Indian J Otolaryngol Head Neck Surg
(Apr–June 2019) 71(2):266–270; https://doi.org/10.1007/s12070-018-1275-x

ORIGINAL ARTICLE

Fiberoptic Endoscopic Evaluation of Swallow (FEES) in Intensive Care Unit Patients Post Extubation

R. S. Ambika[1] · Badari Datta[1] · B. V. Manjula[2] · Unmesh V. Warawantkar[1] · Anita Mariet Thomas[1]

Received: 18 March 2017 / Accepted: 15 February 2018 / Published online: 5 March 2018

Abstract Intensive care unit patients frequently require prolonged intubation and ventilator support. Swallowing dysfunction often occurs in patients who receive prolonged mechanical ventilation. Intubation can cause transient injury to the larynx with a subsequent reduction in protective mechanism and increased incidence of oropharyngeal secretions once patient is extubated. Aim of this study was to evaluate the anatomical damage caused by intubation and the occurrence of aspiration/silent aspiration in patients following extubation, using fiberoptic endoscopic evaluation of swallow (FEES) as diagnostic and therapeutic tool. Participants in the study included all adult ICU patients who were intubated for $\geq$ 48 h. Head injury patients, patients with abnormal neurological status, completely disoriented patients were excluded. We performed FEES in 41 patients. Duration of intubation was in the range of 2–9 days. We studied 41 patients, among them 19(44%) patients had laryngeal injury and 6 (14%) had aspiration. we noticed that all patients who had aspiration had some laryngeal injury. All 6 patients who had aspiration initially recovered their swallowing function fully as noticed during repeat FEES done after swallow therapy. There is a significant impact of intubation on occurrence of aspiration (14%) and laryngeal abnormality (44%). We found in our study that there is a significant correlation to duration of intubation and occurrence of laryngeal injury.

Keywords Aspiration · Deglutition · Swallowing · Dysphagia · Fiberoptic endoscopic evaluation of swallow

✉ R. S. Ambika
drrashi_75@yahoo.co.in; drrashi75@gmail.com

Badari Datta
badari_datta@yahoo.co.in

B. V. Manjula
drmanjubv@gmail.com

Unmesh V. Warawantkar
unmesh284@rediffmail.com

Anita Mariet Thomas
anipious@gmail.com

[1] Bangalore Baptist Hospital, Bengaluru, India

[2] Head and Neck Surgical Oncology, Bangalore Baptist Hospital, Bengaluru, India

Introduction

Hospital-acquired pneumonia is the second most common nosocomial infection in critically ill patients and is associated with increased mortality, morbidity and cost of care. Incidence of hospital acquired pneumonia in critically ill patients generally ranges from 9 to 20% [1]. Critically ill patients frequently require prolonged intubation and ventilator support. Swallowing dysfunction and pulmonary aspiration often occur in patients who receive prolonged mechanical ventilation [2–5].

Aspiration pneumonia can occur for various reasons, several studies have shown a significant association between dysphagia and aspiration pneumonia [6–8]. Several mechanisms for this problem include disuse atrophy of muscles during intubation, suppression of cough reflexes, inconsistent triggering of swallowing reflex, diminished proprioception, and residual effect of sedatives [6, 9].

Evidence suggests that intubation for more than 48 h can cause transient injury to the larynx with a subsequent reduction in protective mechanisms and increased oropharyngeal secretions once patient is extubated. The presence of orotracheal tube has been shown to alter the

mechanoceptors and chemoreceptors of pharyngeal mucosa, causing dysfunction of swallowing reflex. The prevalence of swallowing dysfunction post-extubation has been reported to occur in 20 and 83% of those patients intubated longer than 48 h [2].

FEES is a procedure where fiberoptic endoscope is passed through nose to visualize the larynx, pharynx and the patient is asked to swallow a food bolus. It can achieve a complete assessment of the pharyngeal stage of swallowing. It includes five components: assessment of structural changes in the larynx and pharynx, assessment of movement and sensation, assessment of secretions management, direct visualization of swallowing function for food and liquid, and response to therapeutic interventions.

