CE 2.3 ANCC Contact Hours

Dysphagia Screening and Intensified Oral Hygiene Reduce Pneumonia After Stroke

Rikke Terp Sørensen, Rune Skovgaard Rasmussen, Karsten Overgaard, Axel Lerche, Ann Mosegaard Johansen, Tove Lindhardt

ABSTRACT

Objectives: Dysphagia occurs in approximately 51%–78% of patients with acute stroke. The incidence of pneumonia caused by aspiration in dysphagic patients increases both mortality and the need for hospitalization. The aim of this study was to investigate whether the incidence of aspiration pneumonia could be reduced in such patients by an early screening for dysphagia and intensified oral hygiene. **Material and Methods:** In this controlled trial, 146 hospitalized acute stroke patients with moderate or severe dysphagia were included in three groups: an intervention group (n = 58), one internal control group (n = 58, retrospectively selected from same clinic), and one external control group (n = 30) from a comparable stroke unit in a neighboring hospital. The intervention consisted of early screening with a clinical method of dysphagia screening, the Gugging Swallowing Screen, and intensified oral hygiene. **Results:** The incidence of x-ray verified pneumonia was 4 of 58 (7%) in the intervention group compared with 16 of 58 (28%) in the internal control group ($p < .01$) and with 8 of 30 (27%) in the external control group ($p < .05$). **Conclusions:** Early and systematic dysphagia screening by the Gugging Swallowing Screen method and intensified oral hygiene reduced the incidence of x-ray verified pneumonia.

Keywords: acute stroke management, acute stroke therapy, aspiration pneumonia, cerebrovascular disease, dysphagia screening, oral hygiene, rehabilitation

In acute stroke, dysphagia with an incidence rate of 51%–78% (Martino et al., 2005) is a serious consequence associated with prolonged hospitalization (Hinchey et al., 2005; Odderson, Keaton, & McKenna, 1995), poor prognosis (Falsetti et al., 2009), and increased mortality (Hinchey et al., 2005; Paciaroni et al., 2004; Smithard, Smeeton, & Wolfe, 2007). Patients with acute stroke and dysphagia have an increased risk of developing aspiration pneumonia with incidences of 13%–33 % (Falsetti et al., 2009; Langdon, Lee, & Binns, 2007; Mann, Hankey, & Cameron, 1999; Martino et al., 2005; Smithard et al., 2007), and pneumonia increases the 30-day mortality by threefold and the risk of poor outcome at 1 year (Katzan, Cebul, Husak, Dawson, & Baker, 2003; Vermeij et al., 2009). In patients with acute stroke, early detection of dysphagia reduced the risk of aspiration pneumonia (Doggett et al., 2001; Hinchey et al., 2005; Lakshminarayan et al., 2010; Martino et al., 2005), and several clinical screening methods for detecting dysphagia and aspiration risk have been developed (Courtney & Flier, 2009; Odderson et al., 1995; Perry, 2001). The Gugging Swallowing Screen (GUSS; Trapl et al., 2007) is a reliable clinical method for detection of dysphagia and aspiration risk in patients with acute stroke. It is a simple and easy-to-use bedside instrument and is based on the ability to swallow liquids of different texture and solid food. It has been validated against fiber-optic endoscopy, showing sensitivity for GUSS of 100% and a specificity of 50% and 69%, when screening was performed respectively by therapists and nurses (Trapl et al., 2007).

A significant correlation exists between the presence of pathogenic bacteria in the oral cavity and the occurrence of pneumonia (Abe, Ishihara, Adachi, & Okuda, 2009; Sellars et al., 2007). Patients with stroke

Questions or comments about this article may be directed to Rikke Terp Sørensen, RN, at rikke.terp.soerensen@regionh.dk. She is a Clinical Nurse Specialist at the Stroke Unit, Department C, University Hospital of Copenhagen, Gentofte Hospital, Denmark.

Rune Skovgaard Rasmussen, MA PhD, is an Associate Professor of General Pathology and a Neuropsychologist at the Department of Neurology, University Hospital of Copenhagen, Herlev Hospital, Denmark.

Karsten Overgaard, MD, is an Associate Professor, DLS (Diploma in Leadership Sciences), Head of Stroke Unit & Research, and a Consultant Neurologist at the Department of Neurology, University Hospital of Copenhagen, Herlev Hospital, Denmark.

Axel Lerche, MD, is a Senior Registrar and Specialist in Internal Medicine at the Department of Internal Medicine, University Hospital of Copenhagen, Gentofte Hospital, Denmark.

Ann Mosegaard Johansen, RN SD (Diploma of Health), is a Senior Nurse at the Department of Rheumatology, Department C, University Hospital of Copenhagen, Gentofte Hospital, Denmark.

