Assiut Scientific Nursing Journal
http://asnj.journals.ekb.eg http://www.arabimpactfactor.com
DOI:10.21608/asnj.2025.405044.2132 http://olddrji.lbp.world/indexedJournals.aspx
https://vlibrary.emro.who.int/journals/assiut-scientific-nursing-journal

Predictors for Acute Stroke Associated Pneumonia and Its' Outcomes among Acute Stroke Patients

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Abstract

Background: The most common respiratory complications after acute stroke was stroke-associated pneumonia, which raised the morbidity and mortality rates among stroke patients. **Aim of the study:** to assess the Predictors for Acute Stroke Associated Pneumonia and Its' Outcomes Among Acute Stroke Patients. **Research design:** Descriptive research design was utilized. **Setting:** This study was conducted in stroke unit at Neuro-Psychiatry and Neuro Surgery Hospital - Assuit university. **Sample:** convenience sample of adult patients from both sex male and female admitted to stroke unit, with acute stroke their age groups ranging between 18–65 years. **Tools:** three tools were utilized**, Tool (I)**: Acute stroke patient's assessment sheet, **Tool (II):** predictors for acute stroke Associated Pneumonia by A2DS2 scale, **Tool (III):** Clinical Outcomes Assessment Tool. **Results:** Among stroke-associated pneumonia patients mortality rate was half of patients **(50%), 47.5%** connected on mechanical ventilation and had a lengthy hospital stay with Mean± SD **(11.23±3.438)** and A2DS2 score is a reliable method for prediction of stroke-associated pneumonia. **Conclusion:** stroke-associated pneumonia is one of the most common infections that develops after a stroke which correlates with elevated mortality rates, prolonged length of stay and used of mechanical ventilation. **Recommendation:** Nursing protocol must be implemented for nurses, who are integral part in patient care, for early recognition and management of complications associated with acute stroke.

Keywords: Acute Stroke, Pneumonia & Outcomes

Introduction:

Acute stroke may be defined as a neurological deficit that has a sudden onset, results in permanent damage to the brain, and is caused by cerebrovascular disease. Acute stroke occurs when there is a disruption of blood flow to a region of the brain. Blood flow is disrupted because of an obstruction of a vessel, a thrombus or embolus, or the rupture of a vessel **(Morton et al., 2023)**.

pneumonia is most common complications among patients due to swallowing difficulty and inability to protect the airway adequately which put them at risk for aspiration pneumonia **(Sadik, Ail, et al., 2025)**.

Stroke-associated pneumonia SAP refers to pulmonary infection that develop within the first 3- 7 days of stroke onset among Non-ventilated patients, It refers to the occurrence of pneumonia in individuals who have recently experienced a stroke, often attributable to compromised immunity and a weakened cough reflex in stroke patients **(Westendorp et al., 2018)**.

The A2DS2 score (age, atrial fibrillation, dysphagia, sex, and stroke severity using the National Institutes of Health Stroke Scale score) is a simple scoring system to anticipate incidence stroke associated pneumonia **(Vyas et al., 2022).**

Stroke-associated pneumonia not only extends hospital stays and escalates healthcare costs but also significantly impacts patient outcomes . It correlates with heightened mortality rates, increased risk of hospital readmission, prolonged length of stay **(Xu et al., 2021).**

In recent years, cluster nursing, as a comprehensive, multidisciplinary nursing approach, has been proven to have a positive impact on preventing certain complications. application of a cluster nursing intervention strategy effectively reduced various risk factors for bacterial pneumonia in patients with neurology department stroke **(Hu et al., 2023).**

Significance of the study:

The global incidence of stroke associated pneumonia among acute stroke patients is 14%. However, the incidence has significant variations among the different regions. The incidence in Egypt after acute stroke is 44% **(Lidetu et al., 2023)**.

Incidence of SAP among acute stroke patients was 32.4%, which is comparable to the reports issued by another center in Egypt "Alexandria Main University Hospital" (37.1%) **(Aboulfotooh et al., 2024)**.

Previous studies have shown that SAP can be prevented. In addition, 43–79% of SAP occurs within 3days of acute stroke onset. Therefore, early identification and management of high-risk patients are necessary to reduce the incidence of SAP **(Eltringham et al., 2018) and (Liu et al., 2022)**

Aim of the study: Assess the predictors for acute stroke associated pneumonia and its' outcomes among acute stroke patients.

Research question:

- What are the predictors for acute stroke Associated Pneumonia ?
- What are the outcomes of stroke associated pneumonia?

Operational definitions: Outcomes: include length of stay, mortality rate and Connect on mechanical ventilation.

Patients and Methods:

Research design: A descriptive research design was utilized to carry out this study.

Settings : This study was conducted in stroke ICU in Neuro-Psychiatry and Neuro Surgery Hospital - Assuit university. The stroke unit consists of five sectors, each containing five beds.

Sample: Convenience sample of adult patients from both sex male and female ,admitted to stroke unit, with acute stroke, their age groups ranging between 18–65 years, who were 113 patients, The data collected within six months started from September 2024 to February 2025, patients admitted with stroke from 2022 – 2023 was 283 patients and data collected in 6 months.