Several studies have evaluated orotracheal intubation as an isolated factor for the development of dysphagia, some authors [2–5] include neurological patients in their studies, disregarding the consequences that may be related to the patient's own neurological problem.

Objective of our study was to evaluate critically ill patients who were intubated for causes other than neurological and try to define the exact impact of intubation on swallowing using FEES as diagnostic and therapeutic tool.

Materials and Methods

All adult ICU patients who were intubated for $\geq$ 48 h were included in the study. Head injury patients, patients with abnormal neurological status, completely disoriented patients were excluded from the study.

Patients were assessed for swallowing either in ENT department or bed side, in Intensive Care Unit (ICU) using FEES.

Patients were examined in supine position with the head of bed elevated to approximately 70° with the bend of the bed at the patient's lower back and in patients who are able to sit on a chair during the procedure; it was performed in sitting position. A fibreoptic laryngoscope was passed trans-nasally to the oropharynx, where the larynx and surrounding structures visualized.

Patients were led through various tasks to evaluate the anatomical changes in the larynx, sensory and motor status of the pharyngeal and laryngeal swallow mechanism. Stained liquid and semi-liquid/semisolid boluses were then given to determine the integrity of pharyngeal deglutition. The interior of the larynx and airway was examined for evidence of food penetration i,e when food particle is within the laryngeal vestibule Fig. 1 and aspiration, when food particle enters below the true vocal folds before and after each swallow was noted. Patient who aspirated with cough reflex was labeled aspirator and without cough reflex as silent aspirator. Patients who had aspiration or silent aspiration were given swallowing therapy by speech and swallowing Pathologist. Those patients who had aspiration were reassessed after 5–7 days of swallow therapy to note any improvement in their swallowing. Patients who did not show any aspiration were started on oral feeds after the test.

Results

In the study period of 1 year we performed FEES in 41 ICU patients who were intubated for minimum of 48 h; we excluded patients who were intubated for neurological causes and head injury. Our study population included patients in the age range of 18–74 years.

Our patient population was heterogeneous with diseases ranging from infectious disease, hanging, diabetic ketoacidosis, trauma etc. Important feature of our study was lack of confounding factors as we excluded patients with head injury, chronic neurological disorders and patients who were totally disoriented. Duration of intubation was in the range of 2–9 days, Most of the patients were intubated for 6 days.

19 (46.3%) patients had abnormal laryngeal findings and normal laryngeal findings were seen in 22 (53.7%). Types of laryngeal injury observed are mentioned in Table 1. Of 41 patients studied 12 had congested vocal cords, 4 had congested arytenoids, 3 had arytenoids ulcers, 3 had left vocal cord palsy, 1 had bilateral restricted vocal cord movements, left arytenoids prolapsed, epiglottic edema.

Of 41 patients 6(14.6%) had aspiration both for liquids and semisolids and only one had aspiration for liquid but not for semisolid feed. All patients who aspirated had some laryngeal injury.

In 6 patients who had aspiration initially as diagnosed with FEES, swallowing function recovered fully as found during repeat FEES which was done after swallow therapy on 5th–7th day.

There was no correlation between age of patient ($\leq$ 40 years) and laryngeal abnormality ($p = 0.278$) or occurrence of aspiration ($p = 1.0$). There was no significant association between gender of patient and laryngeal abnormality ($p = 0.79$) or occurrence of aspiration ($p = 0.662$).

There was no significant association between duration of intubation and occurrence of aspiration ($p = 1.00$).

