DISORIENTATION OF SPACE IN ALZHEIMER'S DISEASE PATIENTS

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Abstract

Older age is a well-known risk factor for the AD. Fratiglioni Laura, et al (1997) determined the incidence of different types of dementia in the very old and explored the relationship between age and gender. He has found that incidence of dementia increases with age, and women have a higher risk of developing dementia than men, especially at very old ages. For this study, Sixteen Kashmiri Bilingual female AD (Mild-Moderate-Severe) patients and an equal number of controls matched for age, gender and education were tested in a spatial relation task. The present study attempted to document the effect of Alzheimer's disease on Spatial Relation found in bilingual female Alzheimer's disease (AD) patients using cross-sectional design. The results of cross-sectional comparisons in the present study indicated that mild-moderate AD patients produced more errors in spatial relation test than the control group. Moreover, there is a marginal difference between scores of Spatial Relation tests obtained from female AD patients and female Control group in both the languages.

BACKGROUND

Aging is a multifaceted process composed of several features. There is an exponential increase in mortality with age, physiological changes, functional decline and increased susceptibility to certain diseases with age. Aging, cognition, and language have complex interactions, but it is clear that some cognitive functions which support and interact with language also change with age. In particular, aspects of memory, attention and certain cognitive skills such as problem-solving are known to change with age and will impinge on the older person's ability to process language (Brownell and Joanette, 1993).

Dementia of Alzheimer's Type is a common disorder with a massive impact on the quality of life of patients and their caregivers. After age 65 years, the prevalence of dementia increases greatly with age (Evans DA, 1989; Rocca WA, 1986). In contrast to dementia related to vascular disease, which affects men more often than women, the incidence of Alzheimer's disease is greater in women (Aronson MK, 1990).

Yaakov Stern (1994) have noticed the strong relation between Alzheimer's disease (AD) and limited educational experience. Their data suggested that increased educational and occupational attainment may reduce the risk of occurrence of the AD, either by decreasing ease of clinical detection of the AD or by imparting a reserve that delays the onset of clinical manifestations (David C. Peaslee, 1998).

OBJECTIVE

This paper will attempt to look at the effect of Alzheimer's disease on the patient's concept and perception of Spatial Relation system on mother tongue.e, Kashmiri Language.

PATHOLOGY:

At autopsy, the earliest and most severe degeneration is usually found in the medial temporal lobe (entorhinal/perirhinal cortex and hippocampus), lateral temporal cortex, and nucleus basalis of Meynert. The characteristic microscopic findings are neuritic plaques and NFTs. These lesions accumulate in small numbers during normal brain aging but dominate the picture in the AD.

METHODOLOGY

A random sample of thirty cases of clinically diagnosed Alzheimer's disease patients and thirty normal people as control group are considered for the present study. The data were collected from Shri Maharaja Hari Singh Hospital, and some of them were met personally at their home. The subjects were in the age group 60 to above 90 years. These thirty subjects, upon whom tests were administered, were considered for further study.

This paper deals with the analysis of the thirty subjects, who suffered neuro-degeneration to the different parts of the brain and were able to respond to the tests, along with the thirty subjects as a normal control group. On the basis of the medical reports, all subjects under study are categorized into three groups: Mild AD, Moderate AD, and Advanced AD. Out of thirty cases, 12 cases were Mild AD cases, 10 were AD Moderate and 8 were Advanced AD patients.

TEST BATTERIES FOR LANGUAGE DEFICIT:

Since the present study is focused on Linguistic Profiling of Alzheimer's disease rather than Dementia, it was decided to perform a simple Kashmiri and Urdu bilingual Test with focus on language deficit in production, comprehension, picture naming and picture recognition abilities in the Urdu language.

Phonologically patterned structures were given to both groups. Spatial relation test includes 18 pictures of different objects at various positions and 5 marks are allotted to each correct response. Scoring is done on the basis of Five-Point Scale.

