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Risk Factors for the Onset of Aspiration Pneumonia in Stroke Patients

Shah Umam[1], Naveed Ul Hassan[1], Irfan Ullah[1], Mohammad Haroon[1*], Amjad Shahzad[1], Ejaz Khan[1] and Osama Ali Khan[1]

[1]Department of Medicine, Khyber Teaching Hospital, Peshawar, Pakistan

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Corresponding Author:
Mohammad Haroon
Department of Medicine, Khyber Teaching Hospital, Peshawar, Pakistan
drharoonjr@gmail.com

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ABSTRACT

The third causes disability and is the second most common cause of death in the world. It is an interruption in the flow of blood to the brain and denies the brain tissues oxygen and other vital nutrients, thus causing ischemic damage. **Objective:** To determine the risk factors associated with the onset of aspiration pneumonia in stroke patients. **Methods:** A cross-sectional study was carried out from December 2, 2023, to May 1, 2024, at the Department of Medicine, Khyber Teaching Hospital. Participants included 149 patients aged ≥18 years who had been diagnosed with aspiration pneumonia complicating a stroke. The following risk variables for aspiration pneumonia were investigated: diabetes, smoking, age over 65, stroke type, Glasgow Coma Scale (GCS) <8, and nasogastric (NG) feeding. Data analysis was done with SPSS version 25.0. **Results:** The patients' average age was 61.77 ± 9.58 years. The most frequent risk factor seen in 101 individuals (71.8%) was the kind of ischemic stroke, which was followed by the lack of NG feeding in 95 patients (63.8%). The least prevalent factor was diabetes mellitus (n=66, 44.3%). **Conclusions:** Aspiration pneumonia is a dreadful complication in stroke patients. It is more frequent in patients with advanced age, with a GCS less than 8, and without NG feeding.

INTRODUCTION

Stroke is the third leading cause of disability and ranks as the second most frequent cause of death worldwide. It occurs when blood flow to the brain is interrupted, depriving brain tissue of oxygen and essential nutrients, which leads to ischemic damage [1, 2]. Data on stroke prevalence in Pakistan are limited, but estimates suggest an incidence of around 250 cases per 100,000 population, corresponding to approximately 350,000 new cases each year [3]. The hallmark symptom of stroke is sudden weakness or numbness affecting the face, arm, or leg, typically on one side of the body, known as a focal neurological deficit. Other manifestations may include confusion, difficulty with speech or comprehension, visual disturbances in one or both eyes, problems with walking, dizziness, loss of balance or coordination, severe unexplained headaches, fainting, or loss of consciousness [4, 5]. Risk factors for stroke are classified as modifiable or non-modifiable. Modifiable factors include lifestyle choices such as tobacco and alcohol use, physical inactivity, obesity, high blood pressure, atrial fibrillation, elevated cholesterol, diabetes, and atherosclerosis. Non-modifiable factors encompass age, sex, ethnicity, family history, and previous episodes of stroke or transient ischemic attacks [4, 5]. One of the most common side effects for stroke patients admitted to hospitals is aspiration pneumonia [6]. After being admitted to the hospital for one to two days, stroke patients experience it. A common aspiration among patients who are

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incapacitated, such as those who have had a stroke, is food aspiration, which puts the patient at risk for aspiration pneumonia. Apart from aspirating food, other bodily fluids and any type of gastrointestinal material can also enter the lungs and result in aspiration pneumonia. Patient morbidity and death are rising even with the many preventive and therapeutic strategies used in healthcare facilities for patients with post-stroke aspiration pneumonia [7]. According to a study, aspiration pneumonia was associated with the following risk factors: Glasgow Coma Scale (GCS) ≤ 8 in 82.9%, use of nasogastric feeding in 64.4%, age over 65 in 44.6%, smoking in 62.08%, diabetes in 57.4%, hemorrhagic stroke in 62.7% [8]. The aspiration pneumonia risk variables in one study included age over 65, smoking, diabetes, hemorrhagic stroke, GCS ≤ 8, and nasogastric feeding usage [8].

