Burden, Clinical Outcomes and Predictors of Stroke in Hospital Mortality among Adult Patients Admitted to Stroke Unit of Jimma University Medical Center: Prospective Cohort Study

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Abstract

Background: Global burden of stroke epidemiology is changing rapidly. Over the 1990–2013 period, there was a significant increase in the absolute number of deaths and incident events of stroke. The burden of ischemic and hemorrhagic stroke varies between regions and over time in Ethiopia. The paucity of data has limited research output and consequently the response to this burden. Methods: Prospective cohort study was carried at stroke unit of Jimma University Medical Center from March 10- July 10, 2017. The outcome of interest was mortality and time to death. Data was analyzed using SPSS version 20. Multivariable Cox regression was used to identify the predictors of in hospital mortality and time to death from hospital arrival. Predictors with P< 0.05 was considered statistically significant. Results: A total of 116 eligible stroke patients were followed during the study period with the mean age of the patients was 55.1+14.0 years. Stroke accounted for 16.5 % of total medical admissions and 23.6 % of the total cases of in hospital mortality. A total of 91 (78.4%) of patients were discharged being alive making in hospital mortality of rate of 25 (21.6%). The mean time of in hospital mortality after admission was 4.38+3.The prominent suspected immediate cause for in hospital mortality was increased intracranial pressure 17 (68.0%). The mean length of hospital stay was 9.21+6.82days. Brain edema (AHR: 6.27, 95% CI: 2.50-15.76), urine incontinence (AHR: 3.48, 95% CI: 1.48-8.17), National Institute of Health Stroke Scale (NIHSS) >13 during hospital arrival (AHR: 22.58, 95% CI: 2.95-172.56) and diagnosis of stroke clinically alone (AHR: 4.96, 95% CI: 1.96-12.54) were the independent predictors of in hospital mortality. Conclusions: The mortality of stroke in this set up is similar to other low- and middle-resource countries. There should be burning need to establishing and strengthening the available stroke unit which are well-equipped and staffed intensive care units in different hospitals across the country is necessary.

Background

Global burden of stroke epidemiology is changing rapidly [1]. As heart disease and stroke statistics of 2016 report from American Heart Association (AHA), stroke was the second-leading cause of death behind heart disease in 2013, accounting for 11.8% of total deaths globally [2]. First-time incidence of stroke occurs almost 17 million times a year worldwide; one every two seconds. [3]. It is an important disease worldwide, constituting a big burden on the public health purse as well as on patients and their relative [4, 5]. Stroke is a devastating and disabling cerebrovascular disease with significant amount of residual deficit leading to economic loss [6, 7]. The burden of stroke is high and is not only attributable to its high mortality but also its consequent high morbidity [7-9]. One in six people worldwide will have a stroke in their lifetime [5]. Patients with stroke of under the age of 50 years, account for 5-10% of all stroke worldwide [10].

The global burden of disease (GBD) study also indicated that, 80% of stroke deaths occur in low and middle income regions [4], showing that the developing world carries the highest burden of stroke mortality and stroke-related disability [11]. The poor are increasingly affected by stroke, because of both the changing population exposures to risk factors and most tragically, not being able to afford the high

cost of stroke care [5]. Moreover it remains uncertain if increased urbanization and life expectancy in some parts of sub-Saharan African nations will shift the region to higher CVD burden in future years [12].

The burden of ischemic and hemorrhagic stroke varies between regions and over time in Ethiopia as well [13]. Most deaths occurred early after admission due to stroke related acute complications with respiratory failure. As patients usually present late and the standard of care is poor compared to hospitals in developed countries, the in hospital mortality is expected to be higher [9]. In Ethiopia, patients with stroke are often poorly managed and discharged from hospital without receiving adequate rehabilitation services. This has a series implication in terms of saving the life of patients especially with hemorrhagic stokes which are characterized by sever neurologic presentation [4]. In addition in hospital stroke mortality is higher (14.7%) and more than half of the patients were discharged with severe disability [14].