BAR REPRESENTATION OF SPATIAL RELATION TEST RESULTS OF MALE AND FEMALE AD SUBJECTS

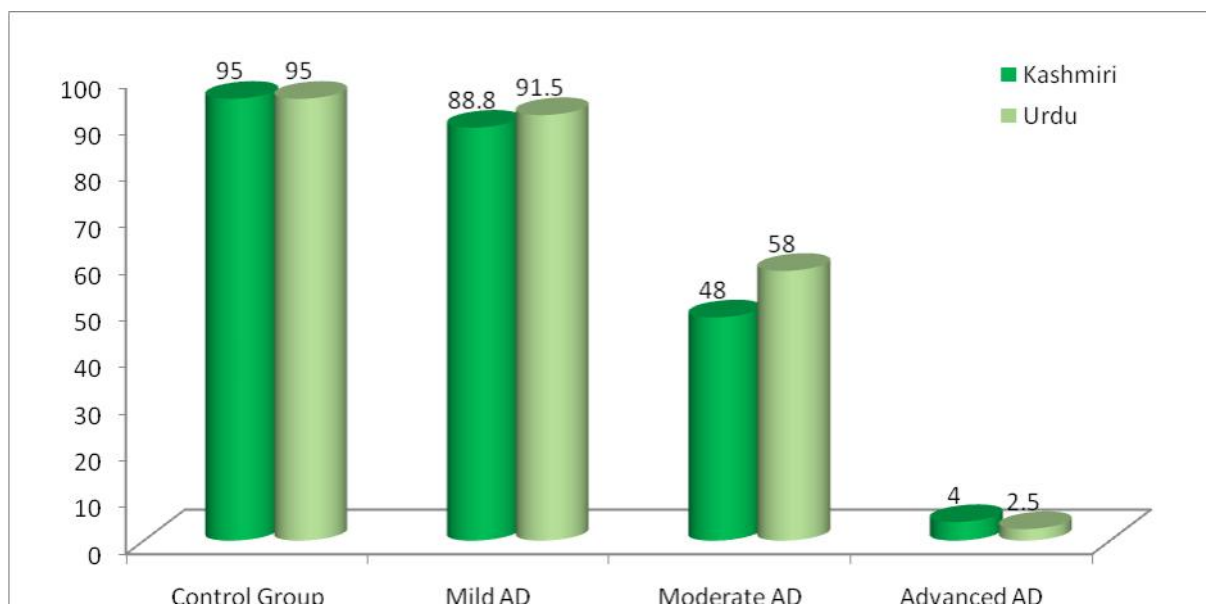## SPATIAL RELATION TEST IN CASE OF MALE AD SUBJECTS

Fig 1: *Percent Scores showing Spatial Relation difficulty among Mild, Moderate and Advanced Male AD Patients.*

From the bar chart presented above the following tentative conclusions can be drawn-

1. As compared to Control Group, Mild AD subjects show better performance than the other two groups (Moderate Alzheimer's disease and Advanced Alzheimer's disease) in both Kashmiri (88.8%) and Urdu Spatial Relation test (91.5%) and show a deficit of 6.2% and 4% respectively.

2. As compared with the Mild AD group, Moderate AD group shows a deficit of 40.8% in Kashmiri Spatial Relation and 33.5% in Urdu Spatial Relation and around 47% and 37% in Kashmiri Spatial Relation and Urdu Spatial Relation test resp. while comparing the performance of Normal Control Group.

3. Mild and Moderate AD group shows better performance in Urdu Spatial relation as compared to Kashmiri Spatial relation because of the influence of Urdu in day-to-day language.