Laryngeal Abnormality was just significant for duration of intubation more than/equal to 5 days and occurrence of aspiration ($p = 0.053$). Only patients with abnormal laryngeal finding showed aspiration on FEES. Among patients with Normal Laryngeal finding none experienced aspiration. Among patients with Abnormal laryngeal findings, 6 (31.6%) experienced aspiration and 13 (68.4%) had

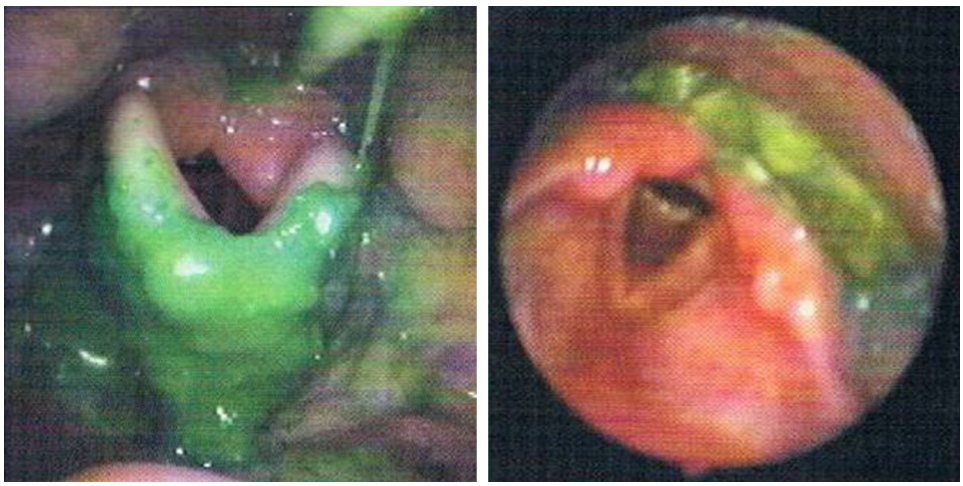

Fig. 1 FEES showing residue of semisolid (porridge) Bolus I,e penetration

Table 1 Type of laryngeal injury

Anatomical injury	Frequency	Percentage
Congestion of vocal cord	12	63.15
Congestion of arytenoids	4	21.05
Arytenoids ulcer	3	15.70
Left Vocal cord palsy	3	15.70
Bilateral restricted vocal cord movements	1	5.26
Left arytenoid prolapse	1	5.26
Epiglottic edema	1	5.265

no aspiration. The correlation was statistically significant ($p = 0.006$).

Discussion

Swallowing is a complex process that needs coordination of over 25 pairs of muscles in oral cavity, pharynx, larynx and esophagus [10]. Neural control of swallowing, which has both voluntary and involuntary components is mediated by interactions between cortical centres in both hemispheres, the "swallowing center" within the brainstem, cranial nerves (V, VII, IX sensory, IX motor, X and XII), and pharyngeal receptors (touch, pressure, chemical stimulus, and water [11].

Videofluroscopy was traditionally considered as a gold standard for diagnosis of oropharyngeal dysphagia as it provides comprehensive information of swallowing and also to assess therapeutic efficacy. However limitations of the procedure including accessibility, need of radiation and radiologist with fluoroscopy machine. This is particularly of concern to evaluate dysphagia in critically ill patients who are bedridden.

FEES has evolved over time as an alternative to videofluoroscopy especially when evaluation has to be done bedside. It is a safe and effective diagnostic tool in swallowing evaluation and helps in swallowing therapy as a visual display to help patients learn various swallowing maneuvers [2, 12, 13]. It can be used in a wide variety of settings including office evaluation, inpatients and ICU settings [13].

The reports of dysphagia associated with a neurological injury are common [2, 14–16]. Several diseases of neurological origin can affect the neuronal structures controlling the complex mechanisms of oropharyngeal swallowing. According to León and Clavé [14], more than 30% of patients who suffered a stroke, 52–82% of patients with Parkinson disease, 100% of patients with amyotrophic lateral sclerosis, 44% of patients with multiple sclerosis, 84% of patients with Alzheimer's disease and more than 60% of institutionalized elderly patients present oropharyngeal dysphagia.

A study by Aviv et al. on laryngopharyngeal sensitivity in stroke patients showed that there was a significant impairment of laryngopharyngeal sensitivity which may attribute to dysphagia and aspiration [17]. Incidence of dysphagia in stroke patient varies from 25% [18] to 67%

[19]. Gerf Hafner et al., included tracheostomy patients (46%) in their study; found aspiration in 69.3% of their study population. Majority of patients who had aspiration had indwelling tracheostomy tube (50.8%) in contrast to those who were intubated with endotracheal tube (48%). Incidence of silent aspiration was also high in tracheostomy patients (36.8%) as against (17%).

