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Original Research Article

Role of fiberoptic endoscopic evaluation of swallowing in evaluating the pharyngeal phase of swallowing in patients with dysphagia: a cross-sectional study

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ABSTRACT

Background: Dysphagia or difficulty in swallowing, is a common symptom of various etiologies. The pharyngeal phase of swallowing is particularly critical for safe deglutition. FEES is a reliable, non-invasive diagnostic tool to evaluate this phase. The article's main purpose is to estimate the prevalence and etiological profile of pharyngeal phase disorders using FEES in patients presenting with dysphagia and to analyze associated clinical and sociodemographic variables. The Associations were calculated by the Chi-square and Fisher's exact tests. Cramer's coefficient calculates the strength of association. SPSS version 20 was used for statistical analysis.
Methods: In this descriptive cross-sectional study, 150 patients presenting with dysphagia were subjected to FEES using standard protocols. Data on demographics, clinical diagnoses and findings, including residue, whiteout, penetration, aspiration and sensation, were analyzed.
Results: In the study, the most common diagnosis was laryngopharyngeal reflux (20%), followed by carcinoma (16%). FEES findings revealed residues for solids in 29.3%, semisolids in 16% and liquids in 12.7%. Aspiration was observed in 4% for liquids and 2.7% each for semisolids and solids. Sensation was abnormal in 0.67% of the patients. A significant association was found between occupation and FEES findings (p=0.012) and between FEES and PAS scores (p=0.001).
Conclusions: FEES is an effective tool for evaluating pharyngeal dysphagia and identifying the risk of aspiration. It allows real-time assessment and supports tailored management strategies.

Keywords: Aspiration, Dysphagia, FEES, Pharyngeal phase, Penetration aspiration scale, Swallowing

INTRODUCTION

Swallowing, also known as deglutition, is a complex process in which food and liquid are transported from the mouth to the stomach. The oral, pharyngeal and esophageal phases are the three stages of swallowing and each one corresponds with the location of the food bolus in the swallowing apparatus. The pharyngeal and esophageal phases of deglutition are involuntary, while the oral phase, the first stage, is voluntary.[1] Dysphagia, derived from Greek, means "difficulty in swallowing". Patients with dysphagia experience a sensation of food sticking in the throat or chest or choking while eating. It may arise due to dysfunction in any of the three stages of swallowing, with the pharyngeal phase being critical for airway protection.[2]

Fiberoptic endoscopic evaluation of swallowing (FEES), introduced in 1988 by Langmore et al has gained popularity for direct visualisation of pharyngeal phase dynamics.[3] The efficiency of swallowing is visualized. If impaired, the nature of the problem can be diagnosed.

The difficulty can then be improved using dietary, behavioural and postural interventions.

The primary objective of this study was to estimate the prevalence of pharyngeal phase swallowing disorders by FEES among patients presenting with dysphagia. Furthermore, the study sought to determine the etiological profile of pharyngeal dysphagia and to analyze the sociodemographic and clinical profile correlates of the patients presenting with dysphagia.

METHODS

A cross-sectional study was conducted from January to December 2024 in the ENT department of Southern Railway Headquarters Hospital, Tamil Nadu. Ethical approval was obtained from the institutional ethics committee. The study aimed to evaluate the prevalence, etiological profile and clinical correlates of dysphagia. A detailed clinical history was taken, including the onset, duration of dysphagia and the consistency of food (solids, semisolids and liquids). Relevant information on occupation, age and systemic illnesses was also documented. A thorough ENT examination was performed, including the oral cavity, oropharynx and larynx. FEES was performed using a flexible Fiberoptic laryngoscope after adequate topical nasal preparation. The patients were administered test boluses of different consistencies (liquid, semisolid and solid) and observed for bolus transit, residue, penetration, aspiration, whiteout and laryngeal sensation.

Inclusion criteria

All individuals presenting with complaints of dysphagia aged above 18 years.

Exclusion criteria

Individuals under 18 years of age, uncooperative patients for whom assessment could not be completed, uncontrolled bleeding disorder.

