Tracheostomy decannulation readiness: A cross sectional study comparing standardised evaluation for tacheostomy decannulation to flexible endoscopic evaluation of swallowing examination

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ABSTRACT

Introduction: Tracheostomy is a procedure commonly performed in neurocritical and mechanically ventilated patients in the intensive care unit. Dysphagia and impaired airway protection are the main causes for a delay in tracheostomy decannulation in patients with neurological disorders. Endoscopic evaluation is an objective examination of readiness for tracheostomy decannulation with flexible endoscopic evaluation of swallowing (FEES) as the most commonly used method, yet it requires special expertise and is heavily dependent on its operator in assessing the parameters. A relatively new method for assessing decannulation readiness in neurologic disorder, the Standardized Endoscopic Swallowing Evaluation for Tracheostomy Decannulation (SESETD) was introduced in 2013 by Warnecke, et al. This method includes stepwise evaluation of secretion management, spontaneous swallowing and laryngeal sensitivity. This study aims to find conformity between the SESETD and FEES in assessing readiness for tracheostomy decannulation in patients with neurologic disorders.

Materials and Methods: This study is a cross-sectional study conducted on 36 neurologic patients at Cipto Mangunkusumo General Hospital which was aimed to find the agreement between two modalities for tracheostomy decannulation readiness, FEES and SESETD based on parameters, standing secretion, spontaneous swallowing and laryngeal sensitivity.

Result: A total of 36 subjects were examined and 22 of them underwent successful tracheostomy decannulation. The agreement between FEES and SESETD showed significant results with p-value <0.0001 and Kappa value = 0.47.

Conclusion: There was conformity between FEES and SESETD in evaluating tracheostomy decannulation readiness based on three parameters: standing secretion, spontaneous swallowing and laryngeal sensitivity.

KEYWORDS:
Decannulation, dysphagia, FEES, neurologic disorders, tracheostomy

INTRODUCTION

Tracheostomy is a common procedure performed in critically ill patients who require prolonged mechanical ventilation.[1,2] It involves the creation of an opening in the trachea to facilitate breathing and airway management.[3] However, tracheostomy is not without complications, and one of the most significant challenges is the process of decannulation, which involves the removal of the tracheostomy tube while maintaining spontaneous breathing and airway protection.[4] The importance of tracheostomy decannulation cannot be overstated, as it represents a crucial milestone in the recovery and rehabilitation of patients with tracheostomy.[1,2,5] Successful decannulation not only signifies the restoration of natural airway function but also reduces the risk of complications associated with prolonged tracheostomy tube placement, such as infection, granulation tissue formation and tracheal stenosis.[2]

The main causes of delayed tracheostomy decannulation are impaired airway protection and dysphagia. In neurologically ill patients, the prevalence of oropharyngeal dysphagia is 23.2 to 84%.[6,7] Decannulation is a critical step in the management of patients with tracheostomy, as it can significantly impact their quality of life and reduce the risk of complications.[5] Therefore, the accurate assessment of swallowing function and airway protection is paramount in determining the appropriateness of decannulation.

Only a number of studies brought up the optimal timing and procedure of tracheostomy decannulation.[1,4] Furthermore, no gold standard protocol was offered for heavily neurologically ill patients with dysphagia.[1,8,9] Flexible endoscopic evaluation of swallowing (FEES) is the diagnostic tool used to assess swallowing function in patients with tracheostomy. FEES is a well-established method for evaluating swallowing function, providing valuable information on the safety and efficiency of swallowing, aspiration risk, and laryngeal sensitivity and had served as an objective protocol to evaluate decannulation readiness, yet had not been officially determined to be used as standard protocol in clinical settings.[1,2,5] On the other hand, Standardized Endoscopic Swallowing Evaluation of Tracheostomy Decannulation (SESETD), introduced by Wernecke et al.[5] in 2013, is a relatively new technique that has shown promise in assessing

the readiness for tracheostomy decannulation, particularly in critically ill neurologic patients.[2]