Exclusion criteria:

This study excluded patients who had the following criteria:

- Patients had pneumonia at hospital admission.
- Patients age more than 65 Years old .
- Patients refused to participate in the study.

Tools of data collection:

Tool (I): Acute Stroke Patient's Assessment Sheet: this tool was developed by the researcher after reviewing the related literature **(Hoffmann et al., 2016), (Banda et al., 2022), & (Song et al., (2024).**

Part (1): Personal data: this part adopted from **(Song et al**., **2024**) and It covers the following areas: patient code, age, sex, BMI, past medical history, surgical history, smoking history ,and dysphagia.

Part (2): Vital signs this part adopted from **(Hoffmann et al., 2016)** and included heart rate, temperature, and respiratory rate.

Part (3): Laboratory tests assessment:- this part adopted from **(Banda et al., 2022)** and included White blood cells, Red blood cells, hemoglobin, platelets and cultures.

Tool (II): Predictors for acute stroke Associated Pneumonia by A2DS2 scale :- This tool adopted by **(Hoffmann et al., 2012),** used to anticipate incidence of stroke Associated Pneumonia, it is consist of 5 points (Age 0-1, Atrial fibrillation 0-1, Dysphagia 0-2, Sex male 0-1 , Stroke severity NIHSS 0-5), stroke patients classified to low risk group 0-4 , and high risk group 5-10.

Tool (III) : Clinical outcomes assessment tool: this tool developed by the researcher after reviewing the current related literature **(Teh et al., 2018),** and **(Li et al., 2023)** used to assess the patient outcomes Such as length of stay, mortality rate and Connect on mechanical ventilation.

Methodology:

Ethical Considerations:

- The research proposal approved from ethical committee in the faculty of nursing.
- There was not risk for study subject during application of the research.
- The study followed common ethical principles in the clinical research.
- Written consent obtained from patients or guidance that are willing to participate in the study after explaining the nature and purpose of the study.
- Patients assured that the data of this research will be used only for the purpose of research.
- Confidentiality and anonymity assured.
- Patients had the right to refuse to participate and/or withdraw from the study without any rational at any time.

Tools development:

- Official permission was obtained to carry out the proposed study, enabling the researcher to initiate data collection.
- Tools for collecting data were developed based on reviewing the current, past, local, and international related literature in various aspects using books, articles, journals, magazines, and references.

Pilot study:

A pilot study included 10% of the studied sample (11patients) they were used to determine the tools' applicability and clarity as well to estimate time needed to fill in the data collection tools. The data from the pilot study were analyzed; no changes were made to the tools utilized, so the sample selected for the pilot study were involved in the study.

Content validity and Reliability

Face validity: Was done by five specialists who evaluated the tools for clarity, relevance, comprehensiveness, and understanding, including three professors and one assistant professors from the critical care nursing team and one professor from neurology specialist. Minor modifications were made and the tools were then designed in their final version and reliability tests were conducted.

Reliability: of the tool was measured by Cronbach's alpha coefficient (r-0.722).

Assessment phase: Assessment of patients at admission, after three days and after seven days.

- The researcher introduced himself to all patients or relatives and explained the purpose and importance of the study so the approval for participation secured from them.
- The researcher collected personal data available in the patient sheet, such as patient code, age, sex, BMI, past medical history, surgical history, smoking history, and dysphagia using tool Part I.
- The Researcher assessed vital signs such as heart rate, temperature, and respiratory rate by used tool I part II.
- The Researcher assessed Laboratory tests as White blood cells, Red blood cells, hemoglobin, platelets and cultures by used tool I part III.
- The Researcher assessed the patient for prediction of incidence stroke Associated Pneumonia by A2DS2 scale, by used tool II.
- Researcher assessed the patient for outcomes as length of stay, connect on mechanical ventilation and mortality rate, by used tool III.

Statistical analysis :

The researcher entered the data by using a personal computer. All data were entered into statistical packages for the social sciences (SPSS) version 26.0 software for analysis and figures were created in Excel. The researcher analyzed, categorized, and then coded the content of each tool. Categorical variables were described by number and percent, whereas continuous variables were described by the mean and standard deviation (Mean, SD). Chi-square test was used to compare between categorical variables, where compare between continuous variables by T-test. (P value < 0.05) was considered statistically significant **(George et al., 2024**)

Results:

Table (1) : Distribution of personal data and medical information of the studied sample N= (113)

