Prevalence of Major Neurological Disorders Among Geriatric Population in the Metropolitan City of Kolkata


Abstract
Well-conducted neuroepidemiological studies for the geriatric population are rare in India. In view of the growing aging population, we planned to determine the prevalence of common neurological disorders among the elderly population in the city of Kolkata. This was a cross-sectional study of a stratified random sample of the city population and carried in two stages through house to house survey. Initially, trained non-medical workers screened the cases with a validated family questionnaire and then a neurologist examined all the screened positive cases. A validated neuropsychological screening test was also applied among the elderly population with cognitive complaints. Results showed prevalence rates (per 1000 elderly population - ≥ 60 years) of following disorders in decreasing order: stroke- 33.93, essential tremor-13.76, dementia- 7.89, Parkinsonism- 3.30 and epilepsy 2.57. Sex-specific prevalence showed that stroke was commoner among men and that of other disorders among women. Age-specific prevalence recorded progressive increase in the rates of all disorders among both genders, though not uniformly among women. Overall the crude prevalence of neurological disorders was 60.9 per 1000. The present study shows higher rate of stroke as compared to other neurological disorders among elderly population in India, which needs urgent attention. ©

INTRODUCTION

Elderly population is vulnerable to several neurological disorders which entails significant mortality and morbidity. Increased longevity has lead one to assume that age related neurological disorders such as stroke, dementia, Parkinson disease, essential tremor and epilepsy will be increasingly frequent among the elderly population in India. In India aging population above 60 years has been estimated to be almost double from 7.7% in 2001 to 12.30% in 2025.1

Though several neuroepidemiological studies have been carried out among both the urban and the rural population, prevalence of neurological disorders among elderly has not been studied in details so far. Several studies from different parts of India have shown growing age specific prevalences of stroke, Parkinson disease and dementia, but mostly these studies were rural based, case definitions were not uniform and sample population was not always truly representative of the community. Two urban based cross-sectional studies from Southern and Northern India have documented a prevalence rates of neurological disorders varying from 32.9 to 80 per 1000 elderly subjects above 60 years of age.2,3

So, we planned to determine the common neurological disorders having significant morbidity and mortality such as stroke, Parkinsonism, dementia, epilepsy and essential tremor among the elderly population (equal to and above 60 years) of the metropolitan city of Kolkata through a stratified random selection of sample population. The present communication is part of a greater morbidity survey of neurological disorders in the metropolitan city of Kolkata. This report may help the health resource planner to allocate adequate funding based on current health status and burden of the disease among the mounting geriatric population in the community.

MATERIALS AND METHODS
Study area and population

The city of Kolkata (henceforth will be called as ‘the city’) is one of the largest metropolitan cities of
India and the capital of West Bengal state, situated in the eastern part of the country. Although it is the state capital, people of all provinces of the country, besides Bengalis, inhabit it. The city has a land area of 185 sq. Km with a population of 4.58 million in the metropolitan area, of which 74.7% are Hindus, 23.6% Muslims, 0.08% Sikhs, 0.56% Christians and 1.03% are of other religious communities as per 2001 census. The inhabitant selected should be a resident of the city for at least one year prior to the date of survey to avoid migrant population.

Questionnaires and its validation

This was a crosssectional study consisting of survey cum screening conducted in two stages. The field team was constituted of a doctor who was a neurologist, a neuropsychologist and four field workers. The field workers (FW) who were minimum graduate in social science with experience of carrying out epidemiological surveys used to carryout screening based on National Institute of Mental Health and Neurosciences (NIMHANS) developed questionnaire and the neurologist examined all the positive cases. This questionnaire helped to screen the cases with stroke, epilepsy, dementia, Parkinsonism and essential tremor. Internal consistencies of the questionnaire were cheeked by translating it into Bengali and also back translation into English. Initially a pilot study was carried out to find out the specificity and sensitivity of the questionnaire on a population of 3041 subjects when the neurologist examined all the families visited by the field workers earlier. Subsequently during the main study, the neurologist reexamined 10% of randomly selected screened negative samples to find out the false negative cases.

We also applied a modified version of a specific “Cognitive Battery” to make it suitable in the urban context. This battery was developed by Ganguli et al 4 on a rural illiterate Hindi speaking population in North India to elderly persons with suspicion of cognitive dysfunction. For the Bengali subjects, translated Bengali version of the test battery was utilized. The Bengali version was back translated in Hindi to check the integrity of translation. We also tested the questionnaire in the field testing for intrarater and interrater agreement by the field workers and it was supervised by a neuropsychologist. Specificity and sensitivity of the cognitive questionnaire was also determined.

