ORIGINAL ARTICLE

THE PRESENTATION OF MEDICAL COMPLICATIONS IN THE ACUTE IN-HOSPITAL MANAGEMENT OF STROKE PATIENTS AND THEIR DETERMINANTS: A CROSS-SECTIONAL STUDY

Muhammad Tabish Ikram[1], Hashim Uddin Azam[2], Kamal Uddin Azam, Amina Arif, Asad Rahman, Bakht Danyal Khan, Adam khan Rahim

[1]Department of Medicine, Hayatabad medical complex, Peshawar - Pakistan

[2]Department of Medicine, Khyber teaching hospital, Peshawar - Pakistan

ABSTRACT

Objectives: To find the frequency of Acute Medical complications and their determinants in stroke patients admitted to a hospital in Peshawar.

Materials and Methods: In this cross-sectional descriptive study in the Department of Medicine and Neurology at Hayat Abad Medical Complex, Peshawar, Pakistan from 1/10/2022 till 31/12/2022, a total of 180 patients who presented with Cerebrovascular events based on CT/MRI were included. Patients' data were collected through questionnaires, NIHSS and GCS scores were calculated at the presentation and patients were followed in the hospital to detect complications. Comparisons with p-values were then determined using SPSS.

Results: The overall rate of stroke complications in 180 patients documented was 90%, the common being Aspiration Pneumonia (48.89%), Urinary Tract infections (30%), Bedsores (28.33%), Pyrexia illness (22.22%) and Seizures (12.78%). NIHSS scores had a direct relationship, with patients scoring >12 having a complications rate of 93% in contrast to 76.5% in patients with scores of ≤3 (p-value 0.032). GCS at presentation had similar predictive value with scores of 15/15 having 73% and ≤8 having a 91% complication rate. Duration of hospitalization (p-value 0.014) had a key impact as patients admitted for a month had higher percentages of complications primarily UTI (52.4%), Bedsores (71%), and Constipation (33.3%). Treatments like Dexamethasone (p-value 0.003) and antiplatelets (p-value 0.010) were found to increase the rate of complications.

Conclusion: In-hospital post-stroke complications are common having a direct link with stroke severity, hospitalization duration, and treatment given. An active approach is needed to identify and treat any complications early, thereby, improving outcomes and decreasing morbidity.

Keywords: Stroke, Complications, in-hospital management

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INTRODUCTION

Stroke or Cerebrovascular Accident (CVA) has been one of the leading causes of mortality and morbidity in evolving medical times. It has the largest share of neurological disease-related deaths primarily because of the numerous complications associated with it.[1]

Its incidence worldwide is 157.99 (Crude rate per 100,000 per year) according to the stroke factsheet 2022. [2] And in Pakistan, it was reported as 1.2% (1200 per 100,000 population) according to a study in KP in 2016 and 250 per 100000 population according to another study done in 2018.[3, 4] The various risk factors for stroke include but are not limited to hypertension, diabetes, old age, clotting disorders, arrhythmias, smoking, valvular heart disease, and hyperlipidemia. Acute in-hospital complications of stroke are common as well lead to poor recovery.

These complications must be recognized and reported to optimize the treatment and rehabilitation of patients. [5, 6] Our study aims at finding the frequency of acute stroke complications and correlating them with key factors like NIHSS severity scale, hospitalization duration, and treatments provided in hospital settings in Peshawar to shed light on patient care and highlight potential areas where the extra focus can reduce the overall morbidity and mortality associated with this disease.

Correspondence
Dr. Kamal Uddin Azam
House officer
Department of Medicine, Hayatabad medical complex
Peshawar - Pakistan
Cell: +92-301-8811290
Email: kamaluddinazam@gmail.com
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MATERIALS AND METHODS

Our team carried out this cross-sectional study in Hayat Abad Medical Complex in Peshawar after approval from the ethical review committee board of the institution. Patients were selected through a convenient non-probability sampling technique by visiting neurology, medicine, and neurosurgery wards for a duration of 4 months from October 2022 to December 2022. The sample size was calculated while keeping the margin of error at 7.3% and the Confidence interval at 95% was 180. All patients gave informed consent for inclusion.