Personal data		Stroke-associated pneumonia	
		N	%
Age group			
18 <39 years		11	9.7
39<59 years		42	37.2
59-65 years		60	53.1
Mean ± SD		**55.23±10.451**	
Sex			
Male		65	57.5
Female		48	42.5
Body mass index			
18.5 - 24.9		13	11.5
25-29.9		90	79.6
30 and above		10	8.8
Mean ± SD		27.107±2.00	
Past medical history			
hypertension	Yes	81	71.7
	No	32	28.3
Diabetes mellitus	Yes	56	49.6
	No	57	50.4
Stroke	Yes	34	30.1
	No	79	69.9
Hepatitis	Yes	7	6.2
	No	106	93.8
Atrial fibrillation	Yes	37	32.7
	No	76	67.3
Congestive heart failure	Yes	1	.9
	No	112	99.1
Chronic obstructive pulmonary disease	Yes	19	16.8
	No	94	83.2
Surgical history	Yes	37	32.7
	No	76	67.3
Smoking status	Yes	53	46.9
	No	60	53.1
Dysphagia	Yes	49	43.4
	No	64	56.6

Table (2): Relation between personal data and medical data with Stroke-associated pneumonia N= (40)

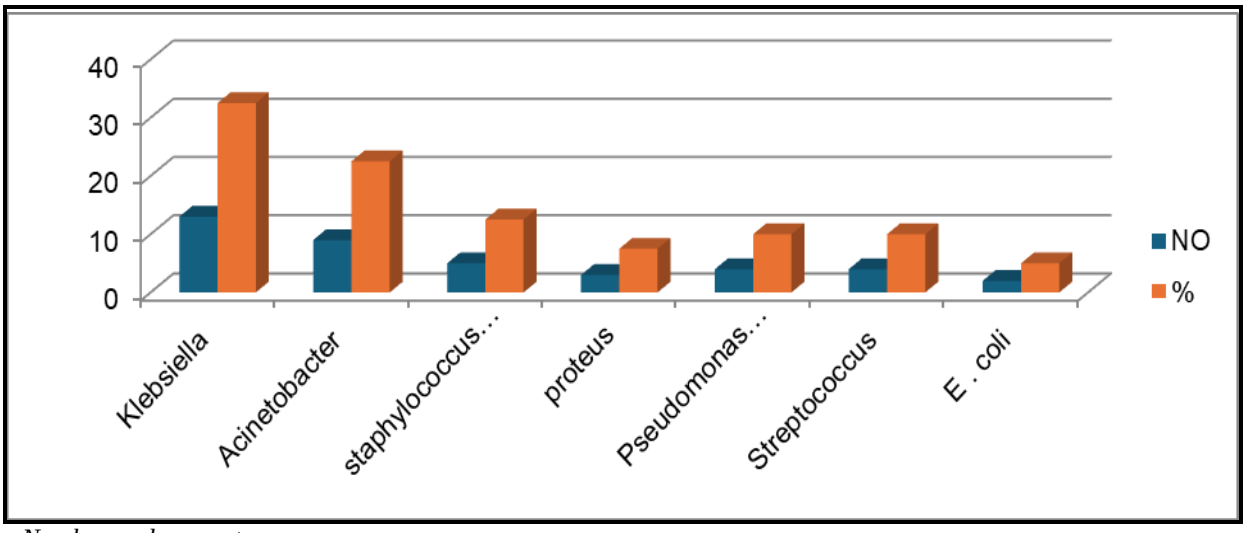
Personal data		Stroke-associated pneumonia	
		N	%
Age group			
18 <39 years		1	2.5
39<59 years		9	22.5
59-65 years		30	75
Sex			
Male		23	35.4
Female		17	35.4
Body mass index			
18.5 - 24.9		5	12.5
25-29.9		28	70
≥30		7	17.5
Past medical history			
Hypertension	Yes	31	77.5
	No	9	22.5
Diabetes mellitus	Yes	20	50.0
	No	20	50.0
Stroke	Yes	14	35.0
	No	26	65.0
Hepatitis	Yes	3	7.5
	No	37	92.5
Atrial fibrillation	Yes	15	37.5
	No	25	62.5
	Yes	1	2.5
Congestive Heart Failure	No	39	97.5
Chronic Obstructive Pulmonary Disease	Yes	14	35.0
	No	26	65.0
Dysphagia	Yes	25	62.5
	No	15	37.5

- *Number and percent*

Table (3): Relation between Vital signs and Stroke patients N= (113)

Vital signs		Stroke patients		p.value
		Pneumonia N.40	Not pneumonia N.73	
		Mean ± SD		
Heart rate	At admission	89.73±9.740	84.22±9.227	0.005**
	3rd day	112.95±4.557	90.34±8.633	0.001**
	7th day	112.95±4.557	90.34±8.633	0.001**
Respiration	At admission	17.00.877	17.77±1.307	0.001**
	3rd day	25.05±3.508	18.56±1.700	0.001**
	7th day	25.05±3.508	18.56±1.700	0.001**
Temperature	At admission	37.352±.2063	37.399±.2202	0.270
	3rd day	38.850±..4414	37.736±..3339	0.001**
	7th day	39.413±.6493	37.736±.3339	0.001**

Independent-Samples T Test
** statistically significant difference (P-Value < 0.05),*
***highly significant difference (P-Value < 0.01),*
Non-significant difference (P-Value > 0.05).