Despite the high burden of strokes globally, there are few available data and there is insufficient information on the current epidemiology, prevention and management of stroke in African countries and other LMICs [9, 15-17]. This is due to lack of adequately trained manpower and other resources to combat the epidemic [16, 17]. The paucity of data has limited research output and consequently the response to this burden [18].

Methods

The study was conducted at stroke unit of Jimma university medical center (JUMC), a tertiary hospital found in Jimma city, south-west Ethiopia. The prospective cohort study was carried out from March 10-July 10, 2017.

Outcome and validating methods

In hospital mortality after hospital admission of the patient was considered as the clinical outcome of the study. Patients were followed from hospital arrival until death/ discharged. Death ascertainment was based on physician on duty note along with suspected immediate causes of death. Length of hospital stay/ admission was measured as the time gap from the patient admitted to stroke unit until patient discharged or died in the hospital. In addition there were different patient status validating methods that measures factors that were important predictors of outcome of interest. Stroke severity was obtained as per by the National Institute of Health Stroke Scale (NIHSS) [14] and level of consciousness was obtained by GCS [19]. Collection of clinical endpoints and other needed parameters were performed daily from the time of patient admission until patient died in the hospital or discharged. Initial neurological assessment was performed within 24 hours of hospital arrival. The decision to perform different ancillary tests, laboratories, imaging and clinical history taking was left to the treating clinicians [20].

Statistical analysis

The data was analyzed using SPSS version 20. Descriptive statistics such as proportions, means, standard deviations, medians and interquartile ranges were calculated to describe the independent variables. Chi-square ($\chi 2$) test was used to test the significance of associations between categorical variables. Initially there were 8 dimensions of independent variables which includes different variables able to predict in hospital mortality. Because of adequate significant variables were obtained at $P<0.05$, it was considered as cut off point for candidate selection and those identified variables at $p<0.05$ on binary Cox regression were subjected to multivariable Cox regression to identify predictors of mortality.

In hospital mortality rate was calculated by the Kaplan–Meier method and compared with the log rank test. Predictors of stroke mortality at hospital were investigated with the use of Cox regression to estimate the hazard ratio of explored predictors. Multivariable Cox regression with backward stepwise approach was used to identify the independent predictors of stroke mortality. Interaction between covariates and types of strokes were tested. Confidence interval which doesn't contain 1 and predictors variables with probability value less than 0.05 was considered statistically significant.

Results

There were a total of 756 medical admissions, of which 125 is stroke related admission. From these total admission, 110 of them experience in hospital mortality and stroke account for 26 of the in hospital mortality. Stroke accounted for 16.5 % of the total medical admissions and 23.6 % of the total cases of in hospital mortality during the study period. Nine patients were excluded from the study for various reasons. One hundred sixteen study participants were included in the final analysis. From these using WHO criteria, 60 (51.7%) of the patients had ischemic stroke while 56 (48.3%) had hemorrhagic stroke[20]. History was obtained solely from 11 patients (9.5%), from the patient and caregiver or other informant in 50 cases (43.1%), and solely from relatives and/or friends in 55 cases (47.4%).

Socio-demographic factors

The mean age of the patients was 55.1±14.0 years (range, 23 to 96 years). Young stroke (age < 45 years) comprised of 22.4% of all patients. Males comprised of 73 (62.9%) with male: female ratio of 1.70:1[20, 21] (Table 1).

Outcome and discharge condition of the patients

A total of 91 (78.4%) patients were discharged alive making in hospital mortality 25 (21.6%). From those discharged patients, 67 (57.8%) discharged with improvement and 16(13.8%) left against medical advice on self and family request. During discharge 81(89.0%) patients were discharged to home, but the remaining 10 (11.0%) were transferred/referred to other hospital/ ward /health facility.

