A STUDY ON STROKE-ASSOCIATED PNEUMONIA IN A TERTIARY CARE CENTER AND EFFECT OF SERUM ALBUMIN ON PATIENT OUTCOMES

RASHMI KP[1], JUBY JOHN[1], JAYACHANDRAN R[1], SANKAR RNK[2]

[1]Department of General Medicine, Government TD Medical College and Hospital, Kerala University of Health Science (KUHS), Alappuzha, Kerala, India. [2]Department of General Medicine, Government Medical College, Kerala University of Health Sciences (KUHS), Konni, Kerala, India. Email: drjubyjohn@gmail.com

ABSTRACT

Objectives: The objectives of this study were to determine if serum albumin level is an independent predictor of nosocomial pneumonia in stroke patients.

Methods: Relevant medical data of 500 consecutive ischemic stroke patients admitted within 24 h of stroke onset during the study period were analyzed. Serum albumin level was measured within 36 h after stroke onset. Nosocomial pneumonia was foundin 10.5% of stroke patients. SPSS (Version 22.0) was used for analysis.

Results: Patients with pneumonia had significantly lower serum albumin level than those without pneumonia (31.5 ± 7.3 g/l vs. 35.3 ± 6.4 g/l) and serum albumin level was associated with risk of pneumonia on multivariate analysis (OR: 0.95, 95% CI: 0.90–0.97).

Conclusion: Our results show that serum albumin level is an independent predictor of nosocomial pneumonia in stroke patients.

Keywords: Stroke, Pneumonia, Serum albumin, Nosocomial infection, Smoking, Total cholesterol.

INTRODUCTION

An infection that is not present or incubating when a patient is admitted to hospital but is detected 48–72 h after admission is considered to be a nosocomial rather than community-acquired infection [1]. Patients with severe brain injury particularly are prone to develop nosocomial infections [2]. Malnutrition is an independent factor associated with nosocomial infections [3]. Albumin is mainly synthesized in the liver and classified as a non-glycosylated plasma protein. It is a vital component of the blood stream, is involved in the transport of small molecules, is used as a cofactor in different essential pathways, and contributes as a major force in limiting fluid leakage from vascular compartment into the interstitial [4,5]. Patients having stroke with hypoalbuminemia at the time of admission in the hospital are prone to develop infection and poor functional outcome, resulting in an increased risk of mortality [5,6]. Low level of serum albumin is linked with malnutrition, chronic inflammatory diseases representing a negative acute-phase protein, and it decreases in concentration during tissue injury and sepsis. Albumin deficiency is often found in hospitalized patients and is reported in up to 19% of stroke patients [7]. Serum albumin level is often used as a marker of nutritional status and its level at admission shows a significant negative correlation with the number of infective complications in stroke patients [8]. The goal of our study was to determine if serum albumin level is an independent risk factor of nosocomial pneumonia in patients with ischemic stroke.

METHODS

We analysed the relevant clinical details and investigation reports of the patients in the study group. Patients of this study were recruited from those with a first occurrence of ischemic stroke admitted to our medicine wards between January 2018 and April 2020, in whom CT was performed within 24 h after stroke onset.

Patients with cancerous disease (two patients) or with other serious diseases potentially interfering with the risk of hypoalbuminemia or infection (four patients with severe circulatory or renal insufficiency) were excluded from the study. Furthermore, three patients with clinical and/or radiological features of pneumonia on admission were excluded from the study.

Operational definition

Acute ischemic stroke was defined as a sudden onset of focal neurological deficit persisting for more than 24 h. A focal neurologic deficit was defined as a constellation of symptoms and/or signs whose cause could be localized to an anatomic site in the central nervous system, with or without a drop in GCS. Ischemic stroke was diagnosed with the radiological evidence on non-contrast CT scan of the brain at the time of admissions as hypodense area of a particular vascular territory or magnetic resonance imaging of the brain, which was suggestive of acute ischemic stroke related to the focal neurological deficit. Early features of infarction on CT scan were also taken in consideration: Hyperdense middle cerebral artery sign, loss of gray-white matter differentiation, hypoattenuation of deep nuclei, cortical hypodensity with associated parenchymal swelling, and resultant gyral effacement [5-7].

