

FREQUENCY AND PATTERNS OF ASPIRATION PNEUMONIA AMONG STROKE PATIENTS PRESENTING TO AYUB TEACHING HOSPITAL ABBOTTABAD, PAKISTAN.

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ABSTRACT

Introduction

Aspiration pneumonia is a common and potentially serious complication of acute stroke, particularly among patients with impaired swallowing and reduced airway protection. Local data on its frequency and clinical patterns remain variable. This study was conducted to determine the frequency and clinical patterns of aspiration pneumonia among patients presenting with stroke at Ayub Teaching Hospital, Abbottabad.

Objectives

To determine the frequency and patterns of aspiration pneumonia among patients presenting with stroke at Ayub Teaching Hospital, Abbottabad.

Methods

A descriptive cross-sectional study was conducted in the Medical Unit of Ayub Teaching Hospital, Abbottabad, from 1 October 2025 to 1 March 2026. A total of 111 patients aged 50 years and above with clinically and/or radiologically confirmed stroke were enrolled through non-probability consecutive sampling. Demographic, clinical, neurological, swallowing, feeding and radiological characteristics were recorded using a structured data collection proforma. Aspiration pneumonia was diagnosed on the basis of predefined clinical and radiological criteria indicating an acute lower respiratory tract infection in the presence of documented or suspected aspiration risk. Data were analyzed descriptively using IBM SPSS Statistics.

Results

Among the 111 stroke patients, 20 developed aspiration pneumonia, giving an overall frequency of 18.0%. The mean age of the study population was 66.8 ± 9.4 years, and 60.4% were male. Ischaemic stroke was predominant, accounting for 73.9% of cases. Among patients who developed aspiration pneumonia, 65.0% had ischaemic stroke and 35.0% had haemorrhagic stroke. Dysphagia was present in 85.0% of affected patients, while impaired gag and cough reflexes were observed in 70.0% and 65.0%, respectively. Half of the affected patients had a GCS of ≤ 8 , and 60.0% had loss of consciousness. Nasogastric tube feeding was present in 70.0% of patients with aspiration pneumonia. The most frequent clinical findings were abnormal chest auscultation (90.0%), fever (85.0%), cough (75.0%) and tachypnoea

(70.0%). Radiologically, new air-space consolidation was seen in 80.0% of cases, with right lower-lobe involvement

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being the most common pattern (45.0%). Most cases developed within the first 72 hours after stroke presentation, with 65.0% occurring between 25 and 72 hours.

Conclusion

Aspiration pneumonia occurred in 18.0% of stroke patients in this study, affecting approximately one in five patients. Among affected patients, dysphagia, impaired gag and cough reflexes, reduced consciousness and nasogastric feeding were frequent findings. Most cases developed during the first 72 hours, with right lower-lobe involvement being the predominant radiological pattern. These findings emphasize the importance of early swallowing assessment, appropriate feeding decisions, airway protection and close respiratory monitoring during the early phase of stroke admission.

Keywords Aspiration pneumonia; stroke; dysphagia; airway protection; nasogastric feeding; swallowing impairment; Abbottabad.

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INTRODUCTION

Stroke is a major cause of death and long-term disability and is frequently complicated by medical problems during the acute hospital stay. Pneumonia is one of the most important of these complications because it can prolong hospitalization, interfere with recovery and increase mortality. Aspiration is an important mechanism of pneumonia after stroke, particularly in patients with impaired swallowing and reduced airway protection. Local Pakistani studies have reported a substantial burden of aspiration or stroke-associated pneumonia, although the reported frequency varies according to the patient population and diagnostic criteria.¹⁻⁴ one of the main reasons for this increased risk is **post-stroke dysphagia**. Stroke can affect the neurological pathways responsible for coordinated swallowing and airway protection, allowing saliva, food or fluids to enter the respiratory tract. Dysphagia is common after acute stroke, but its reported frequency varies with the timing and method of assessment. A systematic review and meta-analysis found that pneumonia was significantly more common in stroke patients with dysphagia than in those without dysphagia, with an odds ratio of 9.60.⁵ this relationship is also evident in Pakistani practice. At Ayub Teaching Hospital, Abbottabad, Jamal et al. studied 100 patients with post-stroke dysphagia and found that 54% developed aspiration pneumonia; among those who developed pneumonia, 88% had dysphagia.⁶ These findings highlight the importance of swallowing impairment in the development of aspiration-related complications after stroke. Aspiration pneumonia,

however, is not caused by dysphagia alone. Severe neurological impairment may reduce consciousness and weaken the cough and gag reflexes, making it difficult for patients to protect their airway or clear aspirated material. Other factors, including advanced age, severe stroke, poor oral hygiene, immobility and the need for enteral feeding, may further increase the likelihood of pulmonary complications. In a study of 500 stroke patients at Jinnah Hospital, Lahore, Bashir et al. reported stroke-associated pneumonia in 37.2% of patients and found swallowing disturbance and greater stroke severity to be important factors associated with its occurrence.³ Similarly, Ikram et al., studying acute stroke patients at Hayatabad Medical Complex, Peshawar, reported aspiration pneumonia as the most frequent acute medical complication.⁷ These findings indicate that aspiration-related pulmonary complications are particularly relevant in patients with severe neurological impairment. The frequency of aspiration pneumonia reported from Pakistani hospitals has not been uniform. Yasmeen et al., in a study conducted at **Ayub Teaching Hospital, Abbottabad**, reported aspiration pneumonia in 46 of 217 patients with cerebral infarction, giving a frequency of 21.2%.¹ Khalid et al., in a descriptive cross-sectional study at Qazi Hussain Ahmad Medical Complex, Nowshera, found aspiration pneumonia in 28 of 180 stroke patients (15.6%).² In another study from Khyber Teaching Hospital, Peshawar, Imran et al. reported aspiration pneumonia in 17% of 100 stroke patients.⁸ Hashim et al. reported stroke-associated pneumonia in 20.4% of 226 patients at Fauji Foundation Hospital, Rawalpindi.⁴ More recently,

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Shah and Khan reported a frequency of 19.8% among 111 stroke patients at Saidu Group of Teaching Hospital, Swat.⁹ Although these studies differ in design, age criteria and diagnostic definitions, their findings consistently demonstrate that pneumonia is a frequent complication among hospitalized stroke patients in Pakistan, particularly in tertiary-care settings.

