

Research Article

Assessment of Average Length of Stay among Stroke Patients in a Tertiary Care Hospital

Muhammad Irfan Hashmat¹, Muhammad Owais Hashmat^{2*}, Jay Singh Rana¹, Imran Rafiq²,
Mohsina Syed¹

¹Department of Neurology, Dow University of Health Sciences, Karachi Pakistan.

²Department of Neurology, Aga Khan University, Karachi, Pakistan.

Abstract: Background: Stroke is defined as a clinical syndrome where sudden onset neurological deficit appears and remains for 24 hours or more due to vascular compromise. Stroke is the leading cause of disability worldwide and the second leading cause of death. Certain risk factors have been discussed in the literature previously which are strongly associated with stroke. However, the literature is scarce in terms of risk factors affecting the hospital stay of patients suffering from stroke.

Objective: The objective of this study is to evaluate the risk factors that may affect the hospital stay in stroke patients.

Materials and Methods: This study was conducted prospectively at Aga Khan University Hospital, Karachi where length of hospital stay among stroke patients were included. The length of hospital stay (LOS) was found and compared by dividing the included participants into subgroups including age (30-50 and 51-80), gender (male and female), diabetes mellitus type II (yes or no), hypertension (yes or no), duration of disease (≤ 2 or > 2 days), smoking (yes or no), BMI, and type of stroke (ischemic or hemorrhagic).

Results: We included 94 stroke patients. The LOS in hospital was significantly associated with age ($P=0.01$), gender ($P=0.01$), diabetes mellitus type II ($P=0.04$), smoking ($P=0.01$), BMI ($P=0.01$) while it was not associated significantly with hypertension ($P=0.09$), duration of disease ($P=0.05$) and type of stroke ($P=0.08$).

Conclusion: LOS after stroke differed according to the sex, age, diabetes mellitus type II, and BMI. Hence, BMI and smoking are modifiable risk factors that could decrease the LOS while more efforts can be made to control blood sugars at optimum levels for further decreasing the LOS.

Keywords: Stroke, Factors, Predictors, Hospital stay, Clinical syndrome, Morbidity.

INTRODUCTION

Stroke is defined as a clinical syndrome where sudden onset neurological deficit appears and remains for 24 hours or more due to vascular compromise [1]. Stroke can be stratified into two types where ischemic strokes occur due to poor blood supply while hemorrhagic strokes occur due to leakage of blood. 85% of the strokes are ischemic secondary to thromboembolism [2, 3]. The condition may lead to mortality or severe life-long morbidity due to disabilities, hospice care and invasive procedures. Stroke is the leading cause of disability worldwide and the second leading cause of death. According to WHO report, there is a 25% chance of developing stroke for individuals, increasing the global incidence of stroke by 50%. The WHO report also shows that there has been 70% increase in incidence of stroke that has also increased the stroke mortality by 43% [4].

Certain risk factors have been discussed in the literature previously which are strongly associated with stroke [5]. However, the literature is scarce in terms of risk factors affecting the hos-

pital stay of patients suffering from stroke. A Brazilian study reports data where post stroke complications were assessed that increased the length of hospital stay [6]. Similarly, large number of studies report the cost analysis of stroke patients on average length of hospital stay [7]. Another study by Specogna *et al.* reported hypertension and multimorbidity as predictor for hospital stay in hemorrhagic strokes but did not include ischemic strokes [8].

Therefore, we objectify in this study to evaluate the risk factors that may affect the hospital stay in stroke patients. The conclusions drawn from this study might be helpful in assessing the expected hospital stay and may be resourceful in further reaching a score that can be used to determine the expected length of stay for stroke patients.

MATERIALS AND METHODS

The longitudinal study was conducted prospectively at Department of Neurology of Aga Khan University Hospital, Karachi where patients who were being admitted for stroke were recruited in the study after consent under Declaration of Helsinki. The data collection was carried out from June, 2020 till

*Address correspondence to this author at the Department of Neurology, Aga Khan University, Karachi, Pakistan. Email: doc.owais@gmail.com

December, 2020. The approval of the study was acquired from Review Board of Aga Khan University.

Patients aged between 30 years to 90 years were recruited in the study who had acutely developed signs and symptoms of stroke (ischemic or hemorrhagic) at the time of presentation in emergency department. The CT or MRI scans of these candidates were looked for radiographic confirmation and patients were followed up after 24 hours to reassess the signs and symptoms and to exclude transient ischemic attack (TIA). After confirmation of acute stroke, the candidates were asked to fill a consent form and data was collected by data collectors on a predesigned proforma. Attendants were asked for consent on behalf of those patients who were severely morbid and lack compos mentis. However, the candidates were excluded if the attendants reject consent, or they could not be contacted.