Inclusion Criteria were aged 18 years or more, patients with acute/new-onset stroke diagnosed via radiology, and clinical evidence as outlined in the operational definition given below.

Exclusion criteria included patients with subarachnoid hemorrhage as it required a separate grading criterion, patients with stroke-mimicking disorders or are in a diagnostic dilemma and patients with cerebral venous infarcts as advanced imaging techniques are required for diagnosis.

The data was recorded after taking permission from the patients by reviewing the patient's history and examining the patient that included GCS (Glasgow Coma Scale), NIHSS (National Institute of Health Stroke Scale), pre-existing conditions, and biodata as well. [7, 8]

Stroke was defined as an acute event of neurological dysfunction causing local or global deficit due to a result of ischemia or intracerebral hemorrhage, lasting for more than 24 hours or death. Stroke was divided into two major categories of ischemic and hemorrhagic types based on initial neurological imaging and ischemic stroke was further classified according to TOAST classification.[9]

Acute in-hospital medical complications were defined as non-neurologic medical consequences occurring during the hospital stay and included the occurrence of aspiration pneumonia, bedsores, urinary tract infection, chest infection, pyrexial illness, deep vein thrombosis, and others with reference taken from previous literature. [6]

Data were analyzed using IBM SPSS version 26 (statistical package for social sciences) and frequencies of different complications were calculated and associations with NIHSS and duration of hospitalization were tested using the Chi-squared test. Where the expected count was less than 5 in >20% of the cells, Fischer Exact test was used for 2x2 contingency tables and the Likelihood ratio for tables larger than 2x2. No missing data was encountered. Data were considered significant where the p-value <0.05.

RESULTS

Figure1 highlights percentages of individual complications in stroke patients, with the highest being Aspiration pneumonia (48.89%) followed by UTI (30%), Bedsores (28.33%), and pyrexial illness (22.22%) among the 19 acute complications documented.

Table 1 shows the summarized profile of study subjects where characteristics were stratified according to the development of acute complications. Age strata showed statistical significance (P-Value 0.047) with patients of age group >70y showing a greater percentage of having developed complications that is 26 (100.0%). Other statistically significant strata included 'Stroke severity' (P-Value 0.032) where 42 patients (93%) with NIHSS score >12 developed complications compared to 26(76.5%) with scores 0-3. 42(97.7%) patients having an atherosclerotic cause of stroke (P-Value 0.028) developed complications as opposed to lesser percentages in other causes. Among the co-morbidities, smoking had a statistical impact (P-Value 0.015) where 54 (98.2%) patients suffered complications. Twenty-one (100%) patients having stayed for > a month in the hospital had complications as opposed to 56 (82.4%) patients having stayed <7 days (P-Value 0.014). Patients with lower GCS at presentation showed a higher complication percentage (P-Value 0.001). Treatment also had a statistical impact where 112 (94.1%) patients on antiplatelets (P-Value 0.010) and 56 (100.0%) patients on dexamethasone (P-Value 0.003) developed complications. Other determinants mentioned had no statistically significant impact.

Table 2 compares complications with stroke severity determined according to NIHSS Score. A statistically significant impact of severity was mainly on Aspiration pneumonia, where 30 (66.7%) patients having a score of >12 developed the aforementioned complication (P-Value <0.001), and on Pyrexial illness, contracted by 16 (35.6%) of patients belonging to the same score category (P-Value 0.016). Percentages of these aforementioned complications were lower in patients having a lower NIHSS score.

Table 3 highlights the frequency and percentages of individual complications and their relation with the duration of hospitalization. Pyrexial illness had higher percentages in patients hospitalized for < 7days (30.9%) and in those hospitalized for >a month (33.3%) as compared to the rest (P-Value 0.032). Among the patients that were hospitalized for >a month, 11 (52.4%) developed UTI (P-Value 0.025), 15 (71.4%) developed Bedsores (P-Value <0.001), 7 (33.3%) developed seizures (P-Value 0.046) and 7 (33.3%) developed constipation (P-Value 0.011), higher than in those that stayed for shorter durations.

