Improving The Accuracy of Screening Pharyngeal Dysphagia Using Ultrasonography in Acute Stroke Patient: A Case Report

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Abstract

Introduction: *Dysphagia is a common complication in acute stroke patients that require early screening to reduce the risk of aspiration pneumonia, disability, and mortality. Bedside examinations such as the Gugging Swallowing Screen (GUSS) test and ultrasonography are non-invasive methods that may improve early diagnosis of dysphagia after stroke.*
Case Report: *We report a 49-year-old man with a history of cerebrovascular event that had difficulty swallowing, followed by coughing and choking after drinking.*
Discussion Case: *The GUSS score indicated moderate dysphagia with a high risk of aspiration. The swallowing ultrasonography showed conformity to the GUSS score and improved the screening accuracy for silent aspiration risk in the pharyngeal swallowing phase.*
Conclusion: *In conclusion, ultrasonography examination may improve the screening accuracy of the GUSS test, particularly for the detection of silent aspiration in pharyngeal dysphagia.*

Keywords: *Dysphagia, pharyngeal dysphagia, Gugging Swallowing Screen, ultrasonography*

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Peningkatan Akurasi Skrining Disfagia Fase Faringeal Menggunakan Ultrasonografi pada Pasien Stroke Iskemik Akut: Sebuah Studi Kasus

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Abstrak

***Pendahuluan**: Disfagia merupakan komplikasi yang sering ditemukan pada pasien stroke akut sehingga memerlukan deteksi dini untuk mengurangi risiko pneumonia aspirasi, disabilitas, hingga kematian. Pemeriksaan langsung, seperti uji Gugging Swallowing Screen (GUSS) dan ultrasonografi, merupakan metode non-invasif yang dapat meningkatkan diagnosis dini disfagia pascastroke.*
***Laporan Kasus**: Laporan kasus ini menyajikan tentang pasien laki-laki 49 tahun dengan riwayat stroke yang mengeluh sulit menelan, disertai dengan batuk dan tersedak setiap kali minum air.*
***Diskusi kasus**: Pemeriksaan GUSS sebagai skrining awal menunjukkan adanya aspirasi saat proses menelan. Pemeriksaan ultrasonografi yang dilakukan saat pasien menelan menunjukkan hasil yang sesuai dengan skor GUSS, bahkan memiliki akurasi yang lebih baik dalam mendeteksi risiko aspirasi tersamar saat fase menelan faringeal.*
***Kesimpulan**: Sebagai kesimpulan, pemeriksaan ultrasonografi dapat meningkatkan akurasi skrining uji GUSS, terutama dalam mendeteksi aspirasi tersamar pada disfagia faringeal.*

***Kata kunci:** Disfagia, disfagia faringeal, Gugging Swallowing Screen, ultrasonografi*

Introduction

Dysphagia is a swallowing disorder that reduces the optimal passage of fluid or food through the gastrointestinal tract.[1-3] Dysphagia is usually found in patients following acute stroke, so called neurogenic dysphagia. It clinically emerges within 2 or 3 days after stroke and presents in more than 50% of cases and leads to higher risk of aspiration in the fifth days after stroke.[1] Therefore, early dysphagia screening is required to minimize aspiration, and eventually decrease mortality rates in patients with stroke. Ideally, the instruments screening should be high in sensitivity and specificity, not or minimally invasive, which might determine the likelihood of dysphagia and aspiration.[4]

The bedside examination for early dysphagia detection is important. Aside from other bedside examinations, the Gugging Swallowing Screen (GUSS) test is a simple procedure that has high sensitivity (93.8%) and specificity (96.1%). This is a non-invasive examination, fast, and allows a graded assessment of the patient's swallowing abilities, measures the severity of dysphagia, and enables dietary recommendations.[2,5]

In addition to physical examination, further diagnostic tools have been developed to investigate the swallowing function to provide quantitative measurement of aspiration risk. Ultrasonography is a non-invasive and free radiation technique that provides a method to evaluate the oropharyngeal swallowing phase.[6] Compared to Video-fluoroscopic Evaluation of Swallowing (VFES) and Fiberoptic Endoscopic Evaluation of Swallowing (FEES), these advantages of ultrasonography make it an ideal tool for screening and serial follow-up of dysphagia patients. Ultrasonography could evaluate swallowing function during the oral and pharyngeal phases. Oral phase swallowing is determined by assessing larynx elevation and tongue thickness as indicators of tongue mobility function (Figure 1).

