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Research Article

Stroke Among Patients Attending a Tertiary Care Hospital in Odisha: Risk Factors and Outcome

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Abstract

Background: Stroke is an important health problem worldwide and a fourth prominent cause of fatality and fifth premier cause of disability in developed countries.

Aims: This study was conducted to determine the risk factors, morbidities and outcome of stroke among patients attending a tertiary care hospital in Cuttack.

Methods: 686 stroke patients admitted in the hospital were recruited in this study as per the eligibility criterion during June,2022 to January,2023. SPSS version 25.0 was used for statistical analysis.

Results: Out of 686 stroke patients, 59% were males and 40% were females. 52% were in the age group, 55-72 years. 32% had intracerebral hemorrhagic stroke and 56% had ischemic stroke. 36% patients exhibited altered sensorium, numbness/ loss of sensation, Dysarthria/slurred speech and facial palsy. Around 69% were hypertensive, 28% were having diabetes and 61% were having dyslipidemia. Hypertension, Diabetes and dyslipidemia are important contributors for stroke ($p = 0.0002$), ($p = 0.019$) and ($p = 0.0001$), respectively. 30% suffered from moderate disability. 51% patients improved upon treatment.

Conclusions: Stroke predominantly affected males and increasing age groups, with ischemic stroke being more common than hemorrhagic stroke. Hypertension, Diabetes and dyslipidemia were important contributors for stroke in this study.

Keywords: Stroke; Outcome; Risk Factors; Morbidities; Cuttack; Odisha

Key Message

This risk factors, morbidities and outcome of stroke among patients attending a tertiary care hospital in Cuttack were determined. Males, increasing age groups, ischemic stroke, Hypertension, Diabetes and dyslipidemia were important risks for stroke.

Introduction

Stroke is an important health problem worldwide and a fourth prominent cause of fatality and fifth premier cause of disability in developed countries. Developing nations bear around 75% of all stroke deaths and health-adjusted life years (HALYs) [1-3]. In

India, there is a considerable burden of stroke and developing, with intense indication for the public health care system. The incidence of stroke varies from 119 to 145 per 100,000 population yearly, with an increase prevalence in cities compared to countryside [4-7]. Rapid industrialization and societal changeover have led to an elevated load mainly due to several risk factors, such as hypertension, diabetes, dyslipidemia, tobacco use and lifestyle changes. Stroke fatality in India is especially high, conferring immensely to the overall load of neurological disorders. Mortality figures for stroke differ broadly throughout different regions and are affected by several factors like healthcare management, social awareness, sociocultural conditions and financial status. Among 70-80% of all strokes, Ischemic strokes are the most recurrent while the rest 20-30% are hemorrhagic strokes [8,9]. There is a slight regional variation spanning different Indian states. Therefore, it is important to understand the type and cause of stroke so that suitable treatment can be started in a well timed manner. Further, interpreting the hazards related to stroke is foremost ahead of basic and minor precautionary course of action. This hospital based desriptive study was conducted to determine the risk factors, morbidities and outcome of stroke among patients attending a tertiary care hospital in Cuttack. This hospital caters to the needs of patients from adjacent districts and neighbouring states of Odisha.

Methodology

- **Study design:** 686 stroke patients admitted in the hospital were recruited in this study as per the eligibility criterion during June,2022 to January,2023.
- **Inclusion criteria:** Adult patients ≥ 19 years old diagnosed with Stroke based on clinical evaluation and imaging, CT Scan [computed tomography]-head were included.
- **Exclusion criteria:** ≤ 18 years old patients, those having intra-cranial Space Occupying Lesion (ICSOL) and patients having conditions similar to stroke due to systemic diseases were excluded.

Data collection

Socio-demographic data like age, gender, family history of stroke, duration prior to hospitalization, medications used to treat stroke, medicines prescribed during discharge and morbidities such as diabetes, hypertension and heart diseases were obtained from the patients/care givers. All patients underwent a stepwise evaluation, which included physical check-up, neurological examination, neuroimaging and evaluation of risk factors such as smoking, hypertension, alcoholism, dyslipidemia, carotid atherosclerosis, etc. Routine blood tests including Hb, serum urea/creatinine, blood glucose and lipid profile, CT scan, etc. were carried out for clinical assessment.