Tove Lindhardt, MScN DMSc, is a Senior Researcher at the University Hospital of Copenhagen, Herlev Hospital, Denmark.

Conflict of interest and sources of funding statement: There are no conflicts of interest. This investigation was financially supported by the Lundbeck Foundation, the Tryg Foundation, and the Aase and Ejnar Danielsen Foundation.

DOI: 10.1097/JNN.0b013e31828a412c

and dysphagia have an increased risk of aspiration of bacteria–saliva and, thus, for development of pneumonia, and previous studies among other populations have shown a significantly reduced incidence of pneumonia by intensified oral hygiene (Adachi, Ishihara, Abe, & Okuda, 2007; Mori et al., 2006; Sarin, Balasubramaniam, Corcoran, Laudenbach, & Stoopler, 2008; Scannapieco, 2006; Sjögren, Nilsson, Forsell, Johansson, & Hoogstraate, 2008; Sona et al., 2009; Yoneyama et al., 2002). By performing an early and systematic screening with the GUSS method and intensified oral hygiene, the primary end point of this study was to investigate if the incidence of x-ray verified aspiration pneumonia could be reduced in hospitalized dysphagic stroke patients.

By implementing early, systematic swallowing screening at the bedside and intensified oral hygiene initiatives, nurses in this study were able to reduce the risk of pneumonia in stroke patients with moderate or severe dysphagia.

Material and Methods

A randomized prospective trial would be preferable but was not possible because of practical and ethical considerations. Primarily, it was impossible to blind the intervention, because patients in the control and interventional groups would be hospitalized in the same department. Furthermore, it was considered likely that new knowledge and procedures acquired by the staff in relation to the intervention would affect the care and treatment of the control patients and thereby constitute a major bias. Secondarily, past practices of dysphagia screening and oral hygiene were unsystematic and arbitrary, and a continuation of such treatment standards in the control group was considered to be unethical.

The study was approved by the Danish Data Protection Agency and the Ethical Committee. One hundred forty-six consecutive hospitalized acute stroke patients with moderate or severe dysphagia were included in three groups: an intervention group ($n = 58$) of prospectively patients from a stroke unit hospitalized between March 2009 and January 2010, an internal historic control group ($n = 58$) retrospectively selected from the same unit and hospitalized between March 2008 and January 2009, and an external control group ($n = 30$) from a neighboring stroke unit hospitalized between March 2009 and January 2010. Although the external control group had fewer patients than the other groups, this group was included to investigate if results and tendencies from the internal control group corresponded to results from a neighboring hospital. Furthermore, results from the external control group and the intervention groups were obtained during the same time.

Eligible patients had an acute stroke and were admitted into the stroke unit no later than 3 days after hospitalization and were diagnosed with moderate or severe dysphagia. Before the intervention, patients were not systematically screened for dysphagia immediately after admission. To avoid sample selections bias, subjects from both the intervention and control groups were included based upon the screening done by the occupational therapists and not the initial screening done by the nursing staff. The severity of dysphagia was determined by the clinical screening and the prescribed type of diet. In moderate dysphagia, a soft diet and thickened fluid were prescribed, and in severe dysphagia, tube feeding and nil per os (NPO) was prescribed.

In the data analysis, only patients diagnosed with ischemic stroke or intracerebral or subarachnoidal hemorrhages at discharge were included. Exclusion criteria were active metastatic cancer, severe liver or kidney failure, and terminal illness including cancellation of active treatment within 3 days after admission at the stroke unit. The follow-up period was from hospitalization after stroke onset to discharge and maximum of 30 days. In the external control group, data were recorded concerning the end points of pneumonia and mortality, and because of practical issues, data were limited to characteristics such as age, gender, stroke type, Scandinavian Stroke Scale (SSS) score, and the occurrence of tube feeding. Data were obtained from medical records and entered into an electronic database. Before the intervention, dysphagia screening and oral hygiene was learned and practiced by the nursing staff, and throughout the 10-month intervention phase, ongoing education was provided, combining theoretical teaching in groups and individual bedside training.

Dysphagia Treatment in the Intervention Group

The GUSS method for dysphagia screening was implemented, and all intervention patients were screened by the nursing staff immediately after admission and before oral administration of nutrition or fluids. An occupational therapist performed further investigations

if there were any signs of dysphagia. If there was doubt about the outcome after GUSS screening, the patient was investigated using video fluoroscopy or fiber-optic endoscopic evaluation of swallowing.