The reducing of tongue thickness indicates an impaired swallowing function. As the larynx elevation is controlled by the hyoid-thyroid movement, therefore, reducing these movements are potential cause of aspiration.[7,8] The estimated sensitivity and specificity for detecting aspiration by ultrasonography were 0.82 (95%CI 0.72-0.89) and 0.87 (95%CI 0.81-0.92), respectively.[9]

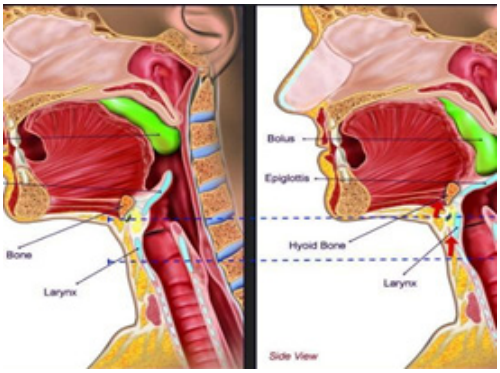


Figure 1. The Elevation of Hyoid and Larynx During Swallowing Phase

Until today, bedside swallowing examination remains the most reliable technique to screen the risk of aspiration in patients with dysphagia following stroke. Bedside examination provides quick results to determine whether dysphagia has emerged.[1] However, in many cases the patient often does not feel choking, but there is aspiration into the respiratory tract which is called silent aspiration. Therefore, it is suggested to perform non-invasive direct swallowing function tests, such as ultrasonography, in addition to the bedside examination. Ultrasonography, in addition to GUSS score, might improve the accuracy of dysphagia assessment. Ultrasonography provides direct views of the airway closure during swallowing which is not provided on GUSS examination. This case report aimed to demonstrate the role of ultrasonography in patient with dysphagia after stroke.

Probe position in oral phase (a): superior placement under mandible bone and inferior placement above hyoid bone. Probe position in pharyngeal phase (b): in front of trachea.

Case Report

A 49-year-old man with a history of cerebrovascular disease 1 month before complained about his difficulty of swallowing. He often chokes and cough after drinking water, mainly in a great amount, but could eat solid food slowly. There was no facial, tongue, or palatal weakness. During hospitalization, the Glasgow Coma Scale score was E4V5M4 and He was able to follow instructions from the examiner. The evaluation of swallowing function was aimed to detect silent aspiration and prevent pulmonary complication.

A preliminary swallow evaluation using the GUSS test revealed a score of 5 which indicated He should be careful in the process of swallowing. Further direct swallow tests using the liquid, semi-solid, and solid textures of food showed a score of 10 which indicated moderate dysphagia with a high risk of aspiration.

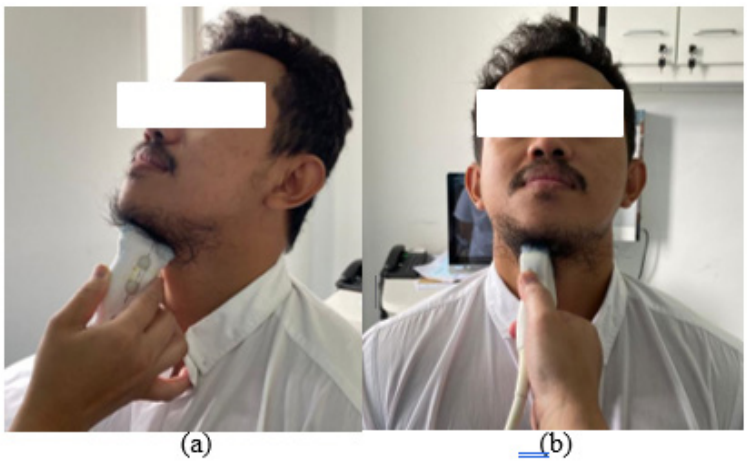


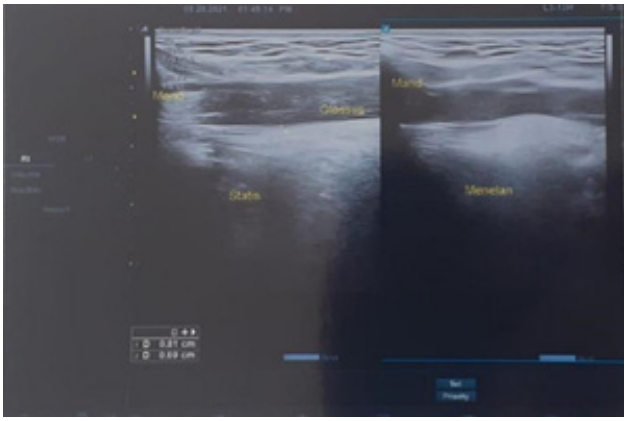
Figure 2. Placement of Ultrasonography Probe

