

Original Article

A STUDY ON SYMPTOMS, RISK FACTORS AND PRESCRIBING PATTERN OF DRUGS USED IN STROKE PATIENTS

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Received: 07 Nov 2014 Revised and Accepted: 05 Dec 2014

ABSTRACT

Objective: This hospital based case study was undertaken with aim to identify the symptoms, risk factors and prescribing trends of medication employed in stroke. The objective of this study was to work out the prevalence of stroke symptoms, risk factors, clinical parameters and medicines prescription pattern in stroke occurred patients.

Methods: Study was carried out in the Rohini Multi specialty hospital, Warangal, Telangana, India. Patients visiting the neurology clinic were asked to answer a form covering demographic factors, predominant stroke symptoms and their prevalence. To determine the clinical status of the patient; stroke history was obtained from every subject from a trained medical specialist. Most of the patients' data were collected from case sheets and laboratory reports of patients. Among patients visited the clinic, patients were categorized into Ischemic stroke and hemorrhagic stroke patients. Risk factors, associated co-morbidities and the prescription pattern of various drugs used in stroke were also recorded in patients recruited.

Results: Out of 150 patients involved in the study, 100 (66.66%) patients presented with symptoms like slurred speech, followed by weakness on right side in 97 (64.66%) patients, headache in 88 (58.66%) patients, change in speech in 87 (58%) patients, weakness on left side in 58 (38.66%) patients and deviation of mouth in 48 (32%) patients. The most common risk factors associated with the stroke was hypertension in 102 (68%) patients, followed by dyslipidemia in 81 (54.2%) patients, diabetes mellitus in 51 (34.6%) patients, heart disease in 49 (32.6%) patients, smoking in 44 (29.3%) patients, diet in 16 (10.6%) and alcohol in 12 (8%) patients. Majority of the stroke patients was prescribed with anti platelets (85%), dyslipidemics (75%), anticoagulants (36%), and Mannitol (98.5%).

Conclusion: The present study helped to identify the cases with predominant symptoms of stroke and to estimate various risk factors in such patients. The findings in our study stress the need for early and appropriate management of stroke to prevent further complications of stroke. Combination therapy, lifestyle changes and better management of risk factors said to have a major effect on recovery of stroke with improved quality of life and symptoms.

Keywords: Stroke, Symptoms, Risk factors, Prescribing patterns, Drugs.

INTRODUCTION

Stroke is the leading reason for permanent disability and also the third commonest cause of death in high-income nations (1). It's also turning into a crucial explanation for premature death and disability in low-income and middle-income countries like India, for the most part driven by demographic changes and increased by the increasing prevalence of the key modifiable risk factors. As a result, developing countries are exposed to double burden of communicable and non-communicable diseases (2). The death rate attributable to stroke in India is 22 times that of malaria and 1.4 times that of Tuberculosis (3). The poor are progressively affected by stroke, because of population exposures to risk factors and, most tragically, not being able to afford the high price for stroke (1).

Stroke symptoms among people without a history of TIA or stroke may be indicative of a clinically unrecognized stroke, and important indicators for an enhanced danger of future stroke events (4-8). Given the powerful prognostic ability of stroke symptoms for future stroke events, recognizing people with a history of stroke indications may give a clinically effective and cost economical approach for focusing on prevention of stroke. Early diagnosis and treatment of a stroke enhance patient outcomes and learning the cause of an initial event is vital for the identification of the appropriate therapy to maximally decrease danger of recurrence (9). Community-based and hospital based studies in tertiary care clinic set ups have reported that consciousness of all stroke symptoms is low among the overall population (10).

Individuals classified as being at higher risk for stroke have additionally been shown to exhibit poor data of its risk factors. There are certain risk factors that are rare, however identified to occur among Indians (like high blood pressure and diabetes). The

common risk factors are diabetes, high blood pressure, smoking, and obesity (11). The prophylactic drugs have remained a vital drug for hypertensive and diabetes mellitus patients to avoid any stroke in the future. These patients are expected to be a lot more familiar with these topics because they're at a larger risk of future stroke events than the general population and should also even be higher educated in this regard (12).