The GUSS is designed as a scoring system from 0 to 20 points that classifies degrees of dysphagia and aspiration risk into four categories, severe, moderate, mild, and no dysphagia, where a score of less than 10 indicates severely reduced swallowing capabilities. Cutoff points for reliability were 19 (dysphagia vs. no dysphagia), 14 (risk of aspiration vs. no risk of aspiration), and 9 (severe dysphagia vs. all others) (Trapl et al., 2007). Depending on the score, GUSS indicated recommendations for diet administrated orally or by tube. In the acute phase where fluctuating levels of consciousness were common, patients with moderate dysphagia were rescreened before each meal using the initial test in GUSS to assess alertness and ability to control and swallow saliva. Interrater reliabilities of GUSS dysphagia screenings were measured, and the time spans between the assessments extended from 1 to 3 hours.

The patients received oral hygiene following a standardized care plan with detailed procedures for mechanical cleaning (tooth brushing), protection and moistening of the oral cavity, and preventive antibacterial cleansing with chlorhexidine 0.12 % (nonalcoholic) mouth rinse. Chlorhexidine was used twice daily in all patients with severe dysphagia. Synthetic saliva was administered to patients who were not fed orally to prevent drying of the oral cavity mucous membrane and reduce the risk of infection.

Dysphagia Treatment in the Control Groups

The formal recommendation in the control groups was dysphagia screening by a clinical screening method (Odderson et al., 1995) within 24 hours and before oral administration of nutrition or fluids. Observations showed that former practice of dysphagia screening and oral hygiene was unsystematic and arbitrary in these groups. Tables 1 and 2 contain results for incidence of dysphagia screening within 24 hours and incidence of prepared care plans of oral hygiene.

Procedure

A physician specialized in infectious diseases and blinded for group affiliation identified patients by journal audit

TABLE 1. Baseline Characteristics

	Intervention, *n* = 58	Control (Internal), *n* = 58	Control (External), *n* = 30
Age, median (interquartile range in years)	84 (79–88)	85 (78–89)	83 (78–90)
Gender, *n* (%)			
Male	22 (38)	21 (36)	10 (33)
Female	36 (62)	37 (64)	20 (67)
Admitted from, *n* (%)			
Medical emergency department	33 (57)	36 (62)	—
Other departments or hospitals	15 (26)	9 (16)	—
Home	10 (17)	13 (22%)	—
Medical history, *n* (%)			
History of dysphagia	2 (3)	6 (10)	—
History of chronic respiratory disease	11 (19)	3 (5)*	—
Stroke severity, median (interquartile range)			
Scandinavian Stroke Scale score	30 (18.5–45.5)	29.5 (14–44)	22.5 (14–32)
Functional ability, median (interquartile range)			
Barthel-100 score before stroke	100 (90–100)	100 (95–100)	—
Stroke type, *n* (%)			
Ischemic	53 (91)	50 (86)	25 (83)
Intracerebral hemorrhage	3 (5)	7 (12)	5 (17)
Subarachnoid hemorrhage	2 (3)	1 (2)	0
Clinical features, *n* (%)			
Dysphagia screening within 24 hours	56 (97)	42 (72)**	—

Note. *n* = number of patients.
*$p < .05$. **$p < .01$. (compared with intervention group).

TABLE 2. Mortality and Outcome Measurements

	Intervention, *n* = 58	Control (Internal), *n* = 58	Control (External), *n* = 30
Mortality, *n* (%)			
After 30 days	7 (12)	13 (22)	9 (30)*
After 180 days	19 (33)	25 (43)	17 (57)*
Length of stay in hospital, median (interquartile range)			
Number of days	16 (10–28)	21 (12–24)	—
Barthel-100 score, median (interquartile range)			
After 1 week	15 (1–50)	7 (0–24)	—
At discharge	17 (2–60)	12 (3–41)	—
Tube feeding, *n* (%)			
Nasogastric	22 (38)	27 (47)	19 (63)*
Percutaneous endoscopic gastrostomy	7 (12)	7 (12)	1 (3)
Other results, *n* (%)			
Unintended per oral feeding during severe dysphagia	7/22 (32)	12/22 (55)	—
Care plan of oral hygiene prepared	41 (71)	6 (10)**	—
Urinary tract infection (during hospitalization)	26 (45)	24 (41)	—
Treatment with acid-reducing drugs	11 (19)	15 (26)	—

Note. *n* = number of patients.
*$p < .05$, **$p < .01$. (compared with intervention group).

who acquired pneumonia during hospitalization. Pneumonia was categorized into two categories:

1. ''Possible pneumonia'' if C-reactive protein > 50 mg/L and/or leukocyte count > 10×10^9/L and accompanied by respiratory symptoms as coughing (with or without expectoration), dyspnea, tachypnea > 20/minute, and/or O_2 saturation < 90%. All but one of the patients in the intervention and the internal control groups had chest x-ray performed to verify the pneumonia.
2. ''X-ray verified pneumonia'' if infiltrative changes was observed by chest x-ray, which could be explained by pneumonia, accompanied with C-reactive protein > 50 mg/L and/or leukocyte count > 10×10^9/L and/or respiratory symptoms.

