



## BILINGUALITY AND COGNITIVE IMPAIRMENT

## Neurology

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## ABSTRACT

**Objective:** The purpose of the study was to assess the relation between the age of onset of cognitive impairment and multilingualism in patients assessed in a specialist clinic in north India

**Methods:** Case records of 76 consecutive patients diagnosed in a speciality clinic were reviewed. The age of onset of cognitive impairment was compared between monolinguals and bilinguals.

**Results:** In our study, in Bilinguals age of onset of cognitive impairment was delayed by around eight years. Along with bilingualism, years of education was also seen to influence the age of onset of cognitive impairment.

**Conclusion:** This is a first study done in north India comparing bilingualism and age of onset of cognition of patients in a speciality clinic. The study shows the beneficial effect of bilingualism on age of onset of cognitive impairment by delaying the onset by around 8 year

## KEYWORDS

Bilingualism, Cognitive impairment, Dementia, Alzheimer's Dementia, Mild Cognitive Impairment

## INTRODUCTION

Recent studies suggest that bilingualism may delay onset of dementia by around 5 years<sup>1,2,3</sup>. The potential mechanism is suggested by emerging literature demonstrating that lifelong factors enhancing premorbid cognitive ability delay the expression of dementia.<sup>4</sup> A bilingual cognitive advantage in executive functioning has also been demonstrated. Although the exact mechanism is not known it has been suggested that bilingualism may affect cognitive reserve.<sup>5,6</sup> Though some studies showed benefit of bilingualism on delay in onset of dementia, some studies did not confirm this finding<sup>7</sup>. In western countries, the benefit of bilingualism in delay in onset of dementia was seen in Alzheimer's patients<sup>7</sup> but in a study in south India similar observation was found not only in Alzheimer's dementia (AD) but also in other dementias like Frontotemporal dementia (FTD) and vascular dementia (VaD)<sup>1</sup>. India in this respect offers a unique situation in that multilingualism is acquired simultaneously early in life and used in parallel. Language switching is common among individuals with multilingualism<sup>8,9</sup>. In India multilingualism is not associated with immigration. It is contact based and is needed for socialisation process in various regions of India. Thus it is seen even in illiterate populations<sup>10,11</sup>. Each state in India has its own official language along with Hindi which is a language common to most states. In formal education, from an early age, students are exposed to English. Thus in India, many people tend to be at least bilingual. Thus India provides a unique opportunity to study relation between multilingualism and dementia. So in this study we aimed to study the relation between age of onset and multilingualism in a region of North India

## METHODS

**Patients :** 77 consecutive patients seen in a cognitive clinic in tertiary teaching government hospital in Delhi from July 2018 to July 2019 were taken. The exclusion criteria were age less than 18 years, patients with only psychiatric symptoms like depression, psychosis and patients having surgical or traumatic cause for cognitive impairment. The patient profile is representative of patients seen in a tertiary neurology Indian centre. All the patients were assessed by neurologists. The assessments were performed using a structured procedure. The Mini Mental State Examination (MMSE), Montreal Cognitive Assessment (MoCA), Adenbrooke's Cognitive Assessment III (ACEIII) and Frontal Assessment Battery (FAB) tests were adapted for the local language. Diagnosis of dementia and its subtype were based on standard criteria<sup>12</sup>.

## Language status

In Delhi, most of the people speak two languages and many people speak more than two languages. Also Delhi being the capital city of

India has people from other parts of India secondary to migration due to work especially from adjacent northern Indian states where again Hindi is the most common language spoken. English is usually taught in schools from primary level and has acquired more functional role in education, administration and media. Thus the two main languages encountered in the patients were Hindi and English. As part of the standard protocol, the language history was obtained by interviewing a reliable family member. The number of languages spoken by the patient before onset of dementia and the ability of the patient to communicate in these languages was noted. Bilinguals in this study were defined based on definition by Mohanty<sup>13</sup>. Mohanty defined bilingual persons as those with an ability to meet the communicative demands of self, and the society in their normal functioning in 2 or more languages in their interaction with the other speaker of any or all of these languages. The native language of the patient was also noted.