The clinical importance of this complication extends beyond the respiratory infection itself. Pneumonia after stroke has been associated with longer hospital stays, increased mortality and poorer functional outcomes. In the Lahore study by Bashir et al., patients who developed stroke-associated pneumonia had an increased burden of adverse in-hospital outcomes, while older age, swallowing disturbance and greater stroke severity were independently associated with pneumonia.³ The potential for prevention makes this complication especially important. Early recognition of swallowing impairment, appropriate feeding decisions, attention to oral hygiene, adequate positioning and close monitoring of patients with reduced consciousness may help reduce aspiration-related complications. A prospective comparative study by Nauman and Tassadaq at Fauji Foundation Hospital, Rawalpindi, found a lower incidence of aspiration pneumonia among dysphagic stroke patients receiving swallowing therapy compared with standard nursing care.¹⁰ Although the present study did not evaluate the effectiveness of preventive interventions, these findings support the clinical value of identifying patients with impaired swallowing and airway protection early during admission. Another important issue is that aspiration may occur without obvious coughing or choking. Patients with severe neurological impairment may have reduced protective reflexes and may silently aspirate oral secretions or feeds. Therefore, relying only on overt symptoms may underestimate the true burden of aspiration-related complications. Standardized clinical assessment of swallowing and careful interpretation of clinical and radiological findings are consequently important when evaluating stroke patients. Differences in diagnostic criteria and patient selection also explain some of the variation in reported frequencies between studies. For example, studies restricted to patients with established dysphagia may report substantially higher rates than studies in which all hospitalized stroke patients are included.^{5,6}

Despite the availability of local evidence, there remains a need for updated institution-specific data describing the frequency and clinical pattern of aspiration pneumonia among stroke patients at Ayub

Teaching Hospital. The previously published studies from Abbottabad provide important information, but they were conducted several years earlier and used different patient selection criteria.^{1,6} In addition, the pattern of aspiration pneumonia may vary with age, stroke severity, level of consciousness, swallowing impairment and feeding practices. Data describing these features together in the current medical-unit population can help clinicians recognize patients who require closer monitoring and support appropriate preventive measures. Therefore, this study was conducted to determine the **frequency and clinical patterns of aspiration pneumonia among patients presenting with stroke at Ayub Teaching Hospital, Abbottabad**. The study also described the demographic and clinical characteristics, stroke type, level of consciousness, swallowing and airway-protection abnormalities, feeding practices, radiological pattern and timing of aspiration pneumonia. By providing locally relevant data from a tertiary-care medical unit, the study aimed to contribute to better recognition of this common and potentially preventable complication of acute stroke.

OBJECTIVES

General Objective

To determine the **frequency and clinical patterns of aspiration pneumonia among patients presenting with stroke at Ayub Teaching Hospital, Abbottabad**.

Specific Objectives

1. To determine the **frequency of aspiration pneumonia** among patients presenting with stroke at Ayub Teaching Hospital, Abbottabad.
2. To describe the **demographic characteristics** of stroke patients who develop aspiration pneumonia, including age and gender.
3. To describe the **clinical characteristics of stroke patients with aspiration pneumonia**, including type of stroke, level of consciousness, neurological severity, dysphagia, and impaired gag or cough reflex.
4. To describe the **common comorbidities and clinical factors** present among stroke patients who develop aspiration pneumonia, including hypertension, diabetes mellitus, atrial fibrillation, and other relevant medical conditions.
5. To describe the **radiological and clinical presentation patterns** of aspiration

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pneumonia among affected stroke patients, including the distribution of pulmonary involvement and commonly observed clinical features.

6. To describe the **timing of development of aspiration pneumonia** following presentation with acute stroke.

MATERIALS AND METHODS

Study Design and Setting

A prospective **descriptive cross-sectional study** was conducted in the **Medical Unit of Ayub Teaching Hospital, Abbottabad**, a tertiary-care teaching hospital serving patients from Abbottabad and surrounding districts of Hazara and adjoining areas. The study was designed to determine the frequency and clinical patterns of aspiration pneumonia among patients presenting with stroke.

Study Duration

The study was conducted from **1 October 2025 to 1 March 2026**.

Study Population

The study population comprised patients aged **50 years and above** who presented with clinically and/or radiologically confirmed stroke and were admitted to the Medical Unit during the study period.

Sample Size

The sample size was calculated using the **World Health Organization (WHO) software for sample size determination in health studies**, using the formula for estimating a single population proportion with specified absolute precision.

- **Anticipated proportion of aspiration pneumonia among stroke patients:** 17%
- **Confidence level:** 95%
- **Absolute precision:** 7%

Based on these assumptions, the calculated sample size was **111 patients**.

Sampling Technique

A **non-probability consecutive sampling technique** was used. All eligible patients presenting with stroke during the study period were consecutively enrolled

until the required sample size of 111 participants was achieved.

Inclusion Criteria

Patients meeting all of the following criteria were included:

- Patients aged **50 years and above**.
- Both male and female patients.
- Patients with a confirmed diagnosis of stroke according to the operational definition.
- Patients with any level of consciousness or Glasgow Coma Scale (GCS) score.

