Retrograde fiberoptic endoscopy evaluation for patients with laryngeal edema

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Abstract
Background: Airway and swallowing evaluation is a crucial step before weaning the patient from a tracheostomy tube. Different evaluation procedures can be used successfully in many patients, but sometimes, this can be difficult or impossible for patients who have laryngeal edema as the existence of edema tends to block the view of true vocal folds. Thus, a new approach using retrograde fiberoptic endoscopy evaluation of swallowing (FEES) has been suggested to help visualize the vocal folds clearly. This study was performed to evaluate the impact of such a modification to the standard FEES.

Methodology: Thirty-six patients were referred for swallowing and airway evaluation. They were examined via nasopharyngolaryngobronchoscopy and FEES; nine of them had laryngeal edema and fit the inclusion criteria.

Results: Four out of the nine patients who had laryngeal edema could immediately swallow after evaluation with retrograde FEES.

Conclusions: Retrograde FEES is suggested to be an effective way to evaluate swallowing and is a valuable tool for research in this area.

Level of evidence: Level 4 (case series).

Keywords
laryngeal edema, retrograde fiberoptic endoscopy evaluation of swallowing, tracheostomy

1 | INTRODUCTION

Laryngeal edema is a common cause of airway obstruction especially after prolonged intubation in intensive care patients that may require a tracheostomy. The difficulty of evaluating swallowing on those patients increases, which is common after extubation.1-4

Air and swallowing evaluation are key steps before weaning the patient from the tracheostomy tube. Different evaluation procedures can be used successfully in many patients, but sometimes, this can be difficult or impossible for some patients who have laryngeal edema. Hence, some of these patients cannot be transferred easily to the radiographic suite for a videofluoroscopic evaluation. Modified barium swallow (MBS) and fiberoptic endoscopy evaluation of swallowing (FEES) are two common ways to detect aspiration, however, many clinicians do not have access to them. As an alternative method,
clinicians may use other clinical examinations to visualize aspiration such as water test, oxygen saturated tests, and modified Evans blue dye test. The latter test is specifically used to detect aspiration in tracheostomized patients especially when instrumental analysis cannot be used due to their illness. However, the accuracy of the blue dye test is much less reliable than the MBS and FEES (as there is an increased risk for a high false-negative rate when using a blue dye test alone). Research has revealed that the bedside blue dye test is not able to recognize all tracheal aspiration found on MBS.

Using the standard method of FEES cannot be implemented as the existence of edema tends to block the view of true vocal folds. Granulation tissue and vocal fold ulceration are also common in many cases. This is most often located in the posterior third of the true vocal fold where the pressure of the tube affects this area. The literature shows that about 15% of patients must be reintubated because of laryngeal edemases. The reintubation and long intubation periods make the edema worse. Thus, using the standard method of FEES cannot be used with edema cases as it has many challenges and most importantly blocking the view of the true vocal folds.

To cope with these problems, an alternative approach has been proposed by the authors to evaluate swallowing via retrograde FEES which is a modified version of the FEES study, where the scope (bronchoscope) is inserted through the tracheostomy and a retrograde evaluation of the vocal folds is performed. The retrograde FEES can easily and quickly be used with experienced examiners and is indicated in patients with edema. Subglottic stenosis will be missed if retrograde endoscopy has not been performed leading to failed weaning or complicated breathing after weaning. This may subsequently lead to reininserting the tracheostomy tube. In other words, it is preferable to assess the subglottic airway space with retrograde endoscopy along with flexible endoscopy to assess nasopharynx and larynx.

The study aims to evaluate the modification of FEES technique using a retrograde FEES approach in a group of patients who have laryngeal edema and to assess the usefulness of this new technique for evaluating swallow.

2 MATERIALS AND METHODS

The study protocol was approved by the ethical committee of the National Care Hospital in Riyadh, Saudi Arabia. The criteria chosen for this study include the following: patients must be oriented and able to follow commands, Glasgow coma scale (GCS) should be at least 11/15, first change of the tracheostomy tube, tracheostomy tube in place for at least 10 days, the procedure must be videotaped, and the patients must be older than 14 years with severe laryngeal edema. Laryngeal edema is referred to as an acute inflammation that causes swelling of the epiglottis and the vocal folds and this can obstruct eh laryngeal orifice. A review of charts from June 2014 to January 2015 showed that 36 patients who have a mean age of 49.8 years (16 males and 20 females aged between 22 and 65 years old) underwent a combined nasopharyngolaryngoscopy (NPL) and FEES study. All patients were conscious and on tracheal oxygen masks with minimum oxygen support. Almost all patients (ie, 33) were intubated for 7 to 14 days before percutaneous tracheostomy. The remaining three patients were intubated for nearly 3 to 4 weeks (ie, 22, 25, and 29 days) and were transferred from another hospital.

The tracheostomy tubes were placed immediately when they arrived in the ICU. Swallowing and airway evaluations were carried out a few days after patient discharge from the ICU to the hospital ward via concurrent NPL and FEES to evaluate the supraglottic airway.

