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Prevalence of Dementia and Cognitive Impairment after Stroke: An Epidemiological Study

Sandeep Kumar Beemreddy[1]*, Amulya Reddy Gade[1], Venumadhav Neerati[1]
1.Department of Pharmacy Practice, St. Peter's Institute of Pharmaceutical Sciences, Hanamkonda, Warangal-506 001, India

ABSTRACT

Vascular dementia and cognitive impairment are major problems in stroke which must be diagnosed properly and very less effort is put into management of cognitive decline after stroke. This study is a prospective; questionnaire based observational study conducted for 6 months among stroke patients admitted into in patient setting of a tertiary care teaching hospital done to estimate the prevalence of stroke based on age, sex and educational status and to estimate the prevalence of dementia and cognitive impairment among stroke patients using neuropsychological testing. Data was collected from a total of 181 stroke patients of the age distribution 20 to 85 y with a mean age of 57.68±12.34 y and 75.6% patients were diagnosed with ischemic stroke and 24.3% with hemorrhagic stroke. Majority (76.79%) of patients were from rural population. Diagnostic and Statistical Manual of Mental Disorders-IV, Revised text criteria were used to assess dementia. Mini-mental state examination and short portable mental state questionnaire were used to know the extent of cognitive impairment. Various comorbid conditions like hypertension, diabetes mellitus, coronary artery disease and epilepsy were observed in 69.06% patients. The percentage (45.83%) of people with mild cognitive impairment is high with short portable mental state questionnaire and the percentage (77.69%) of people with moderate dementia is high using mini-mental state examination. 92.81% patients out of 181 were prescribed with neuroprotective drugs. The tools used for screening dementia are not perfect in case of uneducated patients and patients with low education. Current hypotheses and methodologies for the management of post-stroke dementia must be re-evaluated, and new strategies need to be explored.

Keywords: Stroke, Dementia, Cognitive impairment, MMSE, SPMSQ

*Corresponding Author Email: sandeepbeemreddy@gmail.com
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INTRODUCTION

Stroke is the most dangerous cardiovascular event among healthy subjects and patients with a pre-existing cardiovascular disease[1]. In developed countries, stroke is the major cause of physical disability in adults, the second most common cause of dementia, and the third leading cause of mortality (after coronary-artery diseases and cancers)[2]. The World Health Organization (WHO) defines stroke as "rapidly developing clinical signs of focal(or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death with no apparent cause other than of vascular origin"[3]. Stroke is a general term used to describe a sudden appearance of focal neurological deficit that lasts for at least 24 hours which can be due to a cerebrovascular disease. It is also called as a cerebrovascular accident (CVA)[4].

Dementia is characterized by development of multiple cognitive deficits that include impairment of memory and at least one of the following cognitive disturbances: aphasia, apraxia, agnosia, or a disturbance in executive functioning. Dementia may be etiologically related to a general medical condition, to the persisting effects of substance use (including toxin exposure), or to a combination of these factors[5]. Mild Cognitive Impairment (MCI) is the stage between normal forgetfulness due to aging and the development of dementia. People with MCI have minor problems with thinking and memory that do not interfere with everyday activities. Vascular dementia is the second most common form of dementia after Dementia of Alzheimer's type[6]. A person with dementia may have memory problems, communication difficulties, problems understanding, mood changes and reduced ability to concentrate. Stroke was recognized as an important cause of dementia for more than a century. Now it is considered to be the second most common cause of dementia and one of the rare preventable dementias. Reasons for a stroke patient to become demented are still insufficiently understood. Demographic, clinical, stroke-related, and lesion-related radiological factors have been reported to predict dementia in stroke patients[7,8]. Various neuropsychological and functional testing scales are used to measure the extent of cognitive impairment. They include Barthel Index, Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE), Mini-Mental State Examination (MMSE), Short Portable Mental State Questionnaire (SPMSQ), Clinical Dementia Rating (CDR), Geriatric Mental State Schedule, 15-Word Mental Learning Test, Paper and Pencil Memory Scanning Test, Stroop Test, Selective Reminding Test.