The assessment continued using ultrasonography to investigate the oral and pharyngeal swallowing function (Figure 2). All measurements were performed in two steps: static and dynamic states. In the static state, the patient was not in a state of swallowing, whereas in the dynamic state the patient was asked to swallow 5 ml of water. The exam-

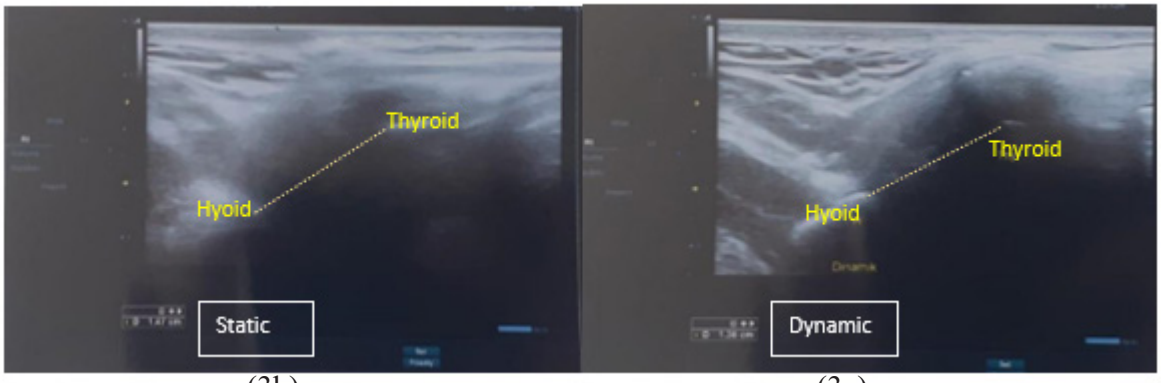
ination started in the oral phase by choosing 7 MHz curvilinear transducers placed at the submental area, vertically to the skin, along the midline of the long axis of the tongue until the hyoid bone, to evaluate the thickness of the tongue. The tongue thickness was measured cross-sectionally by drawing an imaginary vertical line at the middle of the genioglossus muscle from the palatal surface (as the roof of the tongue) to the base of the tongue muscle. In the static state, tongue thickness was recorded as 0.81 cm, whereas in the dynamic state was 0.69 cm.

In the pharyngeal phase, we measured the approximation of the hyoid-thyroid distance during static and dynamic states. The approximation of the hyoid-thyroid distance demonstrates the ability of the vocal cords to close during swallowing (Figure 3c). The thyroid cartilage and hyoid bone appear as two separate hyperechoic plaques with acoustic shadows. The distance was measured by drawing an imaginary line from the hyoid cartilage, which is located deeper into the thyroid cartilage. The hyoid-thyroid distance in the static state was 1.47 cm, while that in the dynamic state was 1.36 cm. The final calculation was obtained from the differences between the static and dynamic states and then multiplied by 100%. Based on this calculation, the approximation of hyoid-thyroid was only 7.48% which indicated poor closure of the vocal cords during swallowing in the oropharyngeal phase.

The patient refused to use the nasogastric tube; therefore, we decided to start a rehabilitation program by referring him to a speech and language therapist. Rehabilitation programs began by providing electrical stimulation to the swallowing muscles three times/week and planning up to 3 months, and educated the patient to restrict liquid dietary intake, suggested the semisolid textured diet, and taught him the Mendelsohn maneuver to prevent aspiration.



(3a)



(3b) (3c)

Figure 3. Oral and Pharyngeal Phase Ultrasonography

Figure 3a showed static oral phase. The thickness of tongue in the static and dynamic state was 0.69 mm and 0.81mm. Figure 3b and 3c showed pharyngeal phase. The hyoid-thyroid distance in the static and dynamic state was 1.47 mm and 1.36 mm.