• *Number and percent*

Figure (1) : Present culture results for patients with stroke-associated pneumonia

Table (4) : Relation between Laboratory tests and Stroke patients N= (113)

Laboratory test		Stroke patients		P.Value
		Pneumonia N.40	Not pneumonia N.73	
		Mean ± SD		
Red blood cells	At Admission	4.53±.305	4.52±.318	0.235
	3 rd Day	4.33±.422	4.65±.339	0.001**
	7th Day	4.22±.454	4.46±.319	0.004**
White blood cells	At Admission	8.79±2.736	8.65±1.856	0.776
	3 rd Day	13.55±4.608	8.64±1.723	0.001**
	7th Day	12.52±4.976	8.69±1.755	0.001**
Hemoglobin	At Admission	11.13±2.005	11.79±1.432	0.072
	3 rd Day	10.84±2.121	11.25±1.486	0.280
	7th Day	10.87±1.952	10.76±2.580	0.801
Platelets	At Admission	380.52±65.796	326.63±60.017	0.068
	3 rd Day	272.13±99.312	303.66±54.191	0.105
	7th Day	268.45±98.664	293.77±65.491	0.150

• *Independent-Samples T Test*
** statistically significant difference (P-Value < 0.05)*
***highly significant difference (P-Value < 0.01)*
Non-significant difference (P-Value > 0.05)

Table (5) : Relation between predictors for acute stroke Associated Pneumonia by A2DS2scale and Stroke patients N= (113)

predictors for acute stroke Associated Pneumonia by A2DS2 scale		Stroke patients				P. value
		Pneumonia N.40		Not pneumonia N.73		
		N	%	N	%	
At admission	Low risk	0	0.0	8	11	0.030*
	High risk	40	100	65	89	
3rd Day	Low risk	0	0.0	22	30.1	0.001**
	High risk	40	100	51	69.9	
7th Day	Low risk	3	7.5	44	60.2	0.001**
	High risk	37	92.5	29	39.8	

• ***A2DS2:*** *age, atrial fibrillation, dysphagia, sex, and stroke severity using the National Institutes of Health Stroke Scale score*
Chi-Square Test
** statistically significant difference (P-Value < 0.05)*
***highly significant difference (P-Value < 0.01), Non-significant difference (P-Value > 0.05)*
Pearson correlation coefficient

Table (6): Relation between clinical outcome and Stroke patients N= (113)

Clinical outcome		Stroke patients				P.Value
		Pneumonia N.40		Not pneumonia N.73		
		No	%	No	%	
Death	Died	20	50.0	7	9.6	0.001**
	Survival	20	50.0	66	90.4	
Connect on mechanical ventilation	Yes	19	47.5	0	0.0	0.001**
	No	21	52.5	73	100.0	
Length of stay	Mean ± SD	11.23±3.438		6.26±1.302		0.001**

*Chi-Square Test * statistically significant difference (P-Value < 0.05) and **highly significant difference (P-Value < 0.01), Non-significant difference (P-Value > 0.05).*
Independent-Samples T Test
** statistically significant difference (P-Value < 0.05),*
***highly significant difference (P-Value < 0.01),*
Non-significant difference (P-Value > 0.05).
Pearson correlation coefficient

Table (1): Shows the distribution of personal data and medical information of study sample which (53.1%) of patients aged 60 and above with Mean ± SD was (55.23±10.451), (57.5%) was male, most patients body mass index was located between 25-29.9 at percentage of (79.6%) with Mean ± SD was (27.107±2.00) , HTN was most past medical history was common between patients at percentage (71.7%) followed by DM and atrial fibrillation (49.6%) and (32.7%) patients surgical history was (32.7%) , smoking status was (46.9%) and dysphagia was (43.4%) .

Table (2): Relation between personal data and medical data with Stroke-associated pneumonia, SAP is common among in patients with 60 yrs. and more at percentage (75%) 0f SAP patients, most common body mass index in patients with SAP is (25-29.9) with percentage (70%) COPD and dysphagia are common in patients with SAP as past medical history at percentage (65%) and (62.7%) .

Table (3): Shows Relation between Vital signs and Stroke patients, where there are differences between all vital signs among SAP patients and not SAP patients except in temperature at admission with statistically significant p. value for all expect in temperature at admission.

Table (4): Shows Relation between Laboratory tests and Stroke patients which red blood cells in SAP group in 3rd and 7th day are (4.33±.422) and (4.22±.454) and white blood cells in same days was (13.55±4.608) and (12.52±4.976) with statistically significant p. value (.001**) and (.004**), Sao2 in SAP group in 3rd and 7th day was (90.95±3.961) and (91.28±3.968) with statistically significant p. value (.001**).

Figure (1): Presents culture results for patients with stroke-associated pneumonia Klebsiella is the most common type of organisms (32.5%), then Acinetobacter (22.5%), staphylococcus aureus (12.5%), proteus (7.5%), Pseudomonas aeruginosa (10%), Streptococcusv (10%), and Escherichia coli (5%).