This study is conducted to estimate prevalence of dementia and cognitive impairment among stroke patients using neuropsychological testing, estimation of prevalence of stroke based on age,

sex, education and location and also aims at counseling stroke patients and their caregivers about possible lifestyle modifications and medication use to manage stroke and cognitive impairment.

MATERIALS AND METHOD

This study is a prospective; questionnaire based observational study conducted for 6 months among stroke patients admitted into in-patient setting in a 300-bedded tertiary care teaching hospital located in Hanamkonda, Telangana between March and September 2013. The participants of the study were taken from patients who were admitted to the in-patient setting of Rohini Super Specialty Hospital with first-ever or recurrent stroke over a period of 6 months. All the patients between age group 20 and 85 years who were clinically diagnosed with stroke were included in the study. Informed consent was obtained from all the patients who participated. Pregnant women, cancer patients and patients with central nervous system diseases like Parkinson's disease, Alzheimers disease were excluded

Case records of all the patients were observed and patients' demographic details (age, sex, education and address), medical history (any comorbid disorder/s), social habits (type of diet, smoking, alcohol consumption), body mass index (BMI), laboratory findings (hemogram, serum biochemistry, blood pressure, lipid panel) and radiological findings (CT, MRI) were collected using structured data collection form. Stroke is categorized using CT or MRI as ischemic (presence of infarct) or hemorrhagic (presence of hemorrhagic infarct, hematoma). In case of pre-existing stroke and other comorbid conditions, the patients' medication consumption behavior is evaluated. The patients are categorized into 3 categories based on their BMI score as underweight (BMI≤18.5) as underweight, normal weight (BMI≥18.5, ≤25) and overweight (BMI≥25).

Diagnosis of Cognitive impairment and Dementia

Diagnostic and Statistical Manual of Mental Disorders-IV, Revised text (DSM-IV-TR) criteria were used to assess dementia. Two different neuropsychological tests namely MMSE and SPMSQ were used to know the extent of cognitive impairment. MMSE tests patient's functions including arithmetic, memory and orientation in about 10 minutes. It tests patient's orientation to time, place, registration, attention, recall, calculation, language, repetition and ability to follow complex commands in 30 questions[9]. Based on MMSE scores, patients were categorized into 4 different categories namely normal cognition (≥25 points), mild dementia (21-24), mild dementia (10-20 points) and severe dementia (≤9 points).

SPMSQ is easier to use than MMSE. SPMSQ items test orientation to time and place, memory, current event and calculation (subtract 3s starting with number 20). The total number of errors made by a patient is computed and it ranges from 0 to 10. The patient is scored based on number of errors he has made[10,11]. Two or less than 2 errors indicate normal cognitive function, 3 to 4 errors indicate mild cognitive impairment, 5 to 7 errors indicate moderate cognitive impairment and 8 to 10 errors indicate severe cognitive impairment.

RESULTS AND DISCUSSION

Data was collected from a total of 181 stroke patients of the age distribution 20 to 85 years with a mean age of 57.68 y (mean age ± SD 57.68±12.34 y). 107 (59.11%) were male with mean age of 56.15±12.33 y and 74 (40.88%) were female with mean age of 59.90±12.10 y. In both male and female patients, maximum numbers of patients were in the age group of 60-69 y (Table 1). The prevalence of stroke was higher in male patients of age younger than 50 y of age than female patients of same age and higher in female patients older than 50 y compared to male patients of same age. Among 181 patients, 137 (75.6%) were diagnosed with ischemic stroke and 44 (24.3%) with hemorrhagic stroke. Among ischemic stroke patients, 77 were male and 60 were female. In case of hemorrhagic stroke the numbers are 30 and 14 respectively. The number of ischemic stroke patients is high (34.30%) in the age group of 60-69 years compared to other groups. In hemorrhagic stroke the number is high (34.09%) in the age group of 50-59 years compared to other groups (fig. 1). In this study the majority (139; 76.79%) of the patients were from rural population compared to urban population (42; 23.2%) (fig. 2). Urban area includes Warangal Corporation and other major municipalities in Warangal and Karimnagar districts.