The incidence of the clinical variables described above was recorded within ±3 days of the qualifying pneumonia. Time of initiation of antibiotic treatments was recorded as the onset time of pneumonia, unless there was an x-ray report confirming an earlier onset. The SSS scoring was performed at admission.

Data Analysis

Mann–Whitney test was used for comparing continuous variables of two individual groups (unpaired observations), and Spearman rank–order correlation test was used for ranked pairs. The Wilcoxon signed-rank test was used for paired observations, and chi-square test or Fisher's exact probability test was performed for categorical variables. A p value of less than .05 was considered statistically significant. Median results are displayed as values followed by the associated 25th and 75th percentiles in brackets.

Power Analysis and Sample Size Calculations

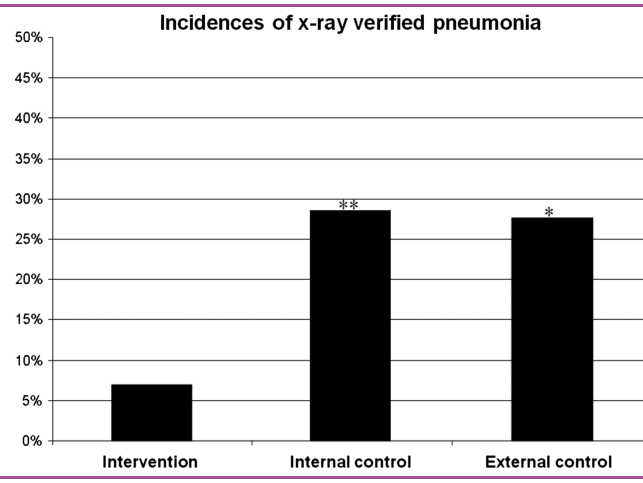
To compare treatment outcomes, a change in the incidence of x-ray verified pneumonia from 28% to 10% would require 58 patients in both the intervention and the internal control group, if z_2-alpha and z-beta (type 1 and type 2 errors) were 5 % and 20%, respectively. Thus, a total of 116 patients would need to be included.

Results

Baseline characteristics are described in Table 1. The total incidence of x-ray verified pneumonia is shown in Figure 1, and Table 2 contains main results, including mortality and outcome measurements. Adverse events related to the intervention were not observed.

Combining x-ray verified pneumonia and possible pneumonia, pneumonia was diagnosed in 34% of the

FIGURE 1 The Incidence of X-Ray Verified Pneumonia



Note. The incidence of x-ray verified pneumonia in the intervention group was 7% (4 of 58 patients) and significantly lower than 28% (16 of 58 Patients) and 27% (8 of 30 Patients) in the internal and external control groups, respectively. *$p < .05$. **$p < .01$.

patients in the intervention group and in 43% of the patients in both control groups ($p > .05$, *ns*). Nearly all patients diagnosed with pneumonia, with or without x-ray verification, received antibiotic treatments, corresponding to 95% (19 of 20 patients) in the intervention group and 96% (24 of 25 patients) in the internal control group ($p > .05$, *ns*).

Interrater Reliabilities

The SSS scores were not documented among 33 %, 19 %, and 17 % of the patients in the intervention, internal control, and external control groups, respectively ($p > .05$, *ns*). In these patients, the SSS scores were calculated retrospectively based on data from the medical records, and this method has provided reliable results in other investigations (Barber, Fail, Shields, Stott, & Langhorne, 2004). Because of insufficient information in the medical records, the SSS score was not calculated in 9 %, 12 %, and 13 % in the intervention, internal control, and external control groups, respectively. Reliabilities of the retrospective SSS-score assessments were investigated by interrater reliability tests and showed a substantial agreement with kappa values of 0.66 and 1.

The SSS scores of 29 points were used as cutoff scores between moderate and severe stroke in a range of 0–54 points with no significant difference between the observations. We found a good agreement with kappa values between 0.48 and 1 regarding the four GUSS scoring categories. With 9 used as a cutoff point, the interrater reliability test yielded excellent agreement. In 22 observations, the occupational therapist classified 13 of 22 (59 %) to severe dysphagia versus 12 of 22 (55 %) rated by the project nurse (kappa = 0.91). In the other group, both the nursing staff and the project nurse classified 3 of 27 (11 %) to severe dysphagia (kappa = 1).