Exclusion Criteria

Patients meeting any of the following criteria were excluded:

- Patients who had evidence of aspiration or chest infection **before the onset of stroke**.
- Patients with a documented history or radiological evidence of pre-existing pulmonary disease that could interfere with the assessment of a new pulmonary infection, including relevant abnormalities on previous chest radiograph, CT scan or other available imaging.
- Patients with metabolic or systemic conditions that could explain the altered neurological status, including significant electrolyte abnormalities, hypoglycaemia, hyperglycaemia with diabetic ketoacidosis (DKA) or hyperosmolar hyperglycaemic state (HHS), uremic, hepatic or septic encephalopathy.
- Patients with meningoencephalitis.
- Patients with traumatic intracranial conditions, including traumatic subarachnoid haemorrhage, subdural haematoma or extradural haematoma.
- Patients with a history of congestive cardiac failure (CCF) or evidence of pulmonary oedema/cardiogenic pulmonary congestion on chest radiography.

Data Collection Procedure

After approval from the relevant institutional ethical committee and obtaining informed consent from the patient or an appropriate attendant where the patient was unable to provide consent, eligible patients were

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enrolled consecutively. A structured data collection proforma was used to record demographic, clinical, neurological, radiological and relevant laboratory information. Demographic variables included age and gender. Clinical information included presenting complaints, duration of stroke symptoms, type of stroke, GCS score, neurological findings, dysphagia, gag and cough reflexes, and relevant comorbidities such as hypertension, diabetes mellitus and atrial fibrillation.

Information regarding feeding status, including oral feeding and nasogastric tube feeding, was also recorded. Patients were assessed clinically for features suggestive of aspiration pneumonia during their hospital stay. Relevant investigations, including complete blood count, inflammatory markers where available, chest radiography and other investigations performed as part of routine clinical management, were recorded.

Assessment of Aspiration Pneumonia

Aspiration pneumonia was diagnosed using a combination of **clinical and radiological findings** consistent with an acute lower respiratory tract infection occurring in the setting of documented or suspected aspiration risk. Clinical features included new or worsening cough, purulent sputum, fever, tachypnea, hypoxemia, abnormal chest examination findings or other evidence of lower respiratory tract infection. Radiological evidence included a **new pulmonary infiltrate/consolidation** compatible with pneumonia, particularly when occurring in a dependent pulmonary segment in a patient with clinical features or risk factors for aspiration.

The diagnosis was based on the predefined operational criteria rather than on the presence of a single clinical symptom or radiological finding alone. Evidence of pulmonary infection present before the stroke was considered an exclusion criterion.

VARIABLES STUDIED

The following variables were assessed:

Demographic variables

- Age
- Gender

Stroke-related variables

- Type of stroke: ischaemic or haemorrhagic
- GCS score
- Neurological severity
- Presence of dysphagia
- Impaired gag reflex
- Impaired cough reflex

Clinical variables

- Fever
- Cough
- Sputum production
- Tachypnoea
- Hypoxaemia
- Abnormal chest auscultation findings
- Relevant laboratory findings

Comorbidities

- Hypertension
- Diabetes mellitus
- Atrial fibrillation
- Other relevant documented comorbidities

Feeding-related variables

- Oral feeding
- Nasogastric tube feeding

Radiological variables

- Presence of new pulmonary infiltrate/consolidation
- Site/distribution of pulmonary involvement

Outcome-related variables

- Development of aspiration pneumonia
- Timing of development of aspiration pneumonia following presentation with stroke

Statistical Analysis

Data were entered and analyzed using **IBM SPSS Statistics**. Quantitative variables such as age were summarized using mean and standard deviation or median and interquartile range, as appropriate. Categorical variables including gender, stroke type, presence of dysphagia, feeding method and aspiration pneumonia were presented as frequencies and percentages.

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The **frequency of aspiration pneumonia** was calculated as the proportion of enrolled stroke patients fulfilling the predefined diagnostic criteria for aspiration pneumonia. Clinical, demographic, neurological, feeding-related and radiological patterns among patients with aspiration pneumonia were presented descriptively using appropriate frequency distributions and summary statistics.

As this was a **descriptive cross-sectional study**, the primary analysis remained descriptive and no causal relationship or independent risk factor was inferred from the findings.

Ethical Considerations

Approval was obtained from the relevant **Institutional Review/Ethical Committee of Ayub Teaching Hospital** before commencement of the study. (Approval Code/Ref.N0.RC-EA-2024/037). Informed consent was obtained from all participants or, where the patient's neurological condition prevented informed consent, from an appropriate legally acceptable representative. Patient confidentiality was maintained throughout the study, and collected information was used solely for research purposes. No additional invasive investigation or treatment was performed solely for the purpose of this study.

Quality Control

A structured and pretested data collection proforma was used to ensure uniform data collection. The investigator personally reviewed the clinical records, examination findings and relevant investigations of enrolled patients. Data were checked for completeness and consistency before entry into the statistical software.

RESULTS

A total of **111 patients** fulfilling the predefined eligibility criteria were included in the study. The results are presented descriptively according to demographic characteristics, stroke-related clinical features, comorbidities, swallowing and feeding characteristics, and the clinical and radiological patterns of aspiration pneumonia.

Table 1. Demographic characteristics of the study population (n=111)

Characteristic	Frequency (n)	Percentage (%)
Age group (years)		
50–59	30	27.0
60–69	38	34.2
70–79	29	26.1
≥80	14	12.6
Gender		
Male	67	60.4
Female	44	39.6
Residence		
Urban	43	38.7
Rural	68	61.3

Mean age: 66.8 ± 9.4 years.

Table 2. Stroke-related characteristics of the study population (n=111)

Characteristic	Frequency (n)	Percentage (%)
Ischaemic stroke	82	73.9
Haemorrhagic stroke	29	26.1
Left hemispheric involvement	47	42.3
Right hemispheric involvement	43	38.7
Bilateral/multifocal involvement	8	7.2

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Characteristic	Frequency (n)	Percentage (%)
Brainstem involvement	13	11.7
Loss of consciousness at presentation	34	30.6
GCS 13–15	55	49.5
GCS 9–12	34	30.6
GCS ≤ 8	22	19.8

Table 3. Distribution of major comorbidities among stroke patients (n=111)

Comorbidity	Frequency (n)	Percentage (%)
Hypertension	78	70.3
Diabetes mellitus	45	40.5
Atrial fibrillation	18	16.2
Ischaemic heart disease	21	18.9
Chronic kidney disease	9	8.1
Chronic obstructive pulmonary disease	7	6.3
Previous stroke	16	14.4
No documented major comorbidity	12	10.8

Percentages do not necessarily total 100% because patients could have more than one comorbidity.

