

Compliance and effect of thickener use in dysphagia patients with brain lesions

An observational pilot study

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Abstract

The study aimed to investigate the status of thickener use in dysphagia patients with brain lesions and incidence of adverse events based on fluid viscosity. Twenty dysphagia patients with brain lesions who were recommended to use thickeners following a videofluoroscopic swallowing study were enrolled in this observational pilot study. Patients were educated to use thickener as level 2 or 3 based on the International Dysphagia Diet Standardization Initiative flow test. We evaluated the viscosity of the fluid that patients drank once a week for 2 weeks, and reviewed medical records regarding adverse events. Patients were divided into 2 groups based on the average value obtained from the viscosity evaluations as thin (Levels 0–2) and thick fluid groups (Levels 3–4). Adverse events were compared between the groups. The number of patients who did not follow the recommendations increased from 35.0 to 45.0% during the 1-week follow-up period. No patient developed pneumonia or urinary tract infection. Constipation ($P = 0.338$) and dehydration status ($P = 0.202$) were not significantly different between the 2 groups. In 2 evaluations for 20 patients, 40.0% of the cases did not follow the educated viscosity, and the number gradually increased in the follow-up evaluation. Considering that there were no significant differences in the incidence of adverse effects including pneumonia according to the fluid viscosity, a further study is necessary to establish detailed criteria for thickener use in dysphagia patients with brain lesions.

Abbreviations: BUN = blood urea nitrogen, IDDSI = International Dysphagia Diet Standardization Initiative, UTI = urinary tract infection.

Keywords: brain lesion, dysphagia, stroke, thickener, viscosity-modified diet

1. Introduction

Dysphagia is defined as any disruption in the swallowing process. Various medical conditions attribute to dysphagia, including neurologic diseases such as stroke, dementia, and traumatic brain injury; progressive diseases such as Parkinson disease; and rheumatoid diseases such as polydermatomyositis and progressive systemic sclerosis.^[1] Approximately 40% of dysphagia patients showed aspiration of fluids or food materials after stroke.^[2] One study of stroke patients reported that the risk of pneumonia was higher in stroke patients with aspiration than those with dysphagia alone. There are various strategies to minimize aspiration risk, including postural compensation techniques and use of texture-modified foods and thickened liquids.

Several studies reported that thickened liquids were aspirated less often than thin liquids.^[3,4] Thickened liquids flow slower than thin liquids, which provides dysphagia patients enough time to engage airway closure before the liquids arrive at the entrance of the larynx and airway.^[5] However, the use of thickened liquids has several disadvantages including poor patient

compliance, patient reluctance to taste and texture,^[6] and increased residue in the pharynx.^[7]

Previous studies on whether the use of thickeners reduces the incidence of pneumonia are controversial. One study regarding patients with pseudobulbar dysphagia reported that patients receiving a soft mechanical diet with thickened liquids showed lower incidence of pneumonia than patients with a pureed diet with thin liquids.^[8] Conversely, 1 systematic review reported that patients who took thin liquids with safety strategies or who took only thickened liquids showed no significant difference in the risk of pneumonia.^[9]

However, no studies measured the viscosity of thickened liquids ingested by patients. Therefore, no studies have evaluated the correlation between pneumonia incidence and the viscosity of thickened liquids ingested by patients.

This study aimed to investigate the viscosity of the thickened fluids consumed by dysphagia patients with brain lesions and evaluate the incidence of adverse events according to the viscosity of these liquids.

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2. Methods

2.1. Participants

This was a prospective, observational, pilot study conducted to identify the status of viscosity-modified diets in dysphagia patients with brain lesions. The study was approved by the Institutional Review Board of our hospital and informed consent was obtained from each patient (approval number 2019-0518).

We enrolled 20 patients who were admitted to the Department of Physical and Rehabilitation Medicine of our hospital from July 2019 to December 2020. Since this was a pilot study, the sample size was not calculated. The following inclusion criteria were applied: (a) age ≥ 19 years at diagnosis; (b) patients diagnosed with brain lesions including stroke, traumatic brain injury, and brain tumor; (c) patients who had a penetration aspiration scale (PAS) score of ≥ 2 in thin fluids on a videofluoroscopic swallowing study (VFSS); and (d) patients who had been recommended to use thickeners in the VFSS. The following patients were excluded: (a) patients with a history of head and neck cancer; (b) patients with severe cognitive impairment; (c) patients with oral thrush or active oral infection; (d) patients diagnosed with progressive or infectious neurologic disease; (e) patients who needed restriction of water due to medical condition; (f) patients with a history of severe pulmonary disease; and (g) patients who had been diagnosed of pneumonia within 4 weeks.