DISCUSSION

The purpose of our investigation was to determine the overall occurrence of post-stroke complications in a tertiary care setup in Peshawar, Pakistan, and to see what risk factors or determinants are most predictive of these

Table 1: Baseline profile of the patients related to acute complications

		Acute Complications		P-Value
		No (n=18)	Yes (n=162)	
	30-40	5(20.0%)	20(80.0%)	0.047
	41-50	5(17.2%)	24(82.8%)	
	51-60	5(8.3%)	55(91.7%)	
	61-70	3(7.5%)	37(92.5%)	
	>70	0(0.0%)	26(100.0%)	
Gender (Male)		8(8.2%)	89(91.8%)	0.397
Stroke Severity (NIHSS Score)				
	0-3	8(23.5%)	26(76.5%)	0.032
	4-5	5(10.4%)	43(89.6%)	
	6-12	2(3.8%)	51(96.2%)	
	>12	3(6.7%)	42(93.3%)	
Stroke Type				0.089
	Hemorrhagic	9(15.5%)	49(84.5%)	
	Ischemic	9(7.4%)	113(92.6%)	
Ischemic Stroke Subtype (TOAST Classification)				0.028
	Thromboembolism	4(28.6%)	10(71.4%)	
	Atherosclerosis of major vessels	1(2.3%)	42(97.7%)	
	Small vessel occlusion	2(14.3%)	12(85.7%)	
	Others	4(22.2%)	14(77.8%)	
	undetermined cause	7(7.7%)	84(92.3%)	
Hypertension		13(8.8%)	135(91.2%)	0.325
Diabetes Mellitus		7(7.7%)	84(92.3%)	0.297
Hyperlipidemia		4(16.0%)	21(84.0%)	0.475
Arrhythmias		1(9.1%)	9(90.9%)	1.000
Previous MI		4(28.6%)	10(71.4%)	0.037
Smoking		1(1.8%)	54(98.2%)	0.015
Previous Stroke		7(11.3%)	55(88.7%)	0.676
Duration of hospitalization				0.014
	<7 days	12(17.6%)	56(82.4%)	
	7-14 days	5(8.6%)	53(91.4%)	
	15-30 days	1(3.0%)	32(97.0%)	
	>a month	0(0.0%)	21(100.0%)	
GCS at presentation				0.001
	15	10(27.0%)	27(73.0%)	
	13-14	4(7.8%)	47(92.2%)	
	9-12	1(1.7%)	57(98.3%)	
	≤8	3(8.8%)	31(91.2%)	
On Antiplatelets		7(5.9%)	112(94.1%)	0.010
Anticoagulants		8(12.1%)	58(87.9%)	0.470
Treatment with steroids (Dexa-methasone)		0(0.0%)	56(100.0%)	0.003

Table 2: Acute complications concerning stroke severity

Complications	Stroke severity (NIHSS Score)				P-Value
	0-3	4-5	6-12	>12	
Aspiration Pneumonia (n=88)	6(17.6%)	21(43.8%)	31(58.5%)	30(66.7%)	<0.001
Pyrexial illness (n=40)	3(8.8%)	7(14.6%)	14(26.4%)	16(35.6%)	0.016
UTI (n=54)	8(23.5%)	11(22.9%)	21(39.6%)	14(31.1%)	0.242
Bedsores (n=51)	6(17.6%)	11(22.9%)	15(28.3%)	19(42.2%)	0.076
DVT (n=12)	1(2.9%)	3(6.3%)	4(7.5%)	4(8.9%)	0.717
Seizures (n=23)	0(0.0%)	8(16.7%)	7(13.2%)	8(17.8%)	0.084
Musculoskeletal pain (n=38)	12(35.3%)	12(25.0%)	8(15.1%)	6(13.3%)	0.062
Gastritis (n=34)	5(14.7%)	8(16.7%)	16(30.2%)	5(11.1%)	0.081
Constipation (n=22)	3 (8.8%)	5(10.4%)	6(11.3%)	8(17.8%)	0.605