Table 1: Age Distribution of Stroke Patients by Gender

Age Group (y)	No. of Patients (%)	Male (%)	Female (%)
20-29	03 (1.6)	02 (1.86)	01 (1.35)
30-39	10 (5.52)	07 (6.54)	03 (4.05)
40-49	35 (19.33)	26 (24.3)	09 (12.16)
50-59	43 (23.75)	23 (21.49)	20 (27.02)
60-69	55 (30.38)	31 (28.97)	24 (32.43)
70-79	30 (16.57)	17 (15.88)	13 (17.56)
80-89	05 (2.76)	01 (0.093)	04 (5.4)
Total	**181**	**107**	**74**

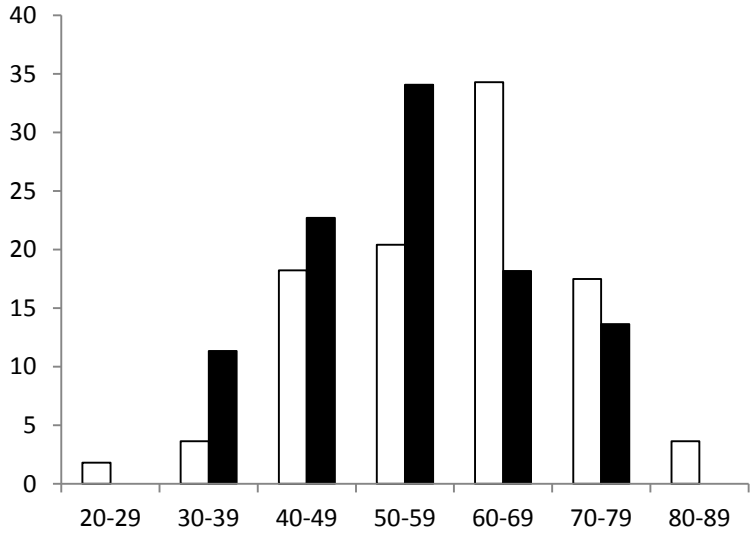

Figure 1: Age distribution by type of Stroke

Age groups in years, Total number of patients=181, □ Ishemic (%), ■ Hemorraghic (%)

