



# Effect on Memory and Cognitive Function in Patients Suffering from Stroke - A Review

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## ABSTRACT

We examined the evidence for widely held clinical beliefs about effect on memory and cognitive function after stroke, conducting narrative review. We sought to determine whether stroke patients experience problem with memory and cognitive function and which aspects of memory and cognitive functions are affected. The authentication for both memory and cognitive function dysfunction with relevance to stroke are mixed in this review. Various studies which are involved in this review are taken from google scholar, pubmed and springer link. The data is collected mainly through various research articles and reviews. Data collected from various epidemiological studies shows that global burden of stroke is high and India like other developing countries is in the centre of stroke outbreak. Correlation of memory and cognitive impairment is also included in this review. The data collected through various studies involving assessment scales provide significant evidence of memory and cognitive impairment after stroke.

**Key Words:** Cognitive impairment, Epidemiology, Correlation, Consequences

## INTRODUCTION

“A stroke is a clinically defined syndrome of expeditiously developing symptoms and signs of focal loss of cerebral function with no obvious cause other than that of vascular origin, but the loss of function can at times be global. Symptoms last more than 24 hours or lead to death<sup>1</sup>. In daily life, besides physical handicaps the cognitive disorders can also come up with disability<sup>2</sup>. The risk factor for impaired cognitive functioning is cerebrovascular disease. If specifically hindered cognitive functions are considered, 50-70% of stroke patients are found to be affected depending on age<sup>3,4,5</sup>. Those patients who abide cognitively unmutated after their index stroke, hospital-based and population-based studies have disclosed a remarkable risk for developing delayed dementia<sup>6,7</sup>. As a direct result of a stroke incident, twenty five percent of stroke left overs have dementia<sup>8,9,10</sup>.

### Epidemiology:

The global load of stroke is high, incorporating of increasing incidence, disability, mortality, Adjusted Life- Years, and economic impact, particularly in low- and middle-income

countries. According to World Heart Federation, 15 million people worldwide agonize a stroke every year<sup>11</sup>. Globally, it is estimated that stroke is the second prime cause of death above the age of 60 years, and the fifth prime cause of death in people aged 15 to 59 years old and it is considered less common below 40 years. According to the American Heart Association, collated to white people, black people have nearly twice the risk of a first –ever stroke and a much higher death rate from stroke. According to Taylor FC et al (2012), the estimated age-adjusted prevalence rate for stroke<sup>12</sup>, is as shown in figure 1.1.

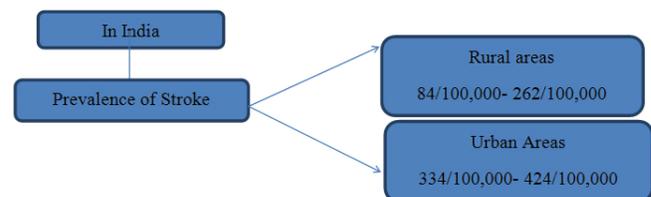


Figure 1.1: Age-adjusted prevalence rate for stroke

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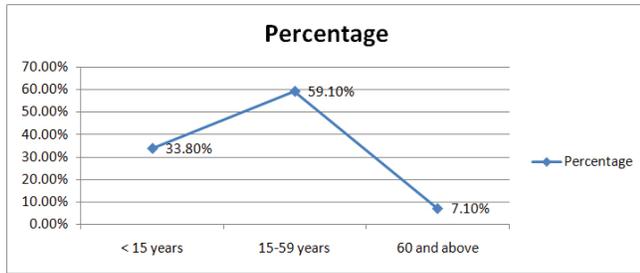
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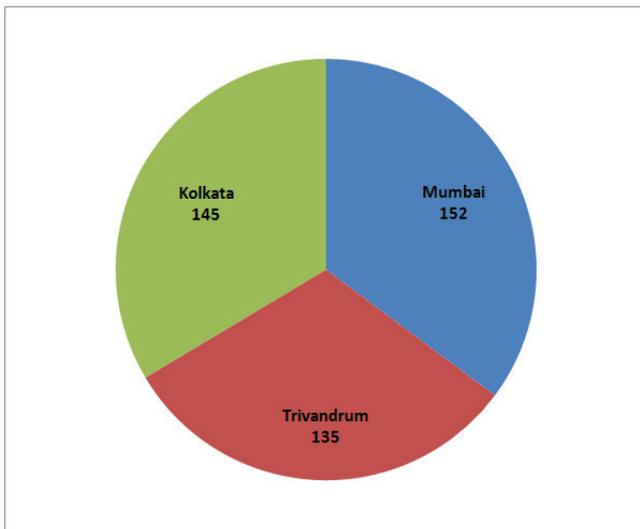
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**Figure 1.2:** Prevalence of stroke (in %) according to age (in years).