Clinical Observations and Correlations

More patients with pneumonia (combining ''possible'' and ''x-ray verified'') were fed by nasogastric tube ($p < .01$), achieved a lower Barthel Index score at 1 week and at discharge ($p < .05$), and had a history of chronic respiratory diseases ($p < .05$). Unintended oral feeding in cases with severe dysphagia, where the recommendation was NPO, was associated with an increased incidence of x-ray verified pneumonia ($p < .05$). No significant correlation was found in relation to baseline SSS scores and occurrences of pneumonia.

Discussion

The incidence of x-ray verified pneumonia was significantly reduced in the group of dysphagic patients treated with an early and systematic dysphagia screening together with intensified oral hygiene compared with control groups (Figure 1). The control group contained patients who were not systematically screened for dysphagia within 24 hours and who received unsystematic and arbitrary oral hygiene without the use of antibacterial mouth rinse with chlorhexidine. These findings are also illustrated by the results from the internal control group in Tables 1 and 2.

Incidence of Pneumonia

From hospital admission to discharge, a pneumonia rate of 13 % among 62 ischemic and hemorrhagic stroke patients who enrolled regardless of consciousness levels has been reported (Falsetti et al., 2009). Using a follow-up period of 6 months in an unselected group

of conscious and stable stroke patients with dysphagia, a pneumonia rate of 29 % (n = 82) was observed (Mann et al., 1999). In comparison, a follow-up period of 7 days among dysphagic stroke patients, including patients with decreased levels of consciousness, yielded a pneumonia rate of 33% (n = 60; Smithard et al., 2007). Using a 30-day follow-up period similar to our study, the incidence of respiratory infection in acute ischemic stroke patients with dysphagia, also including patients with decreased consciousness levels, was 24% (n = 58; Langdon et al., 2007). Thus, after acute stroke, incidences of pneumonia in dysphagic patients ranged from 13% to 33% and corresponded to the incidences of x-ray verified pneumonia among 27%–28% of patients in our two control groups. Studies using a more conservative and specific definition of pneumonia have reported lower pneumonia rates (Martino et al., 2005), and only one of the studies mentioned above used an operational definition of pneumonia requiring pulmonary infiltrates on the radiograph, resulting in a pneumonia rate of 13% (Falsetti et al., 2009).

Respiratory infection has been defined as both x-ray verified pneumonia and chest infection determined by clinical findings (Langdon et al., 2007). This is similar to combining the categories ''x-ray verified'' and ''possible pneumonia'' in our study. When including both categories in our study, the incidence was 34% and seemingly high compared with the findings reported by other investigators (Langdon et al., 2007). However, our intervention group had approximately three times more patients with chronic respiratory diseases as the internal control group, which may explain the nonsignificant effect of the intervention when combining ''x-ray verified'' and ''possible pneumonia.'' Similar to other investigators, we did find a significant correlation between prevalence of chronic respiratory disease and increased incidence of pneumonia (Katzan et al., 2003; Langmore et al., 1998; Masiero, Pierobon, Previato, & Gomiero, 2008; Sellars et al., 2007).

We measured intervention effects on pneumonia incidences in relation to two categories, namely incidences of ''x-ray verified pneumonia'' and ''possible pneumonia,'' and the intervention only reduced the incidence of ''x-ray verified pneumonia.'' Estimates of pneumonia rate vary between studies, which may be explained by differences in operational definitions of pneumonia, the time of follow-up, and selection bias. Risk of pneumonia is affected by factors such as levels of consciousness (Dziewas et al., 2004; Masiero et al., 2008), history of chronic respiratory diseases (Katzan et al., 2003; Langmore et al., 1998; Masiero et al., 2008; Sellars et al., 2007), severity of dysphagia, (Langdon et al., 2007), nasogastric tube feeding (Langdon, Lee, & Binns, 2009; Langmore et al., 1998), and age (Masiero et al., 2008; Sellars et al., 2007). Therefore, such factors must be considered when comparing pneumonia rates between studies.

More patients with severe dysphagia in the internal control group had unintended oral feeding compared with the intervention group, and although this difference was not significant, it may have contributed to the higher rate of x-ray verified pneumonia in the internal control group. Only two patients (3%) in the intervention group had a history of dysphagia compared with six patients in the internal control group (10%). This difference was not significant and is not considered to have affected our results, especially because only one patient from the internal control group with a history of dysphagia developed x-ray verified pneumonia.