Table 4. Swallowing and airway-protection characteristics among stroke patients (n=111)

Clinical characteristic	Frequency (n)	Percentage (%)
Dysphagia present	54	48.6
No dysphagia	57	51.4
Impaired gag reflex	42	37.8
Preserved gag reflex	69	62.2
Impaired cough reflex	38	34.2
Preserved cough reflex	73	65.8
Facial/bulbar weakness	39	35.1
Reduced level of consciousness	34	30.6

Table 5. Feeding method among the study population (n=111)

Feeding method	Frequency (n)	Percentage (%)
Oral feeding	65	58.6
Nasogastric tube feeding	46	41.4
Total	111	100.0

Table 6. Frequency of aspiration pneumonia among stroke patients (n=111)

Outcome	Frequency (n)	Percentage (%)
Aspiration pneumonia present	20	18.0

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Outcome	Frequency (n)	Percentage (%)
Aspiration pneumonia absent	91	82.0
Total	111	100.0

Table 7. Demographic and clinical characteristics of patients with aspiration pneumonia (n=20)

Characteristic	Frequency (n)	Percentage (%)
Age group (years)		
50–59	2	10.0
60–69	7	35.0
70–79	7	35.0
≥80	4	20.0
Gender		
Male	13	65.0
Female	7	35.0
Stroke type		
Ischaemic	13	65.0
Haemorrhagic	7	35.0
Dysphagia		
Present	17	85.0
Absent	3	15.0
Impaired gag reflex		

Characteristic	Frequency (n)	Percentage (%)
Present	14	70.0
Absent	6	30.0
Impaired cough reflex		
Present	13	65.0
Absent	7	35.0

Table 8. Clinical presentation of aspiration pneumonia (n=20)

Clinical feature	Frequency (n)	Percentage (%)
Fever	17	85.0
Cough	15	75.0
Purulent sputum	12	60.0
Tachypnoea	14	70.0
Hypoxaemia	11	55.0
Abnormal chest auscultation	18	90.0
Crackles/crepitations	16	80.0
Reduced oxygen saturation	11	55.0

Patients could have more than one clinical feature.

Table 9. Feeding and neurological characteristics among patients with aspiration pneumonia (n=20)

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Characteristic	Frequency (n)	Percentage (%)
Nasogastric tube feeding	14	70.0
Oral feeding	6	30.0
GCS 13–15	3	15.0
GCS 9–12	7	35.0
GCS ≤ 8	10	50.0
Loss of consciousness	12	60.0
Dysphagia	17	85.0
Bulbar/facial weakness	13	65.0

Table 10. Radiological pattern of aspiration pneumonia (n=20)

Radiological finding	Frequency (n)	Percentage (%)
Right lower lobe involvement	9	45.0
Right middle/lower lobe involvement	3	15.0
Left lower lobe involvement	5	25.0
Bilateral involvement	3	15.0
New air-space consolidation	16	80.0
Patchy infiltrates	4	20.0

Table 11. Timing of development of aspiration pneumonia after stroke presentation (n=20)

Time of development	Frequency (n)	Percentage (%)
Within 24 hours	3	15.0
25–48 hours	7	35.0
49–72 hours	6	30.0
>72 hours	4	20.0
Total	20	100.0

Table 12. Distribution of selected clinical characteristics according to aspiration pneumonia status (n=111)

Clinical characteristic	Aspiration pneumonia present n (%)	Aspiration pneumonia absent n (%)	Total n (%)
Dysphagia	17 (85.0)	37 (40.7)	54 (48.6)
Impaired gag reflex	14 (70.0)	28 (30.8)	42 (37.8)
Impaired cough reflex	13 (65.0)	25 (27.5)	38 (34.2)
Nasogastric feeding	14 (70.0)	32 (35.2)	46 (41.4)
GCS ≤ 8	10 (50.0)	12 (13.2)	22 (19.8)

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Clinical characteristic	Aspiration pneumonia present n (%)	Aspiration pneumonia absent n (%)	Total n (%)
Loss of consciousness	12 (60.0)	22 (24.2)	34 (30.6)
Haemorrhagic stroke	7 (35.0)	22 (24.2)	29 (26.1)
Diabetes mellitus	10 (50.0)	35 (38.5)	45 (40.5)
Hypertension	15 (75.0)	63 (69.2)	78 (70.3)
Atrial fibrillation	4 (20.0)	14 (15.4)	18 (16.2)

This table is presented descriptively. No inferential statistical testing was performed because the study was designed as a descriptive cross-sectional study.

Summary of Findings

Among the 111 enrolled stroke patients, the majority were older adults and males, with ischaemic stroke being the predominant stroke type. Hypertension was the most frequently documented comorbidity. Dysphagia, impaired gag and cough reflexes, and reduced level of consciousness were common clinical findings.

Aspiration pneumonia was identified in **20 of 111 patients (18.0%)**. Among patients who developed aspiration pneumonia, dysphagia was the most frequent swallowing abnormality, followed by impaired gag and cough reflexes. Most affected patients had severe neurological impairment and a substantial proportion required nasogastric feeding. Fever, abnormal chest auscultation, cough and tachypnoea were the most frequently observed clinical manifestations. Radiologically, lower-lobe involvement, particularly on the right side, was the predominant pattern. Most cases developed within the first **72 hours** following presentation with stroke.