The mean national institute of health stroke scale (NIHSS) of the patients during discharge was 10.32±5.80, which was higher in hemorrhagic stroke patients compared to ischemic stroke patient (11.10±6.40 and 9.75±5.32) without statistically significant difference (P=0.275). Majority of the patients

had moderate NIHSS 43 (47.3%) during discharge. Among 91 patients who were alive during discharge, only one patient had severe brain injury (GCS ≤8).

The mean modified Rankin score (mRS) at discharge was 3.97±1.5 for all stroke patients. The mean mRS was 3.63±1.38 for ischemic stroke and 4.34±1.55 for hemorrhagic stroke which was statistically different (P=0.013). At discharge majority of patients 44(37.9%) had severe physical disability (mRS 4–5) (35.0% ischemic versus 41.1% hemorrhagic cases). All patients "discharged to die" were classified as having mRS = 5 (severe disability) at the time of discharge.

The mean length of hospital stay for all patients was 9.21±6.82days (ranged 0.29-39.01days). The mean length of hospital stay for ischemic stroke patients was 9.88±7.47 days, while that of hemorrhagic stroke was 8.49±6.03 days. Seventeen patients (14.7%) discharged within 3 days and 22 patients (19.0%) stayed for greater than 2 weeks after hospital admission (Table 2).

In hospital mortality of stroke patients

The in-hospital stroke mortality was higher for hemorrhagic stroke compared to ischemic stroke (32.1% Vs 11.7%) (P=0.01). The mean time of in hospital mortality after admission was 4.38±3.25days (0.29-13.75 days). The mean time of in hospital mortality after admission for ischemic stroke was 4.30±4.47 days and hemorrhagic stroke was 4.41±2.80 days. From total 25 patients died in hospital, ten patients (8.6%) were died within 3 days, 10 (8.6%) between 3 and 7 days and 5 (4.3%) died after one week of hospital admission.

Immediate causes for in hospital mortality

The prominent suspected immediate cause for in hospital mortality was increased intracranial pressure 17 (68.0%) followed by respiratory failure secondary to aspiration pneumonia 11 (44.0%), stroke itself 3 (12.0%) and ischemic heart disease 2 (8.0%) (Table 3).

Using P <0.05 from binary analysis of multiple variables under different dimensions, 10 variables were selected to be included in multivariable Cox regression (table 4). Up on multivariable Cox regression; development of brain edema / increased ICP during hospitalization (AHR: 6.27, 95% CI: 2.50-15.76), urine incontinence during initial presentation to hospital (AHR: 3.48, 95% CI:1.48-8.17), having NIHSS≥13 during hospital arrival (AHR: 22.58, 95% CI: 2.95-172.56) and diagnosis of stroke clinically (AHR: 4.96, 95% CI: 1.96-12.54) were the independent predictors of in hospital mortality in patients with the stroke during the study period (table 4).

Survival probability curves derived from Log rank Kaplan Meier in hospital mortality with different factors was shown (Figure1).

Discussion

In this study stroke accounted 16.5 % of total medical admissions, and 23.6 % of the total medical cases of in hospital mortality. This admission rate was higher than findings from Gambia in which the stroke patients made up 5% [22] and in southwestern Nigeria 4.5% of medical admission[23]. But this was in agreement with previous study conducted in Hawasa Ethiopia in which stroke accounted for 13.7% of all medical admissions [14]. The elevated number of stroke admission in Ethiopia may be due to lack of awareness, poor risk factor control and being hospital based study with referral bias.

A total of 91 (78.4%) patients were discharged being alive from the hospital with in hospital mortality of 25 (21.6%). From those discharged being alive more than half (57.8%) were discharged with improvement which was lower compared to study by Masood et al in Pakistan: 91% [24], Jowi et al in kenya : 93.8% [25] and Tirschwell etal in Vietnam: 65.8% [16], but higher than study done by Gebremariam etal in Ethiopia: 47.9% [26]. But there was correspondence similarity with study done in Ethiopia by Greffie etal in which 59.18% were discharged with improvement[9]. These difference in outcome/vital status of the patient during discharge may vary with the severity of stroke, set up of the hospital, complications, co morbidities associated with the patients and experts available in caring of the patient.