In Pakistan, there is limited local information regarding risk factors of aspiration pneumonia in stroke patients. There are inconsistent results in the existing international literature, and there is no recent in-depth study that has been carried out in Khyber Pakhtunkhwa. This gap becomes an obstacle to prevention strategies that are evidence-based. This paper determines the important risk factors that can be changed to inform clinical practice. In order to identify and prevent these risk factors, the purpose of this study is to ascertain the frequency with which aspiration pneumonia occurs in stroke patients. This study contributes to improved stroke patient management and a decrease in the morbidity and death of stroke victims. My goal in doing this study is to identify and prevent key risk factors that could further increase the morbidity of stroke patients. This study aimed to determine the risk factors for the onset of aspiration pneumonia in stroke patients.

METHODS

A cross-sectional study was conducted at the Department of Medicine, Khyber Teaching Hospital, from December 2, 2023, to May 1, 2024. The sampling technique used was non-probability consecutive sampling. Ethical approval was obtained from the Review Board of Khyber Medical College (Ref No: 02/DME/KMC; dated 2nd January 2023). The sample size for this study was calculated using the WHO sample size calculator [9], with a 95% confidence interval, 8% absolute precision, and an expected prevalence of aspiration pneumonia of 44.6% in patients aged over 65 years [8], resulting in a total of 149 participants. The study included patients aged 18 years and above who had experienced a stroke and developed aspiration pneumonia, regardless of gender. Patients with congenital anomalies such as cleft palate were excluded. Following ethical approval, eligible inpatients at KTH were approached, and the objectives of the study were explained before obtaining informed consent. Demographic information collected included age, gender, stroke type, body mass index (BMI), residence, socioeconomic status, education level, occupation, and presence of comorbidities such as diabetes and hypertension, as well as duration of symptoms. A detailed history and physical examination were performed for each participant. The level of consciousness was assessed at admission using the Glasgow Coma Scale (GCS). As part of standard clinical management, initial laboratory evaluations were performed. Patients were subsequently observed in the intensive care unit for the development of aspiration pneumonia. Risk factors for aspiration pneumonia were identified according to the operational definition, and all data were systematically recorded using a structured proforma.

Data analysis was conducted using SPSS version 22.0. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were summarized using frequencies and percentages. To account for potential effect modifiers, the data were stratified by variables including age, gender, and duration of stroke. Post-stratification analysis was performed using the chi-square test. A p-value of ≤0.05 was considered indicative of statistical significance.

RESULTS

The age of the patients ranged from 40 to 80 years. The mean age of the patients was 61.77 ± 9.58 years. The mean BMI of patients was 23.04 ± 2.922. 90 (60.4%) were male, and 83 (55.7%) patients had a BMI more than 24.0. Most of the patients had an education below matric, 78 (52.3%), as shown in table 1.

Table 1: Study Participants' Demographic Characteristics

Parameters		Frequency (%)
Age in Years	≤65	72 (48.30%)
	>65	77 (51.70%)
Gender	Male	90 (60.40%)
	Female	59 (39.60%)
BMI (kg/m^2)	24.0 or below	66 (44.30%)
	More Than 24.0	83 (55.70%)
Residence	Rural	77 (51.70%)
	Urban	72 (48.30%)
Education	Matric or below	78 (52.30%)
	Above Matric	71 (47.70%)
Profession	Salaried	42 (28.20%)
	Business	59 (39.60%)
Socioeconomic (SE) Status	Yes	78 (52.30%)
	No	71 (47.70%)
Stroke Duration (days)	5 or below	83 (55.70%)
	More Than 5	66 (44.30%)
Hypertension	Yes	57 (38.30%)
	No	92 (61.70%)

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Ischemic stroke type was the most consistent risk factor observed in 101 participants (71.8%), followed by the absence of NG feeding in 95 patients (63.8%). Diabetes mellitus was the least common factor (n=66, 44.3%). The frequency of risk factors for aspiration pneumonia in patients with stroke is shown in table 2.