Screening procedure and Diagnosis of hypertension, diabetes and dyslipidaemia:

The screening for hypertension, diabetes and dyslipidaemia was followed according to the NPCDCS (National Programme for prevention and control of Cancer, Diabetes, Cardiovascular Diseases and Stroke) in India guidelines [10].

- **Diagnosis of Hypertension:** Blood pressure of > 140/90 mmHg. Patients on anti-hypertensive medications were also considered as hypertensive.
- **Diagnosis of Diabetes:** Fasting blood glucose (FBG) levels ≥126mg/dl for Diabetes or a history of taking anti-diabetic drugs upon diagnosis by a clinician as per guidelines.
- **Diagnosis of Dyslipidemia:** serum triglycerides > 150 mg/dl, LDL cholesterol > 100 mg/dl and HDL cholesterol < 50 mg/dl.
- **CT Scan:** All the patients satisfying the criteria of acute stroke were subjected to CT scan. Results of brain CT scan were used for categorization of stroke. Neurophysician in the hospital evaluated patients for diagnosis. NIH Stroke Scale/Score (NIHSS) was used to quantify stroke severity and monitor neurological changes over time [11,12].

Statistical analysis

SPSS version 25.0 was used for statistical analysis. Prevalences are reported with 95% confidence intervals. Chi-Square ($\chi 2$) test and t test were used to describe the variables as proportions and differences between groups were compared. Statistically significant were considered when P values were < 0.05.

Results

The socio-demographic and clinical profile of patients having stroke are depicted in Table 1. Out of 686 patients, 409 (59.6%) were males and 277 (40.3%) were females. Majority of the cases, i.e., 41% (287) were hospitalized within 12-24 hours. 52% (357)

were in the age group, 55-72 years. CT Scan was performed for 95% (654) of the cases. Moderate stroke, 5-15 as per the NIHSS was observed among 46% (318) of the cases and 38% (262) were having moderate to severe stroke (16-20). Table 2 shows the type of stroke and other manifestations among patients having stroke. 3% (22) of the patients suffered from sub-arachnoid haemorrrhagic stroke, 32% (225) had intracereblar hemorrhagic stroke and 56% (389) had ischemic stroke. Among 7% (50), the cause of stroke was not defined. Type of stroke is a major risk factor (p = 0.0012). Certain other manifestations observed among the stroke patients were cardiovascular diseases (71%), lung diseases (2%), chronic kidney diseases (2%) and neurological disorders (2%). Cardiovascular diseases are a significant risk factor among the patients (p = 0.0475). Further, 19% (132) had no other contraindications at the time of admission. 36% (248) patients exhibited altered sensorium, numbness/loss of sensation, Dysarthria/slurred speech and facial palsy.

Parameters		**Male n = 409, (%)**	**Female n = 277, (%)**	**Total n = 686, (%)**	**Statistical Analysis (X^2, *p*-value)**
Age (in yrs)	19 - 36	8 (2.0)	6 (2.2)	14 (2.0)	$X^2 = 3.50$, $p = 0.06$
	37 - 54	71 (17.4)	57 (20.6)	128 (18.7)	
	55 - 72	214 (52.3)	143 (51.6)	357 (52.0)	
	73 - 90	113 (27.6)	66 (23.8)	179 (26.1)	
	91 - 108	3 (0.7)	5 (1.8)	8 (1.2)	
Time duration prior onset to hospitalization	< 12 hrs	32 (7.8)	22 (7.9)	54 (7.9)	$X^2 = 0.8$, $p = 0.37$
	12-24 hrs	168 (41.1)	119 (43.0)	287 (41.8)	
	25-48 hrs	155 (37.9)	96 (34.7)	251 (36.6)	
	> 48 hrs	54 (13.2)	40 (14.4)	94 (13.7)	
Brain imaging (CT Scan) done for confirmation of Stroke	Yes	389 (95.1)	265 (95.7)	654 (95.3)	$X^2 = 0.115$, $p = 0.734$
	No	20 (4.9)	12 (4.3)	32 (4.7)	
NIH Stroke Scale/Score (NIHSS)	Minor stroke, 1-4	2 (0.5)	1 (0.4)	3 (0.4)	$X^2 = 3.684$, $p = 0.054$
	Moderate stroke, 5-15	198 (48.4)	120 (43.3)	318 (46.4)	
	Moderate to severe stroke, 16-20	155 (37.9)	107 (38.6)	262 (38.2)	
	Severe stroke, 21-42	24 (5.9)	25 (9.0)	49 (7.1)	
	No stroke symptoms, 0	30 (7.3)	24 (8.7)	54 (7.9)	