The mean length of hospital stay of patients was 9.21days which was shorter than study by Walker etal 19 days [22], Jowi et al 12.5 days [25], Greffie etal 13 days [9], Gebremariam etal 11 days [26], and De Carvalho etal 15.4±20.1 days [27]. For the shorter length of hospital stay in our set up, multiple reasons could be explained. Some patients were rapidly improved and discharged due to the stroke unit had proper possible care as compared to other wards in the hospital. Secondly some patients were died rapidly, some discharged LAMA and others discharged with medical advice without improvement due to small bed occupy of the stroke unit of the hospital. In this regard if there is any change to the condition of the patient and patient stayed longer than other patients, the bed would be left for new stroke patients.

In some patients there was shorter length of stay because of stroke unit provides better quality of care during the early phase. Additionally in some patient's delays in complimentary evaluations is one of the most feasible explanations for the prolonged admission time, which not only significantly increases the costs for stroke care, but also increases the risks for infection, other complications, and recurrence in patients with suboptimal treatment and evaluation.

The in-hospital stroke mortality (21.6%) was similar to study by De Carvalho et al in Brazil 20.9% [27], Desalu et al in Nigeria 23.8% [23]. But this death rate was higher as compared study by Deresse et al in Ethiopia 14.7% [14], Tirschwell etal in Vietnam 6.5% [16], Masood etal in Pakistan 9 % [24], Gebremariam etal in Ethiopia 12.0% [26], Greffie et al in Ethiopia 13.3% [9] and Jowi et al in kenya (5%) [25]. In addition, this in hospital mortality was lower as compared to study by Damasceno et al in Mozambique which was 33.3% [28], Atadzhanov etal in Zambia 40 % [15] and Walker et al in Gambia 57% [22]. The difference in hospital mortality rate could be explained by different ways of stroke diagnosis, type of stroke, treatment approaches, risk factors, comorbidities, complications and in hospital patient care.

The prominent immediate cause was increased intracranial pressure 68.0% and respiratory failure secondary aspiration pneumonia 44.0% which complies with other studies particularly in Ethiopia [9, 14]. Additionally, it was also similar to study in Arabian Gulf countries in which both neurologic and systemic complications accounted 63% of in hospital mortality[29]. But it was unlike to study by Walker etal in Gambia as the most immediate cause of death was the initial stroke in 61% patients[22]. The difference could be due to difference in physician's duty note and prediction based on comorbidities as well as complications that were developed in the patient at the end of patient's life. Prevention, early identification and management of complications like increased intracranial pressure and aspiration pneumonia factors would at least have salvaged some of the patients.

In general the in hospital case fatality rate of stroke in our study was higher than reports from western studies, but was quite similar to SSA studies. This difference could reflect the limited access to hospital care, limited staffing, including availability of physiotherapy and occupational therapy similar to other developing countries as well as insufficient number of hospital beds for longer period care. In addition to this some caregivers/patients belief that people should die at home, where they spent most of their lives, with family members around and caring for them. Absence of treatment with thrombolytic, the low frequency of treatment with antiplatelets for patients with ischemic stroke and lack of evaluation with neuroimaging suggest that suboptimal care be the most likely explanation.

The hospital mean survival time for patients who died in hospital was 4.38days which was earlier as compared to study by Walker etal 7.5 days [22], Greffie etal 6 days [9] and Damasceno et al 6 days [28]. However it was similar to study by Deresse et al of 4.5 days after admission [14]. It has been stated that the high mortality rate in this study during the first one-week (17.2%) may be due to raised intracranial pressure and aspiration pneumonia.