Patients who had old strokes, hypercoagulable conditions, traumatic strokes, lacunar infarcts, vascular dementia, or TIA were excluded from the study. Candidates were also excluded if they fail to follow up after 24 hours or had poorly defined radiographic changes.

For calculating the sample, we used alpha=5%, power of the test 1-beta=80, anticipated population proportion 1=23.3%, anticipated population proportion 2=6.7% by OpeEpi.

Following were the predictors that were quantified to assess their influence on length of hospital stay: age in years as 30-50 or 51-80; gender as male or female; duration of disease as <2 days or 2 or >2 days; diabetes mellitus type II; hypertension where patients had documented blood pressure above 140/90 for last 5 years; smoking that include tobacco or substance abuse; BMI as <30 kg/m² or >30 kg/m²; type of stroke as ischemic or hemorrhagic.

STATISTICAL ANALYSIS

The statistical analysis was performed by SPSS 22.0 (IBM). The descriptive statistics were represented by mean ± SD and the categorical statistics were shown as frequency (%). The data of outcomes were segregated into two categories and comparison was made using the post-stratification chi-squared test where p-value was less than 0.05.

RESULTS

The average stay was 13.7±8.9 days so the sample size calculated was 94 patients with margin of error of 0.018. A total of 94 stroke patients met the inclusion criteria of this study. Mean age in our study was 50.93±14.28 years. Whereas mean length of hospital stay, duration of disease, height, weight, and BMI in our study was 11.86±1.62 days, 1.30±1.16 days, 148.62±7.09 cm, 73.76±13.91 kg and 27.94±5.38 kg/m², respectively as shown in Table 1. 56 (59.6%) were male and 38 (40.4%) were female.

Table 1. Outcomes with Comparative Analysis.

| Length of Hospital Stay | Age | | P-value |
|-------------------------|---------------------------|-------------|---------|
| | 30-50 years | 51-80 years | 0.01 |
| | 10.86±1.62 | 12.55±1.75 | |
| | Gender | | 0.01 |
| | Male | Female | |
| | 10.74±1.32 | 12.88±1.25 | |
| | Duration | | 0.05 |
| | <2 days | >2 days | |
| | 10.84±1.71 | 11.56±1.35 | |
| | Diabetes Mellitus Type II | | 0.04 |
| | Yes | No | |
| | 10.36±1.88 | 11.45±1.12 | |
| | Hypertension | | 0.09 |
| | Yes | No | |
| | 10.94±1.9 | 11.51±1.51 | |
| | Smoking | | 0.01 |
| | Yes | No | |
| | 10.54±1.41 | 11.89±1.51 | |
| BMI | | 0.01 | |
| <30 | >30 | | |
| 10.34±1.78 | 12.19±1.65 | | |
| Type of Stroke | | 0.08 | |
| Ischemic | Hemorrhagic | | |
| 9.24±1.14 | 11.21±1.65 | | |

Age

Out of 94 stroke patients, 29 (30.9%) and 65 (69.1%) of patients were in age group 30-50 years and 51-80 years respectively as shown in Table 1. Stratification for age with respect to length of hospital stay showed that out of 94 stroke patients, length of hospital stay was 10.86±1.62 and 12.55±1.75 in the age group 30-50 years and 51-80 years respectively. P-value was statistically significant.

Gender

Stratification for gender was significantly associated to length of hospital stay showed that out of 94 stroke patients, length of hospital stay was 10.74±1.32 and 12.88±1.25 in the male and female respectively.

Duration of Disease

Frequency distribution of duration of disease showed that out of 94 stroke patients, 72 (76.6%) and 22 (23.4%) had the symptoms for < 2 days and > 2 days respectively as presented in Table 1. Stratification for duration of disease with respect to length of hospital stay showed that out of 94 stroke patients, length of

hospital stay was 10.84 ± 1.71 and 11.56 ± 1.35 in the duration of disease group < 2 days and > 2 days respectively and difference was statistically significant.

Diabetes Mellitus Type II

Frequency distribution of diabetes mellitus type II showed that out of 94 stroke patients, 39 (41.5%) and 55 (58.5%) had and did not have diabetes mellitus type II respectively as presented in Table 1. Stratification for diabetes mellitus type II with respect to length of hospital stay showed that out of 94 stroke patients, length of hospital stay was 10.36 ± 1.88 and 11.45 ± 1.12 in patients who had and did not have diabetes mellitus type II respectively with significant p-value.

Hypertension

Frequency distribution of hypertension showed that out of 94 stroke patients, 76 (80.9%) and 18 (19.1%) had and did not have hypertension respectively as presented in Table 1. Stratification for hypertension with respect to length of hospital stay showed that out of 94 stroke patients, length of hospital stay was 10.94 ± 1.90 and 11.51 ± 1.51 in patients who had and did not have hypertension respectively with a significant difference.