Pictorial Depiction of Study Results

Study Flow

The flow sheet below summarizes the overall design of the study, from enrolment of eligible stroke patients through baseline assessment to the identification and detailed evaluation of aspiration pneumonia cases.

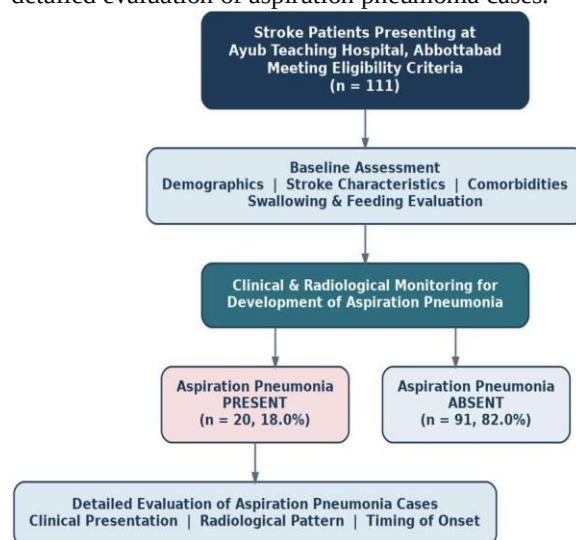
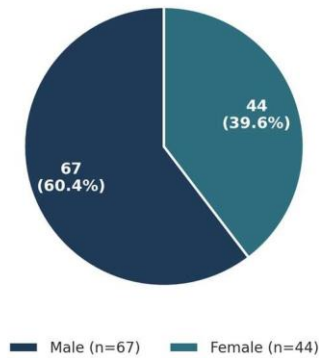


Figure 0. Overview of the study flow and case ascertainment.

Graphical Presentation of Results

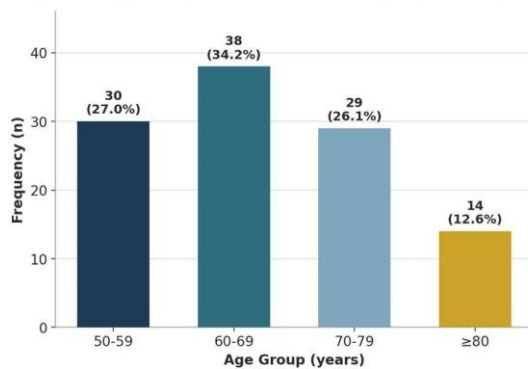
The following figures present the study findings in visual form, mirroring the values reported in the results tables, to allow at-a-glance interpretation of the demographic, clinical, and outcome data.

Figure 1. Gender Distribution of Study Population (n=111)



Males comprised 60.4% (n=67) and females 39.6% (n=44) of the study population.

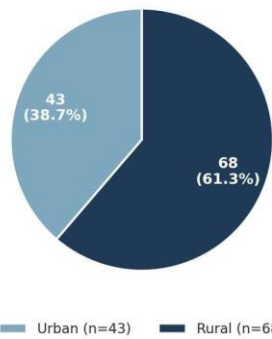
Figure 2. Age Group Distribution of Study Population (n=111)



The 60–69 year age group was the largest, accounting for 34.2% (n=38) of patients.

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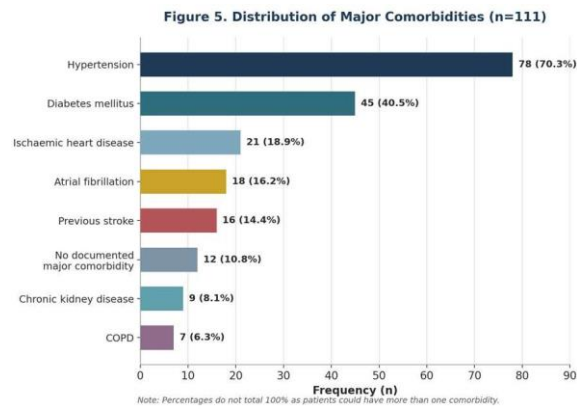
Figure 3. Residential Distribution of Study Population (n=111)



The majority of patients (61.3%, n=68) resided in rural areas.

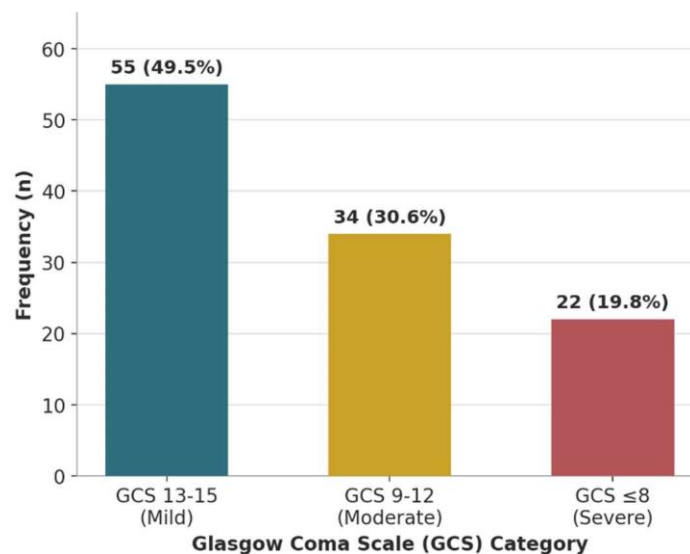
Ischaemic stroke predominated (73.9%, n=82), with left hemispheric involvement being the most common territorial pattern.

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Hypertension was the most frequent comorbidity (70.3%, n=78), followed by diabetes mellitus (40.5%, n=45).

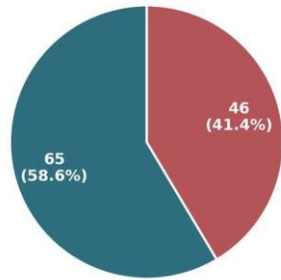
Figure 6. Glasgow Coma Scale (GCS) Category at Presentation (n=111)



Nearly half of patients (49.5%, n=55) presented with a mild GCS category (13–15) at admission.

