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Evaluation of swallowing dysfunction in cases of locally advanced squamous cell carcinoma oral cavity pre and post treatment

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ABSTRACT

Background: Oral cancer is one of the leading causes of dysphagia worldwide and is extremely common in Indian males. Swallowing dysfunction occurs due to the disease itself, its predisposing factors like tobacco chewing or smoking and the treatment undertaken which includes surgery of the primary as well as neck dissection and the adjuvant radiotherapy or chemoradiotherapy. This study was aimed to evaluate swallowing dysfunction in patients of locally advanced squamous cell carcinoma of the oral cavity prior to treatment and post-surgery and adjuvant therapy.
Methods: 30 consecutive patients of advanced oral cavity squamous cell carcinoma planned for definitive treatment at a tertiary care center were randomly selected and included in the study. Evaluation of swallowing function was carried out using a dysphagia score and FEES (functional endoscopic evaluation of swallowing) initially during work-up for surgery, then three to four weeks post-surgery and finally six to eight weeks post adjuvant therapy.
Results: Results of the study revealed that swallowing dysfunctions was observed in all the timelines of the study. Smoking, larger resection and advanced tumour stage were strong risk factors for postoperative aspiration and dysphagia complications in oral cancer patients. Multi-modality treatment also increased the incidence of post treatment dysphagia.
Conclusions: Subjective and objective assessment of swallowing dysfunctions have to be considered as important tools to assess dysphagia pre and post treatment in oral cancer patients to detect swallowing dysfunction especially silent aspiration to institute early intervention in terms of swallow therapy.

Keywords: Oral cancers, Swallowing dysfunction, Dysphagia score, FEES

INTRODUCTION

In the Indian subcontinent, oral cancer ranks among the top three types of cancers.[1] Incidence and prevalence of oral cancer may depend on factors like an ageing population as well as some regional differences in the presence of specific risk factors.[2] Low-income groups in India are known to be affected mainly due to a wide exposure to risk factors such as tobacco chewing, poor oral hygiene and insufficient access to health care and diagnostic aids, resulting in a delay in detection and management of oral cancer.[3,4]

Oral and oropharyngeal cancers and their treatment often causes functional impairment, most notably speech and swallowing dysfunction.[5-7] Dysphagia (swallowing dysfunction) can be debilitating, depressing and potentially life-threatening complication in cancer patients that is likely under reported. Among oral cancers, locally advanced tongue cancers (involving base of tongue excision) and those cancers where genial muscles are separated from their mandibular attachment (due to middle third segmental mandibulectomy, extended hemi-mandibulectomy) affect the pharyngeal phase of swallowing as well causing greater swallowing dysfunction. Such advanced lesions generally merit

adjuvant therapy in the form of radiotherapy or chemo-radiotherapy, which further augments the problem. Swallowing dysfunction in such cases occurs due to associated pain; muscular weakness and treatment related side effects such as distortion of anatomy and function, dental problems, xerostomia, etc.[8-10]

This prospective study was conducted to assess the swallowing dysfunction associated with locally advanced tongue cancers and those oral cavity cancers where genial tubercle is resected. A co-relation between the treatment and severity of dysphagia was established.

METHODS

This prospective observational study was carried out at the Department of Otorhinolaryngology and Head and Neck Surgery, Army Hospital (R&R), Delhi Cant, a tertiary care referral hospital of the armed forces from October 2017 to March 2019. The approval of the Institutional Ethical Committee was obtained prior to commencing the study. 30 patients of advanced oral cavity squamous cell carcinoma were randomly selected for the study from the OPD attendees. A written, informed consent was obtained from each of the selected patients. Previously treated patients and those with a non-squamous pathology were excluded from the study.

The initial evaluation of the subjects involved a thorough clinical examination to arrive at a TNM classification and staging. This exercise was important to determine the appropriate form of therapy, particularly the requirement of adjunct therapy.

Swallowing assessment was done subjectively by dysphagia score and objectively by FEES using Penetration Aspiration Scale and Pharyngeal Residue Severity Scale for complete coverage of the clinical manifestations of dysphagia. Dysphagia score was designed after a pilot study conducted on 10 patients in our institute and quantifies dysphagia grade by assigning a score based on symptoms reported by the patient as follows:

- No symptoms.
- Occasional cough while swallowing liquids.
- Frequent cough while swallowing liquids and occasional cough while swallowing solids.
- Frequent cough while swallowing both solids and liquids.
- Frequent cough not related to food intake.
- Recurrent aspiration pneumonia.