Table 1: Shows the socio-demographic and clnical profile of patients having Stroke.

Parameters		**Male n = 409 (%)**	**Female n = 277 (%)**	**Total n = 686 (%)**	**Statistical Analysis (X^2, *p*-value)**
Stroke diagnosis	Haemorrhagic Stroke (sub-arachnoids')	10 (2.44)	12 (4.33)	22 (3.2)	$X^2 = 10.458$, $p = 0.0012$
	Haemorrhagic Stroke (intra-cereblar)	127 (31.05)	98 (35.37)	225 (32.79)	
	Ischemic Stroke	243 (59.41)	146 (52.70)	389 (56.7)	
	Others	29 (7.09)	21 (7.58)	50 (7.28)	

Other manifestations	Cardiovascular Diseases	292 (71.39)	197 (71.11)	489 (71.3)	$X^2 = 3.927$, $p = 0.0475$
	Lungs Diseases	27 (6.6)	5 (1.8)	32 (4.7)	
	Kidney Diseases	11 (2.68)	5 (1.8)	16 (2.3)	
	Neurological Disorders	10 (2.44)	7 (2.52)	17 (2.5)	
	Others	90 (22)	42 (15.16)	132 (19.24)	
Clinical presentation	Altered sensorium/numbness/loss of sensation, Dysarthria/slurred speech, Facial palsy	136 (33.25)	112 (40.43)	248 (36.15)	$X^2 = 23.530$, $p = 0.0027$
	Hemiparesis, Hemiplagia	142 (34.71)	53 (19.13)	195 (26.42)	
	Aphasia/dysphasia, convulsion/ seizure /acute bacterial meningitis	22 (5.37)	12 (4.33)	34 (4.95)	
	Decreased level of consciousness, quadriparesis/dysarthria/blurred vision	55 (13.44)	52(18.77)	107 (15.59)	
	Others	72 (17.6)	30 (10.83)	102 (14.86)	

Table 2: Shows the type of stroke and other manifestations among patients having Stroke.

Clinical presentation also showed variances based on gender. Both altered consciousness (OR = 1.48) and sensory and speech-related symptoms (OR ≈ 1.36) were more common in females. On the other hand, hemiparesis and other motor impairments were less common in females (OR = 0.45), suggesting a relative predominance in males. Additionally, females had decreased risks for other clinical symptoms (OR = 0.57). Although the clinical implications necessitate careful interpretation, these findings show diversity in symptom patterns at presentation.

4% (195) had hemiparesis or hemiplegia. 4% (34) of patients suferred from aphasia/dysphasia, convulsions/seizures/Acute bacterial meningitis. 15% (107) suffered from decreased level of consciousness, quadriparesis/dysarthria/blurred vision vomiting, headache, etc. upon arrival in the hospital. Clinical presentation is a proven risk factor of significance (p = 0.0027). The approximate odds ratio study revealed significant variations in stroke subtypes according to gender. For instance, sub-arachnoid haemorrhage (OR = 1.81) and intracerebral haemorrhage (OR ≈ 1.21) were more common in females. On the other hand, ischaemic stroke was less common in women (OR = 0.76), indicating that men were more likely to experience it. There was no significant gender difference in the other stroke category (OR = 1.07). These results point to a varied distribution of stroke types among the sexes, but the strength of the correlation seems to be small.