4. Advanced AD group shows a maximum deficit of 91% in Kashmiri Spatial Relation test and almost 92.5% in Urdu Spatial Relation test as compared to Normal Group. The scores generally correspond to the severity of cases.
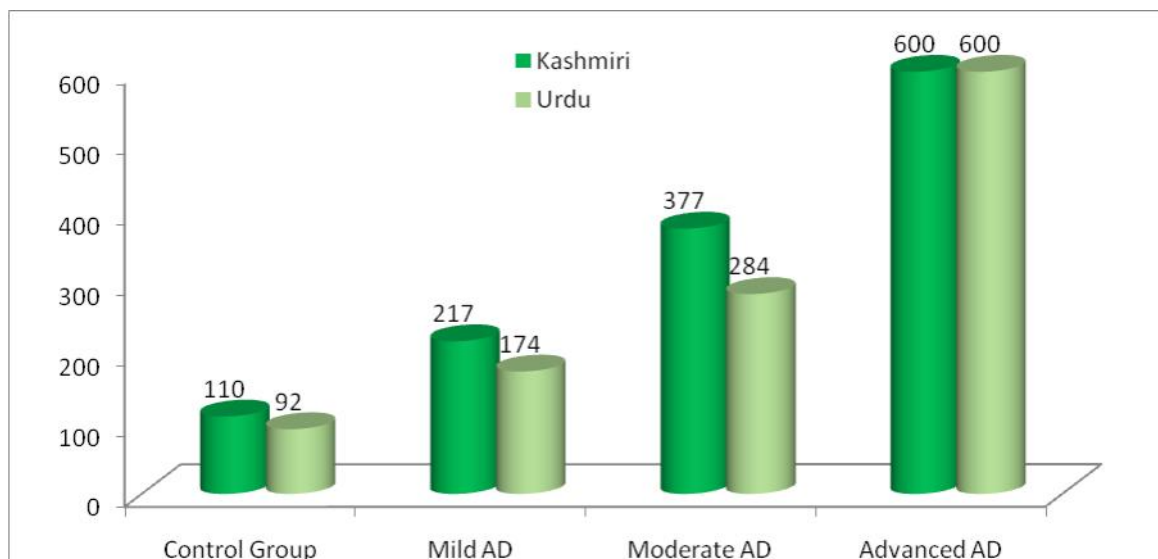

Fig 2: *Average Time taken by Mild, Moderate and Advanced Male AD Patients in case of Spatial Relation Test.*

From the bar chart presented above the following tentative conclusions can be drawn-

1. The span of the time increases as we move from Control group to Advanced AD subjects. The time taken by the control Group for the completion of Kashmiri Spatial Relation test and Urdu Spatial Relation Test is 110 and 92 seconds respectively.

2. The time taken by the Mild AD, Moderate AD and Advanced AD subjects in Kashmiri Spatial Relation test is 217, 377 and 600 seconds respectively and time taken for the completion of Urdu Spatial Relation test is 174, 284 and 600 seconds respectively. The time took generally corresponds to the severity of cases. Lesser the severity lesser is the time taken and more the severity more is the time taken.

