

Prevalence and Effect of Stroke Associated Pneumonia on in-Hospital Stay, Mortality and Functional Outcome at Discharge from Hospital

MUHAMMAD KAZIM BASHIR¹, AFAQ NAEEM², MUHAMMAD HASEEB MASOOD³, HIRA FAROOQ⁴, IQRA IJAZ⁵, NAJMA FATIMA⁶

¹Medical Officer Imran Idrees Teaching Hospital, Sialkot

^{2,3}House Officer, Internal Medicine, Jinnah Hospital, Lahore

⁴Medical Officer, Amina Hospital, Sialkot

⁵House officer, Neurology department, Shaikh Zayed Hospital, Lahore

⁶Woman Medical Officer, BHU Pothhi Makwalan AJK

Corresponding author: Afaq Naeem, Email: afaqdx7@gmail.com

ABSTRACT

Background and Aim: Stroke is the most prominent cause of morbidity and mortality worldwide especially in developing countries. The stroke outcome mainly related to the presence of complications and severity. Stroke associated pneumonia is the post stroke infection significantly associated with a longer hospitalization, increased risk of hospital mortality, and functional outcomes. There is scarcity of data regarding stroke associated pneumonia on a local basis in the developing countries. Therefore, present study aimed to find out the prevalence and effect of stroke associated pneumonia on in-hospital stay, mortality, and function outcome.

Methodology: This observational prospective study was conducted on 500 stroke patients in the Department of Neurology and Medicine, Jinnah Hospital, Lahore from April 2021 to March 2022. Prior to study conduction, written informed consent and ethical approval was taken. All the participants were recruited for this study. Stroke was diagnosed based on relevant clinical history, brain imaging either by CT scan or MRI, and focused physical examination. Stroke patients of either gender above 18 years age with acute ischemic or hemorrhagic stroke and given written consent were included. All those patients who are already having disability due to previous stroke and other neurological or non-neurological issues were excluded from study. Baseline characteristics were recorded. SPSS version 25 was used for data analysis.

Results: Of the total 500 stroke patients, there were 232 (46.4%) male and 268 (53.6%) females. The overall mean age was 62.4 ± 12.6 years. The prevalence of ischemic and hemorrhagic stroke was 334 (66.8%) and 166 (33.2%) respectively among 500 stroke patients. Hemiparesis was the most prevalent neurological findings 464 (92.8%) followed by facial palsy 432 (86.4%) and swallowing disturbance 262 (52.4%). About 186 (37.2%) stroke patients were complicated by stroke associated pneumonia. Multivariate regression analysis was used and revealed that stroke associated pneumonia could be developed in older age patients > 70 years Adjusted odd ratio AOR= 3.862 (1.21-12.86) ($p=0.031$) who suffered from swallowing disturbance AOR= 4.728, (2.415-9.102) ($p<0.001$), epileptic seizures AOR= 2.749 (1.315-5.681) ($p<0.001$), and moderate to severe stroke AOR= 6.183 (2.036-17.647) ($p<0.001$) (NIHSS=16-21).

Conclusion: The present study concluded that prevalence of SAP was 37.2%. Stroke associated pneumonia is a significant medical issue or complications in stroke patients. Furthermore, older stroke patients with epileptic seizure, swallowing disturbance, and stroke severity from moderate to severe were the risk factors for increasing stroke associated pneumonia. Close monitoring and effective intervention might be needed for high risk SAP in stroke patients.

Keywords: Stroke associated pneumonia, Functional outcome, Mortality, Hospital stay, Stroke

INTRODUCTION

Stroke is the third leading cause of morbidity and mortality worldwide [1]. Every year, an estimated 5 million people die as a result of stroke and its complications [2]. Stroke associated pneumonia is the post stroke infection significantly associated with a longer hospitalization, increased risk of hospital mortality, and functional outcomes. The most prevalent complication among stroke-related complications is the stroke associated pneumonia with reported prevalence of 10% [3]. Stroke associated pneumonia leads to poor clinical outcomes in terms of reduced daily life activities and recovery of disturbed neurological function [4-6]. Additionally, mortality risk increases 3-fold in stroke associated pneumonia after stroke [7]. Moreover, the impact of stroke associated pneumonia on mortality and prognosis following stroke is still to be determined as numerous studies do not consider discharge outcomes. Adverse outcomes after three months might be caused by stroke associated pneumonia as an independent risk factor reported in previous studies [8, 9]. In contrast, Lee et al [10] reported that stroke associated pneumonia had no association with discharge adverse outcomes. However, Veyas et al [11] revealed that stroke associated pneumonia is significantly related to discharge adverse outcome and increasing mortality rate.

