CASE REPORT

Bridge Swallowing Exercise for Stroke Patients with Gastroesophageal Reflux Disease Symptoms: A Case Series

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Background: We previously reported that swallowing in the bridge position (bridge swallowing) strengthened esophageal contractions and increased the lower esophageal sphincter pressure against gravity. Furthermore, bridge swallowing exercise improved the symptoms of gastroesophageal reflux disease (GERD) in subjects with GERD. Bridge swallowing may have the potential to strengthen esophageal peristalsis and improve GERD. In this case series, we evaluated the effect of bridge swallowing on GERD symptoms and esophageal residue observed by videofluoroscopic examination of swallowing (VF) in patients with dysphagia after stroke.

Cases: We reviewed the cases of five patients hospitalized with stroke and concurrent GERD symptoms. Dry swallowing exercises in the bridge (hip lift) position were performed ten times per day for 4 weeks. Frequency Scale for Symptoms of GERD (FSSG) questionnaire scores and esophageal residue on VF were compared before and after exercise. All patients completed the bridge swallowing exercise without adverse events and all showed improved FSSG scores after the exercise. Three patients showed improvements in esophageal residue on VF after exercise.

Discussion: Our findings indicated that the bridge swallowing exercise can improve FSSG scores. Some patients showed improved esophageal residue on VF. This exercise was performed easily and safely without adverse events. Further studies are needed to validate the effectiveness of the bridge swallowing exercise in improving GERD.

Key Words: esophageal residue; esophageal training; hip lift; peristalsis; videofluoroscopic examination

INTRODUCTION

There are many treatments for the oral and pharyngeal phases of dysphagia.1,2 However, swallowing rehabilitation treatments for the esophageal phase of dysphagia have yet to be established. We previously focused on the effects of body position and gravity on esophageal motility to enhance esophageal contractility using high-resolution manometry. We found that swallowing in the bridge position (i.e., bridge swallowing) strengthened distal esophageal contractions and increased the lower esophageal sphincter (LES) pressure to a greater degree than swallowing in the upright or supine position.3 Recently, we reported that bridge swallowing can be used as a training method to improve gastroesophageal reflux disease (GERD) symptoms.4

GERD is a condition in which gastroesophageal reflux causes either esophageal mucosal injuries, annoying symptoms, or both. GERD is generally diagnosed based on a combination of clinical symptoms, objective testing with endoscopy, reflux monitoring, and responses to anti-secretory therapy.5

The bridge swallowing exercise has been shown to have the potential to strengthen esophageal peristalsis against gravitational force. Currently, exercises to enhance esopha-
gastroesophageal motility are not widely known. Furthermore, previous studies have reported that patients with cerebral stroke have an increased risk of GERD. The aim of this case series was to determine whether dry swallowing in the bridge (hip lift) position can improve GERD symptoms without the need for additional medication in patients with dysphagia after stroke. Comparison of esophageal residue before and after the bridge swallowing exercise was performed by videofluoroscopic examination of swallowing (VF).

### CASES

We reviewed the cases of five patients hospitalized for stroke who scored 8 points or higher on the Frequency Scale for the Symptoms of GERD (FSSG) (Fig. 1), had evidence of esophageal residue on VF in the anterior–posterior (A-P) view, and did not have any of the following conditions: (1) history of major abdominal surgery, (2) severe weakness (i.e., inability to form position) or back pain, (3) inability to perform dry swallowing because of severe oropharyngeal phase disorder or dementia, and (4) taking medications that could affect upper gastrointestinal motility. All patients had experienced stroke onset within the previous 3 months and none had a history of GERD prior to admission. On initiation of the exercise intervention, all five patients received nutrition via oral intake only and had a score of 7 or higher on the Food Intake LEVEL Scale (FILS).

Informed consent was obtained in written form (including a statement that the training could be stopped at any time) from each patient prior to undergoing the exercise. This case series study was approved by the Ethics Committee of Chikamori Rehabilitation Hospital (approval number: 2022-2).

### Bridge Swallowing Exercise

The dry swallowing exercise in the bridge position was performed ten times per day for 4 weeks. The swallowing exercises were performed at 10-s intervals. To assume the bridge position, each patient laid down on a flat surface with their knees bent and hips raised, with a cushion placed under their back (i.e., a lower back support and hip lift position).

Exercises were performed on the patient’s own bed or in a rehabilitation training room, and patients were required to fast for at least 4 h before each exercise session. Exercises were performed under the guidance of a doctor, a speech–language–hearing therapist, or a nurse. Patients who had difficulty swallowing saliva had their mouth moistened with an ice stick before the exercise. FSSG scores were used to

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**Fig. 1.** The FSSG questionnaire: Frequency Scale for Symptoms of Gastroesophageal reflux disease.
compare GERD symptoms before and after exercise.