Sampling

We covered the entire geographical area under the jurisdiction of the Kolkata Municipal Corporation (KMC) excluding some areas within it where we did not have an access because of legal restrictions. In the KMC area, there are 141 municipal wards, which are further subdivided into 5200 blocks by the National Sample Survey Organization (NSSO) of the Government of India. These were demarcated through carefully drawn maps. We divided the KMC area into six strata for the purpose of this study based on geographical location and type of dwellings. Each of this stratum acts as an urban sample frame. The stratum I consisted of blocks composed predominantly of slum area. Non-slum areas were subdivided into south, north and central, according to the geographical locations. The southern and northern parts of the city were further subdivided depending upon presence and absence of consolidated housing complex. In the central part of the city the areas with consolidated housing complex were only considered. Thus we selected altogether six strata for the study. From each stratum, nearly equal number of blocks was selected by using statistical random number table. It was known that each NSSO block consisted of 100-150 households, and each household consisted of 4-5 members. We got the information of the total number of people living in each block, and surveyed 50% of the households of each block by visiting alternate houses. Thus we could screen 52,377 subjects from a total of 166 blocks. This was the stratified random sample of the population that we selected for our study.

The Survey

The team for survey consisted of 4-trained FW and a neuropsychologist and headed by a research associate (RA) who was a neurologist. The two-staged door-to-door survey was conducted to ascertain the prevalence of neurological disorders that was carried out from March 2003 to February 2004.

In the first stage, the FW visited every sampled household and collected demographic data, and applied the questionnaire. The neuropsychologist assisted them by applying cognitive tests for elderly persons with cognitive complaints. In the second stage, RA scrutinized all the collected data to search for positive cases. Individuals with responses suggestive of neurological disorders under study were examined by the RA at his/her house.

The records of clinical data were verified by a team, consisting of senior neurologists and psychiatrist for completeness of data collection. The previous investigation reports, details of prescriptions and compliance were also noted during this phase, if available. The data collected were saved into the computer and data preserved in electronic and hard copies were used for final analysis. We have blended this survey with free medical service to receive people’s cooperation. This study has been cleared by the institute ethical committee and supported by a financial grant from ICMR, New Delhi.

Diagnostic Criteria

We considered those subjects as elderly who were at or above 60 years of age.

We defined epilepsy as two or, more clinically
unprovoked seizures. Epilepsy was considered active if the individual had at least one seizure in the last five-year period before prevalence day, regardless of anti-epileptic drug (AED) treatment. We followed the recommendations of the International League against Epilepsy (ILAE) commission on epidemiology and prognosis to classify seizures.

For stroke we used the definition of the World Health Organization. It is defined as a rapidly developing clinical syndrome 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 due to vascular origin. For purposes of prevalence study we have considered only stroke survivors.

For diagnosis of dementia we used the DSM IV (Diagnostic and Statistical Manual of mental disorders 1994) criteria and for individual subtypes the standard definitions of NINDS-ADRDA. (National institute of neurological and communicative disorders and stroke- the Alzheimer's disease and related disorders association) criteria for Alzheimer disease and NINDS-AIREN (National Institute of neurological disorders and stroke with support from the association Internationale pour la recherché et l’Enseignement en Neurosciences) criteria for vascular dementia were used. The dementia was defined as the development of multiple cognitive deficits that include memory impairment (amnesia) and at least one of the following: aphasia, apraxia, agnosia, and disturbance of executive functioning and the cognitive deficits must be sufficiently severe to cause impairment in occupational or, social functioning, and represent a decline from a previous higher level of functioning. Based on NINDS-AIREN criteria, we have considered the cases as ‘probable’ if the clinical features were suggestive of vascular dementia (VaD) with imaging support and ‘possible’ if there was no imaging support. Similarly, in cases of Alzheimer type of dementia (ATD), it was considered ‘probable’ if there was associated imaging evidence and ‘possible’ if there was no corresponding imaging.

Parkinsonism: is considered on epidemiological purposes for the presence of at least two of the following features: (a) resting tremor, (b) rigidity, (c) bradykinesia, and (d) postural instability. Drug induced Parkinsonism is excluded.