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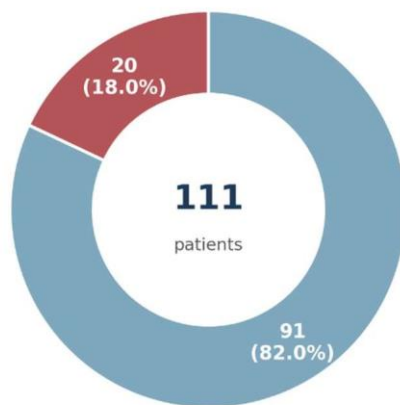
Figure 7. Feeding Method Among Study Population (n=111)



Oral feeding (n=65)
Nasogastric tube feeding (n=46)

Oral feeding was used in 58.6% (n=65) of patients, while 41.4% (n=46) required nasogastric tube feeding.

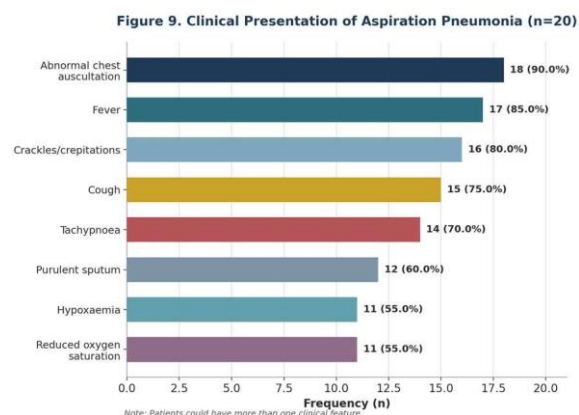
Figure 8. Overall Frequency of Aspiration Pneumonia (n=111)



Aspiration pneumonia present (n=20)
Aspiration pneumonia absent (n=91)

Aspiration pneumonia developed in 18.0% (n=20) of the 111 enrolled stroke patients.

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Abnormal chest auscultation (90.0%) and fever (85.0%) were the most frequent clinical features among aspiration pneumonia cases.

New air-space consolidation (80.0%) and right lower lobe involvement (45.0%) were the predominant radiological findings.

Most cases of aspiration pneumonia (65.0%) developed within 25–72 hours of stroke presentation.

Dysphagia, impaired gag/cough reflexes, and severe GCS were markedly more frequent among patients with aspiration pneumonia than those without.

DISCUSSION

This study was conducted to determine the frequency and clinical patterns of aspiration pneumonia among patients presenting with stroke at the Medical Unit of Ayub Teaching Hospital, Abbottabad. Among the 111 patients included in the study, aspiration pneumonia was identified in 20 patients, giving an overall frequency of **18.0%**. The affected patients were predominantly older adults and males, while ischaemic stroke was the predominant stroke type in the overall study population. Dysphagia, impaired gag and cough reflexes, reduced level of consciousness and nasogastric tube feeding were common among patients who developed aspiration pneumonia. Most cases occurred within the first 72 hours after presentation, and right-sided lower pulmonary involvement was the most frequent radiological pattern.

The frequency of aspiration pneumonia observed in the present study is broadly comparable with several studies from Pakistan and the surrounding region, although substantial variation exists between

individual studies. Yasmeen et al., working at **Ayub Teaching Hospital, Abbottabad**, reported aspiration pneumonia in 46 of 217 patients with cerebral infarction, corresponding to a frequency of **21.2%**.¹ This is close to the 18.0% observed in the present study and provides particularly relevant local comparison because the study was conducted in the same institution. However, the earlier study was restricted to patients with cerebral infarction and included a younger age range of 40–70 years, whereas the present study included patients aged 50 years and above with both ischaemic and haemorrhagic stroke. These differences in study population may partly explain the variation in frequency.

Similarly, Khalid et al. reported an aspiration pneumonia frequency of **15.56%** among 180 stroke patients at Qazi Hussain Ahmad Medical Complex, Nowshera.² Their study also used a descriptive cross-sectional design and included both ischaemic and haemorrhagic strokes. The frequency observed in the present study was therefore slightly higher but remained within a similar range. The similarity between findings from Abbottabad and Nowshera is noteworthy because both populations represent tertiary-care hospitals in Khyber Pakhtunkhwa, where patients may have comparable demographic characteristics, patterns of delayed presentation and availability of inpatient stroke care. In contrast, Shah and Khan reported a frequency of **19.8%** among 111 stroke patients at Saidu Group of Teaching Hospital, Swat, which is again very close to the 18.0% observed in our study.⁹ Taken together, these findings suggest that aspiration pneumonia may affect approximately one-fifth of hospitalized stroke patients in several tertiary-care settings in Khyber Pakhtunkhwa.

The observed frequency was also comparable with the findings of Hashim et al. from Fauji Foundation Hospital, Rawalpindi, where stroke-associated pneumonia was reported in **20.4%** of 226 stroke patients.⁴ The authors used clinical features and chest radiographic abnormalities to identify pneumonia and excluded patients with a previous history of pneumonia. Although the terminology and diagnostic approach were not identical to those used in the present study, the similarity in frequency supports the observation that pulmonary infection is a common early complication of acute stroke in Pakistani tertiary-care hospitals. On the other hand, Bashir et al. reported a substantially higher prevalence of **37.2%** among 500 stroke patients admitted to Jinnah Hospital, Lahore.³ The higher frequency in that study may reflect differences in sample size, patient selection, stroke severity, duration of observation and diagnostic

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criteria. Importantly, their population included patients with a broad age range and the study assessed stroke-associated pneumonia rather than restricting the outcome specifically to aspiration pneumonia.

