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RADIATION INDUCED DYSPHAGIA IN HEAD AND NECK CANCERS - ASSESSMENT AND MANAGEMENT.

Shailley A Sehgal[1], Yashpal Verma[2], Ashok Chauhan[3]
[1]Senior Resident, Department of Radiation Oncology, Pt. B. D. Sharma PGIMS, Rohtak (India)
[2]Addl. Senior Medical Officer, Department of Radiation Oncology, Pt. B. D. Sharma PGIMS, Rohtak (India)
[3]Senior Professor, Department of Radiation Oncology, Pt. B. D. Sharma PGIMS, Rohtak (India)

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Corresponding author:

Dr. Shailley
Senior Resident,
Department of Radiation Oncology,
Pt. B. D. Sharma PGIMS, Rohtak (INDIA) -124001
Email *drshailley@gmail.com*

Abstract:

Disease and treatment-related swallowing dysfunction are quite common in head and neck malignancies. Though the use of high-end technology like Intensity modulated radiotherapy (IMRT) has led to a reduction in morbidity still, the issue of tolerability comes whenever a higher dose of radiation is used for tumor control.

The goal of this review is to emphasize the need for documentation of pretreatment swallowing functions and look into the prospects to improve swallowing function, thence quality of life after radiotherapy by studying factors leading to this impairment. We also looked into the benefit of physiotherapy exercises to increase the capacity of muscles.

INTRODUCTION

Radiotherapy or concurrent chemoradiotherapy is the mainstay of treatment for locally advanced head and neck cancers. Such patients often manifest various degrees of swallowing dysfunction or dysphagia. Dysphagia is a term derived from the Greek word *dys* (difficulty) and *phagein* (to eat). A patient may present with discomfort/ pain, obstruction, or uncoordinated swallowing. Malignancy itself and the treatment per se both add to the etiology of dysphagia. Swallowing dysfunction is also associated with aspiration or sensory dysfunction, especially in laryngeal and hypopharyngeal cancers. It is often attributed to certain functional problems such as reduced retraction of the base of tongue, poor epiglottic movement, reduced laryngeal elevation, delay in pharyngeal transit, and/or poor coordination of swallowing muscles.[1,2]

Most of the time, oncologists concentrate on treatment-induced dysphagia but concern should start even before treatment, with conscious documentation. Pretreatment evaluation helps in a better understanding of the ongoing pathology and measures can be taken at the very beginning.

The swallowing disability rating scale should be used for subjective assessment and reporting. The oral and pharyngeal anatomy or obstruction abnormalities can be quantified and monitored over time with the help of video fluoroscopic analysis and oropharyngeal motility (OPM) studies. Sites of dysfunction can be defined and the risk of aspiration can be looked into so that therapeutic intervention can be initiated.

In this review, the importance of swallowing dysfunction documentation with both subjective and objective parameters is emphasized. Also, its association with radiation treatment and appropriate measures to intervene and treat are being discussed.

Mechanism of dysphagia

Swallowing occurs in four stages- oral preparatory, oral, pharyngeal, and esophageal and is a complex biomechanical interaction of physiology and anatomy.[3,4] Six cranial nerves and over 25 muscles are involved, thus any neurological or structural defect affects swallowing. Disease or the treatment or both lead to the changes in mucosa as well as musculature e.g. edema, mucositis, fibrosis which in turn leads to swallowing dysfunction, a devastating symptom which indicates delay in the passage of solids or liquids from the oral cavity to the stomach. The pharyngeal phase seems more critical portions as it is most likely to be affected in patients with base of the tongue, pharyngeal, or laryngeal cancers.[5,6]

Dysphagia assessment

Assessment of dysphagia typically includes both clinical and instrumental evaluations, however, some studies utilized the presence of feeding tube or dietary changes as surrogate markers for dysphagia.[7] Detailed history should be elicited and utilization of a standard scale is a must. Multiple scales based on subjective, objective/clinical or radiographic parameters have been devised and utilized with varying degrees of success, to date (Table 1a & 1b).

