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Correlation of swallowing function with bilateral diaphragm movement in hemiplegic stroke patient

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Introduction

Stroke Patients with breathing difficulty may have swallowing difficulty because of brief apnea occurring in swallowing process. The objective of this study was to record bilateral diaphragm movement and swallowing function in stroke patients using fluoroscopy at the same time. To identify the correlation of severity of dysphasia with motor function of hemiplegic side, and bilateral diaphragm movement in stroke patients.

Methods

This was a prospective cross-sectional study that assessed inpatients diagnosed as hemorrhagic or ischemic stroke who were referred to rehabilitation department, Pusan University Hospital. 60 subjects who have been diagnosed as stroke and had been requested for dysphagia evaluation were initially enrolled. Finally, 47 patients (28 men, 19 women, Age 66.4 ± 12.8) satisfied our inclusion criteria and were included in the study. Video fluoroscopic swallowing study was performed to evaluate patients' swallowing function.. Penetration aspiration scale (PAS) scale was assessed to grade the depth of airway invasion during video fluoroscopic swallowing evaluation Patients were divided into two groups according to the PAS scale: 1 to 5 were considered as normal, and 6 to 8 were considered as impaired. Diaphragmatic movement was measured by peak to peak distance during spontaneous breathing and forced deep respiration in supine position. Spearman correlation analysis was used to confirm the correlation between swallowing function with diaphragm movement. Mann-Whitney test was used to investigate compare the diaphragm movement between the two groups after dividing into two groups using the PAS scale. A p-values <0.05 were considered to indicate statistical significance.

Results

We found a relationship between the decreased function of swallowing and breathing. There are statistically significant negative correlations between PAS with diaphragm movement of ipsilateral side during spontaneous (rho=-0.340, p=0.019) and forced breathing (rho=-0.379, p=0.009). Also there is statistically significant negative correlation between PAS with diaphragm movement of contralateral side during forced breathing (rho=-0.318, p=0.030). (Figure 1). We divided the two groups according to the amount of residue and confirmed the diaphragm movement difference between the two groups. There are statistically significant difference of diaphragm movement between two groups, divided by amount of residue, during forced breathing in ipsilateral side (Mann-Whitney U=172.5, p=0.028) (Table 1).

Conclusion

In this study, we demonstrated that the extent of diaphragm movement of ipsilateral side during forced and spontaneous breathing and contralateral side during forced breathing as accessed via fluoroscopic examination correlated with patients' swallowing function. Therefore, we can predict insufficient respiration due to decreased diaphragmatic movement by evaluating swallowing function with performing VFSS of post-stroke patient.

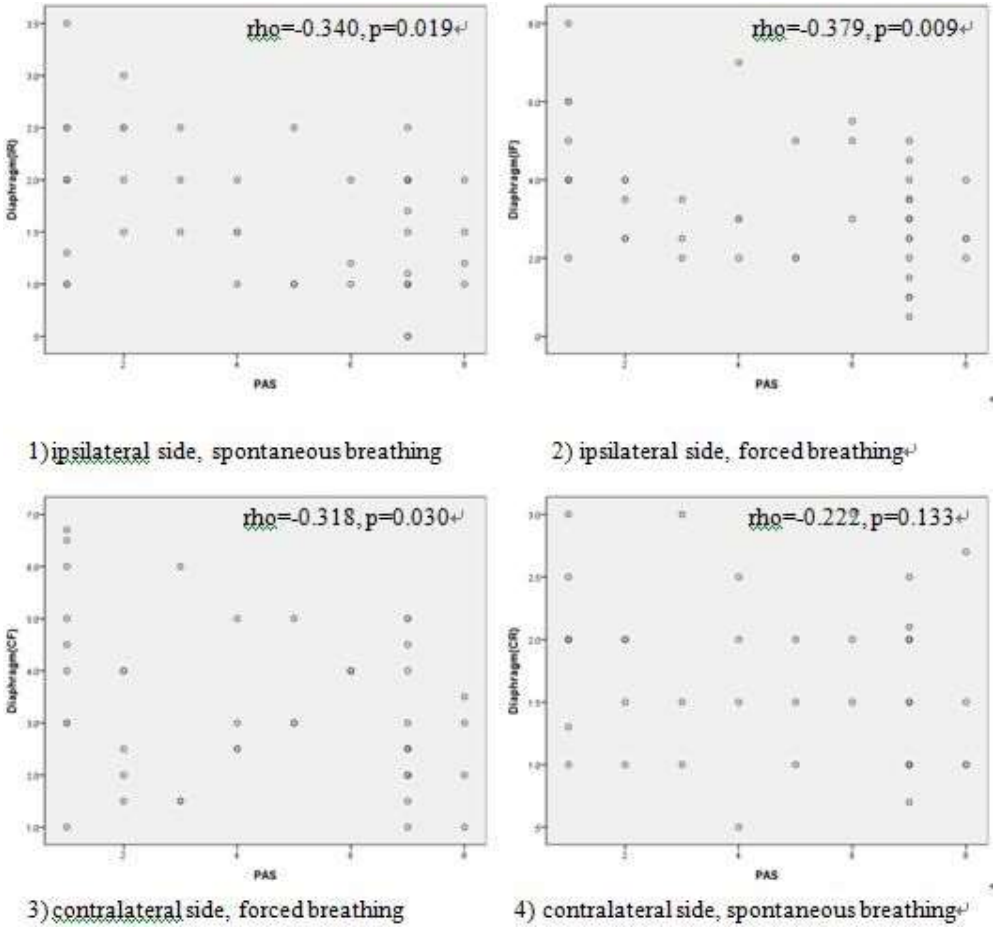

Fig 1. Scatter plot for PAS and diaphragm movement

Table 1. Difference of diaphragm movement

	IS		IF		CS		CF	
	Mann-Whitney U	P value	Mann-Whitney U	P value	Mann-Whitney U	P value	Mann-Whitney U	P value
PAS	179.0	0.035	206.0	0.133	238.0	0.404	204.0	0.123
Residue	194.5	0.079	172.5	0.028	243.5	0.489	278.0	0.949

PAS; Penetration aspiration scale, IS; Ipsilateral Spontaneous, IF; Ipsilateral Forced, CS; Contralateral Spontaneous, CF; Contralateral Forced