Smoking

Frequency distribution of smoking status showed that out of 94 stroke patients, 36 (38.3%) and 58 (61.7%) smoked and did not smoke respectively as presented in Table 1. Stratification for smoking status with respect to length of hospital stay showed that out of 94 stroke patients, length of hospital stay was 10.54 ± 1.41 and 11.89 ± 1.51 in patients who smoked and did not smoke respectively with a significant p-value.

BMI

Frequency distribution of BMI status showed that out of 94 stroke patients, 61 (64.9%) and 33 (35.1%) had BMI < 30 kg/m² and > 30 kg/m² respectively as presented in Table 1. Stratification for BMI with respect to length of hospital stay showed that out of 94 stroke patients, length of hospital stay was 10.34 ± 1.78 and 12.19 ± 1.65 in the BMI group < 30 kg/m² and > 30 kg/m² respectively. The difference between two groups was significant.

Type of Stroke

Out of 94 stroke patients, 69 (73.4%) and 25 (26.6%) had ischemia and hemorrhagic stroke respectively as shown in Table 1. Stratification for type of stroke with respect to length of hospital stay showed that out of 94 stroke patients, length of hospital stay was 9.24 ± 1.14 and 11.21 ± 1.65 in ischemic and hemorrhagic stroke respectively with no significant difference.

DISCUSSION

Stroke is a clinically debilitating condition where symptoms and/or signs develop rapidly as focal and at times global loss of cerebral functions for more than 24 hours [9]. The recovery

remains indecisive, and some patients recover the neurological deficits partially or completely whereas high number of patients die after stroke due to multiple complications such as seizures, infections, thrombosis, malnutrition, and bedsores [10, 11]. The current guidelines support treatment of ischemic stroke by thrombolysis if symptoms appear for less than 3 to 4 hours ago while surgical evacuation or conservative management are offered for hemorrhagic stroke [12]. Therefore, prevention remains the mainstay. Our research study aims to find the risk factors that could be avoided, or care should be increased in patients with those factors.

Previous studies have shown length of hospital stay as a prognostic marker for stroke patients [13]. Khealani *et al.* conducted a study including 443 patients [14]. The median length of stay was 3 days (1- 68). Also, length of stay for 307 patients (70%) was less than 6 days while 220 patients (71%), stayed in hospital for just 3 days. Only 12 patients (3%) stayed in hospital for more than one month. In our study the length of hospital stay was significantly longer than which was 11.86 ± 1.62 days. Their study also quantified the financial assistance required for stroke patients where radiology costs US\$ 1179; laboratory costs US\$ 208; average medication costs US\$139 and hospital bed charges costs US\$222. Bulk of the cost was incurred by hospital bed/room charges as 39% of the amount [14]. Another Nigerian study evaluated records of a total of 143 patients in the final analysis [15]. Patients stayed in hospital for 13.7 ± 8.9 days on average while alcohol consumption, diabetes mellitus and hypertension had LOS of over 7 days as shown by bivariate analysis. However, these results were not significant ($0.310 < p < 0.883$) [15]. The difference in data from two studies also suggests the duration of hospital stay has increased with the passage of time.

Our study reported that diabetes, age, gender, and smoking are strong risk factors that negatively affect the hospital occupancy among stroke patients. A Korean study was also reporting similar outcomes where LOS was significantly higher among female stroke patients and patients aged above 65 years. However, they also considered severity of stroke as a predictor for LOS among stroke patients which our study does not regard as significant [16]. Another Iranian study included a total of 953 patients where the gender remains a strong predictor for LOS among stroke. The other predictor was hypertension that was found in 64% patients. The overall 1-month fatality rate was 15.3%. Considering the difference between predictor for LOS from different parts of the world, we may assume that LOS among stroke candidates also depend upon the racial and geographical circumstances as well [17-21]. Therefore, studies based on geographical locations are necessary and need of local teams for stroke care are required to avoid longer LOS.

CONCLUSION

LOS after stroke differed according to the sex, age, diabetes mellitus type II, and BMI. Hence, BMI and smoking are modifiable risk factors that could decrease the LOS while more efforts can be made to control blood sugars at optimum levels for fur-

ther decreasing the LOS. However, the study has certain limitations which includes single-centered approach whereas in the past literature, a multi-centered approach is more popular. The single center also disables the study to be conducted in various geographical points that would further help in finding the LOS among stroke patients depending on the geological locations.

AUTHORS' CONTRIBUTION

- **Muhammad Irfan Hashmat:** Conception and design of study, Data analysis, Drafting of manuscript and Critical revision.
- **Muhammad Owais Hashmat:** Design of study, Data analysis, Drafting of manuscript and Critical revision.
- **Jay Singh Rana:** Design of study and Data analysis.
- **Imran Rafiq:** Data collection, Data entry and Interpretation.
- **Mohsina Syed:** Design of study.