Table (5): Shows Relation between predictors for acute stroke Associated Pneumonia by A2DS2scale and Stroke patients, this scale predicts that (100%) high risk patients with SAP would suffer from this at admission and 3rd day and at 7th day predicts that (92.5%) would suffer from SAP with statistically significance p.value (0.030*) and (0.001**) for all and weak positive correlation in admission (0.204) , and moderate positive correlation in 3rd day (0.304) and strong positive correlation in 7th and (0.512).

Table (6): Table illustrates Relation between clinical outcome and Stroke patients, which (50%) of SAP patients group die (47.5%) are connected to mechanical ventilation and length of stay is (11.23±3.438) in SAP patients with statistically significance p.value (0.001**) .

Discussion:

According to personal data and medical data:

In light of Age, the current study shown that two-thirds of the cases of stroke-associated pneumonia occurred in age ≥60 year, due to many reasons, such as immunodeficiency and chronic diseases. This study supported by **Ahmad et al.**, (**2024**), who identified that an independent correlation between stroke-associated pneumonia and advanced age. This could be because concomitant medical disorders, swallowing difficulties, and cough reflex dysfunction are associated with aging. Additionally, agreed with **Vandsø Svenningsen et al.**, (**2025**), who discovered that both age and the various risk scores for pneumonia in acute stroke patients were predictors of pneumonia during hospitalization for post-acute stroke patients aged more than 50.

Regarding the patient's gender, The present study displayed that There was not clear difference in the occurrence of stroke associated pneumonia among male and female patients. This finding was supported

by a research conducted by (**Magdy et al. (2021)**, who discovered no observable differences in patients' age or gender in incidence of SAP. On the other side, this study contradicted with **Colbert et al.**, (**2016**), who proposed that sex differences in noradrenergic input or sex hormones drive a local and systemic inflammatory response that is independently linked to a significantly lower risk of hospital acquired sepsis and pneumonia following stroke in women.

Regarding vital signs, the current result indicated that there was increase of body temperature in SAP group comparable to Non-SAP group due to inflammatory response, increase heart rate above 100 beat /minute and increase in respiratory rate. Furthermore SAP was defined by **(Wang et al., 2025),** as worsening cough, dyspnea, or tachypnea, crackles or bronchial breath sounds, worsening gas exchange, fever with unknown cause, leukopenia or leukocytosis, and altered mental status without any known cause.

Concerning cultures results, The current study show Klebsiella was the most common type of organisms (32.5%),then Acinetobacter (22.5%),staphylococcus aureus (12.5%), proteus (7.5%), Pseudomonas aeruginosa (10%), Streptococcusv (10%), and E . coli (5%). Similarly to study carried out by **Martin-Loeches et al.**, (**2023**) who found that positive sputum culture bacteria such as Streptococcus, Staphylococcus aureus, Klebsiella, Escherichia coli, and Pseudomonas aeruginosa were also associated with pneumonia .

In relation to body mass index, present results demonstrated that more than half of SAP patients are overweight with body mass index between 25 - 29.9 These results contradicted with a study conducted by (**Li et al.**, **2023**), who discovered that a severe malnutrition, which has been connected to aging and other chronic metabolic illnesses, may be a surrogate indicator of a higher number of SAP risk factors.

Concerning past medical history, the study result revealed that Patients with chronic obstructive pulmonary disease COPD disease are at risk of developing pneumonia due to the inability to cough and expel secretions from the airway. This study confirmed by **Lin et al.**, (**2017**), who revealed that exacerbations of COPD increased the risk for SAP, post-stroke mortality, and epilepsy. The increased risk of pneumonia in people with COPD may be explained by lung changes associated with the disease that lower resistance to lung infections. Also, Similarly to study carried out by who **Szylińska et al.**, (**2022**)revealed that individuals with COPD had a greater incidence of SAP. Older age, dysphagia, severe consciousness impairment, speech impairment, heart failure, smoking, and COPD are risk factors for SAP.

In highlighting of dysphagia, present result found that more than half of patients have difficult in swallowing and difficulties in the passage of food or liquid from the mouth through the pharynx, esophagus, and stomach are risk for SAP, and lead poor dietary intake, dehydration, malnutrition, and pulmonary complications. Similarly to study carried out by **Chang et al.**, (**2022**) who looked at the relationship between pneumonia and dysphagia in people who had recently experienced an acute stroke revealed that the incidence of pneumonia was higher in patients with dysphagia than in those without.

In highlighting of atrial fibrillation AF, current study showed that there was not difference in the incidence of SAP between patients who suffer from heart problems, such as Atrial Fibrillation, and those who do not. In disagreement with **Zhang et al.**, (**2023**), who clarified that ischemic stroke patients with atrial fibrillation have a significantly higher risk of pneumonia than those without AF, and that AF accounts for 45% of all cardio embolic strokes.

Concerning hypertension and diabetes mellitus, diabetes mellitus increase the likehood of large and small artery occlusive disease but apparently does not predispose to hemorrhage or to poor functional outcome **Sadik & Ail**, (**2025**)

Current study showed that DM and HTN did not contribute to the occurrence of SAP, On the other side **Hashim et al.**, (**2022**) revealed the most common contributory factor for SAP was diabetes, which subsequently followed by hypertension and ischemic heart disease.