Disregarding these findings and evaluating orotracheal intubation as an isolated factor for the development of dysphagia, some authors [4, 17, 20] include neurological patients in their studies, correlating the presence of dysphagia resulting from the use of endotracheal tubes and ignoring the consequences that may be related to the patient's own neurological status.

Aiming to clarify this point of view, our purpose was to study the swallowing abnormality in extubated patients without any kind of brain damage and who were not tracheostomized.

According to a study by Bordan et al. [21] there was increase of 14% chances of aspiration with everyday increase in duration of intubation. According to another study by Brown et al. [22], there was a significant increase in risk of post extubation dysphagia by 73% for duration of more than 72 h of intubation when compared to those intubated for less than 72 h (23%) [22]. Our study did not show any significant association between duration of intubation and occurrence of aspiration.

According to a study by Postma et al. [23], prevalence of abnormal laryngopharyngeal findings was 79% following extubation, findings included arytenoids edema (33%), granuloma (31%), vocal cord palsy (24%), mucosal lesions (17%), vocal fold bowing (14%), diffuse edema (11%), airway stenosis (3%) and ulcer (6%).

A study by Perie et al. showed that aspiration occurs in patients with unilateral recurrent laryngeal nerve palsy [24], this explains our study where 3 patients who had unilateral vocal cord palsy also aspirated. Study by Leder et al. also showed that majority of patients with traumatic intubation suffered from aspiration [3]. This explains our study where all patients who aspirated had some form of laryngeal injury.

Our experience suggests that FEES can be employed as a useful diagnostic tool in ICU patients to assess aspiration because of its feasibility and portability. Given the high likelihood of serious medical complications of dysphagia, particularly pneumonia, we recommend that swallowing assessments should be conducted on patients undergoing prolonged intubation durations. Increasing awareness among intensivist and medical personnel handling endotracheal tubes about laryngeal injury secondary to intubation by ensuring Smooth intubation and handling of endotracheal tubes.

Conclusions

41 patients were evaluated by FEES; 6 (14%) had aspiration and 19 (46%) had post intubation trauma. There was a statistically significant association between laryngeal injury and occurrence of aspiration. All patients who had aspiration responded to swallowing therapy and on repeat FEES had no aspiration after 5–7 days. There was no significant association between duration of intubation and occurrence of aspiration. There was no significant association between age and occurrence of aspiration.

Compliance with Ethical Statement

Ethical Standards The procedure followed in our study was in accordance with ethical standards of responsible committee on human experiment. All participants volunteered for the study. We sought informed consent from every patient involved in our study after explaining the method and purpose of the study. We ensured at most confidentiality of subjects involved in the study. Ethical clearance was obtained from the ethical committee of Bangalore Baptist hospital.

