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Original

Predicting the Prognosis of Swallowing Function in Stroke Patients with Dysphagia Using the Videofluoroscopic Dysphagia Scale

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Abstract: The aim of the present study was to evaluate the correlation between parameters of the videofluoroscopic dysphagia scale (VDS) and the outcome of dysphagia to determine the usefulness of the VDS in patients admitted to convalescent rehabilitation wards. Patients ($n = 23$) with stroke-related dysphagia admitted to our rehabilitation hospital between April 2007 and March 2009. Medical records and videofluoroscopy findings on admission to hospital were reviewed retrospectively and the VDS score was calculated by adding individual VDS parameters. Subjects were divided into two groups: those who were able to ingest orally without tube feeding before discharge (Group 1) and those who still needed tube feeding on discharge (Group 2). The VDS scores were compared between the two groups. There were no significant differences in any individual parameter on the VDS between the two groups. However, the total VDS score was significantly lower in Group 1 patients ($p < 0.05$), as was the time from stroke onset to admission to our hospital ($p < 0.05$). There were no significant differences in any other parameters evaluated. The findings of the present study suggest that the total VDS score may be useful in predicting the prognosis of stroke-related dysphagia.

Key words: dysphagia, stroke, activities of daily living, videofluoroscopic dysphagia scale, videofluoroscopy

Introduction

Current dysphagia tests include videofluoroscopy (VF)¹⁻¹⁴ and fiberoptic endoscopic evaluation of swallowing (FEES)^{1,2,15}. VF is regarded as the gold standard in clinical practice¹. Although VF is useful for the direct evaluation of the status of dysphagia, it is not easy to predict the outcome of swallowing rehabilitation on the basis of the results obtained using VF during the acute stage^{2,3,15} because various factors influence the eating / swallowing function, including the presence or absence of aspiration in the pharyngeal phase, cognition,

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masticatory function in the oral phase, taste, digestive function, and the ability to maintain a sitting position. In addition, the swallowing condition at the time of examination does not always reflect the state of typical nutritional intake in daily life⁴⁾. However, recently, the importance of predicting the outcome of swallowing rehabilitation in clinical practice has been emphasized with the widespread application of early stroke rehabilitation⁵⁻⁷⁾. This information is particularly important in convalescent rehabilitation wards that are not part of an acute-phase hospital because, in many cases, in these kinds of wards it is difficult to perform percutaneous endoscopic gastrostomy (PEG)¹⁶⁾ after admission. On planning swallowing rehabilitation, it is particularly important to predict whether the ability to ingest substances orally is likely to return. Many studies have investigated various prognostic factors and reported that the outcome of swallowing rehabilitation is correlated with aspiration on VF^{2,5,7-9)} reduced pharyngeal sensation⁸⁾, motor function^{5,10)}, activities of daily living (ADL)^{2,17,18)}, the presence of a bilateral lesion^{5,10)}, and psychiatric symptoms¹⁹⁾. In 2007, Han *et al* proposed the videofluoroscopic dysphagia scale (VDS)¹⁴⁾, which facilitates the quantitative evaluation of VF findings, and demonstrated a correlation between the total VDS score and an ability/inability to ingest food 6 months after the onset of stroke. In the present study, we evaluated the correlation between the VDS and other parameters of stroke to determine the usefulness of the VDS in patients admitted to convalescent rehabilitation wards in Japan.

Methods

Subjects

The subjects of the present study consisted of 23 patients with stroke who had been admitted to the convalescent rehabilitation ward in our hospital between April 2007 and March 2009 (18 men and five women; 15 with cerebral infarction and eight with cerebral hemorrhage). None of the patients was able to ingest food orally and thus they required tube feeding. Mean patient age was 77.1 ± 8.6 years. The mean time from stroke onset to admission to the rehabilitation ward was 47.1 ± 9.9 days and the mean duration of hospitalization was 129.1 ± 26.2 days. Of the 23 patients enrolled in the present study, 14 had undergone PEG prior to admission to the rehabilitation ward.

Procedures

After reviewing the subjects' medical records and VF findings upon admission to the rehabilitation ward, we calculated a VDS score for each patient as outlined by Han *et al*¹⁴⁾. In addition, we recorded information regarding patient age, gender, primary disease, days from onset to admission to the rehabilitation ward, the presence or absence of appetite upon admission, duration of hospitalization, and the functional independence measure (FIM)^{20,21)} on admission/discharge. VF was performed within 2 days of admission to the rehabilitation ward. The maximum VDS score is 100 points, and the score increases with

the severity of dysphagia¹⁴⁾. Furthermore, using a receiver operating characteristic (ROC) curve, Han *et al*¹⁴⁾ established a cut-off of 47 points, above which more dysphagia patients could not ingest food orally 6 months after the onset of stroke. The parameters evaluated by VDS and their individual scores are listed in Table 1.

Statistical analysis

Subjects were divided into two groups, those who were able to ingest orally without tube feeding before discharge (Group 1) and the others who required tube feeding on discharge (Group 2). The parameters listed in Table 1 were compared between the two groups. Han *et al*¹⁴⁾ reported a difference in the prognosis of dysphagia for patients with a total VDS score of higher or lower than 47 points; thus, in the present study, we also evaluated the usefulness of this cut-off point. Statistical analyses were performed using the Mann-Whitney *U*-test and Fisher's exact probability test, as appropriate.