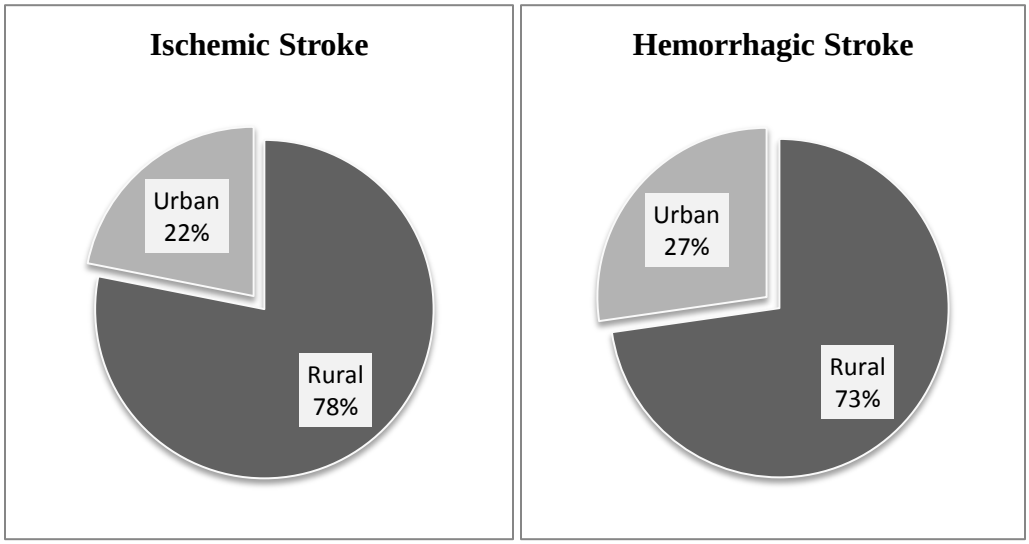

Figure 2: Place wise distribution of different types of Stroke

Various comorbid conditions like hypertension, diabetes mellitus, coronary artery disease and epilepsy were observed in 125 (69.06%) patients (Table 2). Of all these conditions hypertension is most predominant, observed in 80 cases followed by both hypertension and diabetes mellitus in 32 cases. 13 patients had pre-existing stroke. Even though other heart diseases like congestive heart disease and atrial fibrillation are risk factors for stroke, they are not observed in this study.

Table 2: Prevalence of Various Comorbid Conditions in Stroke

Comorbidity	No. of Patients (%)
Hypertension	80 (61.06%)
Diabetes Mellitus	08 (6.108)
Hypertension + Diabetes Mellitus	32 (24.4)
Coronary Artery Disease	07 (5.34)
Epilepsy	04 (3.05)
Total	**131**

Alcohol consumption was observed in 94 (51.93%) patients. The number of patients who consume alcohol regularly is 37 (20.44%), occasional drinkers are 50 (27.62%) and occasional toddy drinkers are 7 (3.86%). It is more common in men than in women (Fig 3). Tobacco usage is classified into tobacco chewing and smoking. Out of a total 181 cases 42 (23.2%) patients were found to be using tobacco of which 33 were smokers and 9 were tobacco chewers (use of tobacco quid, gutkha and tobacco powder) (figure 4).