Methodology

A total of 150 patients underwent FEES using a Pentax EB-1975K scope with an EPK-i5000 monitor. Nasal decongestant and lignocaine jelly were used for comfort. Boluses of water, banana and biscuit with edible food coloring were administered in increasing consistency. Parameters like whiteout, residue, penetration, aspiration and sensation were recorded. PAS (Penetration Aspiration Scale) scores were used to assess severity.

Statistical analysis

Descriptive and inferential statistics were performed using SPSS. Associations were tested using the chi-square test; significance was set at $p<0.05$.

RESULTS

In the study, the mean age (SD) was 60.26±14.80 years, comprised 63.33% males and 36.67% of females, as shown in Table 1. The mean duration of dysphagia was 40.53 months.

Table 1: Demographic characteristics of the study population.

Characteristics	Frequency	%
Age (in years)	-	-
Mean±SD	60.26±14.80	-
Sex		
Male	95	63.33
Female	55	36.67

Most patients had grade 2 dysphagia (60%), followed by grade 1 (28%). Higher grades of dysphagia were less common, with grade 3 in 8%, grade 4 in 3.33% and grade 5 in 0.67% of cases, no patients exhibited grade 6 dysphagia.

A significant association was observed between occupation and FEES findings, with a higher prevalence among individuals engaged in technical jobs, as shown in Table 2.

The most common clinical diagnosis is LPR (20%), followed by Carcinoma (16%), post-radiotherapy (11.30%), CVA (8%) and presbyphagia (8.70%). Other less common diagnoses include tracheostomy, vocal cord palsy, alzheimer's disease, parkinson's disease and motor neuron disorder, as shown in Figure 1.

Table 2: Association between the occupation and FEES findings in the study population.

Occupation x FEES Crosstabulation						
Occupation	**FEES**		**Chi Square**	**df**	**P value**	**Cramer's V Coefficient**
	a	**N**				
Admin	9	10	11.5	2	0.004	0.273
Dependant	11	45				
Technical	35	40				

df-Degree of Freedom.

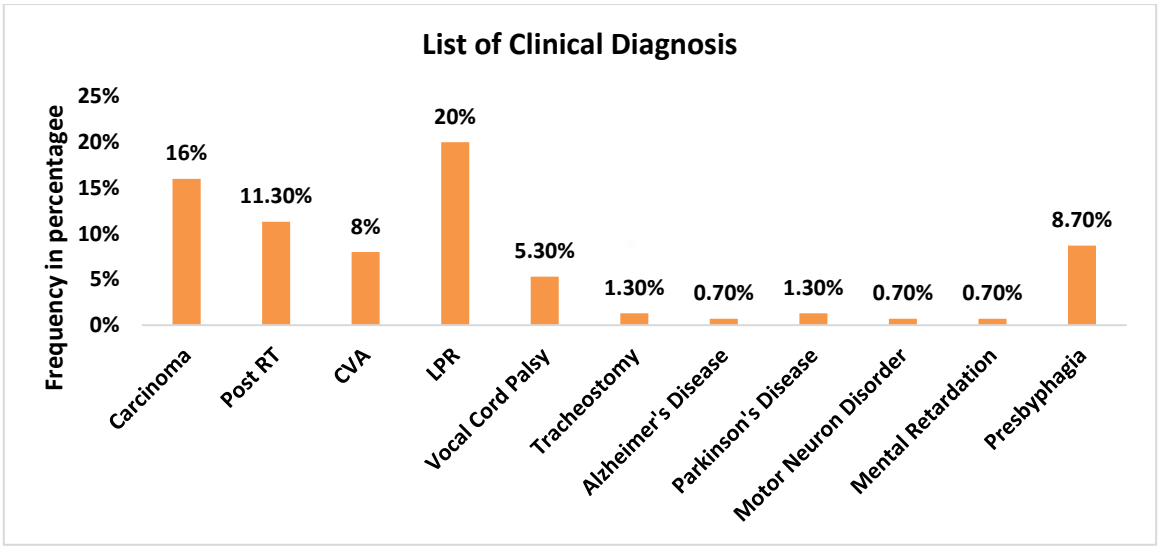

Figure 1: Column chart of different clinical diagnoses.

