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Research Article

# Stroke Associated Pneumonia in Patients of Acute Ischemic Stroke

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**Abstract**

**Introduction:** Stroke associated pneumonia has huge implications in morbidity, mortality and healthcare expenditure after an acute stroke.

**Objective:** To determine the frequency of stroke associated pneumonia in patients who suffer from acute ischemic stroke.

**Methods:** This Cross sectional survey It was conducted in the Departments of Neurology and Medicine, Services and Mayo Hospitals, Lahore from January 2019 to July 2019. Patients of acute stroke (diagnosed as per American Heart Association/ American Stroke Association criteria) were included in the study. Stroke associated pneumonia was assessed as per Pneumonia in Stroke Consensus Group recommendations. Relationship with other factors i.e. age, gender and diabetes mellitus were also evaluated.

**Results:** Out of 285 patients, there were 147 (51.58%) males and 138 (48.42%) females. Sixty patients (21.05%) were in the age range of 30-50 years while 225 patients (78.95%) were between 51-70 years of age. Mean age of the patients was 56.86 +6.81years. Stroke associated pneumonia was found in 51 (17.89%) patients of acute stroke, 23 (45%) males and 28 (55%) females. There was no effect of age (p-value = 0.29) and gender (p-value = 0.30) on stroke associated pneumonia but diabetes mellitus was significantly (p-value = 0.00) related to stroke associated pneumonia.

**Conclusion:** Frequency of stroke associated pneumonia is substantially high (17.89%) in patients of acute stroke. Early diagnosis should prompt management to reduce mortality, morbidity and high healthcare costs related with stroke.

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**Key Words:** Frequency, Stroke, Stroke Associated Pneumonia, SAP

## Introduction:

Stroke is a major cause of long-term disability inflicting more than half of stroke patients aged ≥65 years[1]. A community-based survey estimated that prevalence of stroke and/or transient ischemic attack is 21.8% in Pakistan[2]. Infections are frequent complication of stroke and have significant impact on the prognosis, length of hospital stay and healthcare expenditure. Neurological as well as medical complications, including pneumonia, are major causes of stroke related mortality. Up to one-third of stroke patients suffer from pneumonia.[3,4] Various terminologies (e.g., chest infection, stroke associated pneu-

monia (SAP), post stroke pneumonia, aspiration pneumonia) are used for the variable spectrum of lower respiratory tract infections (LRTIs) complicating stroke[5]. The term 'Stroke Associated Pneumonia' (SAP) was first used by Hilker R and his colleagues[6] and they found 21% incidence of SAP in patients of acute stroke. Finlayson O *et al.*[7] observed SAP in 7.1% of stroke patients which resulted in increased 30-day and 1-year mortality as well as poor functional outcome. Matz K *et al.*[8] reported 5.2% prevalence of post-stroke pneumonia in acute ischemic stroke patients. Ingeman A *et al.*[9] found 25.2% of patients experienced one or more medical complication after acute stroke, i.e., urinary tract infection (UTI) in 15.4%, pneumonia in 9.0% and constipation in 6.8%, all complications were associated with longer length of hospital stay; particularly, pneumonia was associated with higher 30-day and 1-year mortality. Vermeij FH *et al.*[10] found stroke associated infection in 15% of acute stroke patients, 7.5% had pneumonia and 4.4% had UTI. In a meta-analysis done by Westendorp WF et al.[11], the overall pooled post-stroke infection rate was reported 30% and rates of pneumonia and UTI were 10% and 10%; and these rates escalated to 45%, 28% and 20% respectively for the ICU studies. In a systematic review by Hannawi Y *et al.*[12] the incidences of SAP were 4.1-56.6% in neurology intensive care unit (NICUs), 17-50% in medical intensive care units (MICUs), 3.9-44% in stroke units, 3.9-23.8% in mixed studies and 3.2-11% in rehabilitation units.

Aspiration combined with stroke-induced immune depression is the likely pathology of SAP that consisted of complex neuro-humeral pathways including hypothalamic-pituitary-adrenal axis and autonomic system.[13,14] SAP is associated with older age, dysarthria, abnormal water swallowing test, cognitive impairment and severity of post-stroke disability. Timely assessment of these factors can be helpful in determination of stroke patients who are at high risk of developing SAP.[15] The rationale of our study was to find out the magnitude of SAP in our stroke patients since the only local study by *Hassan et al.*[16] showed 23% prevalence of SAP. Early diagnosis of SAP should prompt timely management of these patients.