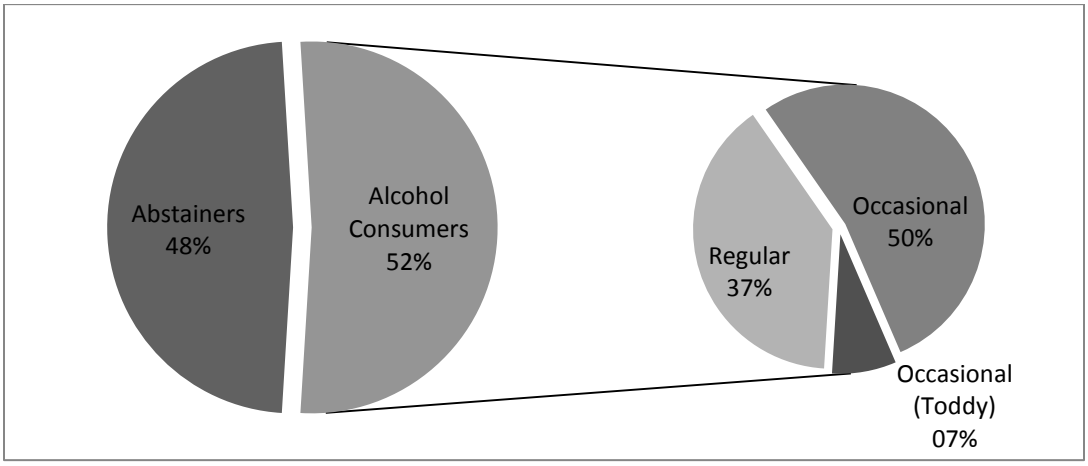

Figure 3: Alcohol Consumption among Stroke Patients

Total alcohol users are 94 out of 181 patients included in the study

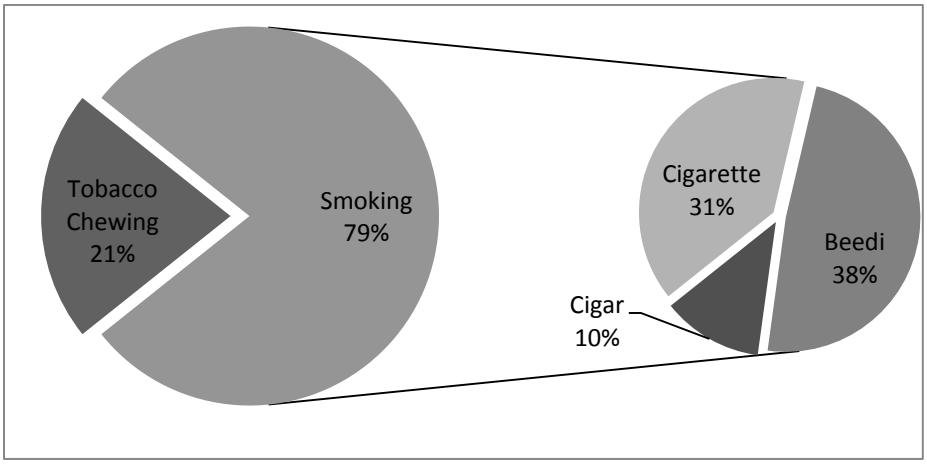

Figure 4: Tobacco Usage among Stroke Patients

Out of a total 181 cases only 42 patients were found to be using tobacco

BMI was used to classify the patients into 3 categories, underweight, normal weight and overweight. Out of 181 patients, 18 (9.9%) were underweight, 125 (69.06) were of normal weight and the rest i.e., 38 (20.99%) were overweight. Overweight category includes both overweight (BMI≥25; ≤29.9) and obese (BMI≥30) patients. Among 181 patients, more than half i.e., 102 (56.35%) patients of total 181 were uneducated and are mostly from rural areas. The rest completed at least their primary education. The major source of livelihood of the patients is agriculture. Most of the patients are farmers (57; 31.49%) and daily wage earners (24; 13.26%) working in agriculture (Table 3).

Table 3: Educational and Occupational Status of Patients

Education	**No. of Patients (%)**
Uneducated	102 (56.35)
Primary	36 (19.88)
Secondary	21 (11.60)
Intermediate	12 (6.6)
Graduation	06 (3.3)
Occupation	
Agriculture	57 (31.49)
Daily wage earners	24 (13.26)
Employees	22 (12.15)
Business	19 (10.49)

Total number of patients 181

Out of 181 patients responded for SPMSQ, 144 (79.5%) were classified into 4 categories based on their scores. The percentage of people with mild cognitive impairment is high (66; 45.83%) followed by people with moderate cognitive impairment (46; 31.94%). Only 25 (17.36%) are of normal cognition. Only 139 (76.79%) patients responded for MMSE out of total 181 cases. In case of MMSE a large number of patients i.e., 108 (77.69%) fell under the category of moderate dementia (Table 4, fig. 5). 168 (92.81%) patients out of 181 were prescribed with neuroprotective drugs like citicoline and piracetam. Of these citicoline alone was prescribed in 156 (92.85%) patients. Piracetam was used in 06 (3.57%) cases and both piracetam and citicoline were used in 06 (3.57%) cases. These drugs are prescribed at the time of start of treatment without the diagnosis of dementia.

Table 4: Prevalence of Cognitive Impairment and Dementia

Severity of Cognitive Impairment/Dementia	Type of Questionnaire Used, No. of Patients (%)	
	SPMSQ	**MMSE**
Normal	25 (17.36)	06 (4.31)
Mild	66 (45.83)	20 (14.3)
Moderate	46 (31.94)	108 (77.69)
Severe	07 (4.86)	05 (3.59)
Total	**144**	**139**

DISCUSSION

Stroke is the major cause of physical disability in adults, the second most common cause of dementia, and the third leading cause of death in developed countries[2]. Vascular dementia is the second most common form of dementia which occurs when stroke or a small vessel disease affects the blood supply to the brain. Stroke increases the risk of dementia 4-12 times[12]. In this study, the prevalence of stroke based on age, sex and education was estimated. Various possible risk factors for stroke are studied. The prevalence of cognitive impairment and dementia was estimated based on SPMSQ and MMSE scores. The neuroprotective treatment received by patients was also observed.