## Statistical Analysis

The monolingual and bilingual patients were compared across clinical and demographic factors including age at presentation, gender, age at onset, occupation, education, vascular risk factors and dementia subtypes. Statistical analysis was performed using SPSS version 20.0 for Windows software and significance was set at  $p < 0.05$ . Univariate linear regression was used to assess the effect of bilingualism, education, type of profession on age at onset of dementia after adjusting for various demographic and clinical variables. Interaction effects of bilingualism with various variables were also calculated by linear regression

## RESULTS

## General characteristics of patients with cognitive impairment

In this case series 76 patients were taken. One patient was excluded as the patient had Major Depression disorder. There were 55 males (72.4%) and 21 females (27.6%). The mean age at presentation was 66.72±8.9 years (range 45 to 86 years). The mean years of education were 9.79±5.055 years. The main causes of cognitive impairment were Mild Cognitive Impairment (MCI) in 21(27.6%), Alzheimer's dementia 20(26.3%), Vascular Dementia in 14(18.4%), frontotemporal dementia (FTD) in 5 (6.6%) Mixed Dementia in 4 (5.3%) and Lewy Body Dementia (DLB) in 4(5.3%)( table1). Forty four patients (57.9%) were monolinguals, 28 (36.8%) were bilingual and 4(5.3%) were trilingual (fig 1).

## Comparison of monolingual and bilingual patient groups

The gender distribution of both the groups was comparable with each group having more males, [68.2% in monolingual group and 75.0% in bilingual group (p value of 0.53)]. The distribution of the major

dementia subtypes like AD dementia, VaD, mixed dementia and FTD was similar in both the groups. DLB and CBD were more frequent in monolinguals as compared to bilinguals. The distribution of MCI was similar in both the groups. There was no difference in the vascular risk factor profile, MOCA score and ACEIII score in both the groups (table 2)

There was significant difference in age of presentation, age of onset of cognitive symptoms, years of education and type of profession between the two groups. The bilinguals presented at an older age, around 8 years later than monolinguals. The age of onset was also later in bilinguals by around 8 years. The age of onset was 68.9±9.6 years in bilinguals as compared to 60.75±8.65 years in monolinguals (p<0.001). The Bilingual cohort had more years of education, 13±4.01years as compared to 7.27±4.32 years in monolinguals (p<0.001). Also the number of skilled professionals was higher in bilinguals as compared to monolinguals, 64.3% to 9.1% respectively (p<0.001).Univariate linear regression analysis showed that bilingualism was significantly (F = 14.10, p<0.001) associated with age of onset of cognitive impairment after adjusting for other variables such as years of education, gender, type of profession vascular risk factors, subtype of cognitive impairment, MOCA and ACE III scores. To assess the interaction of these factors on age of onset of cognitive impairment, we used univariate linear regression analysis. We found other than bilingualism, only years of education was significantly (F= 4.96, p= 0.029) associated with age of onset of cognitive impairment. We found no interaction effect of Gender ( F=0.47,p=0.49),type of profession (F= 0.58,p=0.44), vascular risk factor( F = 0.00, p = 0.80), Cognitive impairment subtype ( F = 0.616, p=0.435), MOCA score ( F= 1.3, p= 0.25) and ACE III score(F= 1.6, p= 0.20)

**DISCUSSION**

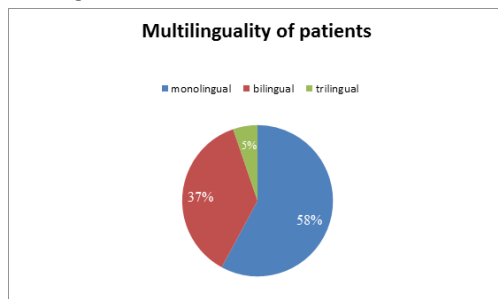
In this series, we tried to assess the effect of multilingualism on age of onset of cognitive impairment in MCI and dementia. To our knowledge, this is the first series of patients with MCI and dementia from North India to evaluate the association of bilingualism and age of onset cognitive impairment. The case series documented the delay in age of onset by around eight years in bilinguals as compared to monolinguals. A similar study done in southern India by Alladi et al found the delay in age of onset of dementia in bilinguals by 4.5 years<sup>1</sup>. A study done in Canada had similar findings with delay in age of onset in dementia in bilingual people by around 4 years<sup>2</sup> but another study in Canada found that multilingualism but not bilingualism delayed age of onset in dementia (3).The greater years in delay in onset of cognitive impairment in our study may be due to the smaller number of patients as compared to other studies. Multilinguality particularly bilingualism attained earlier in life, contact based and used habitually in social context helps probably by creating cognitive reserve in such people. Language switching has been considered as central in establishing the cognitive advantages of bilingualism<sup>14</sup>.The constant need in bilingual person to selectively activate one language and suppress the other is thought to lead to a better development of executive functions and attentional tasks particularly in attentional control, inhibition and conflict resolution.<sup>6,15,16</sup>