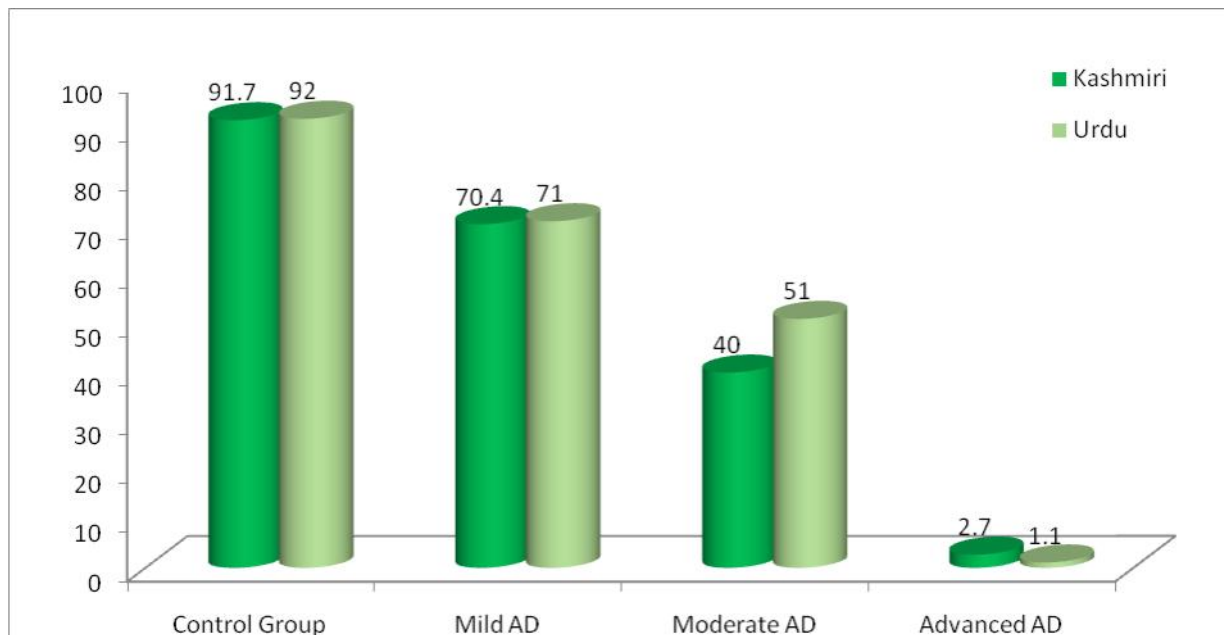**BAR REPRESENTATION OF SUBTEST RESULTS OF FEMALE AD SUBJECTS**

Fig 3: Percent Scores showing Spatial Relation difficulty among Mild, Moderate and Advanced female AD Patients.

From the bar chart presented above the following tentative conclusions can be drawn-

1. As compared to Control Group, Mild AD subjects show better performance than the other two groups (Moderate Alzheimer's disease and Advanced Alzheimer's disease) in both Kashmiri (70.4%) and Urdu Spatial Relation test (71%) and show a deficit of 21.3% and 21% respectively.

2. As compared with the Mild AD group, Moderate AD group shows a deficit of 30.4% in Kashmiri Spatial Relation and 30% in Urdu Spatial Relation and around 51.7% and 41% in Kashmiri Spatial Relation and Urdu Spatial Relation test respectively while comparing with the performance of Normal Control Group.

3. Mild and Moderate AD group shows better performance in Urdu Spatial relation as compared to Kashmiri Spatial relation because of the influence of Urdu in day-to-day life.

4. Advanced AD group shows a maximum deficit of 89% in Kashmiri Spatial Relation test and almost 81% in Urdu Spatial Relation test as compared to Normal Group. The scores generally correspond to the severity of cases.
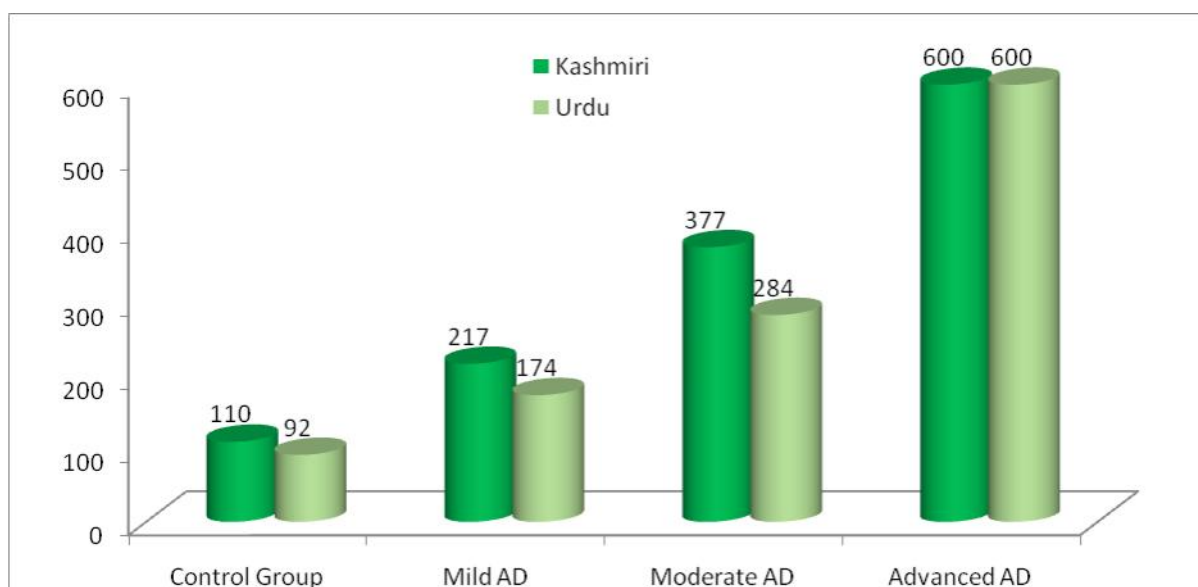