The prevalence of ischemic stroke (75.6%) was higher than that of hemorrhagic stroke (23.3%). This finding was not in accordance with 2006 American Heart Association (AHA) report which estimated the incidence of ischemic and hemorrhagic strokes as 88% and 12% respectively[13]. This may be due to smaller sample size in this study. More over majority of subjects in our study are from rural population (76.79%) who will not consult the physician for an ailment or a disease unless it is fatal. In this study men have a greater prevalence of stroke than women, but age-specific prevalence was higher in women who are older than 50 y of age and in men who are of younger than 50 y of age. This correlates with 2010 AHA report[14]. The patients in this study were much younger with a mean age of 56.78±12.34 y compared to previous studies done by Barba *et al.*, Kase *et al.* and Pohjasvaara, *et al.*, were the mean ages were 76.9±13.6 y, 78.6±0.8 y and 70.2±7.7 y respectively[7-9,15].

The most common risk factors of stroke include hypertension and diabetes mellitus observed in 120 cases. Hypertension was associated with deep infarcts and hemorrhages. Even though smoking is considered an important modifiable risk factor for stroke, its mechanism is not well studied. Smoking is said to cause carotid atherosclerosis which in turn leads to stroke[16]. Smoking was observed in 23.2% patients who are mostly male. Vermeer *et al.*, proposed that

elderly people with silent brain infarcts have an increased of dementia and cognitive decline than those without such infarcts[17]. Almost all the ischemic stroke patients in this study have developed infarcts in various parts of brain.

Dementia can severely affect the Quality of Life of patient. If the patient has any pre-existing disease, the person may forget to take its medication which may worsen their condition. They also might not be able to perform their regular physical activities worsening their personal and social life. The risk factors of vascular dementia include hypertension, cardiac disorders, diabetes mellitus and alcohol abuse[15]. Ischemic brain changes may also contribute to post stroke dementia (PSD). These parameters indirectly increase the risk of dementia primarily by increasing the risk of clinical stroke[18]. In the study by Barba *et al*, conducted in 2000, the severity of PSD was mild in 29.3%, moderate in 29.3% and severe in 41.3% of cases in contrast to our study where the severe dementia cases were less than 5% and moderate dementia cases via MMSE were 77.69%[7]. While using SPMSQ, the number of patients with mild cognitive dysfunction (66, 45.83%) is high compared to MMSE where majority of patients were with moderate cognitive dysfunction (108, 77.69%). Malhotra *et al.*, observed that the cross-tabulation of MMSE and SPMSQ scores suggested that SPMSQ is likely to assign a few individuals with mild cognitive impairment by MMSE as having moderate/severe cognitive impairment[10].

Higher educational status may be a hindering parameter to diagnose dementia. Some questions in both SPMSQ and MMSE are better answered by the patients who have completed at least their primary education compared to the patients with no education. Low education level increases the chances of cognitively intact people being misclassified as having dementia (i.e. false positives). On the other hand, there are likely false negative cases among those with high education level. This was also observed in studies by Malhotra *et al.*, and Barba *et al*. The norms on cognitive tests were not adjusted for education which may have influenced the diagnosis of dementia[7, 8, 10]. Even though MMSE covers a wide range of cognitive domains it is difficult to employ it in severely ill patients and patients with lesser education status. It is not a very sensitive tool for detecting subtle changes in cognitive function. SPMSQ on the other hand can be used easily but the low sensitivity and specificity may limit its ability to be used alone in certain clinical settings.

In this study 168 (92.81%) patients out of 181 were given neuroprotective drugs prior to diagnosis. Citicoline and piracetam which were prescribed did not completely prevent dementia in many clinical studies. They are not much effective in humans but showed effect in animal

trials. Even though oral citicoline administered within 24 hours from symptoms onset has shown evidence of efficacy in 4 different clinical trials in United States its role is not completely established[19].

This study has several limitations. The sample size is much smaller compared to other international studies, we not sure whether all the patients with stroke in the area have came to the hospital where this study has been performed. This may affect the prevalence pattern. The effect of risk factors on PSD was not clearly established due to smaller sample size. The patients who were aphasic were not considered irresponsive as they are not able to provide answers. In such cases only demographic details and data collected from case sheet was used.