Stroke outcomes mainly rely on the presence and post-stroke complications severity. Among the stroke complicated cases, about 5% to 44% cases are complicated by stroke associated pneumonia [12]. Pulmonary infections after 7 days of onset of stroke is defined as stroke associated pneumonia. The increasing risk of longer hospital stay, mortality, and functional outcome were mainly associated with post stroke pneumonia [13]. The incidence of post-stroke pneumonia increases with

medical and neurological conditions reported in hospital-based study [14]. Dysphagia, larger stroke size, altered level of consciousness, prior stroke, dysarthria, higher NIHSS score, cranial nerve palsy, severe neurologic deficit, and middle cerebral artery stroke are the neurology associated risk factors [15]. Medical conditions related risk factors include gender (male), hyperglycemia, older age, nasogastric tube feeding, anemia, endotracheal intubation, hypoalbuminemia, and other comorbidities such as diabetes, heart failure, and chronic lung disease [16]. Identification of post stroke pneumonia related risk factors are prerequisite for prevention of adverse outcomes caused by stroke associated pneumonia. Therefore, the present study aimed to evaluate the prevalence and effect of stroke associated pneumonia on in hospital mortality, stay, and functional outcomes.

METHODOLOGY

This observational prospective study was conducted on 500 stroke patients in the Department of Neurology and Medicine, Jinnah Hospital, Lahore from April 2021 to March 2022. Prior to study conduction, written informed consent and ethical approval was taken. All the participants were recruited for this study. Stroke was diagnosed based on relevant clinical history, brain imaging either by CT scan or MRI, and focused physical examination. Stroke patients of either gender above 18 years age with acute ischemic or hemorrhagic stroke and given written consent were included. All those patients who are already having disability due to previous stroke and other neurological or non-neurological issues were excluded from study. Baseline characteristics were recorded. A convenience sampling method was used to recruit 500 patients. Sample size was determined by considering 95% confidence

interval, 5% margin of error, and previous estimated prevalence of stroke associated pneumonia 44% [17]. Demographic details, clinical characteristics, neurological features, and behavioral factors were different independent variables. Demographic details consisted of MR number, gender, age, occupation, and residency. Admission time in hours from the onset of stroke was the clinical feature. Neurological characteristics included brain lesion's site, stroke severity based on NIHSS score, and stroke subtype such as ischemic and hemorrhagic stroke. Smoking history and tobacco were included in behavioral factors.

Stroke is a sudden cerebral function focal disturbance that lasts for 24 hours or longer, resulting in mortality with no ostensible cause beside vascular origin. Based on neuroimaging (MRI or CT), stroke could be either ischemic or hemorrhagic. Stroke associated pneumonia is defined by various parameters mentioned as follows; Fever $>38^{\circ}\text{C}$ without distinct cause, Leukocytosis ($>12\ 000$ WBC/mm 3) or leukopenia (<4000 WBC/mm 3), change in sputum character or new onset of purulent sputum, Adults of age above 70 years suffering from altered mental status, dyspnea, respiratory crackles, onset of cough, bronchial breath sounds, and tachypnea (respiratory rate $>25/\text{min}$).

SPSS version 25 was used for data analysis. Categorical variables were expressed as frequency and percentage. Numerical or continuous variables were described as mean and standard deviation. Different factors or variables associated with development of post stroke pneumonia were identified using logistic regression analysis. All the descriptive statistics were performed with 95% confidence interval and 5% level of significance. All the data were presented in tabulated form.

RESULTS

Of the total 500 stroke patients, there were 232 (46.4%) male and 268 (53.6%) females. The overall mean age was 62.4 ± 12.6 years. The prevalence of ischemic and hemorrhagic stroke was 334 (66.8%) and 166 (33.2%) respectively among 500 stroke patients. Hemiparesis was the most prevalent neurological findings 464 (92.8%) followed by facial palsy 432 (86.4%) and swallowing disturbance 262 (52.4%). About 186 (37.2%) stroke patients were complicated by stroke associated pneumonia. Multivariate regression analysis was used and revealed that stroke associated pneumonia could be developed in older age patients >70 years Adjusted odd ratio AOR= 3.862 (1.21-12.86) ($p=0.031$) who suffered from swallowing disturbance AOR= 4.728, (2.415-9.102) ($p<0.001$), epileptic seizures AOR= 2.749 (1.315-5.681) ($p<0.001$), and moderate to severe stroke AOR= 6.183 (2.036-17.647) ($p<0.001$) (NIHSS=16-21). Gender's distribution is illustrated in Figure-1. The demographic details and baseline characteristics of the participants are shown in Table-I. The prevalence of stroke subtypes are demonstrated in Figure-2. Neurological findings such as hemiparesis, facial palsy, and swallowing disturbance are shown in Figure-3. Other neurological characteristics are shown in Table-II. Table-III shows the clinical and laboratory findings of the stroke associated pneumonia patients. Logistic regression analysis carried out for different variate as shown in Table-IV.