The physicians are often typically creating the choice on which drug to decide on during a patient-by-patient basis. In the present study, we have assessed the prescribing patterns of Neuro-physicians to identify the selection of a drug over another and what changes are made once a stroke happens in these patients. The rationality is of utmost importance because the irrational use will cause misuse, underuse or overuse of medicines (13). The drug treatment strategy involved with choosing medication like thrombolytics, anticoagulants, antihypertensive (angiotensin changing enzyme-inhibitors, angiotensin II receptor blockers, and diuretics), blood lipid lowering agents (statins), antiplatelet medication (aspirin and clopidogrel), and cerebral activators. It's also suggested to select a route and dosage form of medication to own the best therapeutic effects to manage stroke (14, 15). Primary prevention of stroke includes anti-platelet drugs like aspirin, lipid-lowering medication like statins and blood pressure management. Secondary prevention with artery excision, artery surgical operation, anticoagulant medication like warfarin and heparin is beneficial. Calcium antagonists like Oral Nimodipine is beneficial in cerebrovascular accident (16). One in all the most important complications within the acute part of the stroke is infection. Post stroke, infections are strongly related to poor outcome. Preventive antibiotic therapy within the acute part of the stroke could reduce infections and improve useful outcome. Effective prevention and treatment of

infections ought to thus be a very important element in any strategy aiming to reduce the impact of stroke (17).

Pharmacists are in a key position to provide pharmaceutical care to stroke survivors and to spot, stop and resolve drug related problems. Pharmacists are in a perfect position to review a patient's risk factors for stroke and to initiate or advocate applicable pharmacotherapy wherever indicated. Therefore incorporation of the role of pharmacists within the management of stroke is incredibly crucial and improves outcomes of the patients (18). In rapid increase in burden of stroke in coming years and restricted accessibility of stroke care in India, it might be better to review stroke preventive ways. The present study aims to provide a comprehensive review on sex differences in stroke, with specific stress on the demographics, clinical presentation and medical aid. The objective of this study was to work out the prevalence of stroke symptoms, risk factors, clinical parameters and medicines prescription pattern in stroke occurred patients.

MATERIALS AND METHODS

The study was carried out for a period of seven months (Feb-Aug 2014) in the department of Neurology, Rohini Hospital, multi-specialty hospital situated in Warangal, Telangana, India.

Selection of study subjects

Inclusion criteria

1. Male and female patients of age 20 years and above were included in the study.
2. Patients diagnosed with Ischemic and hemorrhagic stroke were included in the study.
3. Those patients who had radio-logically confirmed diagnosis of stroke using CT/MRI scan were included.
4. Patients with identified and unidentified risk factors were included.

Patients visiting the Neurology clinic were asked to answer a form which covered demographic factors, predominant stroke symptoms

and their incidence. Only symptoms that were definitely present were counted; suspected or attainable weren't taken into consideration. To determine the patient clinical status; stroke history was obtained from every subject by trained specialist. Every patient was examined by a Neurologist and heart surgeon. Most of the patients' data were collected from case sheets and laboratory reports of patients. Among patients visited the clinic, patients were classified into Ischemic stroke and hemorrhagic stroke patients. Risk factors and associated co-morbidities, varied laboratory parameters assessed in patients were recorded in patients recruited.

Subjects were thought-about to have high blood pressure systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg. Diabetes mellitus was diagnosed if the patient had fast blood sugar level was ≥ 120 mg/dl. On admission, we have considered only those individuals that presently smoked cigarettes that were outlined as smoking over ten cigarettes per day for over 6 months. We outlined alcohol consumption as an individual who has consumed alcohol at-least once each day for a minimum period of 6 months. Transient ischemic attack was defined as the abrupt onset of focal neurological deficit lasting for less than 24 hours. Subjects were considered to have obese only when waist hip ratio was ≥ 0.9 cm in males and ≥ 0.8 cm in females and if participants had serum cholesterol ≥ 220 mg/dl, were considered to have hypercholesterolemia. Prescribing pattern of various drugs in patients was also noted. Those patients were excluded from the study if that they had history of the other CNS disorder or CNS infections, hepatic encephalopathy, liver disorder patients, HIV infected patients and children with febrile seizures (to avoid cases during which established disease condition may influence patient clinical status).