FEES were done in our OPD using a fibreoptic laryngoscope. Food material used was of the following consistency- liquid and semi-solid (milk and curd) which was coloured using food colours. Local anaesthesia in the form of lignocaine jelly on the fibre optic scope was used. The procedure was explained to the patient. The test was done in the sitting position recline at 70 degrees from the horizontal axis. The fibre optic laryngoscope was inserted till the level of the nasopharynx to visualize oropharynx, larynx and hypopharynx. Once properly visualized, the patient was asked to swallow the food material. Aspiration and problems associated with swallowing different types of food material was documented. Penetration aspiration (PA) scale was used as follows:[11]

1. Doesn't enter airway.
2. Enters airway/above folds/ejected.
3. Enters airway/above folds/not ejected.
4. Enters airway/contact folds/ejected.
5. Enters airway/contact folds/not ejected.
6. Enters airway/below folds/ejected.
7. Enters airway/below folds/not ejected despite effort.
8. Enters airway/below folds/no effort).

The Yale pharyngeal residue scale was used.[12] The two components assessed were as followed.

Vallecular residue (grading scale):

I - No residue.
II - Trace coating of the mucosa.
III - Epiglottis ligament visible.
IV - Epiglottic ligament covered.
V - Filled to epiglottic rim.

Pyriform fossa residue (grading scale):

I - No residue.
II - Trace coating of mucosa.
III - Up wall to quarter full.
IV - Up wall to half full.
V - Filled to aryepiglottic fold.

The assessment was done thrice. First, at presentation and inclusion into the study while being worked up for the surgery. Second at 2-4 weeks post-surgery and the third assessment was done 6-8 weeks post-adjuvant therapy. Points of dysphagia score, penetration-aspiration scale and pharyngeal residue scale were recorded in a tabular manner each time. Initial, post-surgery values and post adjunct therapy values of various parameters related to swallowing assessment were compared using the paired t-test.

To correlate various factors to swallowing dysfunction, cross tabulation was done and p value was calculated. A p value less than 0.05 were considered significant. All statistical analyses were done using SPSS 21 software.

RESULTS

In our study, the age of the participants ranged from a minimum age of 34 years and a maximum of 66 years (Table 1). A majority of the study participants were male (80%) (Figure 1).

Table 1: Mean age distribution of the subjects.

	N	Minimum	Maximum	Mean	S.D.
Age	30	34.0	66.0	52.500	8.7010

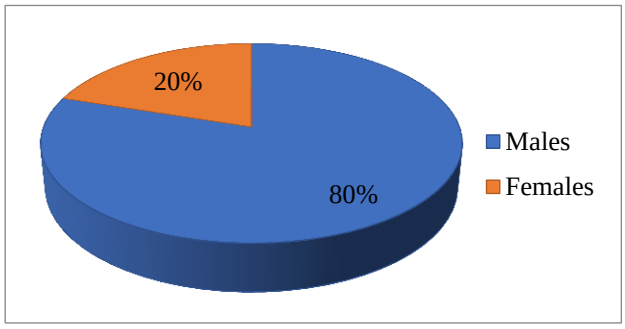

Figure 1: Gender distribution of study participants.

Of the 30 participants in the study, 22 (73.3%) had no co-morbidity, 5 (16.7%) had co-existing hypertension whereas other co-morbidities like alcohol dependency syndrome, ASD/TR and diabetes mellitus were found in 1 (3.3%) participant each. 18 (60%) participants had no positive history of tobacco chewing/smoking whereas 7 (23.3%) were tobacco chewers and 3(10%) were smokers (Figure 2).

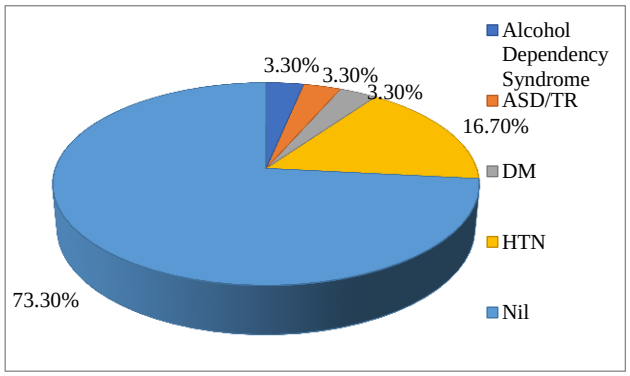

Figure 2: Co-morbidities in study participants.