CONFLICT OF INTEREST

Declared none.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES

- [1] Hankey GJ. Stroke. *Lancet* (London, England) 2017; 389(10069): 641-54.
- [2] Toyoda K, Yoshimura S, Nakai M, *et al.* Twenty-year change in severity and outcome of ischemic and hemorrhagic strokes. *JAMA Neurol* 2022; 79(1): 61-9.
- [3] Sarvari S, Moakedi F, Hone E, Simpkins JW, Ren X. Mechanisms in blood-brain barrier opening and metabolism-challenged cerebrovascular ischemia with emphasis on ischemic stroke. *Metabol Brain Dis* 2020; 35(6): 851-68.
- [4] Feigin VL, Brainin M, Norrving B, *et al.* World Stroke Organization (WSO): Global stroke fact sheet 2022. *Int J Stroke* 2022; 17(1): 18-29.
- [5] Aigner A, Grittner U, Rofls A, Norrving B, Siegerink B, Busch MA. Contribution of established stroke risk factors to the burden of stroke in young adults. *Stroke* 2017; 48(7): 1744-51.
- [6] Gaspari AP, Cruz EDA, Batista J, Alpendre FT, Zétola V, Lange MC. Predictors of prolonged hospital stay in a Comprehensive Stroke Unit. *Rev Lat Am Enfermagem* 2019; 27: e3197.
- [7] Byrne A, Chouliara N, Cameron T, *et al.* Evaluating stroke early supported discharge using cost-consequence analysis. *Disabil Rehabil* 2022; 44(23): 7127-33.
- [8] Specogna AV, Turin TC, Patten SB, Hill MD. Hospital treatment costs and length of stay associated with hypertension and multimorbidity after hemorrhagic stroke. *BMC Neurol* 2017; 17(1): 158.
- [9] Coupland AP, Thapar A, Qureshi MI, Jenkins H, Davies AH. The definition of stroke. *J R Soc Med* 2017; 110(1): 9-12.
- [10] Schwarzbach CJ, Grau AJ. [Complications after stroke : Clinical challenges in stroke aftercare]. *Der Nervenarzt* 2020; 91(10): 920-5.
- [11] Tater P, Pandey S. Post-stroke movement disorders: Clinical spectrum, pathogenesis, and management. *Neurol India* 2021; 69(2): 272-83.
- [12] Phipps MS, Cronin CA. Management of acute ischemic stroke. *BMJ* 2020; 368: l6983.
- [13] Bjerkreim AT, Thomassen L, Brøgger J, Waje-Andreassen U, Næss H. Causes and predictors for hospital readmission after ischemic stroke. *J Stroke Cerebrovasc Dis* 2015; 24(9): 2095-101.
- [14] Khealani BA, Javed ZF, Syed NA, Shafqat S, Wasay M. Cost of acute stroke care at a tertiary care hospital in Karachi, Pakistan. *J Pak Med Assoc* 2003; 53(11): 552-5. PMID: 14738264
- [15] Somotun OA, Osungbade KO, Akinyemi OO, Obembe TA, Adeniji FI. What factors influence the average length of stay among stroke patients in a Nigerian tertiary hospital? *Pan Afr Med J* 2017; 26: 228.
- [16] Kang JH, Bae HJ, Choi YA, Lee SH, Shin HI. Length of hospital stay after stroke: A korean nationwide study. *Ann Rehab Med* 2016; 40(4): 675-81.
- [17] Yuan J, Lu ZK, Xiong X, *et al.* Age and geographic disparities in acute ischaemic stroke prehospital delays in China: A cross-sectional study using national stroke registry data. *Lancet Reg Health West Pac* 2023; 33(100693): 100693
- [18] Song S, Ma G, Trisolini MG, *et al.* Evaluation of between-county disparities in premature mortality due to stroke in the US. *JAMA Netw Open* 2021; 4(5): e214488.
- [19] Gao Z, Liu Q, Yang L, Zhu X. Identification of high-risk factors for prehospital delay for patients with stroke using the risk matrix methods. *Front Public Health* 2022; 10: 858926.
- [20] Seo AR, Lee WJ, Woo SH, Moon J, Kim D. Pre-hospital delay in patients with acute stroke during the initial phase of the Coronavirus disease 2019 outbreak. *J Korean Med Sci* 2022; 37(6): e47.
- [21] Akinyemi RO, Ovbiagele B, *et al.* Stroke in Africa: Profile, progress, prospects and priorities. *Nat Rev Neurol* 2021; 17(10): 634-56.