In terms of age distribution, time to hospitalization and use of diagnostic imaging, there was no significant difference in the sociodemographic features between males and females (p > 0.05). Despite not reaching statistical significance (p = 0.054), a trend toward variation in stroke severity (NIHSS) was noted.

Gender and stroke type were shown to be significantly correlated (p = 0.0012), with differences between the ischaemic and hemorrhagic subtypes.

Table 3 shows the risk factors and morbidities of patients having stroke. About 2% (13) were having family history of stroke. 5% (40) were having family history of both stroke and hypertension. Majority, 31% (218) were having family history of hypertension. Around 69% (477) were hypertensive, 28% (196) were having diabetes and 61% (358) were having dyslipidemia. Hypertension, Diabetes and dyslipidemia are important contributing factors for stroke (p = 0.0002), (p = 0.019) and (p = 0.0001), respectively.

Among 477 hypertensive patients, 13% (96) patients had hypertension for over 5 years and were adherent to prescribed medications. Out of 196 diabetes patients, 8% (56) of the patients had this condition for over 5 years and were taking treatment regularly. Additionally, there was a substantial difference in clinical presentation (p = 0.0027), especially in motor and sensory aspects. Among risk factors, there were significant gender-based variations in lipid abnormalities (p < 0.001), diabetes status (p = 0.019), hypertension management (p = 0.0002) and family history (p = 0.0219). There were clear gender-based trends in the risk factors. The risks of a positive family history of stroke (OR = 2.45) and dyslipidaemia, namely increased cholesterol (OR ≈ 2.35) and LDL (OR ≈ 1.39), were substantially greater in females. In contrast, females were less likely to have low HDL levels (OR = 0.36). The overall prevalence of hypertension did not differ significantly (OR = 0.97), whereas the prevalence of diabetes decreased slightly in females (OR ≈ 0.87). These results point to lipid abnormalities as a potentially significant gender-differentiating factor.

Parameters		**Male n = 409 (%)**	**Female n = 277 (%)**	**Total n = 686 (%)**	**Statistical Analysis (X^2, *p*-value)**
Family History	Stroke	5 (1.2)	8 (2.9)	13 (1.9)	$X^2 = 5.255$, $p = 0.0219$
	Stroke, Ischemic disease, HTN	27 (6.6)	13 (4.7)	40 (5.8)	
	HTN	131 (32.0)	87 (31.4)	218 (31.8)	
	HTN, Diabetes	6 (1.5)	2 (0.7)	8 (1.2)	
	Sudden death/Other diseases	4 (1.0)	1 (0.4)	5 (0.7)	
	No	236 (57.7)	166 (59.9)	402 (58.6)	
Hypertension (477)	Has history of HTN and taking drugs regularly	51 (12.5)	45 (16.2)	96 (13.9)	$X^2 = 13.94$, $p = 0.0002$
	Has history of HTN and taking drugs irregularly	169 (41.3)	128 (46.2)	297 (43.3)	
	Has history of HTN and not taking drugs	34 (8.3)	29 (10.5)	63 (9.2)	
	Newly diagnosed	14 (3.4)	7 (2.5)	21 (3.1)	
(209) 30%	No history of HTN and has normal blood pressure	90 (22.0)	54 (19.5)	144 (21.0)	$X^2 = 5.198$, $p = 0.074$
	No history of HTN and has never measured blood pressure	51 (12.5)	14 (5.1)	65 (9.5)	
Diabetes (196)	Has history of Diabetes and taking drugs regularly	35 (8.6)	21 (7.6)	56 (8.2)	$X^2 = 5.451$, $p = 0.019$
	Has history of Diabetes and taking drugs irregularly	65 (15.9)	38 (13.7)	103 (15.0)	
	Has history of Diabetes and not taking drugs	17 (4.2)	9 (3.3)	26 (3.8)	
	Newly diagnosed	4 (0.9)	7 (2.5)	11 (1.6)	
(490) 71.42%	No history of diabetes and has never measured blood glucose	90 (22.0)	52 (18.7)	142 (20.7)	$X^2 = 1.749$, $p = 0.416$
	No history of diabetes and had normal blood glucose	198 (48.4)	150 (54.2)	348 (50.7)	
Dyslipidemia	Cholesterol	88 (21.5)	109 (39.3)	197 (28.7)	$X^2 = 44.844$, p = 0.00001
	Triglycerides	30 (7.3)	24 (8.6)	54 (7.8)	
	HDL	185 (45.2)	63 (22.7)	248 (36.1)	
	LDL	138 (33.7)	115 (41.5)	253 (36.8)	
	VLDL	54 (13.2)	48 (17.3)	102 (14.8)	