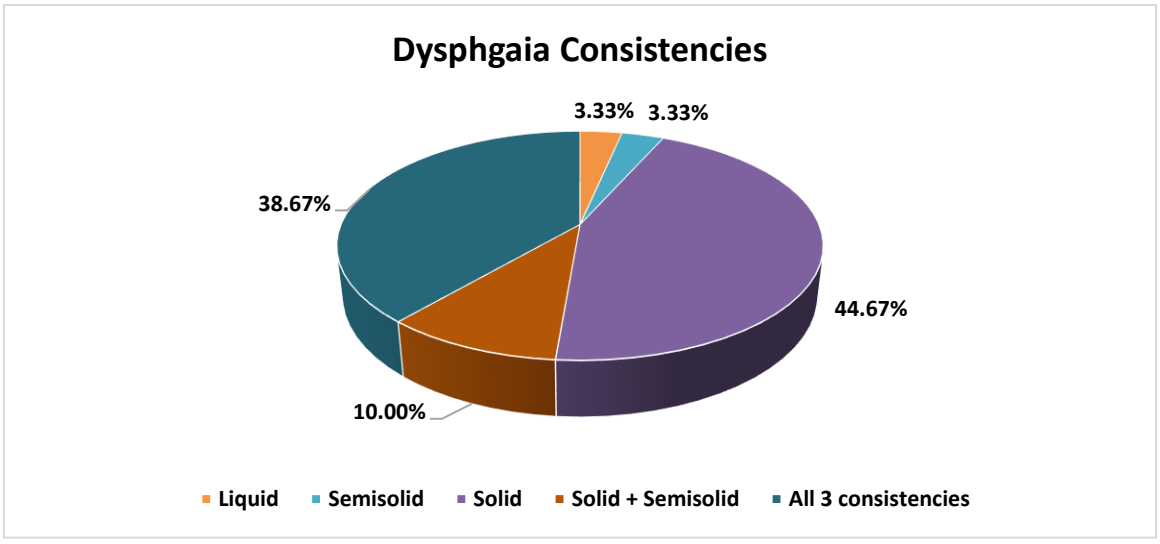

Figure 2: Descriptive analysis of dysphagia consistencies in the study population.

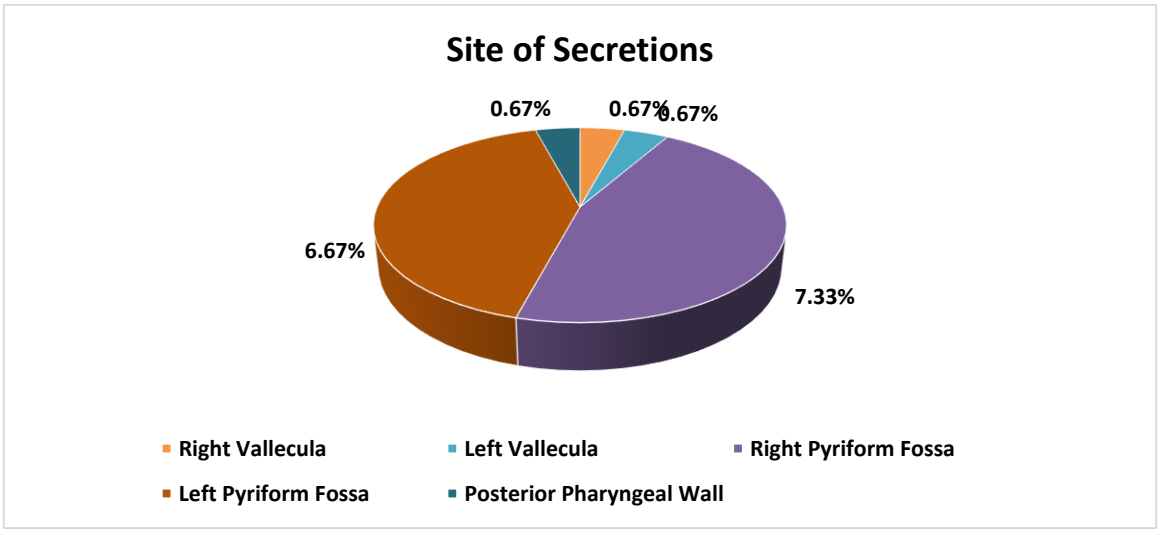

Figure 3: Descriptive analysis of site of secretions in the study population.