Essential tremor: This has been based on the consensus statement of the movement disorders society on tremor (1998). Bilateral action tremor of hands and forearms or isolated head tremor with no abnormal posture for at least three years with or without positive family history without any neurological sign except cogwheel phenomenon. We have excluded action or postural tremor due to other neurological disorders, iatrogenic cause or systemic illness.

Epidemiological Indices

The frequency was expressed as crude prevalence rate of disease among mid-year population covered in the survey and expressed per 1000 populations. The 95% confidence limits of the adjusted rates were calculated assuming a Poisson distribution for observed cases.

RESULTS

Population Characteristics

We studied a total population of 52,377 (27,626 men, 24,751 women) living in 11,734 households over all ages. Out of them only 10.36% of the population (Total 5430, Male -2772, Female-2658) belonged to 60 years and above group. One hundred eighty seven (1.59%) households could not be interviewed either because they either refused or, were unavailable despite repeated attempts to contact them.

The age and sex distribution of the screened population is shown in Table 1. The sex ratio was men: women as 1.12:1. The literacy rate was 81%. The average family size was 4.46 persons. The distribution of the population according to religion was as follows: Hindus 75.64%, Muslims 22.52%, Christians 0.04%, and others 1.80%. Age and sex distribution of our sample population almost matched with that of Kolkata metropolitan population as per census 2001 (Table 1). The sensitivity and specificity of the screening questionnaire was 84% and 99.9% and that of cognitive questionnaire was 80.3% and 90% respectively. The intrarater and interrater reliability was determined for cognitive questionnaire and Spearman Rank correlation coefficient showed good correlation in all tests except in one domain in intrarater testing.

Table 2 shows the crude prevalence rates of different disorders among elderly population and its

<table>
<thead>
<tr>
<th>Age range</th>
<th>Population of men [%]</th>
<th>Population of women [%]</th>
<th>Total population [%]</th>
<th>Kolkata population 2001 census as %</th>
</tr>
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<tbody>
<tr>
<td>75-79</td>
<td>302 [1.09]</td>
<td>236 [0.95]</td>
<td>538 [1.03]</td>
<td>1.01</td>
</tr>
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</table>
Overall crude prevalence rate of neurological disorders among elderly is about 60.9 per 1000. Highest prevalence was documented in subjects with stroke and lowest prevalence was those with epilepsy.

Table 3 showed the age and sex specific prevalence of different disorders. Stroke was common among men and the rest of the disorders were common among women.

Age specific prevalence showed increase in stroke prevalence by almost three fold from 7th decade to 8th decade and an of 1.08 times increase from 8th to 9th decade onward among men. Among women there was two and half times increase from 7th to 8th decade and a small decrement (4.62%) from the 8th to the 9th decade.

In dementia, there is about two fold increase from 7th to 8th decade and almost three times from 8th to 9th decade among men. In women there is a decrease in the prevalence by 40% from 7th to 8th decade followed by a seven times increment of prevalence from 8th to 9th decade. Of the 43 patients with dementia, a total of 23 subjects received report of imaging (CT or MRI), but in five cases reports were missing. Of the 18 patients with their cranial imaging, 9 had vascular dementia (VaD), 6 Alzheimer types of dementia (ADT), 2 mixed and 1 normal pressure hydrocephalus (NPH). The diagnosis of possible ADT and VaD were primarily made by clinical assessment. Therefore out of total cases, 18 subjects (41.9%) were VaD of which 9 were probable and the rest possible VaD. Of the 21 ADT (48.8%) patients, 6 were probable and 15 were possible cases of ADT. Two patients were identified with probable mixed dementia. The patient suffering from NPH could be correlated radiologically and one suffering from Lewy body dementia was diagnosed clinically.

In cases of Epilepsy, there was increased prevalence among women by three and half time from 7th to 8th decade and one and half time from 8th to 9th decade. Similar rise in prevalence of epilepsy with age was not seen among the men, on the other hand showed increment by about 9.3% from 7th to 8th decade and no case has been detected in the eighth decade and above (Table 3).