Brain edema, urine incontinence NIHSS$\geq$13 during hospital arrival and diagnosis of stroke clinically alone were the independent predictors of in hospital mortality up on multivariable cox regression. Except stroke severity other factors were different from the study by Atadzhanov et al in Zambia [15]. In this study increased NIHSS was associated with stroke severity constituting decreased level of consciousness. High NIHSS score as a predictor of mortality, was consistent with previous study done by Deresse et al [14].

In this study brain edema as complication was one predictor of in hospital mortality unlike study by Mamushet et al in Ethiopia in which mortality was not significantly associated with the complication of increased intracranial pressure [30].The overall difference in independent predictors of in hospital mortality could be due to sample size, study design, significance value considered and inclusion criteria of the patient.

The in hospital mortality was higher for hemorrhagic stroke (more than triple) compared to ischemic stroke patients that complies with other studies [14, 15, 19]. In contrary to this, study by Mamushet etal in Ethiopia showed that mortality was higher for cases of ischemic stroke (22%) than hemorrhagic stroke (17%) which was significant (P=0.049) [30]. This contrary finding by Mamushet et al might be due to the

study design, study population and comorbidity of the cases. Similar to our finding, study by Deresse etal showed that stroke mortality risk was not different by age and sex [14].

Conclusions

During discharge majority of the patients were alive and discharged from the hospital with improvement. The mean NIHSS of the patients during discharge was moderate, but majority of patients had severe physical disability. Stroke mortality was very high in this study just like in other most LMICs. The in-hospital stroke mortality was higher for hemorrhagic stroke and the prominent immediate cause for in hospital mortality was increased intracranial pressure and respiratory failure secondary aspiration. Development of brain edema, urine incontinence NIHSS$\geq$13 during hospital arrival and diagnosis of stroke clinically alone were the independent predictors of in hospital mortality up on multivariable cox regression.

The NGOs and other non-profit organizations that work in areas of NCD should focus towards the current debilitating conditions of stroke in SSA including Ethiopia through better funding of the health care system to improve the quality of care. In the absence of these, this high mortality will regrettably continue. Finally there should be burning need to establishing and strengthening the available stroke unit which are well-equipped and staffed intensive care units in different hospitals across the country is necessary.

Abbreviations

AHR: Adjusted hazard ratio, AOR: Adjusted odds ratio, CVA: Cerebrovascular accident, CVDs: Cardiovascular diseases, GBD: Global Burden of Diseases, GCS: Glasgow coma scale, HS: Hemorrhagic stroke, HTN: Hypertension, ICH: Intracerebral hemorrhage, IS: Ischemic stroke, JUMC: Jimma university medical center, LMICs: Low and middle income countries, NCDs: Non-communicable diseases, NIHSS: National Institute of Health Stroke Scale, SSA: Sub Saharan Africa, SU: Stroke unit, WHO: World Health Organization

Declarations

Acknowledgment

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests: No competing interests exist

Authors' Contributions

GF contributes in the design the study, analysis and write up the manuscript. AK made the data analysis and interpretation of the data. LC contributed to the design of the study and edition of the manuscripts. All authors critically revised the manuscript and have approved the final manuscript.

Ethics approval and consent to participate

Ethical clearance was obtained from the Institutional Review Board (IRB) of Jimma University, Institute of health. At hospital written informed consent was obtained from the participants. All patients got the right to opt out of the research. This was done by explaining the objective and importance of the study as it is beneficial for patient's quality service delivery for future encounters. The data from the case records and interview was handled with strong confidentiality. Neither the case records nor the data extracted was used for any other purpose. The confidentiality and privacy of patients was assured throughout by removing identifiers from data collection tools using different codes.