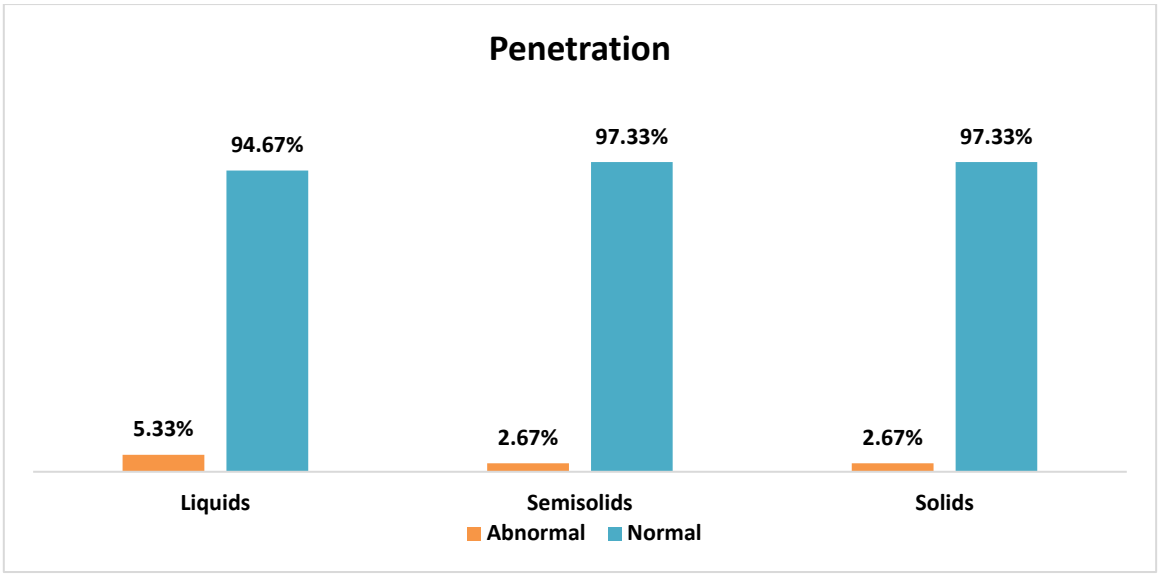

Figure 4: Descriptive analysis of penetration in the study population for liquids, semisolids and solids.

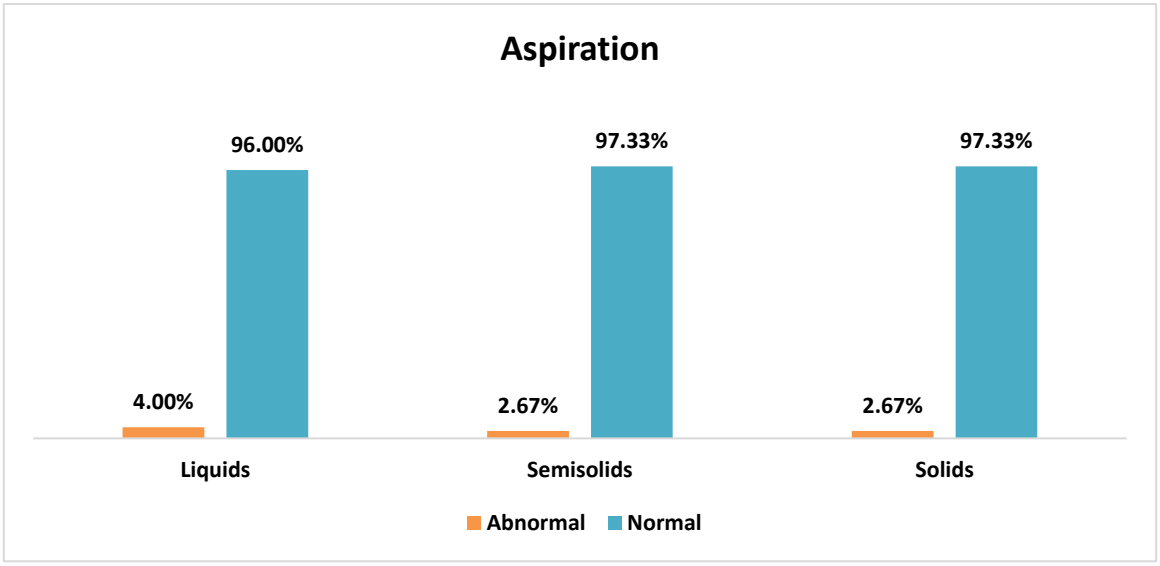

Figure 5: Descriptive analysis of aspiration in the study population.