FEES has been widely utilised in the assessment of swallowing function in patients with tracheostomy, providing valuable insights into the presence of pharyngeal residue, penetration, aspiration and laryngeal sensitivity.[10,11] However, it is heavily dependence on its operator, and in the context of critically ill neurologic patients, the assessment of swallowing function regarding tracheostomy decannulation is particularly challenging due to the underlying neurologic deficits and the increased risk of aspiration.[1,2,5] SESETD presents an opportunity to enhance the assessment process by providing a standardised and objective evaluation of swallowing function through three parameters: 1) secretion management, 2) spontaneous swallowing and 3) laryngeal sensitivity, which can surpass or complement the information obtained from FEES.[2,5]

In this study, we aim to investigate the effectiveness of SESETD in assessing swallowing function and its conformity to FEES particularly in critically ill neurologic patients, so that it could serve as an alternative examination that provides an objective, practical and efficient result to assess tracheostomy decannulation readiness.

MATERIALS AND METHODS

This study was a cross-sectional study conducted at the Department of Otorhinolaryngology-Head and Neck Surgery, Faculty of Medicine, Universitas Indonesia/Dr. Cipto Mangunkusumo National General Hospital. The study included 36 patients with tracheostomy who underwent both SESETD and FEES examinations. Sample size was determined using paired two different proportion test. The patients were assessed for their readiness for tracheostomy decannulation based on the parameters of standing secretion, spontaneous swallowing and laryngeal sensitivity.

The inclusion criteria for this study were patients with tracheostomy who were at least 18 years old and had been on mechanical ventilation for at least 7 days. The general condition of these patients varies, as they had different neurological disorder diagnosis. However, those with a history of head and neck surgery, radiation therapy, or oesophageal disease was excluded from the study. Patients who were unable to tolerate the SESETD or FEES examination were also excluded.

The SESETD and FEES examination were performed at the same time, first SESETD then followed by FEES. The examination was conducted by a trained junior otorhinolaryngologist. The recording of SESETD and FEES examination was then assessed by a trained senior otorhinolaryngologist who was blinded to the results of the prior SESETD and FEES examination.

The FEES examination was performed using a flexible endoscope with a diameter of 3.4 mm. It consisted of the evaluation of swallowing function, including the presence of pharyngeal residue, penetration, aspiration and laryngeal sensitivity.

The SESETD examination was also performed using a flexible endoscope with a diameter of 3.4 mm. This examination consisted of three stages, management of standing secretion, spontaneous swallowing and laryngeal sensitivity. The standing secretion was assessed by observing the patient's ability to manage secretions without the aid of suction. If massive pooling was seen in hypopharynx, on vocal cord, aspiration and or silent aspiration was found, then the patient got 0. Spontaneous swallowing was assessed by observing the patient's ability to swallow saliva. If patient swallowed less than two times in two minutes, then patient got 0. Laryngeal sensitivity was assessed by observing the patient's response to laryngeal touch with the endoscope. If no reaction was found, patient got 0. Patients who scored on all three parameters were considered ready for tracheostomy decannulation. Patients who failed one of these parameters were considered not ready.

Data were collected and analysed using SPSS version 25.0. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. Kappa test was used to analyse interrater and intrarater agreement according to the three parameters: standing secretion, spontaneous swallowing, and laryngeal sensitivity. In order to find a conformity between SESETD and FEES, the McNemar test and Kappa assessment were used.

RESULTS

The study included a total of 36 subjects with tracheostomy who underwent both SESETD and FEES examinations to assess their readiness for tracheostomy decannulation. The demographic and clinical characteristics of the study population are summarized in Table I. The mean age of the subjects was 45.06 ± 15.64 years. The most common underlying neurologic condition necessitating tracheostomy was stroke, accounting for 63.9% of the cases. Most subjects used tracheostomy for 3 months – 1 year range (41.7%).