Table 2: Pre op histopathological examination.

HPE	Frequency	%
MDSCC	16	53.3
PDSCC	1	3.3
WDSCC	13	43.3
Total	30	100.0

Histopathological examination of the biopsy revealed that 16 (53.3%) participant had moderately differentiated squamous cell carcinoma, 13 (43.3%) had a well differentiated squamous cell carcinoma and 1 (3.3%) participant was suffering from a poorly differentiated squamous cell carcinoma (Table 2).

Out of 30 participants, 8 (26.6%) had carcinoma of the left lateral border of the tongue, 6 (20%) presented with a lesion in the right buccal mucosa and 5 (16.6%) participants each had carcinoma of the left lower alveolus and right lower alveolus. 2 (6.7%) participants each had lesions on the right lateral border of the tongue and the right retro molar trigone. 1 (3.3%) participant each had a growth on the anterior 2/3rd of the tongue and the gingivolabial sulcus (Figure 3).

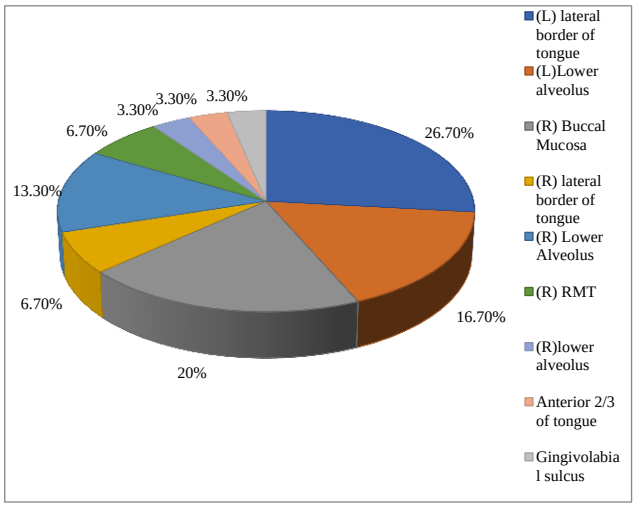

Figure 3: Tumour site.

Table 3: Tumour staging.

Staging	Frequency	%
T3	10	33.3
T4a	20	66.7
Total	30	100.0

In our study, the tumour size ranged from 2 cm to 5 cm. Of the 30 subjects, two-third had T4a staging- 20 (66.7%) and one-third had T3 staging- 10 (33.3%) (Table 3).

Dysphagia score

Dysphagia scoring system was used to quantify dysphagia subjectively in patients in pre and post oral surgery. In the pre-treatment period, out of 30 participants, 27 had no symptoms. 2-4 weeks post-surgery 12 participants still had no symptoms; 8 subjects had occasional cough when swallowing liquids; 6 patients had frequent cough while swallowing liquids and occasional cough while swallowing solids. Cross-tabulation of pre treatment and 2-4 weeks post-surgery swallowing assessment showed that out of 27 subjects who had no symptoms during prior treatment, 10 subjects developed occasional cough during liquid deglutition, 5 subjects had frequent cough during liquid deglutition and occasional cough while swallowing solids, 2 subjects had frequent cough during both solid and liquid food deglutition and 1 subject had frequent cough not related to food intake (Figure 4). Cross-tabulation of dysphagia score at 6-8 weeks post RT/CCRT with the post-surgery scores showed that out of 12 subjects who had no

symptoms at 2-4 weeks post-surgery, 3 subjects now showed occasional cough during liquid deglutition. Out of 8 subjects who had occasional cough during swallowing liquids after surgery, 7 subjects continued to have the same at 6-8 weeks post adjuvant therapy (Figure 5).

Table 4: Distribution based on surgery and reconstruction.