2.2. Methods

This study was conducted on patients admitted or transferred to the Department of Physical Medicine and Rehabilitation of our hospital. Patients who had undergone VFSS prior to admission to the department received education on the use of thickeners the day after hospitalization or transfer. The patients who did not undergo VFSS prior to admission or transfer received education on the use of thickeners the day after undergoing VFSS. The recommended viscosity of fluid was nectar-thick or honey-thick, which is consistent with the International Dysphagia Diet Standardization Initiative (IDDSI) Flow test level 2 or 3, respectively. After education, all patients or caregivers were asked to submit the thickened fluid they actually drink once a week for 2 weeks.

The primary outcome of this study was the viscosity of the thickened fluid that the patients drank. We measured the viscosity of the thickened fluid using IDDSI Flow test. IDDSI Flow test is an objective measurement for liquid thickness using a 10 mL syringe. This test categorizes fluids into 5 levels as follows; level 0 (thin), level 1 (slightly thick), level 2 (mildly thick), level 3 (moderately thick), and level 4 (extremely thick).^[10] All tests were conducted by 1 researcher.

The following data were obtained from medical records: 1) incidence of pneumonia; 2) incidence of urinary tract infection (UTI); 3) incidence of constipation; and 4) dehydration status measured by blood urea nitrogen (BUN) to creatinine ratio at discharge. All data from the medical records were followed till the patients were discharged from our hospital and up to 1 month subsequently. The patients were divided into the following 2 groups based on the average value of 2 viscosity

evaluations: a thin fluid group (levels 0–2) and a thick fluid group (levels 3–4). Adverse events, including pneumonia, UTI, constipation, and dehydration status, were compared between the 2 groups. Patients with fluid viscosity below level 1 at the second evaluation were interviewed for reasons of not following the recommended viscosity.

2.3. Statistical analysis

Statistical analysis was performed using IBM SPSS version 25.0 (IBM Corp., Armonk, NY) and representative values were expressed as mean \pm standard deviation or percentages. The student *t*-test and Pearson Chi-square test were used for continuous variables and categorical variables, respectively. A *P* value of < 0.05 was considered statistically significant.

3. Results

Of the 21 patients enrolled, 20 patients completed the evaluation (21 males, median age of 73.5 years). One patient dropped out because the VFSS result after enrollment concluded that he did not require a thickener. The diagnoses of the enrolled patients were ischemic stroke (65%), hemorrhagic stroke (15%), brain tumor (10%), and traumatic brain injury (10%). The average duration of onset for dysphagia was 42 days.

In the first evaluation, 15.0% of patients drank fluid thinner than recommended and 20.0% drank thicker fluids. During the second evaluation, 30.0% of patients drank fluid thinner than recommended and 15.0% drank thicker fluids. In 2 evaluations for 20 patients, 60.0% of the cases followed the educated viscosity and 40.0% did not follow. The distribution of fluid viscosity for the 20 patients in the first evaluation was as follows: level 0 (1, 5.0%); level 1 (2, 10.0%); level 2 (7, 35.0%); level 3 (6, 30.0%); and level 4 (4, 20.0%). In the second evaluation, it was as follows: level 0 (4, 20.0%); level 1 (2, 10.0%); level 2 (6, 30.0%); level 3 (5, 25.0%); and level 4 (3, 15.0%) (Table 1). The change in fluid viscosity between measurements was as follows: sustained (12, 60.0%); increased (1, 5.0%); and decreased (7, 35.0%) (Fig. 1).

The average of total hospital days after thickener use was 25.1 days. No pneumonia or UTI occurred in any of the patients. Constipation was observed in 14 patients; however, no significant difference was observed between the 2 groups ($P = 0.202$). Dehydration status at discharge was measured by BUN to creatinine ratio at discharge and there was no significant difference between the 2 groups ($P = 0.338$) (Table 2).

Four patients whose fluid viscosity was evaluated below level 1 which is thinner than recommended on the second evaluation were interviewed regarding the reasons for not following the recommended viscosity. Their responses were dissatisfaction with taste (2 patients) and texture (2 patients).

