Elderly Age, Bilateral Lesions, and Severe Neurological Deficit Are Correlated with Stroke-associated Pneumonia

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Causative factors for pneumonia and their impact on prognosis were investigated in patients with acute ischemic stroke. Patient characteristics, swallowing function, lesions, and the presence or absence of intervention by dysphagia rehabilitation were assessed in 292 patients with acute cerebral infarction to determine the association of these factors with pneumonia. As a result, 52 patients (17.8%) experienced pneumonia. Of these, 14 developed pneumonia within 3 days of hospital admission and 38 developed the disease after 4 days or later. Pneumonia was frequently seen among elderly patients, those with severe neurological symptoms or cognitive disorders and those with bilateral multiple lesions, and was associated with prolonged length of stay and decline in activities of daily living at hospital discharge. In conclusion, elderly age, bilateral lesions, and severe neurological deficit were significantly associated with pneumonia. Pneumonia in turn strongly predicted inability to take food orally and be discharged from hospital to home. **Key Words:** Dysphagia—pneumonia—acute stroke—outcome—rehabilitation.

Introduction

Stroke-associated pneumonia (SAP) is one of the most common complications among stroke patients.[1-5] SAP not only increases mortality but also deteriorates the patient's functional prognosis[6,7] and increases the duration and cost of hospitalization. Dysphagia is a main risk factor of SAP: one third of patients with dysphagia develop aspiration pneumonia.[8] Therefore, early diagnosis and treatment of dysphagia is recommended.[9] However, other than dysphagia, risk factors for developing SAP have not been fully elucidated. In addition, the impact of SAP on long-term outcome is not clear. In this study, we determined the factors determining the onset and development of SAP in patients with acute-phase cerebral infarction; we also studied how these factors affect patient outcome.

Subjects and Methods

Subjects

Three hundred six patients with acute cerebral infarction were referred to our Rehabilitation Department, of which 292 patients were included for analysis in this study. Patients who underwent endotracheal intubation or tracheostomy and those who died during the hospital stay were excluded from this study.

The age of the subjects ranged from 31 to 95 years (mean ± SD, 69.9 ± 12.2 years); there were 190 men and 102 women. Cerebral infarction was caused by small-vessel occlusion in 58 subjects, large-artery atherosclerosis in 111 subjects, cardioembolism in 107 subjects, and other conditions in 26 subjects. The period from stroke onset to initial evaluation (start of rehabilitation) was 0-9 days (1.7 ± 1.7 days), whereas the average hospitalization period was 26.5 ± 15.7 days (range 1-116 days).

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The institutional ethics committee (Saitama Medical University International Medical Center, IRB No. 11-018) approval was obtained.

Methods

Bedside Swallowing Assessment

Bedside swallowing function was assessed by the repetitive saliva swallowing test (RSST) and the modified water swallow test, as recommended by the medical examination guidelines issued by the Japan Stroke Society (2009).[10] The RSST was performed by first placing the pads of the second and third fingers lightly on the laryngeal prominence and the hyoid bone of subjects and then instructing subjects to voluntarily swallow saliva repeatedly; less than 3 swallows within 30 seconds was considered an abnormal result.[11] The modified water swallow test was performed by pouring 3 mL of chilled water into the oral vestibule of the subject and then instructing them to swallow; if possible, more water was given, and the subject was asked to swallow 2 more times. Evaluation was performed for the worst swallowing attempt, and a score of 3 points (of swallowing, favorable respiration, choking and/or wet hoarseness) or less was considered abnormal.[12]

Collection of Clinical Data

In addition to swallowing function, the following clinical data were collected from the medical records of the participants: (1) age and gender, (2) stroke subtype based on Trial of Org 10172 in Acute Stroke Treatment criteria[13] (small-vessel occlusion, large-artery atherosclerosis, cardioembolism, and other determined etiology), (3) history of stroke, (4) risk factors (hypertension, dyslipidemia, ischemic heart disease, diabetes mellitus, and atrial fibrillation), (5) site of index lesions (supratentorial, infratentorial, and supra- and infratentorial), (6) duration from stroke onset to admission, (7) duration from stroke onset to initial evaluation, (8) Canadian Neurological Scale score on admission,[14] (9) Mini-Mental State Examination (MMSE) score on admission,[15] (10) length of hospital stay, (11) Functional Independence Measure score at discharge,[16] and (12) destination after discharge.

Diagnosis of SAP

SAP was diagnosed by the study clinician team in close collaboration with an infection control practitioner in accordance with the Centers for Disease Control and Prevention criteria[17] using clinical (lung auscultation and percussion, presence of fever, and purulent tracheal secretion), microbiological (tracheal specimens and blood cultures), and chest radiography findings.

SAP patients were divided into 3 groups based on time to onset from hospital admission and on oral intake capacity: the early-onset pneumonia (EOP) group (patients with development of pneumonia within 72 hours after hospitalization), the off-food pneumonia group (patients with development of pneumonia after 72 hours of hospitalization and no oral intake capacity), and the oral feeding pneumonia group (patients with pneumonia after 72 hours and with oral intake capacity). We compared clinical demographics, bedside swallowing assessment (BSA), activity of daily living (ADL) level, oral intake, and destination after discharge from the hospital among the 4 groups (the 3 pneumonia groups and a control, no pneumonia group).

The occurrence of pneumonia was the first outcome measure, and destination after discharge was the secondary outcome measure.

Training for Eating and Swallowing and Selection of Food Form

Before provision of food, if patients did not exhibit cognitive dysfunction or abnormality in BSA, water intake was gradually increased to 60 mL. After confirming the absence of swallowing disorder, regular food or porridge was provided. If any abnormality in BSA or pulmonary aspiration, such as choking, was suspected after starting oral intake, contrast radiography was performed to assess deglutition with the patient in a stable condition after obtaining the consent of the patient or his/her family. Then, we examined whether it was possible to deliver food for swallowing training (jelly, yogurt, paste, and mousse). However, if it was difficult to start oral intake or the intake amount was not sufficient, nutrition via nasogastric tube was started. Speech–language–hearing therapists and clinical nurses trained patients for eating and swallowing by using indirect strategies such as oral care, oral articulation exercises, and pharynx cooling stimulation. Indirect training was also used for those who started direct training to adjust posture and food form; a compensatory swallowing method including cervical anteflexion and rotation and multiple swallowing was also used if necessary.

Statistical Analysis

Mann–Whitney U test and Kruskal–Wallis test were used for univariate analysis of continuous variables, and the chi-square test was used for univariate analysis of categorical variables. Multivariate analysis was used to study the relationship between physical status, dysphagia, pneumonia, and functional outcome. Significance was set at P less than .05. Statistical analyses were performed using the JMP version 8.02 for Macintosh software (2010) (SAS Institute Inc., Cary, NC).

Results

SAP was found in 52 of the total 292 cases (17.8%). Of these, 14 patients (26.9%) developed SAP within 72 hours after hospitalization (EOP group), 28 (53.8%) developed