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Characteristics and Risk Factors Associated with Aspiration in Lateral Medullary Infarction

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Objectives
Dysphagia is a common symptom of lateral medullary infarction (LMI). The frequency of dysphagia is approximately 57% to 69%, and severe dysphagia and its complication are common in patients with LMI. But the characteristics and risk factors of dysphagia and aspiration were still unclear. Therefore, this study aimed to evaluate the characteristics of dysphagia and risk factors for aspiration or penetration in patients with pure LMI.

Methods
51 subjects with LMI who underwent a first videofluoroscopic swallowing study(VFSS) from onset were enrolled retrospectively from January 2014 to January 2019. To evaluate the oral and pharyngeal functions quantitatively, VFSS findings with Thin liquid (IDDSI level 0) and puree (IDDSI level 4) were assessed using the functional dysphagia scale (FDS) and imaging analysis software, DIPP-Motion V2D (DITECT co, Japan). The penetration-aspiration scale (PAS) was also used to assess the degree of aspiration. Student t-tests and chi-square test were used to compare the aspiration/penetration group and non-aspiration/penetration group. Multiple linear regression analyses with forward step wise method were conducted to evaluate statistically significant risk factors.

Results
The aspiration or penetration were detected in 33(64.7%) of 51 patients. Post-swallowing aspiration was common in puree (60.0%) but pre-swallowing aspiration was common in thin liquid (72.6 %). The common abnormal VFSS findings were delayed triggering of swallow, residue in valleculae, residue in pyriform sinuses and coating of pharyngeal wall after swallow in order (Figure 1). Among general characteristics, age was significantly related to aspiration or penetration incidence in all types of viscosity. The FDS subscores of residue in valleculae, residue in pyriform sinuses and pharyngeal transit time (PTT) were higher in aspiration/penetration group than non-aspiration/penetration group while swallowing puree. The FDS subscores of triggering of pharyngeal swallow, residue in

valleculae, residue in pyriform sinuses and coating of pharyngeal wall were higher in aspiration/penetration group than non-aspiration/penetration group while swallowing thin liquid (Table 1, $p<0.05$). Multiple linear regression analyses showed that residue in pyriform sinuses, PTT were significant risk factors for aspiration or penetration on puree trial. On the other hand, the prolonged pharyngeal delay time (PDT), residue in valleculae and coating of pharyngeal wall were significant risk factors on thin liquid trial (Table 2).

Conclusion

The results revealed that dysphagia in patients with LMI mainly resulted from pharyngeal dysfunction, and the risk factors of aspiration or penetration were different according to the viscosity of the bolus in patients with LMI.

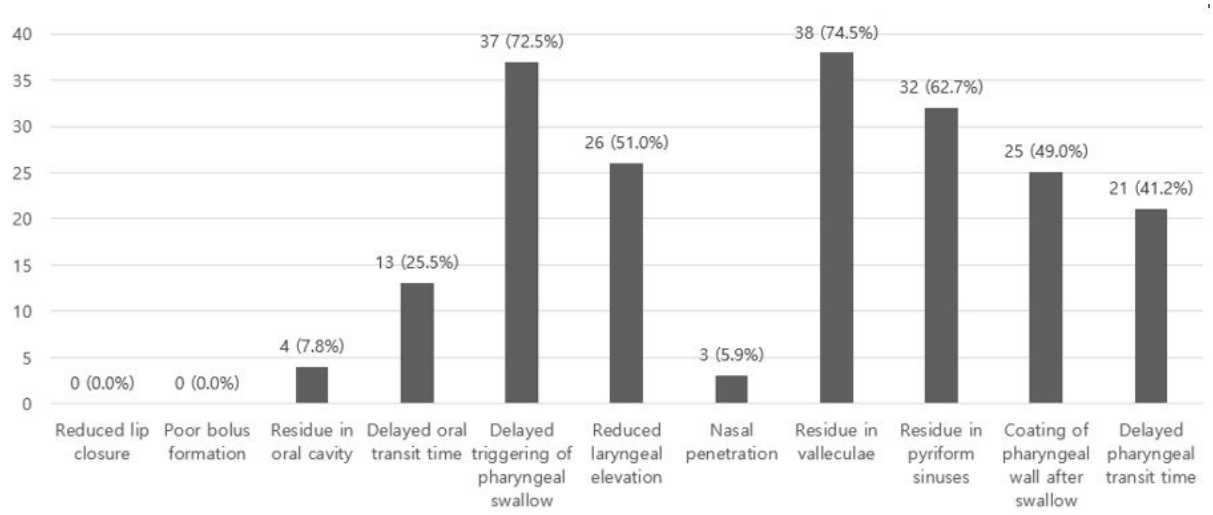

Figure 1. Frequency of patents who showed abnormal findings of functional dysphagia scale (FDS) in lateral medullary infarction (LMI)

Table 1. Comparison functional dysphagia scale (FDS) according to Aspiration/Penetration in lateral medullary infarction

Factors	Puree		Thin liquid	
	Aspiration/Penetration	Non-Aspiration/Penetration	Aspiration/Penetration	Non- Aspiration/Penetration
	n=14	n=37	n=22	n=19
Lip closure	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Bolus formation	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Residue in oral cavity	0.14±0.54	0.16±0.55	0.00±0.00	0.00±0.00
OTT	1.71±2.81	0.81±2.08	0.00±0.00	0.00±0.00
Triggering of pharyngeal swallow	5.71±5.14	6.49±4.84	5.91±5.03*	3.68±4.96
Laryngeal elevation	3.43±5.67	3.89±5.70	4.91±6.04	3.16±5.43
Nasal penetration	0.57±1.45	0.00±0.00	0.18±0.85	0.00±0.00
Residue in valleculae	8.00±2.72*	3.89±3.60	4.73±2.93**	1.68±2.43
Residue in pyriform sinuses	10.00±2.60**	3.03±13.93	4.73±3.18**	1.26±3.00
Coating of pharyngeal wall after swallow	5.71±5.14	4.59±5.05	6.82±4.77**	1.05±3.15
PTT	2.57±1.99*	1.30±1.90	0.00±0.00	0.00±0.00
Total FDS	38.29±8.84**	24.38±15.47	27.00±11.44**	11.79±10.73

Values are presented as mean±standard deviation
OTT: Oral Transit Time ; PTT: Pharyngeal Transit Time
*P<0.05
**P<0.01

Table 2. Linear Regression of Risk Factors for Aspiration/penetration

	Simple		Multiple	
Variable	**β**	**P-value**	**β**	**P-value**
Puree				
Age	0.050	0.030		
Residue in valleculae	0.273	0.003		
Residue in pyriform sinuses	0.331	0.000	0.305	0.000**
PTT	0.163	0.011	0.108	0.040*
Thin liquid				
Age	0.074	0.004		
PDT	4.798	0.016	3.815	0.022*
Residue in valleculae	0.485	0.000	0.382	0.002**
Residue in pyriform sinuses	0.381	0.001		
Coating of pharyngeal wall after swallow	0.317	0.000	0.157	0.047*

PTT: Pharyngeal Transit Time ; PDT: Pharyngeal Delay Time

*P<0.05

**P<0.01