Table 1a: Dysphagia evaluation Scales

Subjective scales (Including Quality of Life related to Dysphagia)	**Objective scales**
Food Intake Level Scale (FILS)[8]	Swallowing Performance Status (SPS) Scale[16]
Functional Outcome Swallowing Scale (FOSS)[9]	Dysphagia Outcome and Severity Scale (DOSS)[17]
Swallowing Quality of Life questionnaire(SWAL-QOL and SWAL-CARE)[10]	Royal Brisbane Outcome Measure for Swallowing (RBHOMS)[18]
Sydney Swallow Questionnaire[11]	
M D Anderson Dysphagia Inventory[12]	
Minimal-Eating Observation Form-Version II[13]	
Functional Oral Intake Scale (FOIS)[14]	
McGill Ingestive Skills Assessment[15]	

Table 1b: Common Dysphagia evaluation Scales

Swallowing scale	Development	Criteria	System specification	Validity and reliability
Swallowing Performance Status (SPS) scale[16]	1991 Karnell MP et al	Video-fluoro-graphic oropharyngeal motility (OPM) evaluation	7-point scale	Not been validated. Reliability data not available.[19]
Food Intake Level Scale[8]	1993 Fujishima I	10-point observer-rating	10-point scale	Reliable and Valid[8]
Dysphagia outcome and severity scale (DOSS)[17]	1999 Karen et al	Video-fluoro-scopic swallowing assessments and dietary assessments	7-point scale	Reliable but no validity testing[17]
Royal Brisbane Outcome Measure for Swallowing (RBHOMS)[18]	1993 Bassett et al	Clinical indicators of swallowing	10-point scale	Reliable and Valid[20]
Functional Outcome Swallowing Scale (FOSS)[9]	1999 Salassa JR	Dietary modifications, mealtime, aspiration risk, weight loss and oral/non oral feeding.	Stage-0 to Stage-5	Reliable and Valid[9]
Swallowing Questionnaire Quality of Life questionnaire (SWAL-QOL)[10]	2000 McHorney CA et al	Patients based questionnaire (10 QoL domains)- food selection, eating duration, eating desire, fear, burden, mental health, social functioning, communication, sleep, and fatigue.	44-item QoL instrument	Reliable and Valid[21]
Sydney Swallow Questionnaire[11]	2000 Wallace KL et al	Anatomic region (oral cavity, glottis, and the pharynx), type of dysfunction and swallowed bolus consistency.	17 questions (10 cm long visual analogue scales, except for Q13 which is a 0–5 scale and multiplied by 20 to get a comparable score with other questions.	Reliable and Valid[22]
MD Anderson Dysphagia Inventory (MDADI)[12]	2001 Amy Y Chen et al	Emotional, global, functional and physical subscales.	20-item self-administered questionnaire	Reliable and Valid[12]
Minimal-Eating Observation Form-Version II[13]	2002 Westergren et al	Involuntary weight loss, Body Mass Index (BMI),eating difficulties, and presence of clinical signs of under-nutrition.	9 items in 3 subscales: ingestion; deglutition; energy and appetite	Reliable and Valid[23]
Functional Oral Intake Scale (FOIS)[14]	2005 Crary MA	Degree of patient's food intake per oral on daily basis	7-point scale	Reliable and Valid[14]
McGill Ingestive Skills Assessment[15]	2006 Lambert HC et al	Self-feeding, positioning, oral motor skills for solid and liquid ingestion, and overall feeding safety.	42 items divided into 5 subscales: 4 items-positioning for meals; 7 items- self-feeding skills ; 12 items- oral motor skills for solid and 7 items-liquid consumption 12 items- texture management	Reliable and Valid[24]

Detailed oral/oropharyngeal examination along with sensory examination should be performed. Swallowing test, which incorporates trials of various food and fluid consistencies should be tested along with bolus size and characteristics (taste, temperature) assessment. Multiple swallows can be performed to see fatigability. Videofluoroscopy of swallowing