Table 3: Acute complications to the duration of hospitalization

Complications	Stroke severity (NIHSS Score)				P-Value
	0-3	4-5	6-12	>12	
Pyrexial illness (n=40)	21(30.9%)	8(13.8%)	4(12.1%)	7(33.3%)	0.032
Aspiration Pneumonia(n=88)	27(39.7%)	30(51.7%)	18(54.5%)	13(61.9%)	0.228
UTI (n=54)	15(22.1%)	21(36.2%)	7(21.2%)	11(52.4%)	0.025
Bedsores (n=51)	9(13.2%)	15(25.9%)	12(36.4%)	15(71.4%)	<0.001
DVT (n=12)	2(2.9%)	3(5.2%)	3(9.1%)	4(19.0%)	0.114
Seizures (n=23)	5(7.4%)	7(12.1%)	4(12.1%)	7(33.3%)	0.046
Musculoskeletal pain (n=38)	19(27.9%)	10(17.2%)	7(21.2%)	2(9.5%)	0.249
Gastritis (n=34)	16(23.5%)	8(13.8%)	6(18.2%)	4(19.0%)	0.583
Constipation (n=22)	4(5.9%)	5(8.6%)	6(18.2%)	7(33.3%)	0.011

complications. Stroke and stroke-related complications are a heavy burden on healthcare systems and having a more complete picture of the outcomes, especially in developing and low to middle-income areas such as Pakistan, adds significantly to the global picture of stroke management.

Our most significant finding was the overall rate of stroke complications which came out to be 90% (163 of 180). This compares very similarly to the results of many other previous studies.[5,10] Although the overall rate of complications varies widely amongst setups and regions ranging from 20% to 95%. Our study lands in the higher ranges of possibilities, although it is not possible to make a proper association based on this one result, it may reflect greatly on our stroke inpatient management as western setups range in the lower numbers.[5, 10, 11, 12]

The overall trend of stroke being a complication was another significant finding and tends to mirror the results of other studies and meta-analyses. In our investigation, the most frequently occurring complications were aspiration pneumonia (48.89%), followed by urinary tract infections (30%), bedsores (28.33%), and pyrexia illness of undetermined cause at 22.22% (figure-1). Kumar et.al observed similar findings with urinary tract infections outpacing aspiration pneumonia (15% vs 11%).[10]Jhonston CK et.al present results more similar to our study, with pneumonia being the most common (5%), followed by Gastrointestinal bleeding and heart failure at 3% each.[5]

A very interesting comparison can be made between our findings and those of Kim BR,[11] Roth EJ,[12]Davenport RJ [13] and longhorn P.[6] In almost all the studies the most frequent complications were urinary tract infections or lower respiratory tract infections (ranging from 4% for pneumonia and 3% UTI for Kim BR all the way to 30% for UTI and 4% for Roth EJ). However, more alarming than the wide range of prevalence is the runner-up complications of bladder dysfunction, bowel incontinence, falls, and depression which would range in prevalence from 8% to 4.8% for bladder dysfunction[11,12] and from 5% to 15% for depression. [6, 13] Our study did take these complications into account and found a prevalence of 3.88% for bladder dysfunction and 10.56% for depression. The takeaway point is that in our study, infections were far outpacing milder complications whereas in other setups, in more developed regions, minor complications such as dysphasia, bladder/bowel dysfunction, and depression were as prevalent if not more common. Further insight is needed into what factors are causing this variability and why these infections are more common in our setup.

When it comes to bed sores and skin ulcers, our

study is very much reflective of others with a prevalence of 28.33%, comparable to the values of 21% and 9% respectively. [6, 10]

Trying to form a more relatable picture requires us to focus more on how our study compares to others done primarily in Lower middle-income regions. Ali M Et.al has done a prospective study on in-patient stroke complications in Lady Reading Hospital, a tertiary care setup similar to ours, and his findings closely matched ours. [14] Aspiration pneumonia was 31% and bedsores were 7%, in contrast to our 48.89% and 28.33%, respectively (figure 1). However, they did not report UTIs or other minor complications. Their most significant finding was constipation, with a prevalence of 28% compared to our 12.22%, and their reported seizure rates post-stroke of 5% to our 12.78%.