Arterial hypertension was diagnosed when its presence was documented in medical records or when at least two readings of blood pressure were ‡140 mmHg (systolic) or ‡90 mmHg (diastolic) after the acute phase of stroke. Ischemic heart disease was diagnosed when there was a history of angina pectoris or myocardial infarction. Diabetes mellitus was diagnosed if its presence was documented in medical records or if the patient was taking insulin or oral hypoglycemic agents. A patient was defined as a smoker if there was a history of cigarette smoking during the past 5 years. Stroke severity on admission was assessed using the Scandinavian stroke scale (SSS) [9]. Biochemical parameters were measured within 36 h after stroke onset.

Hypoalbuminemia was defined as serum albumin level <35 g/l. In all patients, chest X-ray was performed within 48 h after stroke onset. Patients were examined daily for the presence of pneumonia

throughout their hospital stay. Diagnosis of pneumonia was based on clinical findings (presence of fever, productive cough with purulent sputum, lung auscultation, and percussion), abnormal chest X-ray, and microbiological examination of sputum and blood (if needed). The data used in this study were collected as part of a research project investigating the relation between albumin and stroke outcome. The study protocol for this project was approved by the Institutional Ethics Committee and informed consent was obtained from all patients.

Statistical analysis

The Chi-square test was used to compare proportions and the Mann–Whitney U-test to compare continuous variables between groups. Logistic regression analysis was used to assess the independent contribution of variables statistically significant on univariate analysis in the prediction of pneumonia. Values of p<0.05 were considered statistically significant.

RESULTS

As per Table 1, we included 500 consecutive patients (mean age: 70±12.7; 324 men). The mean duration of hospitalization was 10 days. Nosocomial pneumonia was diagnosed in 74 patients (10.5%). In logistic regression analysis, SSS score on admission (OR: 0.94, 95% CI: 0.90–0.97) which was significant, history of hypertension (OR: 0.38, 95% CI: 0.21–0.71), diabetes, IHD, age but not MI (p<0.05) were independently associated with the occurrence of pneumonia. When history of hypertension was excluded from the model, SSS score among characters remained independent predictors. Personal habits like smoking were found to be significantly associated with SAP (p<0.05).

As per Table 2, patients with pneumonia had significantly lower serum albumin level than those without pneumonia, and on univariate

Table 1: Characteristics of stroke patients with or without pneumonia

Characteristics	Stroke with pneumonia (74)	Stroke without pneumonia (426)	p-value
Age	74.6 (10.1)	70 (12.7)	0.001*
Men	48 (64.8)	296 (61)	0.11
Hypertension	64 (86.4)	410 (88.5)	0.01*
Diabetes	54 (72.9)	146 (37.6)	0.01*
Ischemic heart disease	53 (71.6)	370 (79.2)	0.001*
Myocardial infarction	49 (66.2)	81 (14.6)	0.10
Atrial fibrillation	37 (50)	130 (35.8)	0.01*
TIA	32 (43.2)	50 (9.8)	0.10
SSS	17.1	33.3 (7.1)	0.01*
Brain stem infarction	16 (21.6)	59 (10.6)	0.31
Smoking	64 (86.4)	20 (43.7)	0.001*

Table 2: Laboratory parameters of stroke patients with or without pneumonia

Characteristics	Stroke with pneumonia (74)	Stroke without pneumonia (426)	p-value
Fasting glucose	144 mg/dl	114 mg/dl	0.01*
Total cholesterol	233 mg/dl	187 mg/dl	0.22
Triglycerides	167 mg/dl	143 mg/dl	0.13
TLC	11342	7211	0.001*
ESR	53 mm/h	23 mm/h	0.11
Albumin	2.9 g/dl	5.3 g/dl	0.01*
Hyponatremia	121 mEq/L	142 mEq/L	0.001*
GCS score	8.5	12	0.001*
Post circulation versus anterior circulation stroke	41 versus 12	121 versus 100	0.01*

analysis, hypoalbuminemia was associated with increased risk of pneumonia (OR: 3.18, 95% CI:1.88–5.37) which was significant. Fasting glucose, high TLC, and post-circulation stroke were also seen high in patients with pneumonia which was also significant (p<0.05). Hyponatremia is frequently associated with patients having stroke with pneumonia (121mEq/L) (p<0.05), similarly patients with pneumonia having stroke episode were having poor GCS and it was statistically significant (p<0.05).