The use of a historical and an external control group had limitations. Although we observed no such changes, it is possible that subtle changes in care and treatments could have occurred between the pretest control and the intervention and may have affected the risk for development of pneumonia. However, because of the lack of systematic documentation in the medical records, it was impossible to perform elaborate control for such changes. Because patients in the intervention and the internal control groups were placed at the same stroke unit at two consecutive time points and in general exposed to the same personnel, treatment variations other than the GUSS method and intensified oral hygiene are considered to be minimal.

Consciousness Levels and Risk of Pneumonia

Our study only included patients with moderate or severe dysphagia, and we included both conscious patients and patients with reduced levels of consciousness. Investigators have found that a higher severity of dysphagia, or a decreased level of consciousness, was associated with an increased risk of pneumonia (Dziewas et al., 2004; Langdon et al., 2007; Masiero et al., 2008). In the previously mentioned studies, the pneumonia rates referred to cohorts of stroke patients with varying severity of dysphagia, and one study excluded patients with decreased levels of consciousness (Mann et al., 1999). Thus, the pneumonia rate in these investigations is expected to be lower compared with the population presented in our study. Because our patients were unselected acute stroke patients with moderate or severe degree of dysphagia and varying states of conscious levels, these patients might be at high risk for developing pneumonia. Furthermore, our sample contained older patients compared with the previously mentioned studies, and a significant association between age and pneumonia has been reported (Masiero et al., 2008). Therefore, the frequency of pneumonia in our study may be

overestimated compared with patients of younger age and with milder degrees of dysphagia.

Mortality

Mortality was reduced in the intervention group, although only significantly when compared with the external control group, supporting a previously reported correlation between pneumonia and increased mortality (Hinchey et al., 2005; Katzan et al., 2003). The mortality rates in our intervention group resembled the 30- and 180-day mortality rates in other dysphagic stroke patients (Langdon et al., 2007; Smithard et al., 2007). In the external control group, mortalities during hospitalization and after 180 days were significantly higher than in the intervention group. Although not significant, the SSS score was lower in the external group possibly reflecting a higher stroke severity in this group, which may be related to the increased mortality within this group.

Implications of Nasogastric Tube Feeding

In the intervention group, fewer patients had nasogastric tube compared with both control groups. In the pooled data from all groups, we found a significant correlation between nasogastric tube feeding and increased incidence of pneumonia. This finding was consistent with a previous investigation, where a high pneumonia rate of 44% was found in an unselected group of acute stroke patients fed by nasogastric tube because of dysphagia (Dziewas et al., 2004). Thus, the lower numbers of patients with nasogastric tube may have contributed to the reduced incidence of pneumonia in the intervention group. Causes of aspiration pneumonia are multiple, and therefore, aspiration pneumonia appears frequently both in patients fed orally or fed by nasogastric tube and kept NPO (Langmore et al., 1998). Feeding by nasogastric tube will often be the first choice in the care for patients with severe dysphagia, although tube feeding will not prevent gastroesophageal reflux or bacterial colonization of the oropharyngeal secretions. Further research is needed to determine the optimal time for insertion of nasogastric and gastrostomy tubes. Process of care, such as mobilization, administration of nutrition, and oral hygiene, contributes in many ways to prevent aspiration pneumonia, and future research on the effectiveness of clinical interventions within the above topics is also necessary.

Interrater Reliabilities

We found good agreements regarding interrater reliabilities of screening with GUSS within all categories of cutoff points, and our high interrater kappa values may be because of the robust criteria of GUSS providing a narrow field for interpretation. Furthermore, using a cutoff point at 9, the interrater reliability test yielded excellent agreement, and this is particularly important because assessing severe dysphagia is crucial to decision making related to oral or nonoral nutrition.

Conclusion

A systematic identification of dysphagia reduced the risk of developing pneumonia in stroke patients with moderate or severe dysphagia. Dysphagia identification was performed using the clinical screening tool GUSS and the associated nutrition recommendations together with intensified oral hygiene.

Acknowledgments

The authors thank occupational therapist Pernille Rysgaard for great help and support in teaching and implementing the GUSS method. A special thank for enthusiastic support in caring out this study to the nursing staff and occupational therapists at the Stroke Unit, Department C, University Hospital of Copenhagen, Gentofte Hospital.

References

Abe, S., Ishihara, K., Adachi, M., & Okuda, K. (2009). Tongue-coating as risk indicator for aspiration pneumonia in edentate elderly. *Archives of Gerontology and Geriatrics*, *47*, 267–275.

Adachi, M., Ishihara, K., Abe, S., & Okuda, K. (2007). Professional oral health care by dental hygienists reduced respiratory infections in elderly persons requiring nursing care. *International Journal of Dental Hygiene*, *5*, 69–74.