Stroke is a medical emergency which is more prevalent in rural population than urban population. Hypertension and diabetes are common comorbidities among stroke patients. Vascular dementia and cognitive impairment are major problems in stroke which must be diagnosed properly. The tools used for screening dementia are not perfect in case of uneducated patients and patients with low education. To maximize sensitivity and specificity, a cut-off point of 5 or more errors is suggested for screening patients with dementia which needs to be adjusted depending on the educational level of the patient. Current hypotheses and methodologies for the management of PSD must be re-evaluated, and new strategies need to be explored. All the patients admitted into the hospital with stroke must be properly counselled about proper medication use and lifestyle considerations to prevent further damage from stroke.

REFERENCES

1. Kinlay S. Changes in stroke epidemiology, prevention and treatment. Circulation 2011;124:494-6.
2. Murray CJ, Lopez AD. Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. Lancet 1997; 349: 1436-42.
3. Hatano S. Experience from a multicentre stroke register: A preliminary report. Bull World Health Organ 1976;54:541-53.
4. Fagan SC, Hess DC. Stroke. In: Dipiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey ML, editors. Pharmacotherapy: A Pathophysiologic Approach. 7th ed. New York: McGraw-Hill Education 2008. p. 373-82.
5. American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, 4th edn., Text Revision. Washington, IX, American Psychiatric Association, 2000.

6. Stroke Association. Dementia after Stroke. London: Stroke Association. 2012.
7. Barba R, Martínez-Espinosa S, Rodríguez-García E, Pondal M, Vivancos J, Del Ser T. Poststroke dementia : Clinical features and risk factors. Stroke 2000;31:1494-501.
8. Barba R, Morin M, Cemillán C, Delgado C, Domingo J, Del Ser T. Previous and incident dementia as risk factors for mortality in stroke patients. Stroke 2002;33:1993-8.
9. Kase CS, Wolf A, Kelly-Hayes M, Kannel WB, Beiser A, D'Agostino RB. Intellectual decline after stroke: The Framingham study. Stroke 1998;29:805-12
10. Malhotra C, Chan A, Matchar D, Seow D, Chuo A, Do YK. Diagnostic performance of short portable mental status questionnaire for screening dementia among patients attending cognitive assessment clinics in Singapore. Ann Acad Med Singapore 2013;42:315-9.
11. Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. J Am Geriatr Soc 1975;23(10):433-41.
12. Loeb C, Gandolfo C, Croce R, Conti M. Dementia associated with lacunar infarction. Stroke 1992;23:1225-9.
13. Thom T, Haase N, Rosamond W, Howard VJ, Rumsfeld J, Manolio T, et al. Heart disease and stroke statistics--2006 update: A report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation 2006;113:85-151.
14. Lloyd-Jones D, Adams RJ, Brown TM, Carnethon M, Dai S, De Simone G, et al. Heart Disease and Stroke Statistics--2010 Update: A report from the American Heart Association. Circulation 2010;121:46-215.
15. Pohjasvaara T, Erkinjuntti T, Ylikoski R, Hietanen M, Vataja R, Kaste M. Clinical determinants of post stroke dementia. Stroke. 1998;29:75-81.
16. Dyken ML, Wolf PA, Barnett HJM, Bergan JJ, Hass WK, Kannel WB, et al. Risk factors in stroke. A statement for physicians by the subcommittee on risk factors and stroke of the Stroke Council. Stroke 1984; 15:1105-11.
17. Vermeer SE, Prins ND, den Heijer T, Hofman A, Koudstaal PJ, Breteler MMB. Silent brain infarcts and the risk of dementia and cognitive decline. N Engl J Med 2003;348:1215-22.
18. Ivan CS, Seshadri S, Beiser A, Au R, Kase CS, Kelly-Hayes M, et al. Dementia after stroke: the Framingham study. Stroke 2004;35:1264-8.

19. Álvarez-Sabín J, Román GC. Citicoline in vascular cognitive impairment and vascular dementia after stroke. Stroke. 2011;42:40-3.