Surgery and reconstruction	Frequency	%
Anterior 2/3 glossectomy+fraff recon	3	10.0
Hemiglossectomy+fraff recon	6	20.0
Hemiglossectomy+primary closure	1	3.3
Near total glossectomy+free radial artery frorearm flap rcon	1	3.3
Segmental mandibulectomy+free fibula osseocutaneous flap recon	12	40.0
Wide local excision+marginal mandibulectomy+anterolateral thigh flap reconstruction	1	3.3
Wide local excision+marginal mandibulectomy+free radial artery forearem flap recon	3	10.0
Wide local excision+post segmental mandibulectomy+pectoralis major myocutaneous flap recon	2	6.7
Wide local excision+split skin graft recon	1	3.3
Total	30	100.0

Table 5: Adjuvant therapy.

Adjuvant therapy	Frequency	%
Concurrent chemotherapy +radiotherapy	10	33.3
Radiotherapy	20	66.7
Total	30	100.0

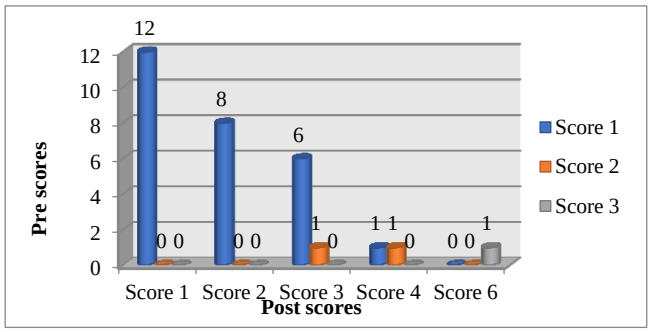

Figure 4: Cross-tabulation of dysphagia score (pre and post-surgical treatment).

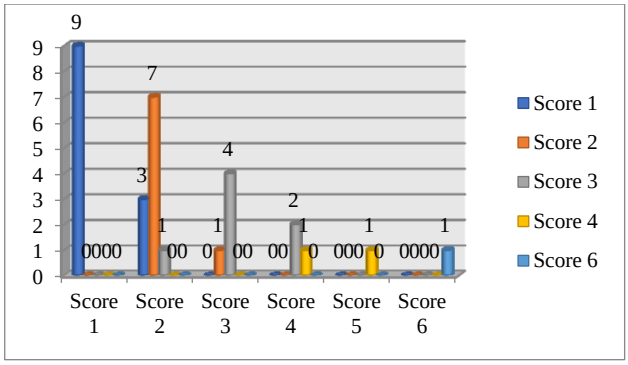

Figure 5: Cross-tabulation of dysphagia score (post-surgery and post adjuvant therapy).

Fibreoptic endoscopic evaluation of swallowing

The anatomical extent of disease as well as objective assessment of the swallowing function in the same sitting was done using fibreoptic endoscopic evaluation of swallowing (FEES). For this two scales were used.

Penetration aspiration scale

In our study, cross-tabulation of penetration aspiration scale showed that 26 subjects had a score of 1 (doesn't enter airway) during pre-treatment stage whereas 2-4 weeks after surgery 13 had score 1; 11 subjects had score 2 (enters airway/above folds/ejected) and 4 subjects had a score of 4 (enters airway/contact folds/ejected). Cross-tabulation of the penetration aspiration scales pre treatment and 2-4 weeks following surgery showed that of the 26 subjects who had a score of 1 (doesn't enter airway) pre-treatment only 7 still had score 1; 13 subjects had score 2 (enters airway/above folds/ejected); 1 subject had score 3 (enters airway/above folds/not ejected); 4 subjects had score 4 (enters airway/contact folds/ejected) and 1 subject had score 5 (enters airway/contact folds/not ejected) (Figure 6).

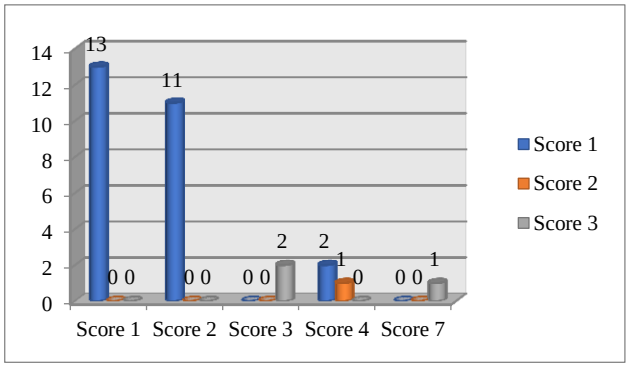

Figure 6: Cross-tabulation of penetration aspiration scale (pre and post-surgery).