2.1 Procedure

The procedure was performed by two clinicians experienced with the use of fiberoptic endoscopy: an ENT consultant with extensive experience in airways and a senior speech-language pathologist who has worked in swallowing and dysphagia field for more than 14 years.

All patients underwent nasopharyngolaryngobronchoscopy (NPLBR), which is a modified version of the ordinary endoscopic evaluation of the larynx and trachea. It examines the status of all structures including the nose, nasopharynx, hypopharynx, larynx, true vocal folds, subglottis, trachea, carina, and the under the surface of the vocal folds. The evaluation also includes FEES study as a part of the routine first change of tracheostomy tube. The retrograde procedure was performed as part of an airway evaluation, which is a standard routine before starting the weaning program on each patient.

The procedure starts with a regular anatomical assessment of the airway and true vocalization before proceeding to the FEES study. Blue and green food coloring were mixed to different consistencies: thin liquid, thick liquid, and puree. Boluses of 1, 3, 5, and 10 mL were created from each consistency such that the patient would take one bolus and repeat with a larger bolus depending on the patient’s condition. To ensure that the patient is not aspirating, the examiner needs to wait for a few seconds (6-9 seconds) before presenting the next bolus. If the patient aspirated, the examiner would wait for a few more seconds (10-11 seconds) before moving to the next consistency.

When the FEES study was completed, the endoscope was removed, cleaned, and then passed through the tracheostomy tube to assess the bronchi. If the patient had a fenestrated tube, then a retrograde procedure was performed through the fenestrated tube; otherwise, retrograde FEES was performed after the tracheostomy was removed. Thus, the subglottic area between the true vocal fold and the tracheostomy tube was evaluated. For patients’ safety, a tracheal mask was used to prevent oxygen desaturation. Endoscopes were 2.8 or 4.9 mm. Thus, if the fenestration is large, then 2.8 mm was for retrograde FEES after placing the tracheostomy tube, so it can pass through the fenestration. If the fenestration is small, 4.9 mm was used before inserting the tracheostomy tube in the first change of tracheostomy tube where the size of the tube is usually 6.

The FEES retrograde study was performed after airway evaluation. Patients were given the same consistencies used for the first evaluation of swallowing for the regular FEES study. The scope was held in the position of retrograde under the true vocal fold with
proper distance while the patient swallows the bolus. If the color passes the true vocal fold, then it will be visible indicating that the patient is aspirated. Once the patient is aspirated, the examiner will move to the next consistencies. For example, if the patient experiences aspiration with 1 mL of thin liquid, the examiner will move to a thick liquid and start with 1 mL. If the patient is tolerating this, 3 mL will be used, 5 mL, and then 10 mL. If there is no aspiration with 10 mL, the examiner will move to puree. Thus, if there is aspiration the examiner will move to the next consistency.

The procedure was performed with an Olympus BF-P180 bronchovideoscope. Bronchoscopy is a standard protocol in the hospital; all cases were video recorded. Suction was used as needed.

3 | RESULT

As shown in Table 1, 9 out of 36 patients had severe laryngeal edema (Figure 1) and met the inclusion criteria. Four out of 9 could take oral directly after the retrograde FEES (Figure 2). Five patients had significant aspiration (Figure 3).

Case 1 was diagnosed as CVA. Retrograde FEES shows that the patient did not aspirate with thin liquid, thick liquid, or puree. The normal true vocal fold and no abnormalities were seen in the subglottic airway.

Case 2 was diagnosed as TBI. Retrograde FEES shows a small granuloma in the subglottic space with normal true vocal folds and no stenosis or abnormalities. Swallowing evaluation shows no aspiration with thin liquid, thick liquid, or puree.

Case 3 was diagnosed as CVA. Retrograde FEES shows bilateral true vocal fold mobile with a better movement of the left vocal fold with clear airway, no subglottic stenosis. Swallowing evaluation shows no aspiration seen with thin liquid, thick liquid, and puree.

Case 4 was diagnosed as CVA. Retrograde FEES shows a mobile bilateral true vocal fold and no abnormalities in the airway. Swallowing evaluation shows clear aspiration with 5 mL of thin liquid and no aspiration with thick liquid or puree.

Case 5 was diagnosed as CVA. Retrograde FEES shows bilateral true vocal fold paresis and no subglottic stenosis with excessive secretion. Swallowing evaluation shows aspiration with thin liquid, thick liquid, and puree. The patient aspirates in saliva.

Case 6 was diagnosed as TBI. Retrograde FEES shows bilateral true vocal fold mobile with better movement in the left fold. They have a partially exposed cricoid cartilage on the subglottic posterior with no subglottic stenosis. Swallowing evaluation shows aspiration with 1 mL of thin liquid, thick liquid, and puree.