**Methods:**

This cross-sectional descriptive study was conducted in the Departments of Neurology and Medicine, Services and Mayo Hospitals, Lahore, Pakistan from January 2019 to July 2019. After obtaining approval of the Institutional Review Boards, 285 patients of both genders aged between 30-70 years with acute ischemic stroke (diagnosed as per American Heart Association/ American Stroke Association criteria[17]) were enrolleded in the study. Acute stroke was defined by stroke that presented in the hospital within 72 hours of its onset. Stroke associated pneumonia was diagnosed as per Pneumonia in Stroke Consensus Group Recommendations.[18] All patients had pneumonia within first week after stroke onset and had abnormal chest examination, fever (temperature $\geq$37.8 C), and purulent sputum. Patients who develop pneumonia after first week of stroke onset during hospitalization i.e. hospital-acquired pneumonia (HAP), patients acquiring pneumonia on ventilator, intravenous chemotherapy or hemodialysis, patients residing in nursing homes and patients with pre-existing dysphagia, were excluded from the study. Patients who already had fever or other identifiable source of infection before the development of pneumonia, were also excluded. Patients' data was collected on the pre-designed proforma after taking verbal informed consent. Detailed history of new-onset purulent sputum, cough or dyspnea was taken, thorough respiratory examination was done including the fever record, blood samples were taken to look for leukocytosis or leukopenia and arterial blood gases, and chest radiographs were done to look for new or progressive infiltrate, consolidation or cavitation.

Statistical Package for the Social Sciences (SPSS) version 20 was used for data analysis. Mean and standard deviation was calculated for the quantitative variables i.e. age. Frequencies and percentages were determined for qualitative variables i.e. gender, diabetes mellitus and stroke associated pneumonia were presented as. Data was stratified for age, gender, diabetes mellitus and stroke associated pneumonia. After stratification Chi-Square test was applied to look for the significance. P-value $< 0.05$ was considered statistically significant.

**Results:**

In our studied population, 285 patients of acute stroke with mean age of 56.86 $\pm$6.81SD, were included. Sixty (21.05%) patients were in age group of 30-50 years while 225 (78.95%) patients were in age group

of 51-70 years; 147 (51.58%) patients were males and 138 (48.42%) patients were females; 107 (37.54%) patients were diabetic while 178 (62.46%) patients were non-diabetic. (Table I)

Fifty-one (17.89%) patients developed stroke associated pneumonia out of 240 patients of acute ischemic stroke; 23 (45%) males and 28 (55%) females. (Table II)

Cross-tabulations of age and gender with stroke associated pneumonia were non-significant (p-value = 0.29 and 0.30 respectively) it showed that distribution of SAP was statistically equal patients in both age groups (i.e. 30-50 years and 51-70 years) and in both genders. While cross-tabulation between diabetes mellitus and stroke associated pneumonia was significant (p-value <0.00). (Table III)

**Table I:** *Frequency of sampled population by age, gender and diabetes mellitus*

| | | Frequency | Percentage |
|---|---|---|---|
| **Age (years)** | **30-50** | 60 | 21.05 |
| | **51-70** | 225 | 78.95 |
| | Total | 285 | 100 |
| | | Mean (56.86 ±6.81SD) | |
| **Gender** | **Male** | 147 | 51.58 |
| | **Female** | 138 | 48.42 |
| | Total | 285 | 100 |
| **Diabetes mellitus** | **Yes** | 107 | 37.54 |
| | **No** | 178 | 62.46 |
| | Total | 285 | 100 |

**Table II:** *Frequency of sampled population by stroke associated pneumonia*

| | Frequency | Percentage |
|---|---|---|
| **Present** | 51 | 17.89 |
| **Absent** | 234 | 82.11 |
| Total | 285 | 100 |