References

1. Shifrin RY, Choplin RH (1996) Aspiration in patients in critical care units. Radiol Clin North Am 34(1):83–96
2. El Solh A, Okada M, Bhat A, Pietrantoni C (2003) Swallowing disorders post orotracheal intubation in the elderly. Intensive Care Med 29(9):1451–1455
3. Leder SB, Cohn SM, Moller BA (1998) Fiberoptic endoscopic documentation of the high incidence of aspiration following extubation in critically ill trauma patients. Dysphagia 13(4):208–212
4. Ajemian MS, Nirmul GB, Anderson MT, Zirlen DM, Kwasnik EM (2001) Routine fiberoptic endoscopic evaluation of swallowing following prolonged intubation: implications for management. Arch Surg Chic 136(4):434–437
5. Barquist E, Brown M, Cohn S, Lundy D, Jackowski J (2001) Postextubation fiberoptic endoscopic evaluation of swallowing after prolonged endotracheal intubation: a randomized, prospective trial. Crit Care Med 29(9):1710–1713
6. de Larminat V, Montravers P, Dureuil B, Desmonts JM (1995) Alteration in swallowing reflex after extubation in intensive care unit patients. Crit Care Med 23(3):486–490
7. Bone DK, Davis JL, Zuidema GD, Cameron JL (1974) Aspiration pneumonia. Prevention of aspiration in patients with tracheostomies. Ann Thorac Surg 18(1):30–37
8. Elpern EH, Jacobs ER, Bone RC (1987) Incidence of aspiration in tracheally intubated adults. Heart Lung J Crit Care. 16(5):527–531
9. DeVita MA, Spierer-Rundback L (1990) Swallowing disorders in patients with prolonged orotracheal intubation or tracheostomy tubes. Crit Care Med 18(12):1328–1330
10. Leonard R, Kendall K (eds) (2014) Dysphagia assessment and treatment planning: a team approach, 3rd edn. Plural Publishing, San Diego, pp 27–34
11. Clinical Management of Swallowing Disorders Companion Cd. Plural Pub Inc; 2012. 15–33p
12. Jones B (2013) Normal and abnormal swallowing imaging in diagnosis and therapy. Springer, New York [cited 2016 Apr 3]. http://www.myilibrary.com?id=14583

13. Flaksman H, Ron Y, Ben-David N, Cinamon U, Levy D, Russo E et al (2006) Modified endoscopic swallowing test for improved diagnosis and prevention of aspiration. Eur Arch Oto-Rhino-Laryngol Off J Eur Fed Oto-Rhino-Laryngol Soc EUFOS Affil Ger Soc Oto-Rhino-LaryngolHead Neck Surg 263(7):637–640
14. Ruiz de León A, Clavé P (2007) Videofluoroscopy and neurogenic dysphagia. Rev Esp Enfermedades Dig Organo Soc Esp Patol Dig 99(1):3–6
15. Daniels SK, Brailey K, Priestly DH, Herrington LR, Weisberg LA, Foundas AL (1998) Aspiration in patients with acute stroke. Arch Phys Med Rehabil 79(1):14–19
16. Terré R, Mearin F (2006) Oropharyngeal dysphagia after the acute phase of stroke: predictors of aspiration. Neurogastroenterol Motil Off J Eur Gastrointest Motil Soc 18(3):200–205
17. Aviv JE, Martin JH, Sacco RL, Zagar D, Diamond B, Keen MS et al (1996) Supraglottic and pharyngeal sensory abnormalities in stroke patients with dysphagia. Ann Otol Rhinol Laryngol 105(2):92–97
18. Gottlieb D, Kipnis M, Sister E, Vardi Y, Brill S (1996) Validation of the 50 ml3 drinking test for evaluation of post-stroke dysphagia. Disabil Rehabil 18(10):529–532
19. Hinds NP, Wiles CM (1998) Assessment of swallowing and referral to speech and language therapists in acute stroke. QJM Mon J Assoc Physicians 91(12):829–835
20. 1000-Einsteinv6n3p343-9.pdf. [cited 2016 Apr 3]. http://apps.einstein.br/revista/arquivos/PDF/1000-Einsteinv6n3p343-9.pdf
21. Bordon A, Bokhari R, Sperry J, Testa D, Feinstein A, Ghaemmaghami V (2011) Swallowing dysfunction after prolonged intubation: analysis of risk factors in trauma patients. Am J Surg 202(6):679–682
22. Brown CVR, Hejl K, Mandaville AD, Chaney PE, Stevenson G, Smith C (2011) Swallowing dysfunction after mechanical ventilation in trauma patients. J Crit Care 26(1):108.e9–13
23. Postma GN, McGuirt WF, Butler SG, Rees CJ, Crandall HL, Tansavatdi K (2007) Laryngopharyngeal abnormalities in hospitalized patients with dysphagia. Laryngoscope 117(10):1720–1722
24. Périé S, Laccourreye O, Bou-Malhab F, Brasnu D (1998) Aspiration in unilateral recurrent laryngeal nerve paralysis after surgery. Am J Otolaryngol 19(1):18–23