Table 2: Frequency of Risk Factors for Aspiration Pneumonia in Patients with Stroke

Risk Factors		n (%)
Age > 65 Years	Yes	77 (51.70%)
	No	72 (48.30%)
DM	Yes	66 (44.30%)
	No	83 (55.70%)
Smoking	Yes	71 (47.70%)
	No	78 (52.30%)
Glasgow ComaScale (GCS) <8	Yes	89 (59.70%)
	No	60 (40.30%)
Nasogastric (NG) Feeding	Yes	54 (36.20%)
	No	95 (63.80%)
Stroke Type	Ischemic	107 (71.80%)
	Hemorrhagic	42 (28.20%)

Risk factor for aspiration pneumonia is stratified by gender and duration of stroke. After stratification by gender and duration of stroke, the age, type of stroke, and state of consciousness were associated significantly (p<0.05), as shown in table 3.

Table 3: Stratification of Risk Factors for Aspiration Pneumonia with Gender and Duration of Stroke

Risk Factors		Gender			Stroke Duration (Days)		
		Male, n (%)	Female, n (%)	p-value	≤5, n (%)	>5, n (%)	p-value
Age > 65 Years	Yes	36 (46.80%)	41 (53.20%)	<0.001*	30 (41.70%)	42 (58.30%)	0.001*
	No	54 (75.00%)	18 (25.00%)		53 (68.80%)	24 (31.20%)	
Diabetes	Yes	36 (54.50%)	30 (45.50%)	0.192	42(63.60%)	24 (36.40%)	0.082
	No	54 (65.10%)	29 (34.90%)		41(49.40%)	42 (50.60%)	
Ischemic Stroke	Yes	54 (50.50%)	53 (49.50%)	<0.001*	65 (60.70%)	42 (39.30%)	0.048*
	No	36 (85.70%)	6 (14.30%)		18 (42.90%)	24 (57.10%)	
Smoking	Yes	42 (59.20%)	29 (40.80%)	0.766	41 (57.70%)	30 (42.30%)	0.632
	No	48 (61.50%)	30 (38.50%)		42 (53.80%)	36 (46.20%)	
GCS <8	Yes	66 (74.20%)	23 (25.80%)	<0.001*	41 (46.10%)	48 (53.90%)	0.004*
	No	24 (40.00%)	36 (60.00%)		42 (70.00%)	18 (30.00%)	
NG Feeding	Yes	36 (66.70%)	18 (33.30%)	0.239	36 (66.70%)	18 (33.30%)	0.042*
	No	54 (56.80%)	41 (43.20%)		47 (49.50%)	48 (50.50%)	

* Shows p-value<0.05

DISCUSSION

The higher risk of aspirating gastric content is common in patients with stroke for several reasons. For instance, aspiration is more likely to occur in stroke patients who have neurological damage because their swallowing reflexes are compromised. Additionally, because mechanical ventilation via an endotracheal tube can hinder common aspiration defense mechanisms like coughing, individuals who need this are more vulnerable to aspiration [10]. The mean BMI of patients was 23.04 ± 2.922. 90 (60.40%) were male, and 83 (55.7%) patients had a BMI of more than 24.0. Most of the patients had an education below matric, 78 (52.30%). The most frequent risk factor seen in 101 participants (71.80%) was the kind of ischemic stroke, which was followed by the absence of NG feeding in 95 patients (63.80%). Diabetes mellitus was the least common factor. Aspiration was more common in males compared to females (60.40% versus 39.60%). Males compared to females exhibited a significantly higher risk of developing aspiration pneumonia, aligning with the findings of Lidetu *et al.* [6]. Additionally, the findings of research carried out in China and the United Kingdom support this trend [11, 12]. A higher GCS level is more protective in stroke patients against aspiration pneumonia. In this study, aspiration was common in those with a GCS below 8 (59.70% versus 40.30%). These findings were consistent with studies from Ethiopia and Nigeria [10, 13]. Impaired consciousness or low Glasgow Coma Scale (GCS) score, reduced airway reflexes are diminished, increasing susceptibility to aspiration. When these defense mechanisms are compromised, the likelihood of aspirating oropharyngeal or gastric contents rises, potentially leading to aspiration pneumonia [6]. Dysphagia is a common complication following stroke and represents a major risk factor for aspiration pneumonia, contributing significantly to higher rates of mortality and long-term disability [3]. Studies estimate that approximately 50-67% of individuals experience swallowing difficulties after a stroke [4, 5]. Prompt evaluation of swallowing function is therefore essential, as it assists in determining appropriate nutritional strategies and may reduce the risk of stroke-associated pneumonia (SAP) [6, 7]. Evidence indicates that patients with post-stroke dysphagia have a substantially