One of the main criticism of linking bilingualism and onset of dementia is the effect of potential confounding factors like education, making it difficult to assess genuine effect of bilingualism. In our series, the number of illiterate patients was quite less to compare the effect of bilingualism between educated and illiterate patients but the in the study by Alladi et al the bilingual effect was shown to be independent from education.<sup>1</sup>

The series has some limitations. First is the small number of patients. A more comprehensive and longitudinal study involving a large number of patients is needed to support the theory of bilingual effect on cognitive reserve. Also the effect of fluency in multiple written languages could not be assessed due to small number of cases. The age of onset was determined based on reports from patient's family in a clinical setting, and therefore could not be validated, but because the same criterion was applied to all patients, a systemic bias affecting the results is less likely. Similar to other studies on bilingualism and onset of dementia<sup>2,3</sup>, the definition used for bilingualism was a subjective rating. Also, a selection bias might have occurred because patients were from a specialist clinic and not from community. This explains the age of onset of our patients which is nearly a decade earlier than the epidemiological studies in India<sup>17,18</sup>.

The series demonstrates the beneficial effect of bilingualism on onset

of cognitive impairment in dementia in a different population with insight of different set of languages spoken as compared to earlier studies. The converging evidence from different countries and cultures points to bilingualism as a potential protective factor against dementia. Further large scale studies are needed to support this theory and elucidate the possible neural mechanisms.



**Table 1 General characteristics of patients with cognitive impairment presenting in cognitive clinic (table 1)**

Characteristics	patients (n=76)
Gender	
Male	55 (72.4%)
Female	21 (27.6%)
Age at Presentation (years)	66.72±8.9
Age at onset(years)	64.14 ±9.71
Years of education(years)	9.79±5.05
Profession	
Skilled professionals	26(34.2%)
Unskilled professionals	31(40.8%)
Housewife	19(25.0%)
Subtype of cognitive impairment	
Mild cognitive impairment(MCI)	21(27.6%)
Dementia	55(72.4%)
Subtypes of Dementia	
Alzheimer's Dementia(AD)	20(26.3%)
Vascular Dementia(VaD)	14(18.4%)
Frontotemporal dementia(FTD)	5(6.6%)
Mixed Dementia	4(5.3%)
Lewy Body Dementia(DLB)	4(5.3%)
Cortico Basal Dementia(CBD)	2(2.6%)
Linguality of patients	
Monolinguals	44(57.9%)
Bilinguals	28 (36.8%)
Trilinguals	4(5.3%)

**Demographic and Clinical profile of monolingual and bilingual patients in cognitive clinic (table 2)**

	Monolingual ( n=44)	Bilingual ( n= 28)	P value
Gender ,male	30(68.2%)	21(75.0%)	0.535
Years of education	7.27±4.32	13±4.01	<0.001
Type of profession			
Skilled professionals	4(9.1%)	18(64.3%)	<0.001
Unskilled workers	26(59.1%)	5(17.9%)	
Housewife	14(31.8%)	5(17.9%)	
Age at presentation, yrs	63.57±8.2	71.29±8.31	<0.001
Age at onset,yrs	60.75±8.65	68.96±9.6	<0.001
Type of cognitive impairment			
MCI	12(27.3%)	7(25%)	0.79
AD dementia	10(22.7%)	9(32.1%)	
VaD	10(22.7%)	4(14.3%)	
Mixed	2(4.5%)	1(3.6%)	
FTD	3(6.8%)	2(7.1%)	
DLB	3(6.8%)	1(3.6%)	
CBD	2(4.5%)	0(0%)	
Vascular Risk factors			
HTN	19(43.2%)	9(32.1%)	0.43
Diabetes	1(2.3%)	1(3.6%)	
HTN + Diabetes	3(6.8%)	6(21.4%)	

CAD	1(2.3%)	1(3.6%)	
MOCA score	13.9±7.47	12.43±7.92	0.48
ACEIII score	67.18±15.03	54.23±31	0.18

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