Concerning Laboratory Test, Among Patients diagnosed with SAP, White blood cells estimated high level, due to stimulating the immune system to kill or destroy pathogens. This result supported by**Wang et al.**, (**2021**), who discovered that the SAP group had much greater WBC and neutrophil counts than the Non-SAP group.

In relation to oxygen saturation SaO_2 level, The study showed that patients suffered from SAP had low level of oxygen due to the lungs' inability to exchange gases., this result confirmed by**Fischer et al.**, (**2023**), His outcomes indicated that increase in body temperature and decrease in oxygen saturation were both indicators of pneumonia that could be seen on a CXR.

In relation to predicting incidence of SAP by using A2 S D2, Patients who scored higher than five were deemed to be at high risk and vulnerable to SAP, and almost all of studied patients had pneumonia . This result supported by **Vyas et al.**, (**2022**), who discovered that patients with high A2DS2 scores had more SAP cases and unfavorable outcomes than those with low A2DS2 values, who had better results. Besides that present study's findings were in harmony

with the results of the investigation conducted by **Ni et al.**, (**2021**), who discovered that the A2DS2 score's very consistent SAP prediction threshold made it a valuable tool for patient triage and early screening.

According to outcomes:

Regarding mortality rate, study show that half of patient with SAP do not survive and die due to complications as respiratory failure and impaired in gas exchanges, increased length of stay after SAP. Besides that current study's findings were in harmony with the results of the investigation conducted by **Sadik, Ail, et al.**, (**2025**),who found that Hospital Length of Stay, Mortality, and Readmissions among Patients Hospitalized for Acute Stroke, and founded that commonly reported complications among their patients were brain edema, pneumonia, deep vein thrombosis. **Tinker et al.**, (**2021**), discovered that SAP significantly affects stroke-related morbidity and mortality, as measured by 30-day mortality based on the following factors: age, hemorrhagic stroke subtype, and pre-stroke modified rankin.

By looking at the length of stay in the ICU, The current investigation indicated a very statistically significant difference between the two groups. patients with SAP have a long period of stay in the ICU. The findings align with **Jitpratoom et al.**, (**2024**), who discovered SAP has been linked to longer hospital stays and worse functional outcomes. And The findings align with **Labeit et al.**, (**2023**), who revealed that the average ICU stay was extended by 4.7 days for patients with post stroke dysphagia and SAP. Also these findings were corroborated by**Teh et al.**, (**2018**) They verified that even after controlling for a number of known prognostic indicators, SAP had a negative impact on mortality for up to a year and is correlated with extended hospital stays and low functional ability at discharge in those with stroke.

Regarding connect on MV, current study show that due to respiratory dysfunction and low oxygen levels, nearly half of the pneumonia cases were connected to a ventilator, This finding in agreement with **Abdeen et al.**, (**2025**),who indicated that, in acute or emergency situations, mechanical ventilation is an essential technique to maintain life, especially for patients with respiratory failure due to hypoxemic conditions, damaged airways, chest infection or obstructed ventilation. Positive ventilation is used during this process, which depends on the resistance and compliance of the airway system.

Conclusion:

- Stroke associated pneumonia represents one of the most prevalent infections occurring post-stroke which correlates with heightened mortality rates, prolonged length of stay and use of MV.

Recommendations

The study's findings prompt the following recommendations

- Develop and implement protocol for nurses, who are integral in patient care, regarding the acute complications associated with acute stroke for early recognition and management.
- Apply of the current study with more participants in other locations around Egypt to generalize the findings.

References:

Heba AA., Abdeen, Hady Atef, Nesreen G., Elnahas, Omnia A, Khalaf, Youssef MA., Soliman, Reem IM Elkorashy, & Neurobiology. (**2025):** Effects of Threshold Inspiratory Muscle Trainer versus Trigger Sensitivity Adjustment versus Conventional Therapy on Respiratory Function in mechanically ventilated patients: A Randomized Controlled Trial. ELSEVIER, Volume 337, 104469. doi:https://doi.org/10.1016/j.resp.2025.104469

Alshaimaa M. Aboulfotooh, Heba Sherif Abdel Aziz, Marwa M. Zein, Mohamed Sayed, Ahmed R. N. Ibrahim, Lamiaa N. Abdelaty, & Rehab Magdy. **(2024):** Bacterial stroke-associated pneumonia: microbiological analysis and mortality outcome. BMC Neurology, 24(1), 265. doi:10.1186/s12883-024-03755-4

M. Ahmad, Z. Ayaz, T. Sinha, T. M. Soe, N. Tutwala, A. A. Alrahahleh, & Ali. **N.** (**2024**)**:** Risk Factors for the Development of Pneumonia in Stroke Patients: A Systematic Review and Meta-Analysis. Cureus, 16(3), e57077. doi:10.7759/cureus.57077

Kondwani Joseph Banda, Hsin Chu, Xiao Linda Kang, Doresses Liu, Li-Chung Pien, Hsiu-Ju Jen, & Kuei-Ru %J BMC geriatrics Chou. **(2022):** Prevalence of dysphagia and risk of pneumonia and mortality in acute stroke patients: a meta-analysis. 22(1), 420.