4. Discussion

This is the first study investigating the viscosity of liquids drank by dysphagia patients and the difference in the incidence

Table 1

Distribution of the viscosity of the fluids ingested by the patients.

Variables	1 st evaluation (n = 20)	2 nd evaluation (n = 20)	Average value of evaluations (n = 20)
IDDSI Flow test level			
0 (thin)	1 (5.0)	4 (20.0)	1 (5.0)
1 (slightly thick)	2 (10.0)	2 (10.0)	3 (15.0)
2 (mildly thick)	7 (35.0)	6 (30.0)	6 (30.0)
3 (moderately thick)	6 (30.0)	5 (25.0)	7 (35.0)
4 (extremely thick)	4 (20.0)	3 (15.0)	3 (15.0)

IDDSI = International Dysphagia Diet Standardization Initiative.

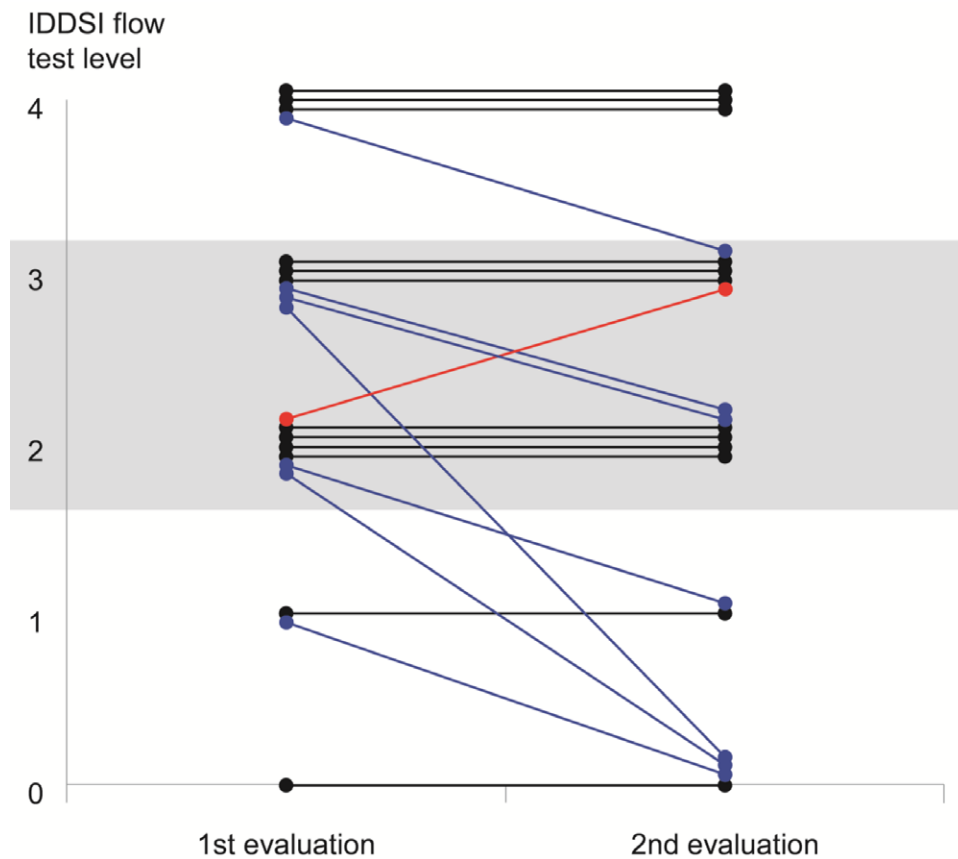


Figure 1. Change in the viscosity of the fluid ingested by the patients (n = 20). Each dot represents the IDDSI Flow test level of each patient, and the lines indicate the change in the level during 2 different evaluations. The shaded area indicates the recommended viscosity level. Black, blue, and red lines mean sustained, decreased, and increased viscosity levels during 2-interval tests, respectively.

Table 2

Adverse event after thickener use.

