



Relationship between swallowing dynamics and suprahyoid muscle activity in sarcopenic dysphagia

Moon-Jung Kim M.D., Kang-Hyeok Kim M.D., Han-Young Jung M.D. , Tai-Hyun Kim O.T., Kyung-Lim Joa M.D.
Department of Physical & Rehabilitation Medicine, College of Medicine, Inha University, Incheon, Republic of Korea.

Introduction

Sarcopenic dysphagia is defined as swallowing difficulty among the elderly due to the loss of whole body skeletal and swallowing muscle mass and function. However, the pathophysiology and dynamics of swallowing in sarcopenic dysphagia have been poorly investigated. Therefore, the present study aims to investigate the characteristics of sarcopenic dysphagia using the Videofluoroscopic Dysphagia Scale (VDS) focusing on each phase of dysphagia, and surface Electromyography (surface EMG) to assess suprahyoid muscle activity.

METHOD

We enrolled 34 patients aged 65 years or older who underwent a videofluoroscopic swallowing study (VFSS) and were diagnosed with sarcopenia based on the cutoff values of the Asian Working Group for Sarcopenia (AWGS) 2019. Patients with a disease that was an obvious cause of dysphagia were excluded. The study outcomes were measured using the VDS, Penetration Aspiration Scale (PAS), Parramatta hospital's assessment of dysphagia (Parramatta) and the American Speech-Language-Hearing Association National Outcome Measurement System swallowing scale (ASHA-NOMS scale). Suprahyoid muscle activity was assessed after the VFSS by surface EMG. We divided the patients into 2 groups based on PAS score. Patients with a PAS score of 3 points or higher were considered to have dysphagia. The Mann-Whitney test, Independent T-test were applied to compare the parameters between the non-dysphagic group and the dysphagic group.

RESULTS

Among the 34 patients, 24 were in the dysphagic group. Among the subscores of VDS, significant differences were observed between the 2 groups in premature bolus spillage ($p=0.004$) and laryngeal elevation ($p=0.031$), aspiration ($p<0.001$) as well as VDS-Oral phase score (VDS-O) ($p=0.034$), VDS-Pharyngeal phase score (VDS-P) ($p=0.007$) and VDS-Total score (VDS-Total) ($p=0.003$). Additionally, the Parramatta hospital's assessment of dysphagia was significantly lower in the dysphagic group ($p=0.046$)(Table 1). In surface EMG, mean peak to end duration was significantly longer in the dysphagic group ($p=0.03$)(Table 2). Moreover, although not statistically significant, there were trends of higher bolus formation score and a lower ASHA-NOMS scale ($p=0.065$) in the dysphagic group compared to the non-dysphagic group (Table 1).

CONCLUSION

In sarcopenic dysphagia, impairments occur in both the oral and pharyngeal phases, particularly affecting bolus formation, premature bolus spillage and laryngeal elevation during swallowing due to the loss of swallowing muscle mass and function. This is considered to have led to an increase in the peak to end duration of suprahyoid muscle activity measured via surface EMG.

Table 1. Comparison of VDS, Parramatta and ASHA-NOMS in the Non-Dysphagic and Dysphagic groups

	Non-Dysphagic group (N=10)	Dysphagic group (N=24)	<i>p</i> -value
Bolus formation	1.80 (2.098)	3.00 (0.89)	0.086
Tongue to plate contact	5.50 (2.838)	7.50 (3.297)	0.109
Premature bolus spillage	0.60 (1.26)	2.438 (1.39)	0.004*
Oral transit time	0.9 (1.45)	1.13 (1.48)	0.752
Triggering of pharyngeal swallowing	1.35 (2.17)	2.79 (2.21)	0.159
Laryngeal elevation	3.60 (4.65)	7.88 (3.04)	0.031*
Aspiration	1.8 (2.898)	9.25 (3.05)	<0.001*
VDS-O	9.17 (9.68)	13.44 (6.19)	0.034*
VDS-P	30.75 (21.094)	31.33 (11.95)	0.007*
VDS-Total	30.75 (21.09)	51.75 (16.14)	0.003*
Parramatta	87.60 (10.27)	79.58 (17.13)	0.046*
ASHA-NOMS (level)	5.2 (1.87)	3.7 (2.14)	0.072

* $p < 0.05$
PAS: Penetration-Aspiration Scale, VDS-O: Videofluoroscopic Dysphagia Scale-Oral phase, VDS-P: Videofluoroscopic Dysphagia Scale-Pharyngeal phase, VDS-T: Videofluoroscopic Dysphagia Scale-Total, Parramatta hospital's assessment of dysphagia (Parramatta), American Speech-Language-Hearing Association National Outcome Measurement System swallowing scale (ASHA-NOMS scale)

Table 2. Comparison of surface EMG parameters in the Non-Dysphagic and Dysphagic groups

	Non-Dysphagic group (N=10)	Dysphagic group (N=24)	<i>p</i> -value
Mean amplitude (%JOC)	157.5 (106.87)	117.86 (57.12)	0.381
Max amplitude (%JOC)	348.72 (253.56)	247.68 (123.07)	0.696
Mean total duration (s)	3.29 (0.89)	3.31 (0.72)	0.724
Mean onset to peak duration (s)	2.14 (0.87)	1.89 (0.56)	0.445
Mean peak to end duration (s)	1.13 (0.21)	1.42 (0.36)	0.018*

* $p < 0.05$
Surface EMG: Surface electromyography, JOC: Jaw Opening Contraction, s: seconds