossal nerve palsy, contralateral hemiparesis, and contralateral lemniscal sensory loss. Unilateral MMI, have a better prognosis than bilateral MMI (Chokroverty et al, 1975; Leetsma & Noronha, 1976; Meyer et al, 1981). MMI in the upper medulla seem to carry a better prognosis as they have lower frequency of respiratory disturbances than in lower medulla (Kim et al,1995; Gan et al, 1995). Most of the individuals with MMI have respiratory distress and symptoms of Dysphagia due to hypoglossal nerve palsy, these clients usually undergo Tracheostomy and NG tube insertion. Role of SLP plays a major role in assessment, counselling and management of individuals who underwent tracheostomy. Swallowing and voicing can be re- established through rehabilitative exercises and one way speaking valve. Tracheal occlusion also improve swallowing, as it re-establish subglottal airway pressure and restore upper airway flow. SLP also plays a major role in tracheostomy decannulation process.

Limitation of the study

- Instrumental evaluation was not carried out hence definitive diagnosis could not be approximated.
- Post therapy voice analysis and analysis of swallowing functions was not done to estimate the quantitative prognosis.

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