RESULTS

In this study, a total of 150 patients were studied during a period of seven months. Out of 150 patients, 104 were males and 46 were females as shown in table 1. The age range was from 21 years to 90 years with mean age of 58.18 years (SD=12.41). The mean age of affected males was 53.83 years (SD=12.30) and that of affected females was 59.13 years (SD=12.06).

Table 1: Data obtained about patients demographic characters (Gender)

Gender	Number of patients (%)
Males	104 (69.33%)
Females	46 (30.66%)

The incidence of stroke was maximum in the age group around 60 years which comprised 50% of the patients followed by the age group of 61-80 years which comprised 37.3% of an entire study population. The results are shown in table 2.

Table 2: Age group categorization of individuals in stroke patients

Age Group (yrs)	Number of patients (Percentage)
21-40	13 (8.66)
41-60	75 (50.0)
61-80	56 (37.33)
81-100	06 (4.0)

Out of the total study population, 98 (65.3%) patients experienced Ischemic Stroke and 49 (32.7%) patients experienced hemorrhagic stroke as shown in table 3. The ratio of Ischemic stroke to Hemorrhagic stroke was 2: 1.

Table 3: Type of stroke

Type of Stroke	Number of patients (Percentage)
Ischemic Stroke	98 (65.3)
Hemorrhagic Stroke	49 (32.6)
Sub Archanoid Hemohorrhgic stroke	3 (2)

Table 4 and fig. 4 shows that out of total patients (N = 150), 100 (66.66%) patients presented with symptoms like slurred speech, followed by weakness on right side in 97 (64.66%) patients, headache in 88 (58.66%) patients, change in speech in 87 (58%) patients, weakness on left side in 58 (38.66%) patients and deviation of mouth in 48 (32%) patients.

Table 4: Symptom wise distribution of patients

Symptoms	Number of patients (Percentage)
Change in Speech	87 (58.0)
Deviation of Mouth	48 (32.0)
Slurred Speech	100 (66.66)
Weakness on Right Side	97 (64.66)
Weakness on Left Side	58 (38.66)
Headache	88 (58.66)

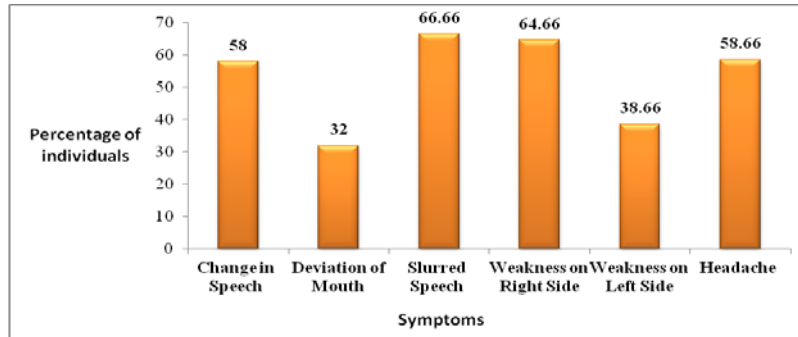


Fig. 1: Percentage of Individuals with various symptoms in stroke patients

Table 5 shows that among 150 patients, the most common risk factors associated with the stroke was hypertension in 102 (68%) patients, followed by Dyslipidemia in 81 (54.2%) patients, diabetes

mellitus in 51 (34.6%) patients, heart disease in 49 (32.6%) patients, smoking in 44 (29.3%) patients, diet in 16 (10.6%) and alcohol in 12 (8%) patients.

Table 5: Assessment of risk factors in stroke patients

Risk Factors	Number of patients (Percentage)
Hypertension	102 (68.0)
Dyslipidemia	81 (54.2)
Diabetes Mellitus	51 (34.6)
Heart Disease	49 (32.6)
Smoking	44 (29.3)
Diet	16 (10.6)
Alcohol	12 (8.0)

Out of the total study population, 126 (84.56%) patients found to have the positive family history for stroke, 24 (15.43%) patients were with negative family history for stroke as showed in table 6.