Fig 4: Average Time taken by Mild, Moderate and Advanced female AD Patients in case of Spatial Relation Test.

From the bar chart presented above the following tentative conclusions can be drawn-

1. The span of the time increases as we move from Control group to Advanced AD subjects. The time taken by the control Group for the completion of Kashmiri Spatial Relation test and Urdu Spatial Relation Test is 129 and 104 seconds respectively.
2. The time taken by the Mild AD, Moderate AD and Advanced AD subjects in Kashmiri Spatial Relation test is 241, 416 and 600 seconds respectively and time taken for the completion of Urdu Spatial Relation test is 231, 334 and 600 seconds respectively. The time took generally corresponds to the severity of cases. Lesser the severity lesser is the time taken and more the severity more is the time taken.

STATISTICAL PROCEDURE

Out of various software available for the statistical analysis, SPSS (Statistical software for social sciences) is used for the statistical analysis of data. For the data analysis in the present study, SPSS used. The statistical technique namely Distance Correlation is used to determine the association between the variables in the form of distances, more the distance far the variables are from each other and vice versa.

DISCUSSION ON DISTANCE CORRELATION RESULTS

The distance correlation displays Bar graphs based on Case summaries and Proximity matrix of Spatial Relation Test:

THE SPSS OUTPUT FOR DISTANCE CORRELATION IN CASE OF URDU SPATIAL RELATION DISORDER AMONG MALE MILD, MODERATE AND ADVANCED AD GROUPS AND DISCUSSION ON CORRELATION RESULTS.

Proximity matrix and Case Summaries showing Distance Correlation in Case of Kashmiri Spatial Relation Test

Table 1: **Case Summaries**

	Control Group	Mild AD	Moderate AD	Advanced AD
Mean	42.8667	40.0833	21.7	1.8
Std. Deviation	1.5751	2.45798	4.45253	1.48324
Time	109	217	377	600

Table 1 indicates that the average score taken by a Control Group in Kashmiri Spatial Relation test is 42 while as score taken by the Subjects in Mild, Moderate and Advanced Stage are 40, 21.7 and 1.8 respectively, also the time taken by a Control Group person in this test is 109 seconds while as time taken by Subjects in Mild, Moderate and Advanced Stage are 217, 377 and 600 seconds respectively.

Table 2: **Proximity Matrix**

	Euclidean Distance			
	Control Group	Mild AD	Moderate AD	Advanced AD
Control Group	0	10.124	49.997	93.507
Mild AD	10.124	0	42.152	85.726
Moderate AD	49.997	42.152	0	45.768
Advanced AD	93.507	85.726	45.768	0