A particularly relevant comparison is provided by Jamal et al., who previously studied patients with post-stroke dysphagia at **Ayub Teaching Hospital, Abbottabad**. They reported that **54%** of 100 patients with post-stroke dysphagia developed aspiration pneumonia, and 88% of those with pneumonia had dysphagia.⁶ At first glance, this frequency appears considerably higher than the 18.0% observed in the present study. However, the difference is expected because their denominator consisted exclusively of patients who had already developed post-stroke dysphagia, whereas the denominator in the present study included all eligible stroke patients. Therefore, these two studies should not be interpreted as contradictory. Rather, the findings support the important role of dysphagia in the development of aspiration pneumonia and demonstrate how the selected study population can markedly influence the reported frequency.

The frequency of 18.0% in the present study also falls close to the pooled pneumonia prevalence of **20.43%** reported in a systematic review and meta-analysis of Indian studies by Krishnamurthy et al.¹¹ Although this was not a Pakistani study, it provides useful regional context because of geographical and healthcare-system similarities between the two populations. The authors also reported a pooled dysphagia prevalence of 47.71% and found that stroke patients with dysphagia had substantially greater risk of pneumonia than those without dysphagia.¹¹ This is consistent with the pattern observed in the present study, where dysphagia was present in 17 of the 20 patients who developed aspiration pneumonia.

Dysphagia was the most prominent swallowing-related finding among patients with aspiration pneumonia in our study, being present in **85%** of affected patients. This observation is clinically plausible because stroke can impair the coordinated swallowing and airway-protection mechanisms required to prevent aspiration of food, liquids and oral secretions. The importance of dysphagia is also supported by Pakistani data. Jamal et al. found dysphagia in 88% of patients who developed aspiration pneumonia following stroke.⁶ Similarly, Bashir et al. identified swallowing disturbance as an important factor associated with stroke-associated pneumonia, with an adjusted odds ratio of 4.728.³ Although our study was descriptive and did not

undertake inferential analysis, the high proportion of dysphagia among affected patients reinforces the clinical importance of early swallowing assessment in stroke patients.

The present findings are also in agreement with evidence from South India. Krishnamurthy et al. found that pneumonia was substantially more frequent among Indian stroke patients with dysphagia, with a pooled relative risk of 9.41 compared with stroke patients without dysphagia.¹¹ More recently, a study from Christian Medical College, Vellore, reported dysphagia in 77% of 100 stroke patients and found that 27 patients developed pneumonia; among patients with dysphagia, pneumonia occurred in 35%.¹² The latter study also reported that a higher NIHSS score and weak gag reflex were important predictors of dysphagia. Although the design of that study differed from ours, its findings provide further regional evidence supporting the close clinical relationship between neurological severity, swallowing impairment and pulmonary complications.

In the present study, an impaired gag reflex was observed in **70%** of patients with aspiration pneumonia, while an impaired cough reflex was present in **65%**. These findings are important because effective airway protection depends not only on swallowing but also on the ability to recognize and expel aspirated material. Reduced consciousness and impairment of protective airway reflexes may therefore allow aspiration to occur without obvious coughing or choking. Yasmeen et al. reported impaired gag reflex in 31.3% of their overall stroke population, while the Peshawar study by Ikram et al. demonstrated that aspiration pneumonia was the most frequent acute medical complication and that its occurrence increased markedly with greater stroke severity.^{1,7} In their study, 66.7% of patients with NIHSS scores greater than 12 developed aspiration pneumonia.⁷ Although our study did not perform statistical testing, the concentration of severe neurological impairment among patients with aspiration pneumonia is consistent with this regional observation.

Reduced consciousness was also common among patients with aspiration pneumonia in the present study. Half of the affected patients had a GCS of ≤ 8 , and 60% had documented loss of consciousness. This pattern is clinically important because impaired consciousness may compromise swallowing coordination, cough strength and the ability to maintain an effective airway. It may also reduce the patient's ability to respond appropriately to aspiration.

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Similar findings have been reported by Umam et al. from Khyber Teaching Hospital, Peshawar, who examined aspiration pneumonia among stroke patients and identified advanced age and GCS below 8 among the important clinical factors observed in affected patients.¹³ Their study population consisted of patients with aspiration pneumonia and therefore cannot be directly compared with our overall frequency; nevertheless, the similarity in neurological characteristics strengthens the clinical interpretation of our findings.

Nasogastric feeding was present in **70%** of patients who developed aspiration pneumonia in the present study. This finding should be interpreted carefully. Nasogastric feeding is frequently introduced because of severe dysphagia or reduced consciousness and therefore may be a marker of underlying neurological severity rather than an independent cause of pneumonia. The recent study by Farooq et al. from Bolan Medical Complex Hospital, Quetta, reported that 77.1% of stroke patients with aspiration pneumonia were receiving nasogastric tube feeding.¹⁴ The close similarity between their finding and ours is noteworthy and suggests that patients requiring enteral feeding constitute an important group for close aspiration surveillance. At the same time, the present descriptive design does not allow us to determine whether nasogastric feeding itself increased the risk of pneumonia.

The importance of swallowing management is further supported by Nauman and Tassadaq, who conducted a prospective comparative study at Fauji Foundation Hospital, Rawalpindi. They reported aspiration pneumonia in 33.3% of patients receiving standard nursing care compared with 8.3% among patients receiving swallowing therapy.¹⁰ This finding provides clinically relevant evidence that systematic swallowing assessment and rehabilitation may reduce aspiration-related complications in selected stroke patients. Although the present study did not evaluate the effectiveness of a specific intervention, the high frequency of dysphagia and nasogastric feeding among affected patients supports the need for early swallowing assessment, appropriate feeding decisions, positioning, oral care and close monitoring in routine stroke management.