Table 6: Assessment of family history in stroke patients

Family History	Number of Patients (Percentage)
Positive	126 (84.56)
Negative	24 (15.43)

On examination of CT scan of brain, Infarcts were seen in 96 (64%) patients and bleeds in 48 (32%) patients. The results are shown in table 7.

Table 7: Classification of patients based on type of clinical features:

Type of Clinical Features	Number of patients (Percentage)
Infarcts	96 (64%)
Bleeds	48 (32%)

Among 150 patients, Anticoagulants like Enoxaparin was given to 54 (36%) patients and Heparin to 9 (6%) patients. Antiplatelet drugs like Aspirin were administered to 128 (85.3%) patients and clopidogrel to 120 (80%) patients. Patients with Hypertension were treated with different classes of anti-hypertensives like beta blockers in 20 (13.6%) patients, Calcium channel blockers in 83 (55.3%) patients, ACE inhibitors in 8 (5.4%) patients, Angiotensin antagonists in 14 (9%) patients and combinations (Ramipril+Telmisartan+Hydrochlorothiazide) in 8 (5.3%) patients. Stroke patients who suffered seizures were given antiepileptics like

Phenytoin in 38 (25%) patients, Carbamazepine in 2 (1%) patients and levetiracetam in 21 (14%) patients. Dyslipidemics like Atorvastatin were administered to 113 (75.3%) patients. Mannitol was administered to reduce intracranial edema and this was prescribed to 148 (98.65%) patients as showed in table 8 and fig 8. Stroke patients are at a high risk of hospital acquired infections, so they were prescribed with antibiotics such as Amoxicillin+Clavulanic acid (36 patients), Clindamycin (12 patients), Ceftriaxone (26 patients), Amikacin (8 patients), Levofloxacin (17 patients), Piperacillin+ Tazobactam (9 patients), Metronidazole (9

patients), Erythromycin and Vancomycin (5 patient). Lactulose was given for constipation in 84 patients and neurotonics like

multivitamins to 62 patients. Majority of the stroke patients were prescribed anticoagulants, anti platelets and dyslipidemics.

Table 8: Types of drugs prescribed in stroke patients

Drugs	Number of patients (Percentage)
Mannitol	148 (98.65)
Aspirin	128 (85.3)
Clopidogrel	120 (80)
Atorvastatin	113 (75.3)
Nifedipine	83 (55.3)
Multivitamin	62 (41.5)
Enoxaparin	54 (36%)
Phenytoin	38 (25)
Atenolol	20 (13.6)
Losartan	14 (9)
Heparin	9 (6%)
Ramipril	8 (5.4)
Ramipril+Telmisartan+Hydrochlorthiazide	8(5.4%)

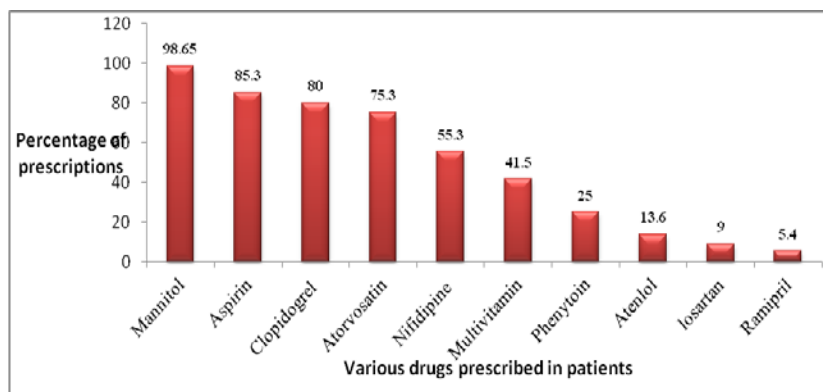


Fig. 2: Prescription Pattern of drugs used in stroke patients

DISCUSSION

The present study highlighted the predominant symptoms, risk factors and drugs used in stroke patients. Our study found that the occurrence of stroke was found to be more in males (69.33%) than in females (30.66%). Study by R P Eapen *et al* (19) also suggests that clinically significant stroke events were more in males than females. The most common biological clarification for sex differences in stroke is related to sex steroid hormones, notably estrogen. Estradiol has terribly potent effects on endothelia that promote dilation and blood flow; whereas testosterone has opposite effects indicating women are protected by endogenous estrogens (20).