65.33% of patients had an insidious onset, while 34.67% had a sudden onset of dysphagia. Dysphagia to solids was present in 93.34%, semisolids in 52% and liquids in 42%, of which 3.33% had dysphagia only to liquids, 3.33% had only to semisolids, 44.67% had only to solids, 10% had dysphagia to both solid and semisolids and 38.67% had dysphagia for all three consistencies, as shown in Figure 2.

Secretions were absent in 90.70% and present in 9.30%. Of the 14 patients with secretions, the most common site was the right pyriform fossa with 7.30%, followed by the left pyriform fossa with 6.70%, as shown in Figure 3.

5 out of 12 CVA patients, 4 out of 24 carcinoma patients, 1 out of 7 VC palsy patients had secretions. Patients with known neurologic and oncologic disorders had lower-than-expected rates of secretion, potentially due to compensation mechanisms or examination timing. Whiteout was observed in 99.33% of patients for all consistencies as shown in table 3 and was absent in only 0.67%. This finding was noted qualitatively, representing the pharyngeal constriction around the endoscope lens and laryngeal elevation during swallowing. Future studies evaluating the duration and intensity of the whiteout could provide more insight into pharyngeal muscular strength and coordination.

Residue was observed in 12.70% of patients for liquids, 16% for semisolids and 29.30% for solids, as shown in Table 4. The most common site of residue for all consistencies was the right pyriform fossa, followed by the left pyriform fossa, valleculae and the posterior pharyngeal wall. Residue in the right pyriform fossa was

noted in 9.30% for liquids, 8% for semisolids and 14.70% for solids. Left pyriform fossa residue was seen in 8%, 5.30% and 10.70%, respectively. Posterior pharyngeal wall residue ranged from 2% to 6.70%, while vallecular residue was least frequent and seen in 0.70% to 10.70%, depending on consistency.

Aspiration and penetration rates were relatively low. Penetration was noted in 5.33% of patients with liquids and in 2.67% with both semisolids and solids, as shown in figure 4. Aspiration was noticed in 4% to liquids and in 2.67% to semisolids and solids, as shown in Figure 5. Laryngeal sensation was preserved in 99.33% of the patients, with only one patient exhibiting a sensory deficit. The low penetration and aspiration rates observed suggest relatively well-compensated swallowing in most cases. The significant association between FEES findings and PAS scores demonstrates that patients with abnormal endoscopic swallowing evaluations are more likely to exhibit penetration or aspiration events, as shown in table 5. This underscores the reliability of FEES as a sensitive tool for detecting airway compromise during swallowing. Incorporating PAS scoring into FEES interpretation enhances the objectivity and clinical relevance of dysphagia assessment, supporting its role in guiding appropriate management and intervention strategies.

Table 3: Descriptive analysis of whiteout in the study population.

Whiteout	Frequency	%
Liquids		
Absent	1	0.67
Present	149	99.33
Semisolids		
Absent	1	0.67
Present	149	99.33
Solids		
Absent	1	0.67
Present	149	99.33

Table 4: Descriptive analysis of residue in the study population.

Residue	Frequency	%
Liquids		
Absent	131	87.3
Present	9	12.7
Semisolids		
Absent	126	84.0
Present	24	16.0
Solids		
Absent	106	70.7
Present	44	29.3

Table 5: Association between PAS Score and FEES findings in the study population.

FEES×PAS crosstabulation							
FEES	**PAS**			**Chi Square**	**df**	**P value**	**Cramer's V Coefficient**
	1	2	6				
Abnormal	47	2	6				
Normal	95	0	0	14.597	2	0.001	0.312
Total	142	2	6				

df- Degree of freedom, PAS- Penetration aspiration scale.