Gender's distribution

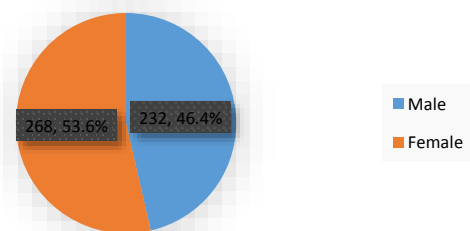


Figure-1: Gender's distribution (n=500)

Table-1: Demographic details and baseline characteristics (n=500)

Variables	Value N (%)
Age (years)	62.4 $\pm$ 12.6
Gender	
Male	232 (46.4)
Female	268 (53.6)
Urban	174 (34.8)
Rural	326 (65.2)
Smoking	
Yes	34 (6.8)
No	466 (93.2)

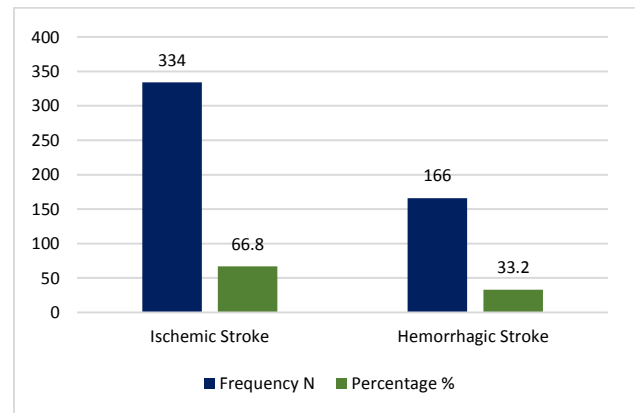


Figure-2: Prevalence of stroke subtype (n=500)

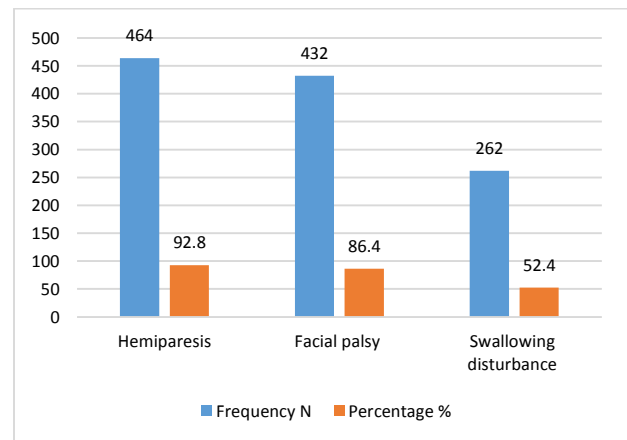


Figure-3: Incidence of neurological findings (n=500)

Table-2: Neurological features of stroke patients

Features	Frequency N (%)
Admission time (hours)	
≤ 24	346 (69.2)
24-72	69 (13.8)
≥ 72	85 (17)
Subtypes of stroke	
Ischemic Stroke	334 (66.8)
Hemorrhagic stroke	166 (33.2)
Lesion's location	
Cortical	234 (46.8)
Subcortical	236 (47.2)
Brain stem	30 (6.00)
Neurological Features	
Vomiting	142 (28.4)
Seizure	82 (16.4)
Facial weakness	432 (86.4)
Swallowing disturbance	262 (52.4)
Hemiparesis	464 (92.8)
Stroke Severity (NIHSS score)	
Mild stroke (1-4)	108 (21.6)
Moderate stroke (5-15)	342 (68.4)
Severe stroke (16-21)	50 (10.0)

Table-3: clinical and laboratory findings of the stroke associated pneumonia patients (n=186)

