Stroke-Associated Pneumonia Risk Score: Validity in a French Stroke Unit

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Background: Stroke-associated pneumonia is a leading cause of in-hospital death and post-stroke outcome. Screening patients at high risk is one of the main challenges in acute stroke units. Several screening tests have been developed, but their feasibility and validity still remain unclear. *Objective:* The aim of our study was to evaluate the validity of four risk scores (Pneumonia score, A2DS2, ISAN score, and AIS-APS) in a population of ischemic stroke patients admitted in a French stroke unit. *Methods:* Consecutive ischemic stroke patients admitted to a stroke unit were retrospectively analyzed. Data that allowed to retrospectively calculate the different pneumonia risk scores were recorded. Sensitivity and specificity of each score were assessed for in-hospital stroke-associated pneumonia and mortality. The qualitative and quantitative accuracy and utility of each diagnostic screening test were assessed by measuring the Youden Index and the Clinical Utility Index. *Results:* Complete data were available for only 1960 patients. Pneumonia was observed in 8.6% of patients. Sensitivity and specificity were, respectively, .583 and .907 for Pneumonia score, .744 and .796 for A2DS2, and .696 and .812 for ISAN score. Data were insufficient to test AIS-APS. Stroke-associated pneumonia risk scores had an excellent negative Clinical Utility Index (.77-.87) to screen for in-hospital risk of pneumonia after acute ischemic stroke. *Conclusion:* All scores might be useful and applied to screen stroke-associated pneumonia in stroke patients treated in French comprehensive stroke units. **Key Words:** Ischemic stroke—stroke-associated—pneumonia—chest infection prediction—screening—predictive value of tests—ROC curve.

Introduction

Post-stroke functional prognosis is related to acute stroke severity and to the occurrence of medical complications, such as pneumonia, urinary tract infections, or deep venous thrombosis, which overall are observed in one third of the patients.[1] Stroke-associated pneumonia (SAP) is one of the most frequent of these complications, between 2.3% and 28% depending on the type of medical ward, and the most disabling with a strong association with a poor functional outcome and mortality.[2-5] Despite significant trends in the reduction of this complication since the development of the stroke units and dedicated medical and paramedical teams,[6] SAP remains still too frequent. Therefore, it is becoming mandatory to identify efficient screening tools in order to predict which patient will have higher risks and implement specific strategies to prevent this disorder.[6,7] To this purpose, several risk scores based on routinely available clinically available parameters have been developed in several countries, such as the A2DS2 in Germany,[8] the Pneumonia score in Korea,[9] the ISAN score in UK,[10] and the AIS-APS in China.[11] To our knowledge, the feasibility and validity of these scores were not compared on an independent population.[12,13]

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Received October 30, 2015; revision received September 1, 2016; accepted September 12, 2016.

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1052-3057/$ - see front matter

http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2016.09.015

The aims of this study were to (1) evaluate the in-hospital rate of SAP and mortality in a population of ischemic stroke patients admitted in a French comprehensive stroke center, (2) investigate the feasibility to retrospectively evaluate four risk scores based on data recorded in the stroke unit, and (3) compare the validity of these scores.

Methods

Patient Selection

Clinical data from patients admitted to our comprehensive stroke center from November 2012 to April 2015 were retrospectively reviewed from computerized medical records that were filled prospectively during in-hospital stay. The inclusion criteria were age over 15 years old, acute ischemic stroke confirmed on brain imaging (either magnetic resonance imaging or computerized tomography), and assessment of the patient for the occurrence of pneumonia or death during hospitalization. The variables mandatory for the retrospective calculation of the four scores were defined according to the original description of the scores (Table 1): age, sex, history of atrial fibrillation or atrial fibrillation on admission electrocardiogram, congestive heart failure, chronic obstructive pulmonary disease and current smoking, prestroke dependence, dysphagia, dysphasia, admission National Institutes of Health Stroke Scale (NIHSS) score, Glasgow Coma Scale score, stroke subtype, blood glucose on admission, and need for mechanical ventilation.

Data Definitions

Pneumonia was diagnosed by the clinician team based on clinical (lung auscultation and percussion, presence of fever, purulent tracheal secretion), microbiological (tracheal specimens, blood cultures), and imaging findings.[14]

Table 1. *Score components and weightings*[8-11]

	Pneumonia score	A2DS2	AIS-APS	ISAN score
Age (years)	1 (≥65)	1 (≥75)	0 (≤59)	0 (<60)
			2 (60-69)	3 (60-69)
			5 (70-79)	4 (70-79)
			7 (≥80)	6 (80-89)
				8 (≥90)
Sex (male)	1	1		1
Medical history/comorbidity				
Atrial fibrillation		1	1	
Congestive heart failure			3	
COPD			3	
Current smoking			1	
Prestroke dependence (Rankin)				
mRS ≥ 2				2
mRS ≥ 3			2	
Admission NIHSS score	1 (≥11)	0 (0-4)	0 (0-4)	0 (0-4)
		3 (5-15)	2 (5-9)	4 (5-15)
		5 (≥16)	5 (10-14)	8 (16-20)
			8 (≥15)	10 (≥21)
Admission GCS score				
15-13			0	
9-12			0	
3-8			3	
Symptom of dysphasia			3	
Symptom of dysphagia	1	2		
Mechanical ventilation	1			
Admission glucose (mmol/L)				
≥11.1			2	
OCSP subtype				
Lacune infarction			0	
Partial anterior circulation infarct			0	
Total anterior circulation infarct			2	
Posterior circulation infarct			2	
Total	5	10	35	22

Abbreviations: COPD, chronic obstructive pulmonary disease; GCS, Glasgow Coma Scale; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; OCSP, Oxfordshire Community Stroke Project.