Min Cheol Chang, Yoo Jin Choo, Kyung Cheon Seo, & Seoyon Yang. **(2022):** The Relationship Between Dysphagia and Pneumonia in Acute Stroke Patients: A Systematic Review and Meta-Analysis. Volume 13 - 2022. doi:10.3389/fneur.2022.834240

James F. Colbert, Richard J. Traystman, Sharon N. Poisson, Paco S. Herson, & Adit A. Ginde. **(2016):** Sex-Related Differences in the Risk of Hospital-Acquired Sepsis and Pneumonia Post Acute Ischemic Stroke. Journal of Stroke and Cerebrovascular Diseases, 25(10), 2399-2404. doi:https://doi.org/10.1016/j.jstrokecerebrovasdis.2016.06.008

Sabrina A. Eltringham, Karen Kilner, Melanie Gee, Karen Sage, Benjamin D. Bray, Sue Pownall, & Craig J. Smith. **(2018):** Impact of Dysphagia Assessment and Management on Risk of Stroke-Associated Pneumonia: A Systematic Review. Cerebrovascular Diseases, 46(3-4), 97-105. doi:10.1159/000492730 %J Cerebrovascular Diseases

Fischer C., Knüsli J., Lhopitallier, L.Tenisch, E.Meuwly, M. G.Douek, P. & Boillat-Blanco N.. (**2023**): Pulse Oximetry as an Aid to Rule Out Pneumonia among Patients with a Lower Respiratory Tract Infection in Primary Care. Antibiotics (Basel), 12(3). doi:10.3390/antibiotics12030496

Darren George, & Paul Mallery. **(2024):** IBM SPSS statistics 29 step by step: A simple guide and reference: Routledge.

Husnain Hashim, Laraib Shahid, Danial Bajwa, Rashid Usman, Sabeen Saleema Ahmed, Momina %J Pakistan Journal of Medical Khokhar, & Health Sciences. **(2022):** Prevalence of stroke associated pneumonia in stroke patients. 16(10), 590-590.

Sarah Hoffmann, Hendrik Harms, Lena Ulm, Darius G. Nabavi, Bruno-Marcel Mackert, Ingo Schmehl, & Andreas Meisel. **(2016):** Stroke-induced immunodepression and dysphagia independently predict stroke-associated pneumonia – The PREDICT study. Journal of Cerebral Blood Flow & Metabolism, 37(12), 3671-3682. doi:10.1177/0271678X16671964

Sarah Hoffmann, Uwe Malzahn, Hendrik Harms, Hans-Christian Koennecke, Klaus Berger, Marianne Kalic, & Peter Ulrich Heuschmann. **(2012).** Development of a Clinical Score (A²DS²) to Predict Pneumonia in Acute Ischemic Stroke. 43(10), 2617-2623. doi:doi:10.1161/STROKEAHA.112.653055

Die Hu, & Jiuxia Zhang. **(2023):** The application of cluster nursing to prevent bacterial pneumonia in stroke patients in neurology department. 102(52), e36657. doi:10.1097/md.0000000000036657

Pornpong Jitpratoom, & Adhiratha Boonyasiri. **(2024):** Factors associated with an increased risk of developing pneumonia during acute ischemic stroke hospitalization. PLOS ONE, 19(1), e0296938. doi:10.1371/journal.pone.0296938

Bendix Labeit, Almut Kremer, Paul Muhle, Inga Claus, Tobias Warnecke, Rainer Dziewas, & Sonja Suntrup-Krueger. **(2023):** Costs of post-stroke dysphagia during acute hospitalization from a health-insurance perspective. 8(1), 361-369. doi:10.1177/23969873221147740

Dongze Li, Yi Liu, Yu Jia, Jing Yu, Fanghui Li, Hong Li, & Zhi %J BMC neurology Zeng. **(2023):** Association between malnutrition and stroke-associated pneumonia in patients with ischemic stroke. 23(1), 290.

Dongze Li, Yi Liu, Yu Jia, Jing Yu, Fanghui Li, Hong Li, &Yu Cao. **(2023):** Association between malnutrition and stroke-associated pneumonia in patients with ischemic stroke. BMC Neurology, 23(1), 290. doi:10.1186/s12883-023-03340-1

Tadios Lidetu, Essey Kebede Muluneh, & Gizachew Tadesse Wassie. **(2023):** Incidence and Predictors of Aspiration Pneumonia Among Stroke Patients in Western Amhara Region, North-West Ethiopia: A Retrospective Follow Up Study. International Journal of General Medicine, 16(null), 1303-1315. doi:10.2147/IJGM.S400420

Chao-Shun Lin, Chun-Chuan Shih, Chun-Chieh Yeh, Chaur-Jong Hu, Chi-Li Chung, Ta-Liang Chen, & Chien-Chang %J PLoS One Liao. **(2017):** Risk of stroke and post-stroke adverse events in patients with exacerbations of chronic obstructive pulmonary disease. 12(1), e0169429.