Barber, M., Fail, M., Shields, M., Stott, D. J., & Langhorne, P. (2004). Validity and reliability of estimating the Scandinavian Stroke Scale score from medical records. *Cerebrovascular Diseases*, *17*, 224–227.

Courtney, B. A., & Flier, L. A. (2009). RN dysphagia screening, a stepwise approach. *Journal of Neuroscience Nursing*, *41*, 28–38.

Doggett, D. L., Tappe, K. A., Mitchell, M. D., Chapell, R., Coates, V., & Turkelson, C. M. (2001). Prevention of pneumonia in elderly stroke patients by systematic diagnosis and treatment of dysphagia: An evidence-based comprehensive analysis of the literature. *Dysphagia*, *16*, 279–295.

Dziewas, R., Ritter, M., Schilling, M., Konrad, C., Oelenberg, S., Nabavi, D. G., … Ludemann, P. (2004). Pneumonia in acute stroke patients fed by nasogastric tube. *Journal of Neurology, Neurosurgery and Psychiatry*, *75*, 852–856.

Falsetti, P., Acciai, C., Palilla, R., Bosi, M., Carpinteri, F., Zingarelli, A., … Lenzi, L. (2009). Oropharyngeal dysphagia after stroke: Incidence, diagnosis, and clinical predictors in patients admitted to a neurorehabilitation unit. *Journal of Stroke and Cerebrovascular Diseases*, *18*, 329–335.

Hinchey, J. A., Shephard, T., Furie, K., Smith, D., Wang, D., & Tonn, S.; , Stroke Practice Improvement Network Investigators (2005). Formal dysphagia screening protocols prevent pneumonia. *Stroke*, *36*, 1972–1976.

Katzan, I. L., Cebul, R. D., Husak, S. H., Dawson, N. V., & Baker, D. W. (2003). The effect of pneumonia on mortality among patients hospitalized for acute stroke. *Neurology*, *60*, 620–625.

Lakshminarayan, K., Tsai, A. W., Tong, X., Vazquez, G., Peacock, J. M., George, M. G., … Anderson, D. C. (2010).

Utility of dysphagia screening results in predicting poststroke pneumonia. *Stroke*, *41*, 2849–2854.

Langdon, P. C., Lee, A. H., & Binns, C. W. (2007). Dysphagia in acute ischaemic stroke: Severity, recovery and relationship to stroke subtype. *Journal of Clinical Neuroscience*, *14*, 630–634.

Langdon, P. C., Lee, A. H., & Binns, C. W. (2009). High incidence of respiratory infections in ''nil by mouth'' tube-fed acute ischemic stroke patients. *Neuroepidemiology*, *32*, 107–113.

Langmore, S. E., Terpenning, M. S., Schork, A., Chen, Y., Murray, J. T., Lopatin, D., & Loesche, W. J. (1998). Predictors of aspiration pneumonia: How important is dysphagia? *Dysphagia*, *13*, 69–81.

Mann, G., Hankey, G. J., & Cameron, D. (1999). Swallowing function after stroke: Prognosis and prognostic factors at 6 months. *Stroke*, *30*, 744–748.

Martino, R., Foley, N., Bhogal, S., Diamant, N., Speechley, M., & Teasell, R. (2005). Dysphagia after stroke: Incidence, diagnosis, and pulmonary complications. *Stroke*, *36*, 2756–2763.

Masiero, S., Pierobon, R., Previato, C., & Gomiero, E. (2008). Pneumonia in stroke patients with oropharyngeal dysphagia: A six-month follow-up study. *Neurological Sciences*, *29*, 139–145.

Mori, H., Hirasawa, H., Oda, S., Shiga, H., Matsuda, K., & Nakamura, M. (2006). Oral care reduces incidence of ventilator-associated pneumonia in ICU populations. *Intensive Care Medicine*, *32*, 230–236.

Odderson, I. R., Keaton, J. C., & McKenna, B. S. (1995). Swallow management in patients on an acute stroke pathway: Quality is cost effective. *Archives of Physical Medicine and Rehabilitation*, *76*, 1130–1133.

Paciaroni, M., Mazzotta, G., Corea, F., Caso, V., Venti, M., Milia, P., … Gallai, V. (2004). Dysphagia following stroke. *European Neurology*, *51*, 162–167.

Perry, L. (2001). Screening swallowing function of patients with acute stroke. Part one: Identification, implementation and initial evaluation of a screening tool for use by nurses. *Journal of Clinical Nursing*, *10*, 463–473.