Table 3: Shows the risk factors and morbidities of patients having Stroke.

Further, 30% (209) were having normal blood pressure and 71% (409) were having normal blood glucose. 30% (209) were not aware of hypertension and 71% (490) were not knowing about diabetes. Table 4 shows the medications used for patients having stroke. About 26% (180) were administered both Asprin and Statin whereas 67% (459) were treated with Statins only during hospitalization. Further, ASA and Atorvastatin was administered to 20% (137) of the stroke patients and 64% (440) were administered Atorvastatin only during discharge of the patients. There was a statistically significant difference between gender in treatment patterns during hospitalization and at discharge ($p < 0.05$).

Parameters		**Male n = 409 (%)**	**Female n = 277 (%)**	**Total n = 686 (%)**	**Statistical Analysis (X^2, p-value)**
Medications used to treat stroke during hospitalization	Aspirin	8 (2.0)	4 (1.4)	12 (1.8)	$X^2 = 4.593$, $p = 0.0321$
	Aspirin, Statin	10 (2.4)	3 (1.1)	13 (1.9)	
	Aspirin + Statin	112 (27.4)	68 (24.5)	180 (26.2)	
	Statin	268 (65.5)	191 (69.0)	459 (66.9)	
	Statin + Aspirin + Statin	0 (0.0)	1 (0.4)	1 (0.1)	
	No medications	11 (2.7)	10 (3.6)	21 (3.1)	
Medications given at discharge for treatment of stroke	American Stroke Association (ASA)	1 (0.2)	1 (0.4)	2 (0.3)	$X^2 = 7.11$, p = 0.0077
	ASA, Atorvastatin	9 (2.2)	3 (1.1)	12 (1.7)	
	ASA + Atorvastatin	91 (22.3)	46 (16.6)	137 (20.0)	
	ASA + Atorvastatin, Atorvastatin	2 (0.5)	0 (0.0)	2 (0.3)	
	Atorvastatin	253 (61.9)	187 (67.5)	440 (64.1)	
	Atorvastatin + Aspirin	1 (0.2)	0 (0.0)	1 (0.2)	
	No medications	52 (12.7)	40 (14.4)	92 (13.4)	

Table 4: Shows the medications used for patients having Stroke.

The outcome of the patients having stroke are shown in Table 5. Various degrees of disabilities were noted among the patients. 30% (212) suffered from moderate disability. About 18% (217) each were either having slight and or moderately severe disability.

Parameters		**Male n = 409 (%)**	**Female n = 277 (%)**	**Total n = 686 (%)**	**Statistical Analysis (X^2, p-value)**
Disability	No symptoms at all	88 (21.5)	43 (15.5)	131 (19.1)	$X^2 = 10.458$, $p = 0.0012$
	No significant disability despite symptoms; able to carry out usual duties and activities	17 (4.2)	7 (2.5)	24 (3.5)	
	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance	72 (17.6)	55 (19.9)	127 (18.5)	
	Moderate disability; requiring some help, but able to walk without assistance	115 (28.1)	97 (35.0)	212 (30.9)	
	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance	81 (19.8)	44 (15.9)	125 (18.2)	
	Severe disability; bedridden, incontinent and requiring constant nursing care and attention	20 (4.9)	14 (5.1)	34 (5.0)	
	Dead	16 (3.9)	17 (6.1)	33 (4.8)	

Patient Outcomes	Death	22 (5.4)	20 (7.2)	42 (6.1)	$X^2 = 3.927$, $p = 0.0475$
	Improved	215 (52.5)	141 (50.9)	356 (51.9)	
	Left against medical advice on self and family requests	112 (27.4)	78 (28.2)	190 (27.7)	
	Referred to other health facilities	60 (14.7)	38 (13.7)	98 (14.3)	

Table 5: Shows the outcome of patients having Stroke.