In terms of stroke characteristics, **ischaemic stroke accounted for 65%** of patients with aspiration pneumonia in the present study, while haemorrhagic stroke accounted for 35%. This pattern largely reflected the predominance of ischaemic stroke in the overall study population, where 73.9% had ischaemic

stroke. Therefore, the greater absolute number of aspiration pneumonia cases among patients with ischaemic stroke should not be interpreted as evidence that ischaemic stroke carries a greater individual risk. Similar predominance of ischaemic stroke has been reported in several Pakistani studies. Khalid et al. reported ischaemic stroke in 65% of their participants,² while Bashir et al. reported ischaemic stroke in 66.8% of 500 patients.³ These findings demonstrate that the stroke-type distribution in our study was broadly representative of patterns reported from comparable Pakistani tertiary-care populations.

The radiological pattern in the present study showed a predominance of **right-sided lower-lobe involvement**, accounting for 45% of aspiration pneumonia cases. A further 15% had involvement of the right middle/lower lobes, while 25% had left lower-lobe involvement and 15% had bilateral disease. This distribution is compatible with the anatomical tendency of aspirated material to enter dependent pulmonary segments, particularly when aspiration occurs in a relatively upright position. However, the radiological distribution should be interpreted alongside the patient's position at the time of aspiration and the clinical context. The predominance of lower-lobe and right-sided involvement in our patients supports the usefulness of chest radiography as part of the clinical assessment, although radiological findings alone cannot establish aspiration as the mechanism of pneumonia.

The timing of pneumonia in our study was also clinically relevant. **Eighty percent of cases developed within the first 72 hours**, with the largest proportion occurring between 25 and 48 hours. This early clustering is consistent with the recognized pattern of stroke-associated pneumonia, in which aspiration and impaired airway protection are particularly important during the acute phase of neurological injury. Hashim et al. noted that a substantial proportion of stroke-associated pneumonia occurs within the first 72 hours and emphasized early identification of high-risk patients.⁴ The early timing observed in our study therefore reinforces the importance of performing swallowing assessment and implementing aspiration-prevention measures soon after admission rather than waiting for respiratory symptoms to develop.

The demographic profile of the present study showed a predominance of males (60.4%), with the majority of participants aged 60 years or above. Among patients who developed aspiration pneumonia, 65% were male and 90% were aged 60 years or above. This is broadly

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consistent with findings from several Pakistani studies. Yasmeen et al. reported that 57.1% of their cerebral infarction cohort were male,¹ while Khalid et al. reported 56.67% males.² Bashir et al. found a mean age of 62.4 years in their Lahore cohort and demonstrated an association between older age, particularly age above 70 years, and stroke-associated pneumonia.³ The recent Quetta study by Farooq et al. also identified aspiration pneumonia as a frequent complication in a predominantly older stroke population.¹⁴ These findings suggest that older stroke patients represent an important population for early assessment and preventive care.

Hypertension was the most common comorbidity in the present study, affecting 70.3% of the overall cohort, followed by diabetes mellitus in 40.5%. Among patients with aspiration pneumonia, hypertension and diabetes were present in 75% and 50%, respectively. These findings are consistent with the high prevalence of vascular risk factors among Pakistani stroke populations. However, because the present study was descriptive and did not perform inferential testing, these observations should not be interpreted as demonstrating that hypertension or diabetes independently increased the risk of aspiration pneumonia. This distinction is important because the primary purpose of the study was to describe the frequency and patterns of the complication rather than to identify independent predictors.

The findings of the present study have practical implications for stroke care at Ayub Teaching Hospital. The occurrence of aspiration pneumonia in nearly one-fifth of the enrolled patients, combined with the high frequency of dysphagia, impaired airway-protection reflexes and severe neurological impairment among affected patients, indicates that aspiration prevention should remain an important component of acute stroke management. The previous study conducted at the same hospital by Jamal et al. reported a particularly high burden among patients with post-stroke dysphagia, while Yasmeen et al. demonstrated a frequency close to that observed in the present study among patients with cerebral infarction.^{1,6} The current findings therefore add to the existing institutional evidence and provide a broader description of aspiration pneumonia among stroke patients aged 50 years and above.

LIMITATIONS & STRENGTHS

The study also has several limitations. First, the sample size was relatively small and patients were recruited from a single medical unit using non-

probability consecutive sampling; therefore, the findings may not be generalizable to all stroke patients in Pakistan. Second, the study was descriptive and did not employ multivariable statistical analysis; consequently, the observed relationships between pneumonia and factors such as dysphagia, GCS, impaired reflexes and nasogastric feeding cannot be interpreted as causal or independent associations. Third, aspiration pneumonia was diagnosed using clinical and radiological criteria, and instrumental swallowing investigations such as videofluoroscopic swallow study or fiberoptic endoscopic evaluation of swallowing were not routinely available. Therefore, clinically silent aspiration may have been missed. Finally, the study was conducted in a medical-unit setting rather than a dedicated stroke unit, and differences in referral patterns and available supportive services may have influenced the observed frequency.

Despite these limitations, the study provides useful local data from a tertiary-care hospital in Abbottabad and complements previously published evidence from other Pakistani centres. The overall frequency of 18.0% was similar to findings reported from Abbottabad, Nowshera, Rawalpindi and Swat, while the clinical pattern of dysphagia, impaired protective reflexes, reduced consciousness, nasogastric feeding and early onset was consistent with regional literature.^{1-4,6,9,13-14} The findings therefore support the importance of early identification of swallowing impairment and systematic aspiration-prevention measures in patients presenting with acute stroke.

CONCLUSION

In conclusion, aspiration pneumonia was a frequent complication among stroke patients in this study, affecting approximately one in five patients. It occurred predominantly in older patients and was characterized by a high frequency of dysphagia, impaired gag and cough reflexes, reduced consciousness and nasogastric feeding. Most cases developed during the first 72 hours, with right lower-lobe involvement being the predominant radiological pattern. These findings highlight the need for early swallowing assessment, careful selection of feeding methods, maintenance of airway protection, appropriate positioning and close respiratory monitoring during the early phase of stroke admission. Further multicenter studies with larger sample sizes and standardized instrumental assessment of swallowing are warranted to establish the true burden of aspiration and to evaluate preventive strategies in Pakistani stroke populations.

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