Further assessment at 6-8 weeks post adjunct therapy and the cross-tabulation of the penetration aspiration scales thereof showed that out of the 13 subjects who had a

score of 1 (doesn't enter airway) post-surgery, 7 had score 1 and 6 subjects had score 2 (enters airway/above folds/ejected) post adjunct therapy. Of the 11 subject who had a score of 2 (enters airway/above folds/ejected) post-surgery, 7 subjects continued to have score 2 at 6-8 weeks post adjunct therapy and the remaining 4 worsened (Figure 7).

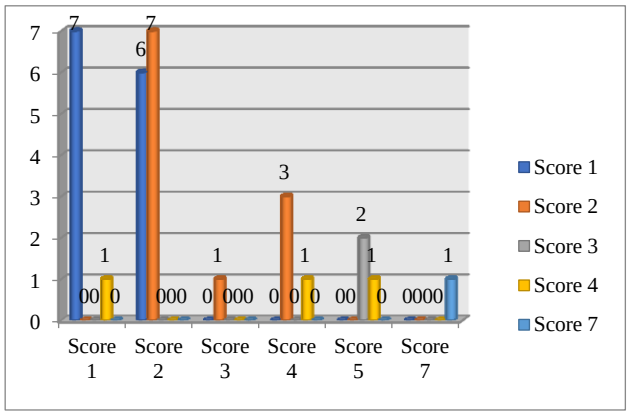

Figure 7: Cross-tabulation of penetration aspiration scale (post-surgery and post adjuvant therapy).

Pharyngeal residual scale

Vallecular residual scale

In our study, 23 subjects out of the 30 participants had no residue (pre-treatment) whereas at 2-4 weeks post-surgery 6 subjects had no residue; 12 subjects had a trace coating of mucosa; 9 subjects had epiglottic ligament visible and 3 subjects had epiglottic ligament covered. On cross tabulation, of the 23 subjects had no residue during pre-treatment assessment only 6 subjects had no residue and 12 subjects had a trace coating of mucosa (Figure 8). There was a significant association between pre-treatment and post-surgery vallecular residual scale scores (p=0.001).

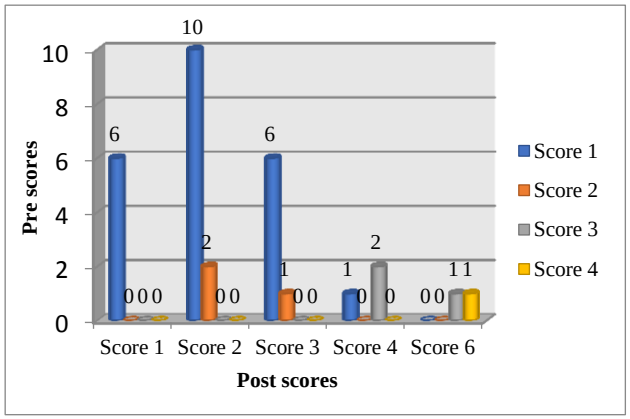

Figure 8: Cross-tabulation of vallecular residual scale (pre and post-surgery).

On cross tabulation after 6-8 weeks of adjuvant therapy, of the 6 subjects who had no residue (post-surgery) 2 subjects still had no residue and 4 subjects had trace coating of mucosa. Out of 12 subjects who had trace coating of mucosa, 3 remained the same at the third assessment whereas, 9 subjects now had thicker coating with the epiglottic ligament just visible (Figure 9). There was a significant association between post-surgery and post adjuvant therapy vallecular residual scale scores (p=0.002).

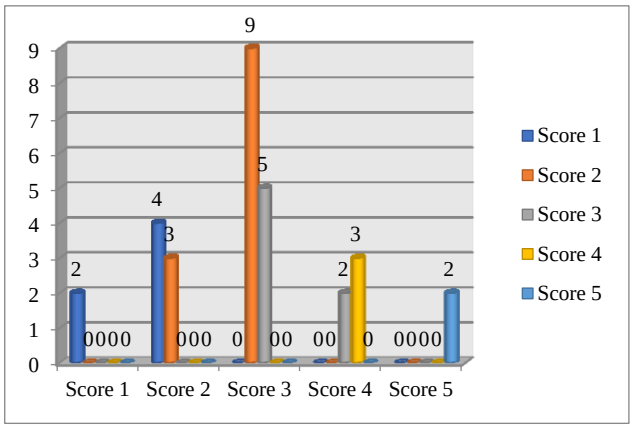

Figure 9: Cross-tabulation of vallecular residual scale (post-surgery and post adjuvant therapy).