The summarized data of Stroke Epidemiology, according to the ‘World Health Organisation-STEPS Stroke protocol’ during the first decade of the 21<sup>st</sup> century in Mumbai<sup>13</sup>, Trivandrum<sup>14</sup> and Kolkata<sup>15</sup>, has shown in figure 1.3.



**Figure 1.3:** Showing age standardized incidence of stroke in rate/lakh(person-years) in Mumbai, Kolkata and Trivandrum.

Stroke is also more likely to influence people if they are obese, aged 55 or older, lack of exercise, drink excessively, have a personal or family history of stroke, stress and depression smoke or use illicit drugs, heart ailments such as recent Myocardial Infarction, atrial fibrillation and presence of blood fat molecules called apolipoproteins.

There are three chief kinds of stroke<sup>16</sup>: 1) Ischemic stroke 2) Hemorrhagic stroke 3) Transient ischemic attacks also referred to as mini-strokes.

### **Etiology:**

Narrowing or blocking of arteries can lead to Ischemic Stroke in the brain. It is the most common type of stroke, resulting in around 85% of strokes. Blood clots can lead to these blockages. Bursting or leaking of blood vessels in and around the brain can lead to Hemorrhagic stroke. Hypertension, trauma, blood-thinning medications and aneurysms are the conditions which can lead to rupturing of blood vessels.

The most frequent form of hemorrhagic stroke is Intracerebral Hemorrhage and the second type of hemorrhagic stroke is Subarachnoid Hemorrhage. In Transient Ischemic Attack the flow of blood to the brain is only shortly interrupted.. They serve as deterrant signs for future stroke<sup>17</sup>. A study performed to assess ‘Evolution of cognitive dysfunction after stroke and risk factors for delayed progression’ concluded that cognition is rather stable for 2 years after stroke. Age, poly-pharmacy, previous cognitive decline and hypotension during admission are risk factors for its development<sup>18</sup>.

The symptoms of memory loss and vascular dementia involve slow movement and thinking, lack of attention and inability to do simple tasks. The symptoms of dementia after stroke can be masked by more evident post stroke conditions such as paralysis, depression, blindness. Other consequences of stroke are: Confusion, Headache, Numbness, trouble with seeing, trouble with walking, bladder or bowel control problems, depression, weakness or paralysis on one or both the sides of body, trouble controlling or expressing emotions. In order to remember the signs of stroke acronym F.A.S.T. is a way, which shows Face drooping; Arm weakness; Speech difficulty, if these symptoms seen then it is the time to call for emergency services<sup>19, 20</sup>.

### **Assessment Scales:**

Various scales which can be used for assessment of memory and cognitive functioning in stroke patients are: Wechsler Memory scale- Revised<sup>21,22</sup>, Wechsler Adult Intelligence Scale –Revised<sup>23</sup>, Mini Mental State Examination<sup>24,28</sup>, Scaffold Objective Recognition Test<sup>25,28</sup>, Recognition Memory Test<sup>26,28</sup>, FuldObject Memory Evaluation<sup>27</sup>.

### **Memory:**

“Memory is the faculty of mind by which information is encoded, stored or retrieved”. Memory is essential to experience and related to limbic systems, it is the withholding of information over time for the determination of influencing future action. Usually, memory comprises sensory processor, short-term (or working) memory, and long term memory. Explicit and Implicit functions of memory are also understood as declarative and non-declarative systems. By information type, there are Topographic memory and Flashbulb memories. By temporal direction, retrospective and prospective memory<sup>29</sup>.