**Table III:** *Cross-tabulations of Stroke Associated Pneumonia with Age, Gender and Diabetes Mellitus*

| | | | Stroke associated pneumonia (SAP) | | Total | P-Value |
|---|---|---|---|---|---|---|
| | | | Present | Absent | | |
| 1. | **Age (years)** | **30-50** | 8 | 52 | 60 | |
| | | **31-70** | 43 | 182 | 225 | |
| | Total | | 51 | 234 | 285 | |
| | | | | | | *= 0.29 |
| 2. | **Gender** | **Male** | 23 | 124 | 147 | |
| | | **Female** | 28 | 110 | 138 | |
| | Total | | 51 | 234 | 285 | |
| | | | | | | *= 0.30 |
| 3. | **Diabetes Mellitus** | **Yes** | 34 | 73 | 107 | |
| | | **No** | 17 | 161 | 178 | |
| | Total | | 51 | 234 | 285 | |
| | | | | | | *< 0.00 |

*p-value < 0.05 was considered significant

**Discussion:**

In this two-centers' study, stroke associated pneumonia was found in 17.89% patients suffering from acute ischemic stroke. The incidence of SAP in patients of acute stroke, is quite variable in the western population, ranging from 5.2%[8] to 33.3%.[3,4] A single study done in Pakistan by Hassan A *et al.*[16] showed prevalence of SAP was 23% in stroke patients with male predominance (68%), in comparison to our findings of 17.89% prevalence of SAP in acute stroke patients with female predominance (55%). Mean age of their sampled population was 64 ±14SD, while, in our study population mean age was 56.86 ±6.81SD. Moreover, they reported that 67% patients manifested pneumonia within 48 hours and 33% after 48 hours of admission in the hospital.

In a systematic review by Hannawi Y *et al.*[12] the incidences of SAP were 4.1-56.6% in neurology intensive care unit (NICUs), 17-50% in medical intensive care units (MICUs), 3.9-44% in stroke units, 3.9-23.8% in mixed studies and 3.2-11% in neurorehabilitation units. Majority of studies conducted in NICU and MICU were heterogeneous having diverse neurovascular spectrum as these included patients with intracerebral hemorrhage (ICH) or subarachnoid hemorrhage (SAH) in addition to ischemic stroke, this partly give explanation for the wide range of SAP incidence in these settings. In a meta-analysis by Westendorp WF *et al.*[11] they reported overall pooled post-stroke infection rate 30% and rates of pneumonia and UTI 10% and 10% that increased substantially to 45%, 28% and 20% respectively, for the ICU settings. The higher incidence of SAP in majority of intensive care unit studies compared to acute floor or stroke unit studies, is likely explained by the presence of nasogastric tube feeding, mechanical ventilation, vertebrobasilar stroke, higher severity of stroke as per National Institutes of Health Stroke Scale (NIHSS) score causing higher rates of stroke-induced immunodepression syndrome and aspiration among intensive cre (spelling) unit stroke patients. Differences were also found in the methods of diagnosing SAP (Clinical plus microbiological or radiological diagnosis), diagnostic criteria used (Mann or Center for Disease Control and Prevention (CDC) criteria) [18] and the likely leniencies in inclusion criteria.

When cross-tabulation between age group with SAP was done using Chi-square test, results came up non-significant ($p = 0.29$). It implied that there is no effect of age on SAP in acute stroke patients. There were 15.7% SAP patients in the age group of 30-50 years while 84.3% SAP patients were in the age group of 51-70 years, i.e. SAP is more prevalent in older age group. This finding was consistent with the previously published data by Sellar C *et al.*[15] and Hassan A *et al.*[16] When cross-tabulation between gender and SAP was done, statistically equal distribution of SAP in both male and female patients was shown by a non-significant ($p = 0.30$) that showed Cross-tabulation between diabetes mellitus and SAP was significant ($P = 0.00$) that showed diabetes is significantly related to SAP. This finding was comparable to the studies by Ding R *et al.*[19] and Liao CC *et al.*[20], that showed higher prevalence of diabetes in acute stroke patients with stroke associated pneumonia. They had poorer functional outcome and high mortality rates than in non-diabetic patients.

There are some limitations in this study. Firstly, this study was a hospital-based, two-center study conducted on those patients of acute stroke who belonged to low socio-economic status and had heterogeneous risk factor and clinical profiles; so these results may not be applicable to the general population. Secondly, precision of the results would certainly be improved by a large sample size. Lastly, having a control group would make such study more yielding.

## Conclusion:

It is concluded that the frequency of stroke associated pneumonia is significantly high (17.89%) in patients of acute ischemic stroke. These patients should be diagnosed early and managed accordingly to reduce mortality, morbidity and high healthcare costs related with stroke.

**Ethical Approval:** Given
**Conflict of Interest:** The authors declare no conflict of interest
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