Infections Diagnosed after Admission to a Stroke Unit and Their Impact on Hospital Mortality in Poland from 1995 to 2015

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Background: Implementation of modern stroke unit care might have attenuated the negative effect of infections on stroke outcome. Our aim was to investigate changes in the occurrence of pneumonia and urinary infections diagnosed after admission to experienced Polish stroke center between 1995 and 2015, and their association with hospital mortality. *Materials and Methods:* This is a retrospective registry-based analysis of consecutive patients with acute stroke from highly urbanized area (Warsaw, Poland) in years 1995-2015. A total of 5174 patients were divided to 4 time periods: 1995-2000 (n = 883), 2001-2006 (n = 1567), 2006-2010 (n = 1539), and 2011-2015 (n = 1183). Odds ratios (ORs) for hospital death were calculated after adjustment for age, congestive heart failure, preexisting disability, stroke type, and baseline neurological deficit, separately in years 1995-2015, 1995-2000, and 2011-2015. *Results:* Over time there was a significant decrease in the proportion of patients diagnosed with pneumonia (20%, 19%, 9%, and 15%, respectively) or urinary tract infection (29%, 21%, 24%, and 18%, respectively) and in the proportion of patients having body temperature of 38.0°C or higher at least once within first 7 days of hospital stay (20%, 20%, 13%, and 13%, respectively), without significant change in the use of antibiotics (range 35%-37%). Hospital mortality was strongly predicted by pneumonia (OR 3.6-4.2) and fever (OR 2.7-4.7) but not urinary infections. *Conclusions:* Over the last 2 decades there was a decrease in the proportion of patients with acute stroke diagnosed with pneumonia or urinary tract infection during stroke unit stay. Hospital death was strongly predicted by pneumonia and fever but no by urinary infections. **Key Words:** Acute stroke care—infection—pneumonia—urinary infection—hospital mortality.

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Introduction

Stroke remains one of the leading causes of death and disability worldwide, which results from brain injury and subsequent medical complications.[1] Infections, especially of respiratory and urinary tract, occur in approximately 30% of patients with acute stroke. They usually develop within the first 3 days of hospital stay and markedly contribute to early morbidity and mortality.[2-4] Both community-acquired and nosocomial infections may worsen stroke outcome. Therefore, their prevention and proper management is one of the key elements of stroke unit care.[3] Current evidence strongly supports screening for dysphagia, avoidance of indwelling catheters, and early mobilization but does not justify prophylactic therapy with antibiotics.[5,6]

One may expect that implementation of modern stroke care and constant development in this field should have reduced the occurrence of infections diagnosed after admission and potentially attenuated the negative impact on prognosis. However, there have been no studies that addressed those issues directly over a long time period.

Our aim was to investigate changes in the occurrence of infections diagnosed after admission to a stroke unit and their association with hospital mortality from 1995 to 2015 in an urban Polish stroke center.

Materials and Methods

Study Design and Population

This is a retrospective analysis of consecutive patients admitted to a single stroke center due to acute ischemic stroke or intracerebral hemorrhage between July 1995 and December 2015. Our stroke unit consisting of intensive care and nonintensive beds is a part of Department of Neurology that provides services for a population of approximately 200,000 to 250,000 Caucasians living in a highly urbanized area (Southern Warsaw, Poland). The diagnosis of stroke was routinely based on clinical symptoms and noncontrast brain computed tomography, sometimes complemented or substituted with brain magnetic resonance imaging. Data were prospectively collected in a detailed registry that was initially developed in 1991 as a modification of the National Institute of Neurological and Communicative Disorders and Stroke Data Bank protocol, and upgraded in subsequent years.[7-9] Briefly, the registry includes information about patient's demographics, preexisting conditions and medications, results of diagnostic workup, the course of index stroke throughout hospital stay, vital signs (including body temperature) measured at least twice daily for the first 7 days, hospital adverse events, treatment, and outcome at discharge.

The diagnosis of pneumonia or urinary tract infection was routinely established as consensus of treating neurologist and consulting internal medicine specialist. It was based on clinical symptoms and signs supported by laboratory findings or chest x-ray without strictly defined criteria. Body temperature was initially taken from armpit using medical mercury-in-glass thermometer, and since year 2009, from temporal artery using medical infrared thermometer. The temperature was measured at least 2 times per day and the highest daily values from the first week of hospital stay were recorded in the registry. As there is no universal definition of fever, 2 different cut-offs of body temperature (at least 37.5°C and at least 38.0°C) were used for the purpose of this analysis. The hospital diagnosis of both infectious events, difficulties in swallowing, urinary catheterization and treatment with antibiotics were recorded in the registry as nominal variables and referred to the hospital stay as a whole. Stroke severity was measured at admission and multiple times later using Scandinavian Stroke Scale and since 2009, National Institutes of Health Stroke Scale (NIHSS). All Scandinavian Stroke Scale scores were converted to NIHSS using a validated equation.[10] The level of prestroke disability of any cause was measured with modified Rankin Scale. The discharge from our stroke unit is either to home, nursing home, rehabilitation ward or other non-neurological wards if medically justified. The outcome measure was death before discharge from the stroke unit.

For the purpose of the current study we distinguished between 4 consecutive time periods: (1) years 1995 to 2000; (2) years 2001 to 2005; (3) years 2006 to 2010; and (4) years 2011 to 2015.

Ethics

The registry was conducted in concordance with the Declaration of Helsinki and approved by the local Ethics Committee. The paper follows Strengthening the Reporting of Observational Studies in Epidemiology guidelines.[11]

Statistical Analysis

Categorical variables were presented as a number of valid observations and proportions calculated with exclusion of unknown values from the denominator. Due to non-normal distribution, continuous variables were presented as a median with interquartile range (first quartile to third quartile, Q1-Q3).

Comparisons between particular time periods were done using chi-square test and Kruskal–Wallis test, as appropriate. If the overall test for significance was positive ($P < .05$), pairwise comparisons were made between each time period and the first time period (e.g., years 2011-2015 versus years 1995-2000). Similar comparisons were made between each following time period (e.g., years 2011-2015 versus years 2006-2010). Such approach allows minimizing the risk of type I error without losing power by applying the Bonferroni correction.

Logistic regression was used to calculate odds ratios (ORs) with 95% confidence interval for hospital death