In our study the mean age of individuals was 58.18 ± 12.41 yrs (Mean \pm S. D). This finding was closely related with the study done by R P Eapen *et al* (19) and Naik M *et al* (21) who found the mean age as 57 & 58.27 years respectively. Most common age group individuals experiencing stroke were between 41-60 yrs (50%) followed by people whose age range is between 61-80 yrs (37.33%). These findings were in concordance with the study of Wadhvani J *et al* (22) and Celin A. T *et al* (23) where stroke incidence was higher in age group 41-60 years and 51-60 years.

After 60 years with increasing age, the magnitude of this disparity in stroke mortality decreases, and by age 85 years, risk of stroke death is high. Our findings support heightened vigilance for detection, treatment, and management of stroke risk factors among age group 41-60 years (24). Young stroke patients (<40 years) comprised of 13% of all the patients that closely relates to study by Gouri *et al* in which young stroke patients constituted about 15% of all cases (25).

Out of total patients in our study, most patients were found to have suffered with an ischemic stroke compared with the hemorrhagic

stroke. These findings were similar to findings of a study done by Aiyar *et al* (26) and R P Eapen (19)

Most of the patients presented with predominant symptoms like slurred speech (Speech defects), change in speech followed by weakness on the right side, headache, weakness on the left side and deviation of the mouth. These findings were in concordance with the study conducted by Aiyar *et al* (26). This implies that participants were probably to report all six symptoms (speech disorder, numbness, weakness and standing) suggesting that physicians ought to be notably tuned into these symptoms in patients, but also sensitivity to the possibility that these symptoms may be under reported in some population. The high rate of symptoms reported in the present study suggests individual stroke symptoms are also necessary to gather in research studies and, perhaps, clinical practice.

Our study identified the most common risk factors associated with the stroke were hypertension followed by dys lipidemias, diabetes milletus, heart disease, alcohol, smoking and diet. Similar findings were found in data from the study as Inter heart and Inter stroke studies conducted in 22 countries included India by Donnell *et al* identified major risk factors for stroke as are Hypertension (34.6%), smoking (18.9%), waist, hip ratio (26.5%) Diet (18.8%), Regular Physical activity (28.5%), Diabetes (8%), Alcohol intake (5%), psychosocial stress (4.6%) depression (5.2%), cardiac causes (6.7%) (27). Our findings about risk factors also correlated with the findings observed by Vijaya Sorangvi *et al* (28). The presence of stroke was higher in patients with positive family history than the patients with a negative family history of stroke and similar results were found in the study conducted by Vijaya Sorangvi *et al* (28) and Kaur *et al* (29). Ischemic stroke tends to aggregate in families, with a positive family history, which was noticed in our study.

In our study, TIA/stroke symptoms were found to be significantly elevated in patients with diabetes mellitus; smoking and hypertension among all other risk factors identified. These findings suggest that age, male sex, hypertension, diabetes and current cigarette smoking are associated with stroke symptoms. However, the differential association of individual stroke symptoms with stroke by demographics and risk factors has not been well characterized in this study.

In the present study, most of the patients were prescribed with anticoagulants, anti platelets (aspirin, clopidogrel) and dyslipidemics (atorvastatin) which is similar to the findings conducted by Prathyusha *et al* (30) where the same drugs were prescribed in stroke patients. The most commonly prescribed drugs in our study were Mannitol (98%), followed by Aspirin (85%), Clopidogrel (80%), Atorvastatin (75%), and Nifedipine (55%). Neurotoxins such as multivitamins (41%), Antiepileptic like Phenytoin (25%), beta blockers (13%) followed by Angiotensin antagonists (9%) and ACE inhibitors like Ramipril (5%) were also prescribed in recruited patients. In the study by Prathyusha *et al* (30), she reported that patients were given Phenytoin for control of seizures, which showed uniform results as that of the present study.