(VFSS) can be used. All phases of the swallowing process can be assessed functionally and radiographically. This procedure is often referred to as modified barium swallow (MBS), which is a validated instrument developed by Logemann and coworkers.[25]

Fiberoptic Endoscopic Evaluation of Swallowing (FEES) is another objective tool for dysphagia assessment. It visualizes the pharynx using a trans-nasal endoscopic tube and detects premature food or fluid leakage from the oral cavity thus helps assess aspiration risk, but it does not provide information on the oral stages of swallowing.[26]

In addition, acute and chronic dysphagia can be assessed using the Common Terminology Criteria for Adverse Events (CTCAE) and the Radiation Therapy Oncology Group/European Organization for Research and Treatment of Cancer's (RTOG/EORTC) Acute and Late Radiation Morbidity Scoring System.

There are other scales where dysphagia is a part of assessment but not totally comprising of the same e.g. Head and Neck Module, the Performance Status Scale for HNC patients (PSS-H&N), the Functional Assessment of Cancer Therapy Head and Neck Module (FACT-H&N), European Organization for Research and Treatment of Cancer (EORTC) QLQ C-30 (global quality of life scale), the University of Washington Quality of Life Revised (UW-QOL-R), the Head and Neck Cancer Inventory (HNCI), and the University of Michigan Head and Neck Quality of Life survey (HNQOL),the Oral Mucositis Weekly Questionnaire-Head and Neck (OMWQ-HN),Head and Neck Symptom Survey (VHNSS).[27-30]

The Radiation Therapy Oncology Group (RTOG) acute and late radiation morbidity scoring system is widely used scale which grades from 1 to 5 based on eating habits, tube or parenteral nutrition requirements.

There is lot of discrepancy in reporting, sometimes by analyst and sometimes by patients, which in turn leads to discordance between subjective and objective assessment and use of different tools in different studies adds to the bias leading to difficulty in comparative analyses of different studies. Thus worldwide standardization is required to define the use of tools and assessment criteria.

Correlation of dysphagia with primary site and stage of disease

Logemann et al reported prevalence of pre-treatment dysphagia in 28.2% patients with stage T2 or more oral cancer, 50.9% in pharyngeal cancer, and 28.6% in laryngeal cancer[31].In retrospective analysis of 63 patients, Nguyen et al reported the same as 71.5%, grade 1-3; 17.5%, grade 4-5; 11%, grade 6-7 by MBS and SPS.[33] Study by Stenson et al found that more patients with hypopharyngeal and laryngeal cancers aspirated and had more severe degree of pharyngeal impairment than the patients with oral cavity or oropharyngeal cancer.[32]

Radiation treatment related swallowing dysfunction

The severity of radiation-induced dysphagia is dependent on total radiation dose, fraction size and schedule, target volumes, treatment delivery techniques, concurrent chemotherapy, genetic factors, smoking history and present status, psychological factors, percutaneous endoscopic gastrostomy (PEG) tube or nil as reviewed by Platteauxet al.[33]

As studied by Alterio et al, in 42 head and neck cancer patients, absorbed dose to the crico-pharyngeal muscle and cervical esophagus might play a role in the development of acute radiotherapy related dysphagia.[34]

Dose and/ or volumetric dose (VD) limits to the following areas, have been suggested to mitigate dysphagia, including anterior oral cavity (V30 < 65% and V35 < 35%), geniohyoid (<60

Gy), glottic and supraglottic larynx (<40-48 Gy; V50 to <21%), superior and middle pharyngeal constrictors (<63Gy; V55 < 80% and V65 < 30%), and inferior pharyngeal constrictors (<54 Gy; V50 to <51%).[32,35-38]