Results

The results are given in Table 2. There were no significant differences in individual VDS parameters between the two groups. However, the total VDS score was significantly lower in Group 1 than in Group 2 ($p < 0.05$). In addition, the time from stroke onset to admission to the rehabilitation ward was significantly shorter in Group 1 ($p < 0.05$). Using a cut-off of 47 points for the total VDS score resulted in a significantly different prognosis for those with scores above and below this point ($p < 0.01$). In patients with a total VDS score of ≤ 46 points, the odds ratio for achieving oral ingestion was 20-fold higher (95% confidence interval 1.85–216) than that for patients with a total VDS score of ≥ 47 points. There were no significant differences in any other parameters, including FIM scores, although there was a tendency for a higher FIM score on discharge in Group 1.

Discussion

The results of the present study indicate that the total VDS score may be useful in determining the prognosis of dysphagia. Because the total VDS score represents comprehensive findings of dysphagia from the oral to pharyngeal phases, it could be a better predictor of the outcome of swallowing rehabilitation than the assessment of other local eating / swallowing functions, such as the presence or absence of aspiration. Furthermore, the cut-off (47 points) proposed by Han *et al*¹⁴⁾ was found to be meaningful in the present study. However, there are some differences between the present study and the study of Han *et al*¹⁴⁾ that must be taken into consideration: the number of patients evaluated ($n = 83$) was greater, mean patient age was lower (62 ± 10 years), and the duration of hospitalization was shorter (40 ± 19 days) in the study of Han *et al*¹⁴⁾. Furthermore, the mean Barthel index²¹⁾ in the study of Han *et al*¹⁴⁾ was 53 ± 27 , reflecting a high ADL, although this measure cannot be compared directly with the FIM used in the present study. In future studies, the

Table 1. Videofluoroscopic dysphagia scale

Parameter	Coded value	Score	
Lip closure	Intact	0	4
	Inadequate	2	
	None	4	
Bolus formation	Intact	0	6
	Inadequate	3	
	None	6	
Mastication	Intact	0	8
	Inadequate	4	
	None	8	
Apraxia	None	0	4.5
	Mild	1.5	
	Moderate	3	
	Severe	4.5	
Tongue-to-palate contact	Intact	0	10
	Inadequate	5	
	None	10	
Premature bolus loss	None	0	4.5
	< 10%	1.5	
	10%–50%	3	
	> 50%	4.5	
Oral transit time	≤ 1.5s	0	3
	> 1.5s	3	
Triggering of pharyngeal swallow	Normal	0	4.5
	Delayed	4.5	
Vallecular residue	None	0	6
	< 10%	2	
	10%–50%	4	
	> 50%	6	
Laryngeal elevation	Normal	0	9
	Impaired	9	
Pyriiform sinus residue	None	0	13.5
	< 10%	4.5	
	10%–50%	9	
	> 50%	13.5	
Coating of pharyngeal wall	No	0	9
	Yes	9	
Pharyngeal transit time	≤ 1.0s	0	6
	> 1.0s	6	
Aspiration	None	0	12
	Supraglottic penetration	6	
	Subglottic aspiration	12	
Total		100	

The scoring system above is reproduced with permission from Han *et al*¹⁴⁾.

Table 2. Results

	Oral intake at time of discharge	
	Yes (Group 1 ; n = 9)	No (Group 2 ; n = 14)
Age (years)	74.6 ± 9.6	78.7 ± 7.5
Gender (M/F)	6 / 3	12 / 2
Etiology		
Cerebral infarction (n)	7	8
Cerebral hemorrhage (n)	2	6
Time from stroke onset to admission (days)	40.7 ± 9.6	51.2 ± 7.6*
Appetite on admission		
Present (n)	6	4
Absent (n)	3	10
Duration of hospitalization (days)	130.9 ± 33.6	128.0 ± 20.0
VDS on admission		
Total score	34.3 ± 9.6	47.7 ± 14.1*
Cut-off of 47 points		
≥ 47 points (n)	1	10
≤ 46 points (n)	8	4 [†]
Functional independence measure on admission		
Total score	55.8 ± 30.8	43.1 ± 31.2
Motor score	38.7 ± 23.5	30.1 ± 22.5
Cognitive score	17.1 ± 8.0	13.0 ± 9.1

* $p < 0.05$ compared with Group 1 (Mann-Whitney U -test) ;

[†] $p < 0.01$ compared with Group 1 (Fisher's exact probability test).

Note, there was no significant difference for any of the individual parameters on the videofluoroscopic dysphagia scale (VDS).

cut-off of 47 points on the VDS should be confirmed in a larger number of patients.

In the present study, there was no significant difference in the FIM at discharge between Groups 1 and 2. Previous studies have reported a correlation between swallowing function and ADL^{2, 17, 18)} and, although a similar tendency was noted in the present study, the difference between Groups 1 and 2 did not reach statistical significance. This issue requires further investigation in a larger number of patients.

In the present study, VF was performed at the time of admission to the convalescent rehabilitation ward. The interval from stroke onset until VF varied and we could not control this. The mean interval between stroke and VF in the study of Han *et al*¹⁴⁾ was 40±19 days and, if this interval can be standardized, an ideal study investigating the value of the procedure in the prognosis of dysphagia may be possible. However, because the course of stroke management varies in the Japanese medical system, this is unlikely. Thus, the present study evaluating the effects of timing of VF may be more practical, given the current system regarding convalescent rehabilitation wards in Japan. There was also significant variability in

the time from stroke onset until admission to the rehabilitation ward. With the addition of this parameter to the evaluation process, the VDS may become a more sensitive predictor for the prognosis of dysphagia in the future. Further studies are warranted.

Conclusion

In the present study, we retrospectively reviewed medical records and VF findings in patients with stroke-related dysphagia who were admitted to the convalescent rehabilitation ward in our hospital. The findings suggest that the VDS is useful for predicting the prognosis of stroke-related dysphagia.

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