Consent for publication

Not applicable

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Tables

Table 1: *Socio-demographic characteristics of stroke among adult patients admitted to stroke unit of JUMC from March 10-July 10, 2017*

Socio-demographic factors		Frequency (n=116)	Percentage (%)
Age (years)	< 45	26	22.4%
	45-65	65	56.0%
	>65	25	21.6%
Sex	*Male*	73	62.9%
	Female	43	37.1%
Residence	*Rural*	84	72.4%
	Urban	32	27.6%
Marital status	*Married*	104	89.7%
	Widow	11	9.5%
	Divorced	1	0.9%
Education status	*Unable to read and write*	42	36.2%
	Able to read and write, informal education	49	42.2%
	Elementary school (1-8)	17	14.7%
	Secondary school (9-12)	3	2.6%
	College/university or above	5	4.3%
Occupational status (over the last 1years)	*Agriculture / farmer*	44	37.9%
	Homemaker/ housewives	41	35.3%
	Merchant	11	9.5%
	Retired	6	5.2%
	Government employee	5	4.3%
	Other own business work	5	4.3%
	Skilled/unskilled manual labor/ daily worker	4	3.4%
Body mass index (BMI)(kg/m^2)	*≤18.5 (underweight)*	24	20.7%
	18.6–24.9 (normal)	74	63.8%
	25.0–29.9 (overweight)	18	15.5%
Approximated monthly income (Dollar)	*None (dependent)*	20	17.2%
	<20	46	39.7%
	20-40	25	21.6%
	>40	25	21.6%

Table 2: Outcome and discharge conditions of stroke among adult patients admitted to Stroke unit of JUMC from March 10-July 10, 2017

Outcome and discharge conditions		Total patients (n=116)	Ischemic stroke (n=60)	Hemorrhagic stroke (n=56)	P value (OR)
vital status of the patient during discharge (n=116)	*Improved*	67 (57.8%)	42 (70%)	25 (44.6%)	-
	Dead	25 (21.6%)	7 (11.7%)	18 (32.1%)	0.010
	LAMA on self and family request	16 (13.8%)	8 (13.3%)	8 (14.3%)	0.350
	not improved/ the same condition/static	4 (3.4%)	2 (3.3%)	2 (3.6%)	0.615
	Referred to higher facility	3 (2.6%)	1 (1.7%)	2 (3.6%)	0.332
	Worsened / residual motor deficit	1(0.9%)	0 (0%)	1(1.8%)	-
NIHSS at discharge (N=91)	*Mean ±SD*	10.32±5.80	9.75±5.32	11.10±6.40	0.275
	NIHSS 0–6 (mild)	23 (25.3%)	15 (28.3%)	8 (21.1%)	-
	NIHSS 7–12 (moderate)	43 (47.3%)	24 (45.3%)	19 (50.0%)	0.460
	NIHSS 13–20 (severe)	19 (20.9%)	12 (22.6%)	7 (18.4%)	0.890
	NIHSS ≥ 21 (very severe)	6 (6.6%)	2 (3.8%)	4 (10.5%)	0.173
GSC at discharge (N=91)	*Median*	15.0	15.0	15.0	0.571
	Poor GCS (≤8)	1 (1.1%)	0 (0%)	1 (2.6%)	-
	Moderate GCS (9-12)	8 (8.8%)	5 (9.4%)	3 (7.9%)	0.828
	Good GCS (13-15)	82 (90.1%)	48 (90.6%)	34 (89.5%)	1.000
mRS at discharge (n=116)	*Mean± SD*	3.97±1.5	3.63±1.38	4.34±1.55	0.013
	mRS: 0–2 (mild disability)	20 (17.2%)	13 (21.7%)	7 (12.5%)	-
	mRS: 3 (moderate disability)	27 (23.3%)	19 (31.7%)	8 (14.3%)	0.696
	mRS: 4–5 (severe disability)	44 (37.9%)	21 (35.0%)	23 (41.1%)	0.203
	mRS: 6 (death)	25 (21.6%)	7 (11.7%)	18 (32.1%)	0.016
Length of hospital stay (days) (n=116)	*Mean ± SD (days)*	9.21±6.82	9.88±7.47	8.49±6.03	0.276
	≤3 days	17 (14.7%)	6 (10.0%)	11 (19.6%)	-
	3.01-7 days	32 (27.6%)	18 (30.0%)	14 (25.0%)	0.167
	7.01-14 days	45 (38.8%)	25 (41.7%)	20 (35.7%)	0.160
	>14 days	22 (19.0%)	11 (18.3%)	11 (19.6%)	0.360