Sarin, J., Balasubramaniam, R., Corcoran, A. M., Laudenbach, J. M., & Stoopler, E. T. (2008). Reducing the risk of aspiration pneumonia among elderly patients in long-term care facilities through oral health interventions. *Journal of the American Medical Directors Association*, *9*, 128–135.

Scannapieco, F. A. (2006). Pneumonia in nonambulatory patients: The role of oral bacteria and oral hygiene. *Journal of the American Dental Association*, *137*, 21S–25S.

Sellars, C., Bowie, L., Bagg, J., Sweeney, M. P., Miller, H., Tilston, J., … Stott, D. J. (2007). Risk factors for chest infection in acute stroke: A prospective cohort study. *Stroke*, *38*, 2284–2291.

Sjögren, P., Nilsson, E., Forsell, M., Johansson, O., & Hoogstraate, J. (2008). A systematic review of the preventive effect of oral hygiene on pneumonia and respiratory tract infection in elderly people in hospitals and nursing homes: Effect estimates and methodological quality of randomized controlled trials. *Journal of the American Geriatrics Society*, *56*, 2124–2130.

Smithard, D. G., Smeeton, N. C., & Wolfe, C. D. A. (2007). Long-term outcome after stroke: Does dysphagia matter? *Age and Ageing*, *36*, 90–94.

Sona, C. S., Zack, J. E., Schallom, M. E., McSweeney, M., McMullen, K., Thomas, J., … Schuerer, D. J. E. (2009). The impact of a simple, low-cost oral care protocol on ventilator-associated pneumonia rates in a surgical intensive care unit. *Journal of Intensive Care Medicine*, *24*, 54–62.

Trapl, M., Enderle, P., Nowotny, M., Teuschl, Y., Matz, K., Dachenhausen, A., & Brainin, M. (2007). Dysphagia bedside screening for acute-stroke patients: The Gugging Swallowing Screen. *Stroke*, *38*, 2948–2952.

Vermeij, F. H., Scholte op Reimer, W. J. M., de Man, P., van Oostenbrugge, R. J., Franke, C. L., de Jong, G., … Dippel, D. W. J. (2009). Stroke-associated infection is an independent risk factor for poor outcome after acute ischemic stroke: Data from the Netherlands Stroke Survey. *Cerebrovascular Diseases*, *27*, 465–471.

Yoneyama, T., Yoshida, M., Ohrui, T., Mukaiyama, H., Okamoto, H., Hoshiba, K., … Sasaki, H.; Of The Oral Care Working Group M. (2002). Oral care reduces pneumonia in older patients in nursing homes. *Journal of the American Geriatrics Society*, *50*, 430–433.

Instructions for Taking the CE Test:

- Read the article. The test for this CE activity can be taken online at www.NursingCenter.com/CE/JNN.
- There is only one correct answer for each question. A passing score for this test is 13 correct answers. If you pass, you can print your certificate of earned contact hours and the answer key. If you fail, you have the option of taking the test again at no additional cost.
- If you prefer to mail in the test, access it and the enrollment form at www.JNNOnline/CE. Print the enrollment form and mail it with payment to the address listed. You will receive your earned CE certificate in 4 to 6 weeks.
- Visit www.nursingcenter.com for other CE activities and your personalized CE planner tool.
- For questions or rush service options, contact Lippincott Williams & Wilkins: 1-800-787-8985.

Registration Deadline: June 30, 2015

Disclosure Statement:
The authors and planners have disclosed that they have no financial relationships related to this article.

Provider Accreditation:
Lippincott Williams & Wilkins, publisher of *Journal of Neuroscience Nursing*, will award 2.3 contact hours for this continuing nursing education activity.

Lippincott Williams & Wilkins is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 2.3 contact hours. Lippincott Williams & Wilkins is also an approved provider of continuing nursing education by the District of Columbia and Florida CE Broker #50-1223. Your certificate is valid in all states.

The ANCC's accreditation status of Lippincott Williams & Wilkins Department of Continuing Education refers only to its continuing nursing educational activities and does not imply Commission on Accreditation approval or endorsement of any commercial product.

Payment and Discounts:

- The registration fee for this test is $21.95.
- AANN members – For free CE (online only), members can take the test by logging into the secure ''Members Only'' area of http://www.aann.org to get the discount code. Use the code when payment is requested when taking the CE test at NursingCenter.com/CE/JNN.
- We offer special discounts and institutional bulk discounts for multiple tests. Call 1-800-787-8985 for more information.

The CE test for this article is available online only. Log onto the journal website, www.JNNOnline.com, or to www.NursingCenter.com/CE/JNN to access the test. For additional continuing education articles related to Neurological topics, go to www.NursingCenter.com/CE.