DISCUSSION

In the previous studies, pneumonia after ischemic stroke was diagnosed in 6.9–13.6% of patients [10-12] and its incidence was higher in patients treated in intensive care units (21%) [13]. As pneumonia in stroke patients is associated with a threefold increased risk of 30-day mortality [11] and with poor outcome [12], it is important to recognize the risk factors for nosocomial pneumonia. In one study, higher baseline using the National Institute of Health Stroke Scale (NIHSS) age, male sex, stroke subtype, and history of diabetes predicted aspiration pneumonia [12]. Other studies focused on special groups of stroke patients. Mechanical ventilation, multiple location, and vertebrobasilar stroke, as well as dysphagia and abnormal chest X-ray, were identified as risk factors for pneumonia in stroke patients treated in intensive care units [13]. Dziewas *et al.* [14] found high frequency (44%) of pneumonia in patients fed by nasogastric tube. In that study, decreased level of consciousness and severe facial palsy independently predicted occurrence of pneumonia. In our study, stroke severity on admission, history of hypertension, and serum albumin level were independently associated with the risk of pneumonia. Conditions related to stroke per se such as secondary adrenal insufficiency due to pituitary ischemia or hemorrhage, SIAD, and cerebral salt wasting (CSW) could also lead to hyponatremia. In a study of 100 stroke patients, CSW was the most common cause of hyponatremia (44.2%), whereas only 7% of hyponatremia cases were attributed to SIAD [15]. On the contrary, in another series of 100 patients with mild/moderate subarachnoid hemorrhage (corresponding to a median Hunt and Hess scale of 2/5 and a median Fisher grade of 3/4), SIAD (71.4%) and acute glucocorticoid insufficiency (8.2%) were found to be the leading causes of hyponatremia. Of note, no cases of CSW were identified in this study [16]. Sarah *et al.* [17] carried out an assessment and analysis on multiple risk factors of SAP in 15 335 patients with acute ischemic stroke and established the A2DS2 scoring tool. They found that the tool had excellent resolving power for prediction of SAP and may be used in identification of patients at high risk and to guide preventive and management measures for pneumonia. In a study, pneumonia frequency was higher in patients with hemorrhagic stroke, more common in those with higher NIHSS (p=0.033) and higher Glasgow Coma Score (p=0.538) [18]. Some studies have demonstrated that complication such as a stroke progression or pneumonia adversely affects clinical outcome. Increase risk of poor outcome in patients with pneumonia, if unadjusted, reflects not only the effect of pneumonia but the effect of other factor predisposing them to pneumonia, such as initial stroke severity or neurological complications [19,20].

The result of multivariate analysis is strongly affected by the independent variables used. They should be clinically and intuitively relevant. We are unable to explain why patients with history of hypertension had lower risk of pneumonia and we cannot rule out that it is a spurious association. When we excluded hypertension from the statistical model, it did not change significantly the results of analysis and ORs for SSS score and albumin level remained similar to those obtained when hypertension was included in the model. To the best of our knowledge, this is the first report showing that serum albumin level is an independent predictor of nosocomial pneumonia in a group of unselected stroke patients. The major limitation of our study is its retrospective character.

CONCLUSION

Hypoalbuminemia can damage the immune response and predispose

patients to infections foremost to complications. Our results show that serum albumin level built on stroke severity, independently forecasts pneumonia in stroke patients. Therefore, patients with hypoalbuminemia must be considered being at hazard of pneumonia and carefully monitored. Furthermore, it is necessary that the government should invest resources to inform the population about the significance of hypoalbuminemia and take measures to correct it.

AUTHORS' CONTRIBUTIONS

Dr. Juby John has finalized the draft and is the guarantor, Dr. Rashmi KP and Dr. Juby John have prepared the conceptual framework, designing of draft, and data analysis, Dr. Jayachandran R and Dr. Sankar RNK were involved in data collection and analysis.

CONFLICTS OF INTEREST

None declared.

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