CONCLUSION

The present study helped to identify the cases with predominant symptoms of stroke and to estimate numerous risk factors in such patients. The findings in our study stress the requirement for early and acceptable management of stroke to prevent any complications of stroke.

- The predominance of stroke was found to be more in males than in females and the predominant age group was between 40-50 years.

- Most patients were found to have an ischemic stroke compared with the hemorrhagic stroke indicating atherosclerosis is the major risk factor in contributing stroke.

Common risk factors in patients of stroke were identified. It had been found that, hypertension, hypercholesteremia, diabetes is the largest risk factors for all kinds of strokes. Like several other factors, these are modifiable risks that may be treated with appropriate medication and lifestyle changes. This can be vital to low-income settings as screening programs, resources and interventions are expensive. Weight reductions, reducing alcohol intake, cessation of smoking and exercise and lifestyle alterations have a greater potential for stroke prevention. The data of the study could prove helpful in of risk factor avoidance and early appropriate medical therapy in these patients.

This study also showed various medicines prescribed in stroke patients like anticoagulants, antiplatelet drugs, dyslipidemics, anti-hypertensive's, and neurotoxins. Drugs to be administered for conditions occurring after the initial event (depression, dementia, epilepsy) like antiepileptics, antipsychotics were additionally prescribed for a few patients. The use of medication differs with hospitals and physicians. Finally, prevalent cerebro-vascular risk factors (hypertension, diabetes and smoking) all raised the prevalence of stroke symptoms, suggesting that a better level of vigilance for the potential stroke symptoms in these populations is likely guaranteed. Identifying differences within the association between demographics and individual stroke symptoms could facilitate disentangle the highest stroke risk present in some sub-groups of the population. Combination therapy, lifestyle changes and better management of risk factors said to possess the major effect on recovery of stroke with improved quality of life and symptoms.

CONFLICT OF INTERESTS

Declared None

REFERENCES

1. Jan L, Madeleine JM, Richard GT, Gary AF, Martin W, Martin E, *et al.* Response to symptoms of stroke in the UK: a systematic review. *BMC Health Serv Res* 2010;10:157.
2. Jeyaraj Durai P, Paulin S. Stroke Epidemiology and Stroke Care Services in India. *J Stroke* 2013;15(3):128-34.