DISCUSSION

One hundred fifty patients with dysphagia were included in this study. The mean age was 60.26+14.80 years. The mean dysphagia duration was 40.53 months and 63% (95 patients) were males and 37% (55 patients) were females. The gender ratio is the same as in a study conducted by Datta et al has 60% males and 40% females.[4] In the study, patients were categorized into three occupational groups: technical, dependant and admin for analysis. A weak but statistically significant association was found between occupation and FEES abnormalities (Cramer's V=0.273, p=0.004), suggesting that occupational status may influence swallowing function, possibly due to associated lifestyle or health factors or the potential influence of occupational exposure as a contributing factor to dysphagia. A cross-sectional study done by Tobias Barun et al demonstrated that early FEES post-

stroke prevents pneumonia and helps guide dietary modifications.[5] While not occupation-specific, high-risk groups like first responders and industrial workers exposed to stress-related stroke risk may benefit from such assessments.

A study of 241 neurological patients (stroke, Parkinson's, ALS, dementia) examined via FEES reported a high prevalence of dysphagia; abnormal observations such as aspiration, penetration and residue were systematically documented. While not occupation-specific, professions with neurological exposure risk (e.g., neurotoxins, repetitive injury) are indirectly implicated.[6] Although the association in our study was weak, it highlights that occupation may act as an indirect factor through lifestyle differences and occupational exposure risk may influence swallowing function. As the study was done in a specific employment sector (Railways), future studies focusing on different occupational exposures and including larger sample sizes with longitudinal follow-up could help clarify causal pathways and identify at-risk groups for early FEES screening.

In the study, dysphagia to solids was observed in 93.34%, to semisolids in 52% and to liquids in 42%. Among these, 3.33% had dysphagia only to liquids, 3.33% only to semisolids, 44.67% only to solids, 10% to both solids and semisolids and 38.67% to all three consistencies. The most common clinical diagnosis in our study is LPR (20%), followed by Carcinoma (16%), post-radiotherapy (11.30%), CVA (8%) and presbyphagia (8.70%). Other less common diagnoses include Tracheostomy, Vocal Cord Palsy, Alzheimer's Disease, Parkinson's disease and Motor Neuron Disease.

Oropharyngeal pathology can cause aspiration in many ways. Pathological tongue movements during mastication disrupt the oral phase of swallowing, leading to inefficient bolus formation, delayed transit and increased aspiration risk and this was observed in our study subjects with neurological deficits (e.g., stroke and Parkinson's disease). This causes the food to fall into the pharynx and larynx before swallowing starts. Such patients are prone to aspiration.[7] A study conducted by Duval et al in 2004 evaluated dysphagia in patients using flexible FEES appropriate treatment, dietary modifications and swallowing techniques were then taught to the patients. Their study result showed that FEES was normal for all consistencies in 28% of patients and pooling was the most common abnormal finding.[8] The most common etiologies were neurologic (27%), laryngopharyngeal reflux (22%) and malignancy (21%). The four treatment modalities consisted of dietary modifications (37%), teaching therapeutic swallowing manoeuvres (33%), medical treatment (26%) and surgical treatment (11%).[9] Similar findings were also noted in our study, where 10.7% had neurological aetiology, while 20% had laryngopharyngeal reflux.

Presbyphagia represents a common yet frequently overlooked health concern with significant risks. Age-related changes impair swallowing efficacy and safety, predisposing to severe complications such as aspiration pneumonia.[10] This study similarly identified presbyphagia in 8.7% of patients. In the study, Secretions were absent in 90.70% (136 patients) and present in 9.30% (14 patients). 5 out of 12 CVA patients, 4 out of 24 carcinoma patients, 1 out of 7 VC palsy patients had secretions. Secretions were noted most commonly in the right pyriform fossa. While the site of secretion may reflect localized neuromuscular or structural impairment, its isolated presence does not confirm specific pathology. Clinical correlation and additional findings, such as residue, penetration or absence of sensation, are essential for interpretation.