For the evaluation of esophageal residue on VF before and after the exercise, a single swallow with the same form and amount of fluid in the A-P view was monitored after the first peristalsis in the upright position. Patients with spontaneous additional swallowing of saliva were not included in the evaluation. The evaluation of esophageal residue on VF was performed by two specialist doctors of rehabilitation medicine with at least 9 years of clinical experience. In line with a previous study,9 the degree of residue was classified into one of three levels by observation as follows:

1. None or minor residue (no residue or double contrast-like esophageal wall observed);
2. Moderate residue (residue of less than approximately 50% of swallowed volume, or residue observed as mass);
3. Severe residue (residue greater than approximately 50% of swallowed volume).

Findings

Table 1 summarizes the characteristics, FSSG scores, and VF findings of each patient. All five patients who had recently experienced stroke showed improvement in FSSG scores before and after the bridge swallowing exercises. Three patients showed improvement in esophageal residue on VF. Figure 2 shows the VF findings for patient 4. In a single swallow of 5 cc of barium water, an esophageal residue (level 3) was observed before exercise; however, no residue (level 1) was observed after exercise.

DISCUSSION

Recently, we reported that the bridge swallowing exercise significantly improves FSSG scores for subjects with GERD symptoms.4 In the current case series, we found that the exercise of dry swallowing in the bridge (hip lift) position can improve GERD symptoms and esophageal residue in patients with dysphagia after stroke.

Our most important finding was the improvement in FSSG scores in all five patients after the exercise. We previously reported changes in esophageal motility according to changes in position while swallowing, where distal esophageal contractions, integrated relaxation pressure, and esophagogastric junction pressure (free of swallows) became stronger against gravity.3 These past results suggested that the bridge swallowing exercise increased esophageal contractions and LES pressure. Such changes may help to explain the improvements in acid clearance and prevention of gastroesophageal reflux. In addition, the ability to improve esophageal motility may be of clinical importance for improving outcomes in patients with GERD symptoms. A second important finding was that although this was a small case series, three of the five patients showed improvement in esophageal residue on VF.

In this study, we selected patients with stroke because our hospital specializes in convalescent rehabilitation and is occupied by a large number of patients with stroke. Moreover,
previous studies have reported an increased risk of GERD in patients with stroke. Further studies are needed to determine the effectiveness of bridge swallowing exercises in patients with other diseases and in those with GERD.

Notably, all patients completed the exercise without adverse events. This result suggested that the task of dry swallowing in the bridge position ten times each day was not difficult to complete. The exercise did not require the measurement of position angles with specialized equipment and could be performed in comfort with several cushions.

No adverse events were observed in any of the patients. Although other patients with stroke and concurrent GERD were admitted to our institution, not all were eligible because of severe weakness (i.e., inability to attain position), dementia, back pain, or inability to perform dry swallowing because of oropharyngeal dysphagia. The efficacy and long-term therapeutic effects of bridge swallowing exercises are unknown and need to be compared with the conventional treatment for GERD and should be studied in a larger number of participants.

Although the efficacy of lifestyle change has been reported for GERD, there have been few reports of the effectiveness of swallowing rehabilitation treatments. Bridge swallowing exercises might improve GERD symptoms. Further studies are needed to evaluate patient esophageal motor function before and after bridge swallowing exercise using devices, such as high-resolution manometry, for validation and to compare the effectiveness of bridge exercise with medications and other conventional management strategies for GERD.

The present case series has several limitations. First, data were collected from a small sample size. Further studies should include a larger sample size and a control group. Given that this case series did not include a control group, the improvement in FSSG scores was not caused by a placebo effect. Second, the body angle of each patient while in the bridge position was not specifically measured. However, this is also an inherent advantage of this method because it can be performed anywhere if a cushion is available. Third, despite the improvement of GERD symptoms after the exercise, the long-term effects were not evaluated and are therefore unknown. Finally, although the patients were deemed at high risk of GERD based on FSSG scores, they were not objectively diagnosed with GERD by endoscopy. Future studies should also include severe cases of GERD that are diagnosed based on endoscopic findings. Regarding the use of VF for assessment of esophageal residue, specific protocols should be established, such as the exact volume of thickened water administered in one swallow before and after exercise.

**CONCLUSION**

A program of bridge swallowing exercises improved FSSG scores in patients with stroke. Some patients also showed im-

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**Fig. 2.** VF findings for patient 4. In a single swallow of 5 cc of barium water, an esophageal residue (level 3) was observed before training (left), whereas no residue (level 1) was observed after training (right).
proved esophageal residue on VF after exercise. In this case series, the exercise was performed easily and safely without adverse events. However, further multicenter prospective studies are needed to validate the effectiveness of the bridge swallowing exercise in improving the symptoms of GERD.

**CONFLICTS OF INTEREST**

The authors have no conflicts of interest to declare.

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