Only 5% (34) suffered from severe disability and were confined to bed and suffered from incontinence thus, needing constant assisted living and observation. Disability was a significant outcome following stroke (p = 0.0012). There was a significant difference in functional outcomes and disability scores across the groups (p = 0.0012), but the extent of these changes has to be further assessed for therapeutic relevance.

With regards to patient outcomes, 4% (33) were brought dead to the hospital and 6% (42) died in the hospital following stroke. 51% (356) patients improved upon treatment and 14% (98) were referred to other health facilities.

Moderate gender-based disparities were revealed by outcome analysis. While the likelihood of improvement was similar for both groups (OR = 0.94), females had somewhat higher risk of death than males (OR ≈ 1.36). Although the difference was not significant, there was a majority of moderate to severe disability among males. Overall, these results imply that although gender may have some impact on outcomes, these differences are still rather small.

Discussion

In the present hospital based study, the sociodemographic and clinical features of 686 stroke patients admitted in a tertiary care hospital in Cuttack were analyzed. These included age, gender, CT scan, type of stroke, NIH stroke scale, presentations, risk factors, comorbidities [diabetes, hypertension, dyslipidemia] and treatment during hospitalization. The patients were followed up for disabilities and outcome for a period of 3 months.

Numerous studies have determined the incidence of stroke in various regions of the country and abroad assessing the impact of several risk factors on outcome of stroke [13-23]. Hypertension, diabetes, dyslipidemia, smoking, alcohol abuse, physical inactivity, etc. were steady comorbities for stroke patients in these studies. Patients with stroke confront a myriad of challenges for recovery, such as restricted access to rehabilitation services after hospitalization. In order to improve access and quality of recovery services, establishing in-patient stroke units, increased training facilities for rehabilitation professionals, relocation of duty of existing healthcare workers and caregivers are need of the hour [24-26]. Enhancing healthcare infrastructure, mobile stoke units, post-stroke rehabilitation services like tele-rehabilitation, community-based rehabilitation services and establishing robust support systems are essential to surmounting these challenges [27,28].

Strengths and Limitations

There were certain strengths and few limitations of this study. The clinical features and risk factors of stroke patients have been analyzed in detail and correlated with outcome. CT Scan was used only in those having symptoms indicative of stroke in our study. Although, CT Scan has been used for diagnosis, there is likelihood that some of the patients with signs and outcome coexisting with stroke might be having other complications could not be excluded. Selection bias of the stroke patients and absence of control groups was a major drawback for determing the incidence of stroke. Follow-up duration was for a shorter period of 3 months. Referral might have been biased depending on the financial conditions of the patients. Longer follow-up would have lead to a clearer outcome of the patients, in terms of disabilities.

Conclusion

Stroke is a major burden on the patients and those giving care to these patients. The 2024 stroke management guidelines emphasize a comprehensive approach to stroke management, encompassing prevention, acute treatment and long-term care while optimizing time-sensitive interventions and addressing modifiable risk factors

[29,30]. Screening patients with chronic long-term hypertension, dyslipidaemia and diabetes, at regular intervals, would go a long way in prevention of Stroke. Conducting awareness camps for the patients and care givers for signs and symptoms of stroke as well as seeking immediate medical help and transferring the patient to medical institute for initiation of treatment would help and be an additional advantage.

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Appendix

NIH stroke scale calculator: The NIH stroke scale calculator consists of 15 items, which evaluate the effect of acute cerebral infarction on the levels of consciousness, language, neglect, visual-field loss, extraocular movement, motor strength, ataxia, dysarthria and sensory impairment. Each item contains three to five grades and can score from 00 to 44 points, where a score of 00 typically indicates normal function, while a higher score indicates some level of impairment. The assessment usually requires less than 10 minutes to complete.

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