### **Correlation with memory and cognitive function:**

Hypo-perfusion and functional deactivation in neighboring and distant areas of brain are associated with cognitive dysfunction in the acute stage of stroke. Both pathological ups and downs of glucose concentrations may influence cognition<sup>30</sup>. A study performed by Glenn T. Stebbins et al, titled, ‘Gray Matter Atrophy in patients with Ischemic Stroke

with cognitive impairment' concluded that there is a central role for the thalamus and lesser role for other cortical regions in the development of cognitive impairment after ischemic stroke.<sup>31</sup>

General cerebral atrophy has also been related to the development of cognitive impairment after stroke<sup>31</sup>. Severe white matter hyper-intensities are related to global cognitive dysfunction. A study performed by Emma J. Burton et al, titled 'White matter hyper-intensities are associated with impairment of memory, attention, and global cognitive performance in older stroke patients' concluded that in older stroke patients, cognitive processing speed and performance on measures of attention are remarkably related to White Matter Hyper-intensity volume, particularly in frontal lobe regions, whereas memory dysfunction is related to the volume of temporal lobe White Matter Hyperintensity<sup>32</sup>.

Memory impairment has been reported to be one of the most common cognitive deficits experienced by leftovers of stroke<sup>33</sup>. Awareness of the lateral asymmetry, termed "hemispheric specialization", is critically important for understanding the nature of memory impairment following unilateral brain damage<sup>33</sup>. Memory deficit may be an important predictor for cognitive decline<sup>34</sup>.

## DISCUSSION

Cognitive impairment occurs frequently after stroke, commonly involving memory, orientation, attention and language. Some studies which shows memory and cognition decline in stroke patients included which are: A study performed to evaluate the 'Incidence and relationship of post-stroke dementia to the influence of pre-stroke cognitive decline' concluded that the risk of Post-stroke dementia is high, and enhanced in patients with pre-stroke cognitive shrinkage, with about one-third of patients summing the basis for Alzheimer Disease and two-thirds meeting the basis for Vascular Dementia. These inferences confirm that, in stroke patients, an underlying degenerative pathology may play a role in the evolution of Post-stroke dementia<sup>35</sup>. Another study performed in order to investigate 'Cognitive impairment after stroke' concluded that stroke-associated cognitive impairment is encircled by many issues with respect to prevalence, relevance heterogeneity and uniqueness. There is no consistent phenotype because strokes can rap any part of the brain. Moreover, it is difficult to establish a causal link between stroke and dementia, or to exclude the possibility that Alzheimer disease is responsible for the cognitive impairment<sup>36</sup>.

Another study is performed to detect the 'Cognitive functioning after stroke' concluded that few patients become demented after stroke, and most cognitive disturbances are in the field of mental speed and calculation<sup>37</sup>. Late emergence of Cognitive dysfunction following stroke also occurs in

neonatal stroke in order to detect this a study performed by Robyn Westmacott et al, 'Late emergence of cognitive deficits after Unilateral Neonatal Stroke' concluded that the children with unilateral neonatal stroke, particularly males, are at increased risk for emerging deficits in higher-level cognitive skills during the school years<sup>38</sup>.

A combination of diffusion-weighted imaging, T1 and T2-weighted images has been used to determine tissue aberrations in Stroke patients<sup>39</sup>. Therapies or medicines almost never fully restore memory after stroke. However, many people do recover at the very least some memory instinctively after stroke<sup>20</sup>. A study performed by Fregni et al, reported that left prefrontal anodal stimulation for 10 minutes at 1 mA in healthy participants increased working memory performance<sup>40</sup>. A study performed 'To investigate whether anodal trans-cranial direct current stimulation over the left dorsolateral prefrontal cortex affected the working memory performance of patients after a stroke' concluded that the anodal trans-cranial direct current stimulation over the left dorsolateral prefrontal cortex was related to increased working memory interpretation as indexed by the recognition accuracy in patients after a stroke<sup>41</sup>. Now- a- days, mnemonics either plays a little role in treatment program or is not used at all. Memory impaired patients benefit more from images generated by the experimenter than by those self-produced. These findings decrease the practical value of mnemonics because rehabilitation is focused at administering interventions to be used independently from therapy setting<sup>42</sup>.

A study performed to examine the 'Prognosis of acute cognitive disorders post-stroke, and to evaluate which clinical factors estimate domain-specific cognitive recovery' concluded that recovery in visual perception/construction (83%) and visual memory (78%) was the most common. Cognitive recovery is related to age, lesion volume, lesion location, pre-existent ability and diabetes mellitus<sup>30</sup>.

## CONCLUSION

Like other evolving countries, India is in the centre of a stroke outbreak. There is an enormous burden of stroke with remarkable geographical variations. Through various studies involving various assessment scales also it is concluded that stroke can lead to various memory and cognitive dysfunctions. Stroke allied cognitive dysfunction is encircled by many difficulties with respect to relevance, prevalence, heterogeneity and uniqueness.

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