Caudell et al examined the effects of laryngeal blocking with IMRT using a matched low anterior neck field and found reduction in the mean dose to inferior pharyngeal constrictors, without alteration in total dose to larynx and no improvement in late-onset dysphagia was noted.It was commented that though IMRT allows for sparing critical swallow structures outside the target volume, radiation can still lead to unavoidable swallow complications.[35]

Schwartz et al analyzed dose-volume constraints associated with dysphagia in primary oropharynx cancers treated by IMRT using laryngeal block and conventional AP low neck field. It was demonstrated strong association between radiation dose to anterior oral cavity structures and superior pharyngeal constrictor muscles and poor swallowing outcomes as measured by Oropharyngeal Swallowing Efficiency leading to dysphagia.[38]

Improvement in functional outcome has been tried by sparing Dysphagia-Aspiration Related Structure (DARS) but the concept is still evolving with limited randomized controlled data. Relationship between irradiation of various swallowing structures and persistent dysphagia is found to be significant in numerous phase-II trials and/or retrospective studies.[39-42]

In a systematic review by Duprez et al, pharyngeal constrictor muscles mean dose reduction from 61-64 to 52-55 Gy resulted in decrease in swallowing disturbances and thus appeared to be the most important dosimetric predictor of late swallowing disturbances.[43] Multiple phase III randomized trials are upcoming which may solve the query,one such trial is by Petkar et al, on patients undergoing primary radiotherapy for pharyngeal cancers, where dysphagia-optimized intensity modulated radiotherapy (Do-IMRT) was compared with standard IMRT to assess the difference in mean MD Anderson Dysphagia Inventory (MDADI) composite score, measured at 12 months post radiotherapy.[44]

Late radiation effects may includexerostomia, osteoradionecrosis, trismus, reduced capillary flow, altered oral flora, dental caries, and altered taste sensation, which all contributed to dysphagia.[45-47]

Further research is needed to determine radiation effect/s on the morphology and physiology of structures prominently involved in swallowing.

Prevention and treatment

Specific swallowing exercises e.g. jaw motion, tongue base range of motion exercises, effortful swallowing exercises, tongue holding maneuver, Mendelsohn maneuver, and super-supraglottic swallow have been shown to reduce these effects and may improve oral intake. Mendelsohn maneuver involves voluntary elevation of the larynx and prolonged opening of the crico-pharyngeal sphincter. Patients should be encouraged to practice these exercises daily, during and after treatment, to alleviate dysphagia. Muscle disuse likely plays a role in development of swallowing muscle impairments after radiation which is justified by the fact that oral intake declines during radiotherapy, for head and neck cancers. Thus, these exercises have got both preventive and therapeutic role.[48-50]

Hutcheson et al carried an analysis for swallowing activity, over 497 patientswho underwent radiotherapy or chemoradiation to treat pharyngeal cancer. Their results showed significantly better long-term swallowing outcomes (2-4 times more likely to eat a regular diet at ~2 years) when patients adhered to

prophylactic swallowing exercise-goals and/or maintained full oral intake during treatment.[51]

Electrical stimulation has been tried with controversial results. Along with this, psychosocial support is must for such patients which surely adds to quality of life improvement.[52,53]

Conclusion

- Pretreatment dysphagia assessment and documentation is must.
- Type and way of fluid/food should be reported at the beginning, during and after treatment and a pre-defined protocol should be set.
- All phases of swallowing should be looked for carefully viz. oral, pharyngeal, laryngeal, and crico-pharyngeal and be documented using both objective and subjective tools.
- Post-treatmentswallowing function preferably should be compared with baseline pre-treatment dysfunction.
- There is unmet need to standardize reporting methods to ensure reliability and consistency.
- Commencement of physiotherapy exercises/maneuver before start of definitive treatment should be motivated as a preventive measure for dysphagia and these exercises should be continued later.
- All parameters related to aspiration, starting from swallowing dysfunction to laryngeal sensitivity should be looked carefully.

Further research is needed to determine radiation effect on the morphology and physiology of structures prominently involved in swallowing and dysphagia prevention and treatment.

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