3. Banerjee TK, Roy MK, Bhoi KK. Is stroke increasing in India-preventive measures that need to be implemented. *J Indian Med Assoc* 2005;103:162-6.
4. Chambless LE, Shahar E, Sharrett AR, Heiss G, Wijnberg L, Paton CC, *et al.* Association of transient ischemic attack/stroke symptoms assessed by standardized questionnaire and algorithm with cerebrovascular risk factors and carotid artery wall thickness. *The ARIC Study, 1987-1989. Am J Epidemiol* 1996;144:857-66.
5. Chambless LE, Toole JF, Nieto FJ, Rosamond W, Paton C. Association between symptoms reported in a population questionnaire and future ischemic stroke: the ARIC study. *Neuroepidemiol* 2004;23:33-7.
6. Vermeer SE, Hollander M, Van EJ, Hofman A, Koudstaal PJ, Breteler MM. Silent brain infarcts and white matter lesions increase stroke risk in the general population: the Rotterdam Scan Study. *Stroke* 2003;34:1126-9.
7. Hart CL, Hole DJ, Smith GD. The relation between questions indicating transient Ischemic attack and stroke in 20 years of follow up in men and women in the Renfrew/Paisley Study. *J Epidemiol Community Health* 2001;55:653-6.
8. Kleindorfer D, Judd S, Howard V, McClure L, Safford M, Cushman M, *et al.* Self-reported stroke symptoms without a prior diagnosis of stroke or transient ischemic attack-a powerful new risk factor for stroke. *Stroke* 2011;42(11):3122-6.
9. Liyan G, James FM, Suzanne J, Paul M, Leslie AM, Virginia JH, *et al.* What stroke symptoms tell us: association of risk factors and individual stroke symptoms in the reasons for geographic and racial Differences in Stroke (REGARDS) study? *J Stroke Cerebrovasc Dis* 2012;21(5):411-6.
10. Gill R, Chow CM. Knowledge of heart disease and stroke among cardiology inpatients and outpatients in a Canadian inner-city urban hospital. *Can J Cardiol* 2010;26(10):537-41.
11. Census of India, Registrar General and Census Commissioner, Delhi, India; 2001.
12. Abraham J, Rao PS, Inbaraj SG, Shetty G, Jose CJ. An epidemiological study of hemiplegia due to stroke in South India. *Stroke* 1970;1:477-81.
13. Pooja S, Rahul P, Neha S, Neelima S, Bishal G, Dhruva S, *et al.* Pattern of prescribing prescriptions among the patients attending the department of respiratory medicine in a tertiary care teaching hospital in India, Indo. *Am J Pharm Res* 2013;3(12):1544-51.
14. Das SK, Banerjee TK, Biswas A. A prospective community-based study of stroke in Kolkata, India. *Stroke* 2007;38:906-10.
15. Dalal PM, Malik S, Bhattacharjee M. Population-based stroke survey in Mumbai, India: Incidence and 28-day case fatality. *Neuroepidemiol* 2008;31:254-61.
16. Susan RW. *Pharmacotherapy Principles and Practice: Stroke*, 3rd New York, McGraw Hill; 2008. p. 161-73.
17. Kammergaard LP, Jorgensen HS. Early infection and prognosis after acute stroke: the Copenhagen stroke study. *J Stroke Cerebrovasc Dis* 2001;10:217-21.
18. Management of patients with stroke. Scottish Intercollegiate Guidelines Network. Scotland: NHS, June 2010. Available from: <http://www.sign.ac.uk/pdf/sign118.pdf>
19. Eapen RP, Parikh JP. A study of clinical profile and risk factors of cerebrovascular stroke. *GMJ* 2009;64(2):47-54.
20. Mathew JR, Cheryl DB, George H. Sex differences in stroke: epidemiology, clinical presentation, medical care, and outcomes. *Lancet Neurol* 2008;7(10):915-26.
21. Naik M, Rauniyar RK. Clinico-radiological profile of stroke in eastern Nepal: a computed tomographic study. *Kathmandu Univ Med J* 2006;4(2):161-6.
22. Wadhvani J, Riar H, Raman PO. Natures of lesion in cerebro vascular stroke patients' clinical and computed tomography scan correlation. *J Asso Phy India* 2002;50:777-81.
23. Celin AT, Seuma J. Assessment of drug related problems in stroke patients admitted to a South Indian tertiary care teaching hospital. *Indian J Pharm Prac* 2012;5(4):28-33.
24. Virginia JH, Dawn OK, Suzanne EJ, Leslie AM, Monika MS, David R, *et al.* Disparities in stroke incidence contributing to disparities in stroke mortality. *Ann Neurol* 2011;69(4):619-27.
25. Gauri. A study of risk factors and clinical profile of stroke at Bikaner. *J API* 2000;48:1.

26. Aiyar. A study of clinic-radiological correlation in cerebrovascular stroke. Gujarat medical Journal; 1999. p. 52.
27. Donnell MJD, Liu L, Zhang H, Chinsl Rao, Melacini P. Inter stroke investigators, Risk factors for ischemic and intracerebral hemorrhagic stroke in 22 countries (the INTER STROKE study): a case control study. Lancet 2010;376(9735):112-23.
28. Vijaya S, Kulkarni MS, Deepak K, Suhasini A. Risk factors for stroke: a case control study. Int J Cur Res Rev 2014;6(3):46-52.
29. Kaur K. Study of clinical profile and CT correlation in CV stroke. JAPI 2001.
30. Preethi PB. Prescribing pattern of drugs in stroke patients admitted to a multi specialty hospital, India. Indo Am J Pharm Res 2014;4(2):1015-20.