In the study, whiteout for liquids, semisolids and solids was present in 99.33% (149 patients) and absent in 0.67% (1 patient) as noted qualitatively. The whiteout represents pharyngeal constriction around the endoscope during swallow. Assessing the duration and intensity in future studies may provide a better insight into pharyngeal strength. Reduced laryngeal elevation causes food to lodge at the top of the larynx, which is aspirated during inhalation after the swallow. Reduced laryngeal closure can also cause aspiration during the pharyngeal swallow. Both of these were seen in a patient with intellectual disability in our study.

Residue was observed in 12.70% of patients for liquids, 16% for semisolids and 29.30% for solids. The most common site of residue for all consistencies was the right pyriform fossa, followed by the left pyriform fossa, valleculae and the posterior pharyngeal wall. Residue in the right pyriform fossa was noted in 9.30% for liquids, 8% for semisolids and 14.70% for solids. Left pyriform fossa residue was seen in 8%, 5.30% and 10.70%, respectively. Posterior pharyngeal wall residue ranged from 2% to 6.70%, while vallecular residue was least frequent, seen in 0.70% to 10.70% depending on consistency. Post-radiation edema most commonly causes residue in the vallecula and pyriform fossa. This was seen in patients who had undergone radiotherapy for head and neck carcinoma.

In the study, penetration for liquids was absent in 94.67% (142 patients) and present in 5.33% (8 patients). Penetration for semisolids was absent in 97.33% (146 patients) and present in 2.67% (4 patients). Penetration for solids was absent in 97.33% (146 patients) and present in 2.67% (4 patients). In the study, aspiration to liquids was absent in 96% (144 patients) and present in 4% (6 patients). Aspiration to semisolids was absent in 97.33% (146 patients) and present in 2.67% (4 patients). Aspiration to solids was not present in 97.33% (146 patients) and present in 2.67% (4 patients). Sensation was present in 99.33% (149 patients) and absent in 0.67% (14 patients). In the study, the statistically significant association between FEES findings and PAS scores highlights the clinical utility of FEES in objectively identifying and grading swallowing impairment. Patients with abnormal FEES findings were more likely to exhibit

higher PAS scores, indicating penetration or aspiration, thereby reinforcing the diagnostic relevance of FEES in dysphagia evaluation. The moderate strength of association (Cramer's V=0.312) suggests that while PAS is not the sole determinant of abnormal FEES findings, it is an important complementary measure in assessing airway protection and swallow safety.

It has been mentioned in previous studies that an accurate and in-depth evaluation of oral, pharyngeal and esophageal swallowing anatomy and physiology is necessary for the successful re-establishment of oral nutrition in patients with swallowing disorders.[7] Authors found that the same can be achieved with FEES. Even if videofluoroscopy (VFSS) is the gold standard for diagnosing dysphagia, FEES is easier to administer to acute bedside stroke unit patients who are immobile or have altered consciousness. FEES uses actual food and provides a clearer view of laryngeal movement.[11] Assessing the effectiveness of the protective mechanisms and the sensitivity of the pharyngeal structures, as well as visualising secretions and penetrations, is all possible by this particular method.

In the study, none of the patients had any adverse effects or complications like epistaxis or laryngospasm. There are many studies like those by Aviv et al.[12] In which 1340 patients underwent FEES and a few patients underwent the procedure multiple times. It was found out that FEES is an effective and safe procedure for sensory and motor assessment of dysphagia and Chih-Hsiu et al compared FEES with videofluoroscopy, which showed FEES to be a safe and effective procedure.[13]

CONCLUSION

FEES is a valuable tool for assessing the pharyngeal phase of swallowing. It also facilitates therapeutic interventions and helps guide safe dietary recommendations and rehabilitation strategies. Routine use of FEES can enhance early detection and management of swallowing disorders. It has proved to be a useful, reliable, cost-effective and efficient procedure for diagnosing, categorizing and treating dysphagia. The ability of patients to improve with swallowing exercises and their compliance can be assessed. The patient and the family members can be shown the video of the examination to explain the problem and educate them accordingly. Multiple FEES examinations in a single patient can be done to follow the improvement with exercises or treatment, as it does not involve exposing the patient to any harmful radiation or drugs and is an office procedure.

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