Pyriform fossa residual scale

During pre-treatment period, pyriform fossa residual scale showed that 20 subjects had no residue. Cross-tabulation of pyriform fossa residual scale showed that of these, 10 still had no residue; 8 subjects changed to score 2 and 2 subjects had score 3 (up wall to quarter full) 2-4 weeks after surgery (Figure 10).

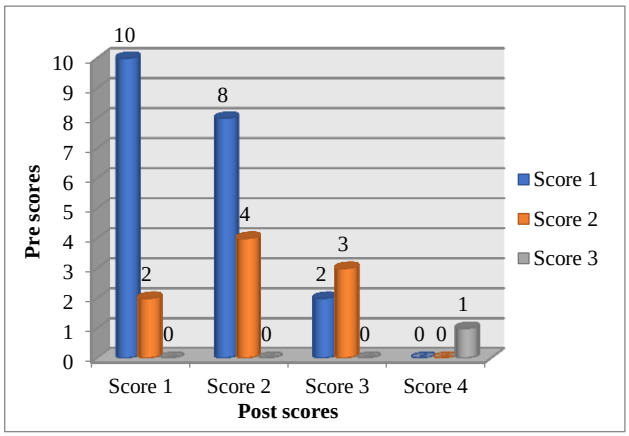

Figure 10: Cross-tabulation of pyriform fossa residual scale (pre and post-surgery).

Cross-tabulation of pyriform fossa residual scale between post-surgery and 6-8 weeks post adjuvant therapy scores showed that out of 10 subjects who had no residue (post-surgery), 7 remained at score 1 (no residue); 3 subjects

changed to score 2 and 1 subject had score 3 (up wall to quarter full) (Figure 11).

Results of pharyngeal residual scale showed there was a significant association between the three different timelines of assessment and dysphagia among the study subjects.

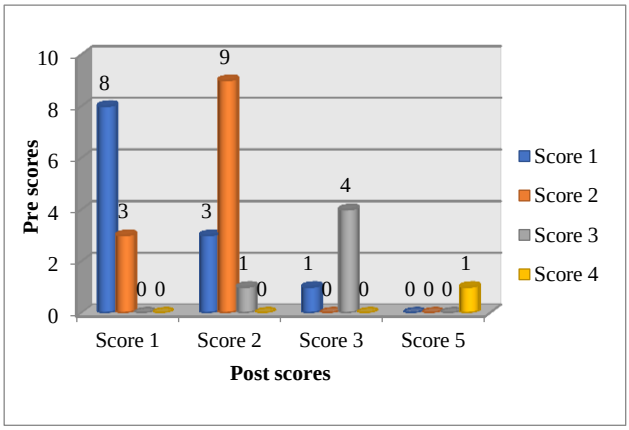

Figure 11: Cross-tabulation of pyriform fossa residual scale (post-surgery and post adjuvant therapy).

DISCUSSION

Dysphagia is an unavoidable consequence of oral cancers per se and may worsen with treatment. The oral preparatory phase, oral phase, and pharyngeal phase of swallowing are all adversely affected. Patients in the sixth and seventh decades of life with oral cancers reportedly show the greatest risk of post-treatment dysphagia.[13] In our study, the mean age of the study subjects was 52.5 years with minimum age of 34 years and maximum being 66 years. Majority of the study participants were males. This corroborates findings of other studies which have brought out that the male population above 50 years are more prone to oral cancers and the complications thereof.[14]

T and N stage, primary site, type of treatment, extension of treated region, patient characteristics such as baseline swallowing function, performance status, smoking and alcohol abuse, lean body mass etc., are other factors which predict the risk of early or late onset dysphagia. In our study, two-third (66.7%) of the subjects had T4a staging and had poorer dysphagia scores as compared to the one-third (33.3%) with a T3 staging. Studies have shown a prevalence of pre-treatment dysphagia in 28.2% in patients with stage T2 or more oral cancer.[15]

Surgical interventions for oral cancers result in anatomic or neurologic insults with site-specific patterns of dysphagia. Transection of muscles and nerves, loss of sensation and scar tissue may all affect the function of swallowing. The swallowing deficits that occur after surgical resections vary with the extent of surgical resection and the type of reconstruction. In general, the larger the resection, the more swallowing function will be impaired. However, resection of structures vital to bolus formation, bolus transit and airway protection such as the tongue, tongue base, and the larynx will have the greatest impact on swallowing function.