The variation in complications presentation is quite stark and perhaps we can elaborate when looking at the risk factors and determinants that we assessed. The most important determinant we must acknowledge is the NIHSS scoring (table-1). We reported a direct relationship between NIHSS scores at presentation with patients scoring above 12 having a complication rate of 93%, and those with a score of 3 or less having a complication rate of 76.5%. The p-value attained was 0.032 and this shows the value in using the NIHSS. This compares well with Muir KW who reported an accuracy of the NIHSS as 0.83.[15]The value of the NIHSS is well documented.[16]It is useful for determining the long-term outcomes after a stroke, this is more significant when taking into account the inconsistency in initial patient assessment and stratification in our setup.

The GCS at presentation had a similar predictive value with a p-value of 0.001 (score of 15/15 having 73% and less than 8 having 91% complication rates) (table-1). Similar studies attest to the value of the GCS by using regression analysis to determine how it relates to outcomes. [17, 18] These studies show an inverse association with the GCS at presentation and the 1–3-month outcome. We took our study even further by analyzing which complications have the strongest association with the scoring system (table-2). The strongest is association with aspiration pneumonia, with a p-value less than 0.001. No other complication presented a significant association warranting documentation, but overall, the NIHSS score has a direct correlation with complication rates and the need for care. No comparative literature could be found analyzing the relationship between the NIHSS score and complications.

Other determinants of complications were age, with a 100% complication rate amongst >70-year-olds and an 80% rate in 30–40-year-olds. This is mirrored in the findings of Kim BR. [11] Duration of hospital admission with 82% having complications below 7 days of admission and 100% having complications after a month of admission. This compares well to other studies where hospital duration is directly related to complication rates.[11,12] We extrapolated our findings to determine a relationship between duration of stay and complications and found that the strongest association was with bedsores, constipation, UTIs, and seizures in that order (table-3).It is important here to highlight the fact that these complications had no statistically significant relationship with the NIHSS score. The association between bedsores and constipation is well documented with these two complications being common in all admitted patients, not just the stroke ones. [19, 20]

Other than these determinants we looked at many other factors such as type of stroke, secondary risk factors (MI, DM, IHD) arrhythmias, and gender. All these had a visible positive association with complications but were statistically not significant. These factors are well documented as risk factors for strokes to occur, but may also have a knock-on effect when it comes to post-stroke outcomes.[5,10,11]

One very unusual association that came to light in our study was with treatment and complication rates. In our setup, guideline-based therapy is not strictly followed and we observed a paradoxical negative association between treatment and complications, most apparent being with anti-platelets (aspirin or aspirin plus clopidogrel) and steroids (IV dexamethasone). Complications are more common in groups treated with these medications that make up part of guideline-directed stroke treatment and have a proven outcome benefit.[21] The cause of this association needs further study.

Some of the limitations of our study are low sample size and single-center study. Further multicenter, large-scale studies are needed to elaborate the findings more.

CONCLUSION

Our study further complimented previous literature on stroke and hospitalized patients. Complications were commonly prevalent in stroke patients with the incidence increasing when hospitalization duration, severity, and age of the patient were increased. Patients on dexamethasone and anti-platelet drugs had a higher rate of complications. Several pathologies like UTI, Bedsores, and Constipation were linked more to the duration of hospitalization than the severity of the stroke. We noticed that the overlap between complications and common risk factors was sufficient to embrace prophylactic measures and be ready for all possible contingencies that healthcare professionals can come across while dealing with stroke patients.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Ikram MT:	Concept, Critical appraisal, and Discussion Writing
Azam HU:	Data collection, compilation of results, formatting of the article
Azam KU:	Data Collection, Manuscript writing
Arif A:	Manuscript Writing, Bibliography
Rahman A:	Overall compilation of the article
Khan BD:	Supervision, Critical appraisal
Rahim AK:	Data Collection, Manuscript writing

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.