*GCS: Glasgow coma scale, LAMA: left against medical advice, mRS: modified Rankin score, NIHSS: national institute of health stroke scale, OD: Odds ratio, SD: standard deviation

Table 3: Immediate causes of in hospital mortality of stroke among adult patients admitted to stroke unit of JUMC from March 10-July 10, 2017

Immediate causes of death for in hospital mortality	Total patient (n=25)	Ischemic stroke (n=7)	Hemorrhagic stroke (n=18)
Increased intracranial pressure (ICP)	17 (68.0%)	2 (28.6%)	15 (83.3%)
Respiratory failure secondary aspiration pneumonia	11 (44.0%)	4 (57.1%)	7 (38.9%)
Stroke itself (primary or other stroke)	3 (12.0%)	1(14.3%)	2 (11.1%)
Ischemic heart disease	2 (8.0%)	1(14.3%)	1(5.6%)
Intracranial hemorrhage	1(4.0%)	0 (0%)	1(5.6%)
Refractory status epilepticus / other Seizure	1(4.0%)	1(14.3%)	0 (0%)
Hypertensive encephalopathy	1(4.0%)	0 (0%)	1(5.6%)
Renal and hepatic diseases	1(4.0%)	0 (0%)	1(5.6%)
Other heart diseases	1(0.9%)	1(14.3%)	0 (0%)

Table 4: Predictors of in hospital mortality among adult stroke patients admitted to stroke unit of JUMC from March 10- July 10, 2017

Variables		Dead	alive	Crude HR 95%CI	P value	AHR 95%CI	P value
GCS of the patient on hospital arrival	*≤8*	10	7	18.44 (5.06-67.24)	<0.001		
	9-12	12	21	8.53 (2.41-30.22)	0.01		
	13-15	3	63	1.00			
NIHSS at hospital arrival	*≥13*	24	49	15.06 (2.04-111.37)	0.008	22.58(2.95-172.56)	0.003
	<13	1	42	1.00			
Urine/ bladder incontinence	*Yes*	16	28	2.56 (1.13-5.80)	0.024	3.48 (1.48-8.17)	0.004
	No	9	63	1.00			
Comatose presentation	*yes*	7	4	6.21 (2.56-15.07)	<0.001		
	no	18	87	1.00			
Ways of stroke diagnosis	*clinically*	17	38	3.37 (1.43-7.94)	0.005	4.96 (1.96-12.54)	0.001
	imaging	8	53	1.00			
Type of the stroke	*Hemorrhagic*	18	38	3.05 (1.27-7.31)	0.012		
	Ischemic	7	53	1.00			
Brain edema complication	*yes*	18	17	6.93 (2.90-16.63)	<0.001	6.27 (2.50-15.76)	<0.001
	no	7	74	1.00			
Swallowing difficulty	*yes*	6	7	3.02 (1.19-7.64)	0.02		
	no	19	84	1.00			
Aspiration pneumonia complication	*yes*	11	12	3.50 (1.60-7.72)	0.002		
	no	14	79	1.00			
Previous history of medication	*no*	16	39	2.29 (1.01-5.20)	0.047		
	yes	9	52	1.00			

*AHR: adjusted Hazard ratio, GCS: Glasgow coma scale, NIHSS: national institute of health stroke