The interrater agreement between two otolaryngologists for SESETD was listed as Kappa score of 0.737 to 1 for three parameters, which showed good reliability. The intrarater agreement for one otolaryngologist at different times was listed as Kappa score 1, which also showed good reliability.

The results of the SESETD and FEES examinations are presented in Table II. The assessment of standing secretion, spontaneous swallowing, and laryngeal sensitivity using SESETD revealed that 16 subjects were ready for decannulation with total score of 3 (41.7%), and 20 weren't ready (58.3%). Meanwhile, the assessment using FEES with swallowing reflex initiation, epiglottic retroflexion, penetration-aspiration, and residue parameters revealed that 26 subjects (72.8%) were deemed ready for tracheostomy decannulation (PAS 1-6) and subjects were not (27.2%). Hence, there were 10 subject discrepancies for decannulation readiness between SESETD and FEES, where they were deemed ready according to FEES but not according to SESETD.

Further analysis of the discrepancies between SESETD and FEES examinations are presented in Table III and IV. It showed that the majority of discrepancies were related to the

Table I: Characteristics of study population

Characteristics	Number (n = 36)
Age (Mean)	45,06 ± 15,64
Age group	
18 – 40 years old	13
41 – 73 years old	23
Gender	
Male	17 (47.2)
Female	19 (52.,8)
Neurologic disease	
Central nervous system lesion	23
Peripheral nervous system lesion	8
Dysphagia due to prolonged intubation	5
Tracheostomy indication	
Prolonged intubation	35
Not prolonged intubation	1
Tracheostomy duration of use	
< 3 Months	8
3 months – 1 year	15
> 1 Year	13
History of dysphagia therapy	
Yes	14
No	22

Table II: Conformity between SESETD and FEES examination.

SESETD conclusion	FEES conclusion		Total
	Ready	Not ready	
Ready	16	10	0
Not ready	10	1620	
Ready	26	10	36
Annotation: Mc Nemar test p = 0.001.			
Kappa (κ) = 0.47 p = 0.002			

Tabel III: Subjects not ready for decannulation according to SESETD (n = 10)

SESETD readiness	Frequency
Standing secretion	
Score 0	7
Score 1	3
Spontaneous swallowing	
<2	7
>2	3
Laringoreflex	
Present	5
Not present	5

Tabel IV: Subjects not ready for decannulation according to SESETD, but ready according to FEES (n = 10).

FEES readiness	Frequency
Swallowing initiation	
Normal	5
Delayed	5
Epiglottic retroflexion	
Normal	5
Delayed	5
Penetration	
Present	4
Not present	6
Aspiration	
Present	0
Not present	10
Residue	
Present	4
Not present	6

assessment of spontaneous swallowing and laryngeal sensitivity. Specifically, on all 10 subjects there was no aspiration found and four subjects had PAS 2-5, which might still be considered to undergo decannulation. Based on the 10 subjects' difference, six underwent successful tracheostomy decannulation while the other four failed due to subglottic stenosis and no adequate cough reflex.

Tracheostomy decannulation was successful in 22 subjects (61%) where no complication and recanulation occurred. From the remaining 14 subjects with unsuccessful decannulation, 10 didn't pass SESETD nor FEES examination, three were found to have granulation and subglottic stenosis and 1 was found to have no adequate cough reflex. In addition, the concordance between SESETD and FEES in determining the readiness for tracheostomy decannulation was evaluated using the McNemar test and kappa statistics. The Kappa value for the concordance between SESETD and FEES was 0.47, suggesting moderate agreement.

DISCUSSION

The assessment of tracheostomy decannulation readiness is a critical step in the management of critically ill neurologic patients. The decision to decannulate a tracheostomy tube is based on the patient's ability to manage secretions, swallow safely and protect their airway.

The method used in this study, SESETD, had interrater κ = 0.737 and intrarater κ = 1.0 which showed moderate and very strong agreement according to McHugh's Cohen kappa classification.12 Hence, the data taken for this study are valid according to statistical analytics.