Discussion

Dysphagia is a swallowing disorder that reduces the optimal passage of fluids and/

or food through gastrointestinal tracts and could increase the risk of aspiration, dehydration, malnutrition, and eventually mortality.[2] The incidence of pneumonia in patients with dysphagia after stroke varies from 7% to 33%.[10] Dysphagia after stroke may also lead to a significant decrease in quality of life.[11,12] The most common symptoms are repetitive swallowing to clear throat, hoarse voice, recurrent pneumonia, and cough due to food sticking.[11]

As a simple screening method for dysphagia, GUSS test can assess the swallowing function, by using indirect or direct test, and determine the severity of dysphagia that is beneficial for rehabilitation and dietary recommendation.[1] Preceding GUSS screening, patients must able to recognize the food texture, sit in bed or 60 degrees upright position, and follow the instructions from the examiner. Indirect swallowing test assesses the patient's ability to control saliva swallowing by observing the drooling and coughing reflex. Meanwhile, direct swallowing test is initiated using semi-solid, liquid, and solid consistency food. In contrast to other dysphagia screening tools which are started with liquid or water only and neglecting other consistencies, GUSS is more safe from the risk of liquid bolus than solid bolus aspiration. The evaluation criteria of aspiration are drooling, hoarse, coughing, and repetitive deglutition.[2]

The GUSS score are divided into four categories of severity (no dysphagia, slight dysphagia, moderate dysphagia, and severe dysphagia) and dietary recommendations based on the risk of aspirations. Several instructions in the GUSS test may also benefit for speech and language therapy recommendation. The GUSS score of 0-9 indicates high risk of aspiration that need full nasogastric tube feeding with nothing per oral (NPO), while score of 20 indicates normal swallowing function with no aspiration risk and no restriction of oral feeding.[1,2] If one of the subtests in direct swallowing test is unsuccessful or the patient shows any sign of aspiration, then it is suggested to continue with further functional investigations, such as VFES or FEES.[2]

The GUSS score of this patient was 10 which was classified as moderate dysphagia with a high risk of aspiration. Therefore, the dietary recommendation was a semi-solid texture with additional parenteral feeding. The use of nasogastric tubes becomes a critical point to avoid complications of aspiration pneumonia although the patient did not complain of choking during swallowing.[13] However, this bedside examination has a limitation in detection of silent aspiration and pharyngeal residues in the patient with absence of cough reflex and voice changes.[9] Clinically, we have to perform further evaluation using FEES or VFSS as the gold standard. Unfortunately, the requirement for patient transport and radiation exposure often limits the use of VFSS. In contrast, FEES has no radiation, and is less invasive yet less quantitative compared to VFSS, but higher cost and tool availability become the most hindering factors for FEES, especially in Indonesia.[14]

In addition to the GUSS test, ultrasonography may provide benefit as a screening tool to detect silent aspiration and pharyngeal residues.[16] The examination is started from tongue movement observation as the most important aspect in oral phase. The tongue surface is seen as a convex bright echogenic line describing the tongue muscle position intraorally. The tongue thickness should be observed in static and dynamic movements during swallowing.[7] After clearly described the musculature of the tongue, ultrasonography is continued by assessing the pharyngeal phase that observe the lateral pharyngeal wall motion and hyoid-thyroid bone movement.[7,8] Recent studies have identified that ultrasonography is a promising method to detect aspiration and pharyngeal residue. Ultrasonography at the level of the laryngeal prominence and above the hyoid bone would enable to visualize pyriform sinus, epiglottic vallecula, and pharyngeal residue. It is important to detect pharyngeal residues because insufficient pharyngeal clearance is a risk factor for aspiration pneumonia.[15]

In this case, ultrasonography did not find any change in tongue thickness during static and dynamic swallowing tests, while tongue movement is mandatory for bolus formation in the oral phase. Patients who have difficulty in forming a bolus easily experience delays in swallowing initiation and choking. The hyoid-thyroid distance in this patient (about 0.2 cm) had not significantly changed (or less than 61% of static distance compared to healthy subjects without dysphagia). According to the sonogram, patient with changes in tongue thickness less than 1.0 cm and hyoid bone displacement less than 1.5 cm (or less than 60%) was recommended to use tube feeding (sensitivity 70.73% and specificity 67%).[7] Therefore, the dietary recommendation for this patient was semi-solid food using a nasogastric tube.

Ultrasonography is non-invasive,

available in many health care centers in Indonesia, including primary services, and free from radiation. However, it is operator-dependent and needs the cooperation of the patients during the examination. A patient who is unable to follow instructions may cause relative dysphagia due to reduced tongue movement and hyoid-thyroid cartilage approximation during swallow tests.

Conclusion

The use of ultrasonography might improve the accuracy of dysphagia screening after stroke in the pharyngeal phase. The combination of the GUSS test and ultrasonography is expected to improve the accuracy dysphagia screening, particularly to detect silent aspiration. The examination is easy to perform, non-invasive, not expensive, provides convenient results, and could be widely used, including peripheral health services.

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