Surgery disrupting the continuity of the mandibular arch without reconstruction has a profound negative impact on swallowing function. Resection of tumors involving the palate and maxillary sinus often creates defects that need reconstruction to restore oral function.[5,8] In our study similar results were obtained with significant co-relation between the extent of surgical resection and severity of dysphagia.

Adjuvant radiotherapy and concomitant chemotherapy have emerged as the strongest independent factors correlated with acute morbidity in the form of dysphagia in several studies.[8,16,17] When chemotherapy is associated with radiotherapy the critical dose to impair swallowing function is lower. These differences are related to acute mucositis and its consequential effect on the pharyngeal tissue. Irradiation of swallowing structures and altered dose fractionation contributes to worsening of dysphagia. Eisbruch et al identified dysphagia/aspiration-related structures whose treatment-related damage can lead to swallowing dysfunction.[18] In our study, 20 (66.7%) participants were manged with adjunct radiotherapy whereas 10 (33.3%) were given concurrent chemotherapy and radiotherapy. Dyspahgia was more severe after adjuvant therapy than at the pre-treatment or the post-surgery stage in our study.

Dysphagia scoring system is used in our study is appropriate for subjective quantification of dysphagia in patients in pre and post treatment in oral cancers. The anatomical extent of disease as well as swallowing function can be objectively assessed in the same sitting easily using FEES.[19-21] The range of motions of the oropharyngeal, hypopharyngeal and laryngeal structures can be assessed in real time under direct visualization. The major advantage of the procedure is its cost effectiveness, portability, no radiation, quick testing and immediate results. The ability to protect airway, prompt swallow, timing and direction of bolus, ability to clear secretions, pooling of secretions/food particle and sensations of the pharyngeal and laryngeal structures can be objectively studied and evaluated.

The penetration-aspiration scale has been developed to allow objective reports of penetration and aspiration events. The 8-point scale provides reliable quantification of selected penetration and aspiration events observed during FEES. The use of this scale permits a numeric quantification of dysphagia, facilitating accurate communication among clinicians. Nguyen et al have reported 17% aspiration rate at the baseline evaluation, which increased to 59% post treatment.[22] Similarly, Stenson et al have reported aspiration rate in the range of 30-67% in their patients with head and neck cancer.[23]

A study by Pauloski et al suggested that complaints of dysphagia may act as a reliable indicator of aspiration.[24] Our data also supports this important aspect. Coughing while swallowing is an alarm symptom for silent aspiration, particularly if it is reported as a single symptom. In the study by Rogus-Pulia et al, all occurrences of penetration and 83% of aspiration occurrences were silent.[25] Their reults also indicated that higher amounts of pharyngeal residue were found post-treatment compared to pre-treatment, but patients did not report higher occurrence of food sticking in the throat. Hence, patients may not always be aware of all dysphagia-related symptoms and accordingly do not report them. Our study findings were consistent other reported studies.

Identification of pharyngeal residue severity located in the vallecular and pyriform sinuses has always been a primary goal during fiber optic endoscopic evaluation of swallowing (FEES). Pharyngeal residue is a clinical sign of potential prandial aspiration and accurately predicts its severity.

Thus this study has added to the findings of previous work on the subject by demonstrating that in oral cancer patients these scales can be administered to assess both covert dysphagia and clinically manifest dysphagia.

CONCLUSION

Dysphagia is a common complication of surgery, radiotherapy, and chemotherapy in oral cancer patients. Subjective and objective measurement of swallowing dysfunctions after treatment of oral cancers are underreported and underrecognized. In the present study, most of the patients had significant swallowing impairment after treatment and these results have helped in filling the gaps in the knowledge about swallowing problems in such patients. Pre and post intervention assessment of swallowing function is important especially for detection of silent aspiration to institute early intervention in terms of swallow therapy and to develop better preventative and rehabilitative measures that will improve patients' quality of life while still being cost effective.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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