Variables	Values	P-value
The number of pneumonia events during admission (%)	0 (0)	
Urinary tract infection (%)	0 (0)	
Dehydration status (BUN/Cr)		
Thin fluid group (average ± SD)	24.6 ± 13.9	0.338
Thick fluid group (average ± SD)	19.3 ± 7.7	
Constipation	14 (70.0)	
Thin fluid group (%)	9 (81.8)	0.202
Thick fluid group (%)	5 (55.5)	

BUN/Cr = blood urea nitrogen to creatinine ratio, SD = standard deviation.

of adverse events according to the viscosity of the liquids. In previous studies, compliance with a viscosity-modified liquid diet was only approximately 50% among Korean dysphagia patients^[6] and approximately 80% among those from New Zealand.^[10] These studies did not measure the viscosity of the liquid. Instead, they measured compliance of viscosity-modified liquid according to patients' interview. In our study, 19 of 20 patients (95%) replied that they used thickeners when they drank fluids. However, in the 2 evaluations, 35% and 45% of patients did not follow the recommended viscosity, respectively.

In our study, we evaluated the viscosity twice and 7 of 20 patients (35.0%) showed reduction of viscosity use in a 1-week interval, which suggests that compliance declines progressively. This result is consistent with a previous study which reported that only 40.5% of outpatients maintained thickener use,

compared to only 90.0% of inpatients, implying that patients' compliance gradually decreased.^[6]

We interviewed patients whose liquid viscosities were thinner than recommended at the second evaluation for noncompliance with the recommended viscosity. Among the 4 patients, dissatisfaction with texture or taste was the reason for thinner viscosities. This is in accordance with a previous study which reported that the main reason for patient noncompliance is dissatisfaction with the product.^[11]

There was no significant difference in the incidence of adverse events, including pneumonia, between the 2 groups in our study. The incidence of pneumonia with the use of thickened liquids remains controversial. One systematic review reported that there was no significant difference in the risk of aspiration pneumonia between patients who received thin liquids with safety strategies and those who received thickened liquids only.^[9] However, another study reported that noncompliant patients had more hospital admissions for chest infections or aspiration pneumonia.^[12] In our study, no pneumonia occurred in any patient. Therefore, there is a possibility that the use of thickeners may not be necessary for some patients, and further studies are recommended to establish the application of thickeners only to limited patients.

There were no significant differences in adverse events such as UTI and constipation, which were thought to be adverse events of dehydration after thickener use, between the thin and the thick fluid groups. One randomized-controlled trial reported that UTIs were diagnosed more in the thickened liquids only group than in the water protocol group, which permitted patients to drink water between meals even though they showed aspiration with thin fluid on VFSS; however, there were no significant differences in dehydration or constipation between the 2 groups.^[13]

One study reported that both nectar-like and honey-like thickened liquids are recommended as a compensatory strategy to improve swallowing safety.^[3] However, to the best of our knowledge, there is no common guideline for the exact viscosity level of liquids in dysphagia patients.^[14,15] Our institute recommends nectar-like or honey-like thickened liquids similar to the aforementioned study.

In our study, we showed that a significant number of patients did not follow the recommended viscosity of liquids. Noncompliant patients who drank thinner liquids than recommended at the second evaluation reported that they were dissatisfied with the texture and taste of thickeners. However, there were no significant differences in adverse events including pneumonia, UTI, constipation, and dehydration. We recommend that a further study is necessary to establish detailed criteria for thickener use in these patients.

This study had some limitations. We could not follow-up the patients for a long period since our hospital is a tertiary hospital where only acute-stage patients are hospitalized for <1 month. Further randomized controlled studies are needed to compare the compliance and adverse events according to the level of viscosity with a long-term follow-up period. Furthermore, this study did not include patients with various brain diseases. As this was a pilot study conducted in a single hospital, we only included patients with stroke, traumatic brain injury, and brain tumor which are common in our center. Further studies are needed to include more brain diseases, such as multiple sclerosis, acute disseminated encephalomyelitis, sequelae of meningoencephalitis, cerebral palsy, and Parkinson disease.

5. Conclusion

In 2 evaluations for 20 patients, 40.0% of the cases did not follow the educated viscosity, and 35.0% of patients showed decreased viscosity compliance in the follow-up evaluation. Considering that there were no significant differences in the incidence of adverse effects including pneumonia according to the fluid viscosity and that patients were dissatisfied with taste and texture of thickened fluids, a further study is necessary to establish detailed criteria for thickener use in dysphagia patients with brain lesions.

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Author contributions

Hyejoon Ahn : Data curation, Formal analysis, Investigation, Writing-original draft

Junekyung Lee : Methodology, Supervision, Writing-review&editing

Minho Chun : Conceptualization, Supervision, Writing-review&editing

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