Figures

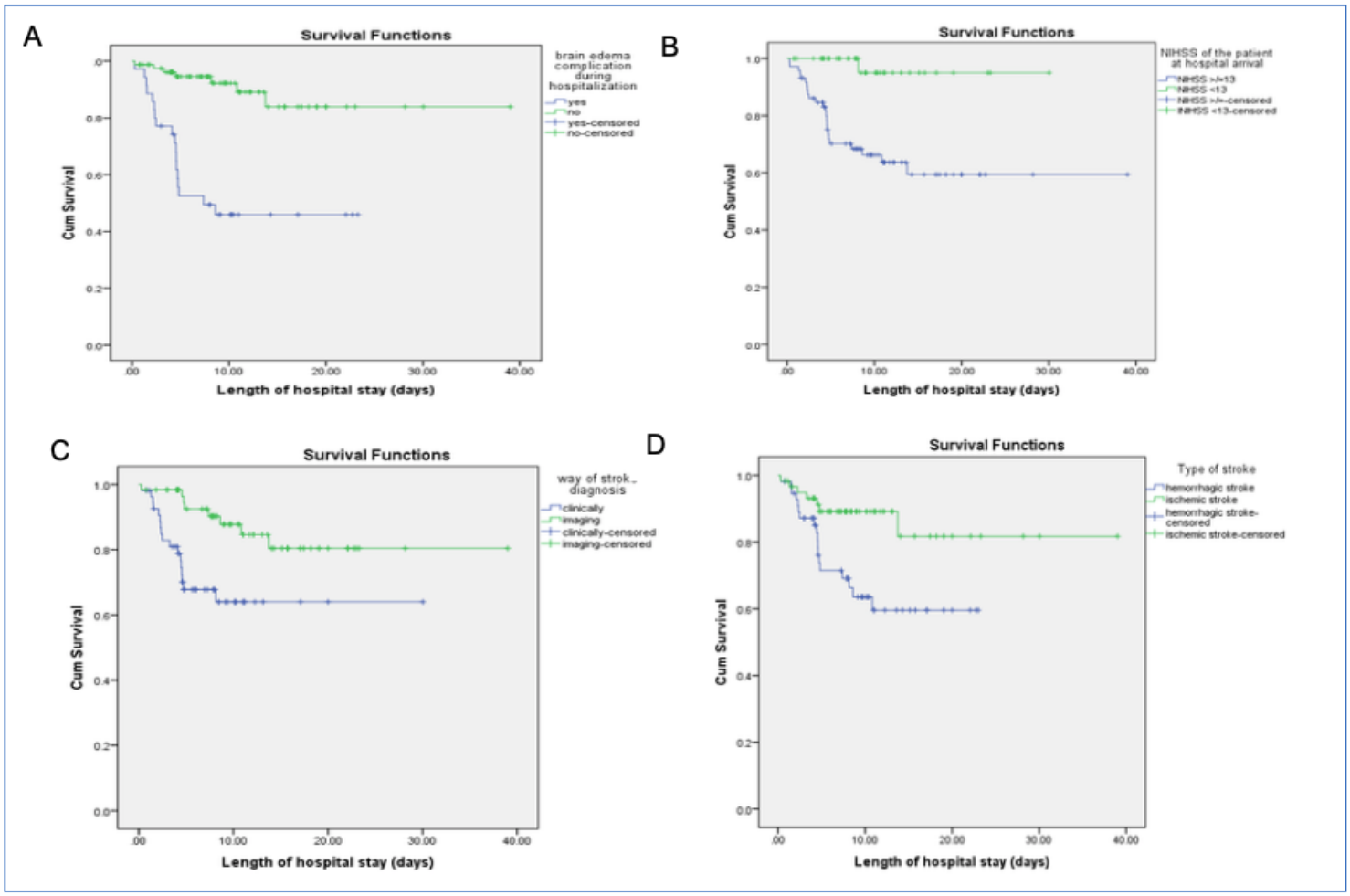

Figure 1

Survival probability curves derived from Log rank Kaplan Meier in hospital mortality and brain edema complication (A), NIHSS of patient during hospital arrival (B), way of stroke diagnosis (C), type of stroke (D)