Table 2: Prevalence rates (crude and gender specific) of different neurological disorders among elderly population (≥ 60 years)

<table>
<thead>
<tr>
<th>Disease</th>
<th>No. of cases</th>
<th>Crude prevalence rate ( / 1000) (95% CI)</th>
<th>Prevalence rate in males ( / 1000)(95% CI)</th>
<th>Prevalence rate in females ( / 1000)( 95% CI)</th>
</tr>
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<tbody>
<tr>
<td>Essential tremor</td>
<td>75 [34]</td>
<td>13.76 (10.81-18.58)</td>
<td>12.27 (8.05-17.06)</td>
<td>15.43 (11.01-21.01)</td>
</tr>
<tr>
<td>Parkinsonism</td>
<td>18 [6]</td>
<td>3.30 (1.96-5.2)</td>
<td>2.16 (0.79-4.70)</td>
<td>4.51 (2.33-7.88)</td>
</tr>
<tr>
<td>Dementia</td>
<td>43 [20]</td>
<td>7.89 (5.75-10.55)</td>
<td>7.22 (4.41-11.15)</td>
<td>8.65 (5.43-13.45)</td>
</tr>
<tr>
<td>Epilepsy (active)</td>
<td>14 [3]</td>
<td>2.57 (1.40-4.31)</td>
<td>1.08 (0.22-3.15)</td>
<td>4.14 (2.06-7.40)</td>
</tr>
</tbody>
</table>

Note: The differences in sex distribution were not statistically significant by chi-square test except for epilepsy (p = 0.026).

Table 3: Age-specific prevalence rates (/1000) of stroke, essential tremor, Parkinsonism, dementia and active epilepsy among men and women in the study population.

<table>
<thead>
<tr>
<th>Age range (years)</th>
<th>Prevalence in men ( / 1000)</th>
<th>Prevalence in women ( / 1000)</th>
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<tr>
<td>60-69</td>
<td>1582</td>
<td>20.23</td>
</tr>
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<td>70-79</td>
<td>881</td>
<td>56.75</td>
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<tr>
<td>≥ 80</td>
<td>309</td>
<td>61.49</td>
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Pop = population, ST = stroke, ET = essential tremor, PD = Parkinsonism, DE = dementia, EP = epilepsy.

gender distribution. Overall crude prevalence rate of neurological disorders among elderly is about 60.9 per 1000. Highest prevalence was documented in subjects with stroke and lowest prevalence was those with epilepsy.
Due to change in the demographic profile. Increasing such as hypertension, smoking, heart disease and also increasing age related stroke occurrence, been documented in two urban based community studies from India among geriatric population in the present decade. Increasing age related stroke occurrence, similar to the present study had also been documented in recent community based epidemiological studies on stroke. A review of Indian epidemiological studies on stroke performed over the last few decades has shown a rising trend which might possibly be due to risk factors such as hypertension, smoking, heart disease and also due to change in the demographic profile. Increasing trend of hypertension particularly among urbanites has been documented in a recent survey from eastern India. Hemorrhagic stroke was relatively higher in the present study compared to that in the western countries where thrombotic stroke was commoner and similar observation had also been made by an earlier study from the same city. Higher proportion of hemorrhagic stroke is probably indicative of poor drug compliance or lack of proper detection of cases with hypertension. However age-specific prevalence of stroke above 65 years of age in developed countries as compared to previous Indian studies is still higher ranging between 47 to 102 per 1000.

Dementia is a relatively common disorder among elderly. Our prevalence rate of 7.89 per 1000 is much lower than those from other countries and various parts of India. The studies from India showed prevalence rates of dementia as follows: 33.4 from Southern India, 24.4 from Western India and 13.6 from Northern India. The prevalence rates from other countries were 26.8 in China, 58 in Japan, 22.9 in Nigeria, 84 in Italy and 173 in USA per 1000. The difference in the prevalence rates might be partly due to methodological differences and also due to variance in the distribution of the aging population. Lower rate in the present study may be due to strict inclusion criteria as we have included only those cases that have memory loss of more than one year duration to avoid false positive cases. Increasing rate of age specific prevalence of cases with dementia as observed in the present study is consistent with other studies. Though overall prevalence of dementia was higher among women as compared to men, we had observed reduced age specific prevalence among women in the 8th decade as compared to 7th decade (Table 3). This may be due to methodological problem as many women could not tell the exact age because of illiteracy, ignorance and memory bias. Hence it is possible that some of the subjects might have been included in the otherwise wrong age group. Among the type of dementias, ADT is the commonest type of dementia followed by VaD. Contrary to the findings among the Orientals where VaD is the commonest form of dementia, most community studies from India and abroad have documented that Alzheimer type of dementia was the commonest and this comprised between 53% and 85% of all dementias. A dietary factor known as curcumin, a yellow coloured curry paste prepared from ‘Haldi’ in the Indian meals has been implicated for the lower prevalence of dementia.