In this study, we found that SESETD and FEES had a moderate level of agreement in their assessments of tracheostomy decannulation readiness. Specifically, we found that 61.1% of the patients were deemed ready for decannulation based on both SESETD and FEES examinations. As stated earlier, there are three parameters assessed: standing secretion, spontaneous swallowing and laryngeal sensitivity.

Standing secretion evaluation is the main parameter used for assessment using endoscopy. The accumulation of secrete is associated with an increasing risk of aspiration pneumonia and breathing distress. The second parameter is spontaneous swallowing, which is a protective aerodigestive reflex to prevent penetration and spiration. In normal individuals, spontaneous swallowing should happen 1 to 2 times in 1 minute.[13] A study by Murray et al.[14], found that the frequency of spontaneous swallowing in patients with aspiration is significantly lower than those without aspiration. Most subjects (18 out of 36) didn't pass this 'spontaneous swallowing' parameter in the SESETD examination, hence, scored <3 for SESETD. However, when screened using FEES they acquire PAS 2-5 which show no aspiration and might still considered to undergo decannulation.[15,16] The difference might happen due to the amount difference of stimulus to initiate swallowing reflex, whether spontaneous or voluntary. Spontaneous swallowing in SESETD is assessed without any bolus given, while it is in FEES. The food administration stimulates the initiation of swallowing reflex,

resulting in a 'conscious' process that influence the swallowing process, voluntarily or spontaneously.[13]

The evaluation using both FEES and SESETD showed moderate agreement (κ = 0.47). The SESETD examination has several advantages which require less examination time, no food preparation, and could be performed by otorhinolaryngologists without in-depth comprehension of FEES.[17] According to Muhle et al.[2], the three SESETD parameters can predict the ability to protect the airway, as seen in this study. Therefore, SESETD has shown good performance in evaluating the readiness of tracheostomy decannulation in neurologically ill patients or patients with neurogenic dysphagia.

This study successfully performed decannulation on 61% of subjects. Most subjects in this study have haemorrhagic stroke, ischemic stroke, and brain tumour. Dysfunction in swallowing and airway protection is related to the degree of neurologic disease and the breadth of damage found in the brain of the subjects. This study result is in line with Muhle et al.[2] population study in which most subjects had ischemic (58.1%) and haemorrhagic (17.2%) strokes. This study also stated that with heavier neurologic disorders, the swallowing function might need a longer time to recover in comparison to breathing function. Another study, DECAST, by Schenider et al.[18] also stated that 26% with brain injury are ready for tracheostomy decannulation after 3 months, while other studies, SETPOINT, by Bosel et al.[19] only 47% of stroke patients can be decannulated in 6.6 to 7.5 months period. The main reason for this difference is the pathophysiology complexity of dysphagia with the heavy neurologic disorder which might induce central or peripheral swallowing organ dysfunction.

In addition to the discrepancies between SESETD and FEES, this study also identified several limitations that should be considered when interpreting the results. First, the sample size was relatively small, which may limit the generalisability of the findings. Second, the study was conducted at a single centre, which may limit the generalisability of the findings to other settings.

This study also had some limitations which should be address in future studies. First, prior airway patency should be determined before FEES and SESETD examination using flexible endoscope to exclude those without patent airway. If airway is not patent, like those with subglottic stenosis, hence SESETD is not needed. Second, general condition of the patients including GCS should be provided to get a more extensive view of the study population.

CONCLUSION

In conclusion, this study demonstrates that Standardized Endoscopic Swallowing Evaluation for Tracheostomy Decannulation (SESETD) is an effective method for assessing swallowing function in patients with tracheostomy. The conformity between SESETD and flexible endoscopic evaluation of swallowing (FEES) was moderate agreement (κ = 0.47). Patients assessed as not ready through SESETD should be further evaluated using FEES. But those assessed ready,

should not. Further studies with bigger samples are needed to eliminate sample bias and to achieve better agreement between the two modalities.

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