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greater risk of developing pneumonia (22.9%) compared to those without swallowing impairment (1.1%), largely due to aspiration events [8]. Furthermore, the probability of pneumonia may increase incrementally by approximately 1% per day when dysphagia remains undetected or untreated [10]. Stroke frequently results in dysphagia, which raises the possibility of aspiration pneumonia, which has been linked to increased mortality and disability rates [14]. Poststroke dysphagia affects between 50% to 67% of stroke victims [15]. Decisions about nutritional treatment and the potential reduction of stroke-associated pneumonia (SAP) problems are informed by early assessment of swallowing ability in stroke patients [16]. Compared to those without dysphagia (1.1%), patients with dysphagia (poststroke) have a higher incidence of pneumonia (22.90%), which is most likely caused by aspiration [17]. This study observed aspiration in stroke patient were more common in patients aged 65 years of age (51.70% versus 48.3%). Progressive neurological deficits, swallowing difficulties, weakened immunity, and a higher prevalence of comorbidities are all associated with advanced age. Together, these variables increase the incidence of post-stroke aspiration pneumonia in elderly individuals, which is in line with research from several other nations [18, 19]. Aspiration occurred more often in individuals with ischemic stroke than hemorrhagic stroke in the current study (71.8% vs. 28.2%). These results are in line with those of Khalid *et al.* who found that 35% of their study sample experienced hemorrhagic stroke and 65% had ischemic stroke [20]. Other research, however, has shown contrasting findings, suggesting that people who have had an ischemic stroke may be less likely than those who have had a hemorrhagic stroke to get aspiration pneumonia [6]. The variation between our findings and previous research could be attributed to differences in study design and patient selection. Our study specifically included only stroke patients who developed aspiration pneumonia and did not compare them with stroke patients without aspiration, which may have influenced the distribution. A comparable methodology was adopted in the study conducted by Khalid *et al.* [20]. This study's findings demonstrated that a greater proportion of patients who developed post-stroke aspiration pneumonia were receiving oral feeding (63.8%) compared to those fed via a nasogastric (NG) tube (36.2%). These results differ from those reported by Nigus *et al.* who found that stroke patients receiving NG tube feeding were 10.58 times more likely to develop aspiration pneumonia [10]. Additional studies have similarly suggested that NG tube feeding carries a higher risk of aspiration than oral feeding [21, 22]. The elevated risk associated with NG tube feeding may be explained by factors such as excessive feeding volumes, improper patient positioning, particularly feeding in the supine posture, or incorrect placement of the NG tube. Furthermore, Lin *et al.* found that patients with oropharyngeal dysphagia were more likely to aspirate when receiving NG tube feeding [23], while it was unclear if the study group was limited to stroke patients. Existing literature indicates that the incidence and determinants of pneumonia during the subacute phase of stroke have not been thoroughly investigated. Moreover, pneumonia developing in the subacute period may follow a different clinical course compared to pneumonia occurring in the acute phase [8]. A notable strength of the present study is the incorporation of admission imaging findings alongside established clinical predictors in the evaluation of pneumonia. This approach may represent a relatively underexplored factor in pneumonia development and could provide a valuable direction for future research.

The small sample size (n=149), no control group, and single-center cross-sectional design limit the generalizability of the findings, as the study was not conducted to determine causality, but only to identify associations; it was also not followed up over the long term, which increases the risk of recall bias. Multicenter prospective cohort designs, control groups, larger samples, prolonged follow-up, dysphagia screening systems, early NG feeding, and designing a local risk score to prevent aspiration pneumonia in stroke patients.

CONCLUSIONS

In conclusion, patients with ischemic stroke with a Glasgow Coma Scale score of less than 8 having no nasogastric feeding were most frequently observed with aspiration pneumonia. Patients with stroke should be evaluated for aspiration at the time of presentation.

Authors' Contribution

Conceptualization: SU, NUH
Methodology: SU, NUH
Formal analysis: IU
Writing and Drafting: SU, NUH, IU, MH, AS, EK, OAK
Review and Editing: SU, NUH, IU, MH, AS, EK, OAK

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflict of Interest

All the authors declare no conflict of interest.

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