Features	N (%)
Cough Yes/no	171 (91.9)/15 (8.1)
Fever >38 °C Yes/no	121 (65.1)/65 (34.9)
Respiratory rate <25 ≥25	73 (39.2)/113 (60.8)
Respiratory crackles Yes/no	117 (62.9)/69 (37.1)
Oxygen saturation (Spo ₂) % ≤90 >90	111 (59.7) 75 (60.1)
WBC (× 10 ³ /μ) ≤12,000 >12,000	67 (36.0) 119 (64.0)

Table-4: Logistic regression analysis of stroke associated pneumonia patients

Variables	Adjusted odd ratio AOR (95% CI)	P-value
Age >75 years	3.862 (1.21-12.857)	0.031
Swallowing disturbance	4.728 (2.415-9.102)	<0.001
Epileptic seizures	2.749 (1.315-5.681)	<0.001
Moderate to severe stroke (NIHSS=16-21)	6.183 (2.036-17.647)	<0.001

DISCUSSION

The present study mainly focused on the effect of stroke associated pneumonia on in-hospital stay, hospital mortality, and function outcomes of stroke patients presented to a tertiary care hospital. It has been found that the prevalence of SAP was 37.2% among 500 stroke patients. According to our study, the adverse prognosis outcome and mortality could be significantly predicted by stroke associated pneumonia. This study predicted various risk factors such as bedridden status, dysphagia, invasive procedure, atrial fibrillation, and massive cerebral infarction could be the reason for developing stroke associated pneumonia. Furthermore, while the long-term impact of SAP on the outcome of stroke patients has yet to be determined, a link was discovered between SAP and a poor prognosis three months after stroke treatment. The mean age of the stroke patients was 62.4 ± 12.6 years. Similar age range stroke patients were investigated in a previous study conducted by Buye [18]. In Africa, the average age for stroke patients was 15 years lower than in the developed world due to differences in predisposing factors for stroke, life style, population pyramid, and genetic factors [19].

In the present study, the incidence of hemorrhagic stroke was 33.2% which is within the range 30% to 54% reported in a previous study [20]. In the developed world, preventive strategies and effective treatment limited the incidence of hemorrhagic stroke to 5-10% [21]. The higher prevalence of hemorrhagic stroke in Pakistan might be caused by undiagnosed hypertension, genetic factors, changes in lifestyle, evolving urbanization, variant dietary, and concomitant social stress. In our study, mostly stroke patients 346 (69.2%) hospitalized within 24 hours of stroke initiation. Similarly, about 62% of stroke patients were admitted within 24 hours as reported in a previous study [22]. In contrast, another study [23] reported that more than 72% of patients were hospitalized within 24 to 72 hours. The difference in hospitalization timing could be explained by the population approach toward health care facility, access to health system, and adoption to old traditional treatment.

The overall prevalence of SAP was 37.2%, validating findings were observed in previous studies [24, 25]. SAP patients were mostly older, had higher inflammatory markers and added comorbidities. Previous study recommended that SAP patients have a medical complexity, disease severity, and frailty [26]. Another study used the survival analysis for long-term impact examination

on stroke patients beyond 1 year. According to their study, cumulatively, the mortality rate rose over the follow up period [27]. The authors emphasized that the increased risk of death after a medical complication never went away, implying that the characteristics of the population were to blame rather than the insults of the complication episode.

Numerous studies conducted on stroke in stroke units have found the decline mortality rate [28, 29]. However, this decline was seen in a single study on stroke patient's follow-up for 6 weeks [30]. The decrease in mortality in stroke unit patients did not result in the increased discharge rate. Four of five stroke unit trials [31, 32] showed a reduction in the need for institutionalization after stroke. The hospitalization stay was significantly reduced by treatment provided in the stroke unit. Though, one previous trial [33] confirmed the reduction by 25-50% in hospital stay but our study confirms that improving outcome could influence the stroke patient's recovery and considerably hastens recovery. Reduce mortality rate, length of hospital stay, and discharge rate were independent of patient's treatment either in the stroke unit or neurology unit. SAP can be avoided in a number of ways. SAP can be avoided in a number of ways. Factors such as continuous tube feeding, head position, vomiting or gastroesophageal reflux, getting out of bed, dysphagia location, and post-acute stroke immunosuppression are associated with stroke associated pneumonia and respiratory infections must be prevented in acute stroke patients [34, 35].

CONCLUSION

The present study concluded that prevalence of SAP was 37.2%. Stroke associated pneumonia is a significant medical issue or complications in stroke patients. Furthermore, older stroke patients with epileptic seizure, swallowing disturbance, and stroke severity from moderate to severe were the risk factors for increasing stroke associated pneumonia. Close monitoring and effective intervention might be needed for high risk SAP in stroke patients.

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