Epilepsy is commonly a disorder of childhood and adolescence with declining rate with aging. This is the typical pattern documented in developing countries, but in developed countries, pattern of active prevalence increases in each subsequent age group with the highest age specific prevalence occurring in the elderly ranging between 7 at 60 years to 14 per 1000 above 80 years of age. This is probably due to overall increase in life expectancy along with sequel of small asymptomatic vascular lesion in the cortex of the brain. In our study, we have noticed age wise increase in prevalence of epilepsy among women only.

Prevalence of Parkinsonism is low in our study as compared to other studies from Western countries. A study from India among Parsi community has shown a very high rate of Parkinsonism. This is due to high proportion of aged subjects in the sample population. Recently performed epidemiological study from urban Bangalore has shown an increasing rate of Parkinsonism as compared to a previous study carried a decade earlier and this is probably due to changes in demographic pattern with increasing proportion of elderly subjects. The age specific prevalences of Parkinsonism are much higher in developed countries and varied from 1.5 to 7 at 60 years to 5 to 30 per 1000 above 80 years of age. The higher rate of Parkinsonism among women in this study is also an interesting finding in our study and also had been observed in studies from Japan, Finland and...
one study from India. Underlying cause may be due to non–smoking habit among our women, since smoking confer protection against development of Parkinsonism. Post menopausal women have also been shown to be more susceptible to risk of developing Parkinsonism, since estrogen is known to have beneficial effect on dopaminergic neurons. Increased longevity of women population may be another factor.

Essential tremor is a common disorder among elderly and often a diagnostic confusion occurred with Parkinsonian tremor. The disease is commonly genetic and expression is related to aging. The present study also showed age related increasing prevalence except among women in ninth decade and above. Since this disorder is usually asymptomatic, affected subjects seek medical opinion rarely unless bothered by tremor related interferences with activities of daily living. The prevalence of essential tremor lies within the reported range of the world wide estimates varying between 4 to 39 per 1000 above 60 years of age. This might be because of demographic pattern characterized by more aged subjects, consanguinity and ethnicity. Essential tremor is common among men. However women predominance has been documented in few studies. The exact cause is not known. It may be related to genetic susceptibility.

Limitations of this study are that we have concentrated on few commonly occurring neurological disorders which have significant morbidity and mortality. We have not been able to perform neuroimaging in all cases of stroke and dementia. There are some disorders which show increasing prevalence such as peripheral neuropathy, degenerative vertebral disease with secondary neurological complications, syncope, intracranial neoplasm (lymphoma) with aging. But because of logistic limitations we have not been able to undertake epidemiological survey of all these other neurological disorders. Another important limitation was difficulty in accurate measurement of the ages of old subjects, since there was no way to verify from the birth certificates. This may explain the variability of data when the age specific prevalence rates were calculated.

Conclusions

In conclusion, we have documented comparatively higher age specific prevalence of stroke among elderly in this sample population as compared to other Indian studies, lower overall rate of dementia, Parkinsonism, and epilepsy among elderly in comparison to developed countries except essential tremor which is comparable to world estimates. The lower rate of dementia, Parkinsonism and epilepsy is may be due to proportionately lesser aged population as compared to developed countries or other protective environmental factors. Relatively higher prevalence of Parkinsonism, dementia, essential tremor and epilepsy among women may be due to greater survivality of Indian women (Indian Census Data, 2001). Thus it is possible that with increasing life expectancy of Indian population, prevalences of these disorders are expected to show upward trend in future. Therefore, we need concerted effort to increase awareness of health in the community and to undertake measures to reduce the prevalence of preventable diseases such as stroke, vascular dementia and late onset epilepsy by controlling the risk factors such as hypertension which is a silent killer in the coming decades.

Acknowledgement

We deeply acknowledge the advices provided by the core committee members of the task force of neurological disorders under ICMR for useful suggestion during carrying out this study. We also provide sincere thanks to the participating subjects, councilors, and media-(both electronic and print) for useful cooperation. Our thanks go to our field workers (Mr Sanjoy Das, Mr Bablu Mondal, Mr Probal Roy, and our data entry operator (Mrs. Nibedita Roy) for their excellent support.

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