Case 7 was diagnosed as TBI. Retrograde FEES shows right vocal fold paresis. Small areas of ulceration were seen in the subglottic

TABLE 1  Retrograde fiberoptic endoscopy evaluation of swallowing (FEES) results of aspiration and patient characteristics

| Patient | Gender | Age | Aspiration with thin | Aspiration with thick | Aspiration with puree |
|---------|--------|-----|----------------------|----------------------|----------------------|
| 1       | M      | 62  | −ve                  | −ve                  | −ve                  |
| 2       | M      | 74  | −ve                  | −ve                  | −ve                  |
| 3       | F      | 59  | −ve                  | −ve                  | −ve                  |
| 4       | F      | 64  | +ve                  | −ve                  | −ve                  |
| 5       | M      | 23  | +ve                  | +ve                  | +ve                  |
| 6       | M      | 26  | +ve                  | +ve                  | +ve                  |
| 7       | F      | 58  | +ve                  | +ve                  | +ve                  |
| 8       | M      | 82  | +ve                  | +ve                  | +ve                  |
| 9       | F      | 66  | +ve                  | +ve                  | +ve                  |

Abbreviations: +ve, aspirated; −ve, no aspiration; F, female; M, male.
space on the right side. Swallowing evaluation shows that the patient aspirated with 1 mL of thin liquid, thick liquid, and puree.

Case 8 was diagnosed as CVA. Retrograde FEES shows bilateral true vocal fold paresis in the adduct position with no subglottic stenosis. Swallowing evaluation shows aspiration with 1 mL of thin liquid, thick liquid, and puree.

Case 9 was diagnosed as CVA. Retrograde FEES shows bilateral true vocal fold mobile with better mobility on the left side with no subglottic stenosis and excessive secretion. Swallowing evaluation shows aspiration with 1 mL of thin liquid, thick liquid, and puree.

4 | DISCUSSION AND CONCLUSION

This series study showed that four out of nine patients who had laryngeal edema with retrograde FEES could take oral immediately after evaluation. The evaluation of this group of patients who had laryngeal edema with the classical approaches of standard FEES is difficult. The decision to start oral intake without proper evaluation will increase the risk of aspiration pneumonia. On the other hand, not giving oral fluids will not improve the patient swallowing and maintaining tracheostomy will be essential for the patient’s protection. Booking the patient for MBS will delay the process and increase the cost as well as exposure to radiation because the patient may need to repeat the procedure several times during the weaning process.

One of the main limitations of retrograde FEES was desaturation; however, this was seen in only one case. The possible cause was irritation of the airway. This might be due to the size of the scope (4.9 mm). Doing the procedure with a smaller sized scope might overcome this limitation. Another possible limitation is that placing tracheostomy tube may limit the elevation of the larynx. Thus, to minimize this limitation, a smaller size of tracheostomy tube was used.

A third limitation is that more subglottic pressure is generated when the bronchoscope is in place compared to an open tracheostomy. In this study, the outer diameter of 2.8 and 4.9 mm was used, and the outer diameter of tracheostomy tube was 11.8 mm, so that generation of subglottic pressure was minimized. Furthermore, false positive is less likely to happen as the scope used by the examiner has a small diameter. However, the stoma for all patients is bigger than 11.8 which is considered to be large when compared with the scope 4.9 for patients who had examination without tracheostomy.

In conclusion, retrograde FEES could be a more accurate diagnostic tool to evaluate the airway and swallowing information promptly in patients with laryngeal edema. Further large studies are needed to support this conclusion.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

REFERENCES

1. Thomas R, Vijaya Kumar E, Kameshwaran M. Post intubation laryngeal sequelae in an intensive care unit. J Laringol Otol. 1995;109:313-316. https://doi.org/10.1017/S0022215100130002.
2. Esteller-Moré E, Ibañez J, Matiño E, Ademá JM, Nolla M, Quer IM. Prognostic factors in laryngotracheal injury following intubation and/or tracheotomy in ICU patients. Eur Arch Otorhinolaryngol. 2005;262:880-883. https://doi.org/10.1007/s00405-005-0929-y.
3. Colice GL, Stukel TA, Dain B. Laryngeal complications of prolonged intubation. Chest. 1989;96:877-884. https://doi.org/10.1378/chest.96.4.877.
4. Wittekamp BHJ, van Mook WNKA, Tjan DHT, Zwaveling JH, Bergmans DCJJ. Clinical review: post-extubation laryngeal edema and extubation failure in critically ill adult patients. Crit Care. 2009;13:233. https://doi.org/10.1186/cc8142.
5. Groher M, Crary M. Dysphagia: Clinical Management in Adults and Children. Elsevier Health Sciences; Mosby; S.I; 2015. 154 p.
6. Peruzzi WT, Logemann JA, Currie D, Moen SG. Assessment of aspiration in patients with tracheostomies: comparison of the bedside colored dye assessment with videofluoroscopic examination. Respir Care. 2001;46:243-247.
7. Epstein SK, Clibotaru RL. Independent effects of etiology of failure and time to reintubation on outcome for patients failing extubation. Am J Respir Crit Care Med. 1998;158:489-493.
8. O’Connor HH, White AC. Tracheostomy decannulation. Respir Care. 2010;55:1076-1081. https://doi.org/10.1002/hed.20653.

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