Zhu-Yun Liu, Lin Wei, Ri-Chun Ye, Jiao Chen, Dan Nie, Ge Zhang, & Xiao-Pei Zhang. **(2022):** Reducing the incidence of stroke-associated pneumonia: an evidence-based practice. BMC Neurology, 22(1), 297. doi:10.1186/s12883-022-02826-8

Ignacio Martin-Loeches, Antoni Torres, Blin Nagavci, Stefano Aliberti, Massimo Antonelli, Matteo Bassetti, & Jan %J Intensive care medicine De Waele. **(2023):** ERS/ESICM/ESCMID/ALAT guidelines for the management of severe community-acquired pneumonia. 49(6), 615-632.

Patricia Gonce Morton, & Paul Thurman. (**2023**). Critical care nursing: a holistic approach: Lippincott Williams & Wilkins.

Jianchao Ni, Shou Weiqing, Wu Xiuping, & Jianhong and Sun. **(2021):** Prediction of stroke-associated pneumonia by the A2DS2, AIS-APS, and ISAN scores: a systematic review and meta-analysis. Expert Review of Respiratory Medicine, 15(11), 1461-1472. doi:10.1080/17476348.2021.1923482

Gehad Mahmoud Sadik, & Anwar Mohamed %J Assiut Scientific Nursing Journal Ail. **(2025):** Assessment of Risk Factors for Hemorrhagic Stroke Patients in the Intensive Care Unit. 13(48), 32-42.

Gehad Mahmoud Sadik, Anwar Mohamed Ail, & Mervat Anwar Abd el aziz. **(2025):** Assessment of Risk Factors for Hemorrhagic Stroke Patients in the Intensive Care Unit %J Assiut Scientific

Nursing Journal. 13(48), 32-42. doi:10.21608/asnj.2024.330081.1938

Wenjing Song, Minmin Wu, Haoran Wang, Ruifeng Pang, & Luwen %J Frontiers in Neurology Zhu. **(2024):** Prevalence, risk factors, and outcomes of dysphagia after stroke: a systematic review and meta-analysis. 15, 1403610.

Aleksandra Szylińska, Katarzyna Kotfis, Marta Bott-Olejnik, Paweł Wańkowicz, & Iwona Rotter. **(2022):** Post-Stroke Outcomes of Patients with Chronic Obstructive Pulmonary Disease. 12(1), 106.

Teh W., Smith, C. Barlas, R., Wood, A. Bettencourt-Silva, J. Clark, A. & Myint. **P. (2018).** Impact of stroke-associated pneumonia on mortality, length of hospitalization, and functional outcome. 138(4), 293-300. doi:https://doi.org/10.1111/ane.12956

Rory J Tinker, Craig J Smith, Calvin Heal, Joao H Bettencourt-Silva, Anthony K Metcalf, John F Potter, & Phyo K %J Acta Neurologica Belgica Myint. **(2021):** Predictors of mortality and disability in stroke-associated pneumonia. 121, 379-385.

Anne Louise Vandsø Svenningsen, Mohit Kothari, Simon Svanborg Kjeldsen, & Jesper %J Brain Injury Fabricius. **(2025):** Development of a pneumonia risk score for post-acute rehabilitation in patients with severe acquired brain injury. 1-8.

Chintal Vyas, Hemang Suthar, & Nachiket %J National Journal of Integrated Research in Medicine Parmar. **(2022):** The A2DS2 Score As A Predictor of Pneumonia In Acute Ischemic Stroke. 13(1).

Quanpeng Wang, Yao Liu, Ling Han, Fei He, Nan Cai, Qiuling Zhang, & Jun Wang. **(2021)**: Risk factors for acute stroke-associated pneumonia and prediction of neutrophil-to-lymphocyte ratios. The American Journal of Emergency Medicine, 41, 55-59. doi:https://doi.org/10.1016/j.ajem.2020.12.036

Willeke F. Westendorp, Jan-Dirk Vermeij, Nina A. Hilkens, Matthijs C. Brouwer, Ale Algra, H. Bart van der Worp, & Pual J. Nederkoorn. **(2018):** Development and internal validation of a prediction rule for post-stroke infection and post-stroke pneumonia in acute stroke patients. European Stroke Journal, 3(2), 136-144. doi:10.1177/2396987318764519

C-Y Xu, H-W Ye, B Chen, Y-F Wu, Z Cao, Z Ding, & Pharmacological Sciences. **(2021):** Analysis of risk factors and prognosis of post-stroke pulmonary infection in integrated ICU. 25(2).

Shou-Ye Zhang, Jing Huang, & Xiao-Ling %J JCPSP Zhou. **(2023):** A meta-analysis of the risk factors for stroke-associated pneumonia. 33(7), 799-803.