Table 2 is called a Proximity matrix/Distance Matrix/ Dissimilarity Matrix which is used to predict the differences in the variables, more value between the variables corresponds to the severity of the case.
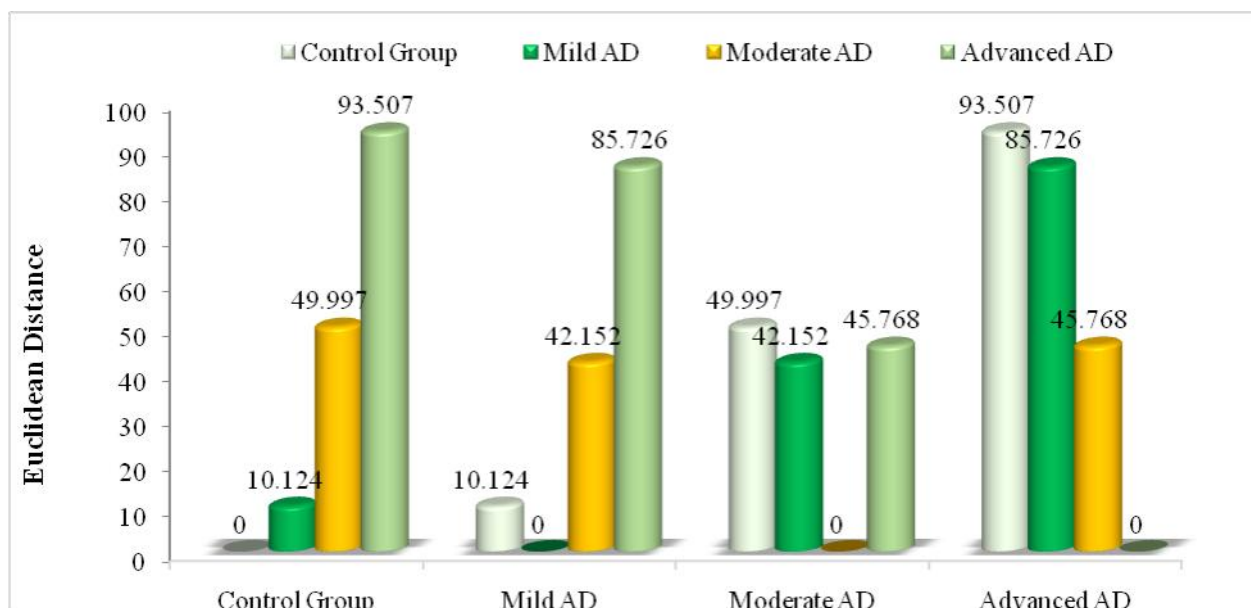

Fig 5: Euclidean distance showing the difference between Mild, Moderate and Advanced Male AD Patients in case of Kashmiri Spatial Relation Test.

From the table and the bar chart given above, the following conclusions can be drawn:

1. Compared to the performance of Control group, Mild AD subjects, on the other hand, demonstrates almost similar performance in Kashmiri Spatial Relation test. Hence, Mild AD subjects have well-kept knowledge of Spatial Relations.

2. In case of the Moderate AD and Advanced AD subjects, there is a drastic fall of result which leads to increase in Euclidean distance. Hence, there is a visible loss of control over spatial judgment.

3. As compared to Control Group, the Euclidean distance shows an increase from Mild AD to the Moderate AD and from Moderate AD to Advanced AD subjects. The Euclidean distance between Control Group and Mild AD subjects is 10 whereas, the Euclidean distance between Control Group-Moderate AD subjects and Control Group-Advanced AD subjects is 49.9 and 93.5 respectively. The Euclidean distance is least for Mild AD subjects and greater for Advanced subjects.

4. As compared to Mild AD subjects, the Euclidean distance between Mild AD-Moderate AD subjects and Mild AD -Advanced AD subjects is 42 and 85.7 respectively.

5. As compared to Moderate AD subjects, the Euclidean distance between Mild AD-Moderate AD subjects and Moderate AD -Advanced AD subjects is 42 and 45.7 respectively.

6. As compared to Advanced AD subjects, the Euclidean distance between Mild AD-Advanced AD subjects and Moderate AD -Advanced AD subjects is 85.7 and 45.7 respectively.

The SPSS Output for Distance Correlation of the Deficits of Language and Number among Female Mild, Moderate and Advanced AD Groups and Discussion on Correlation Results
Proximity matrix and Case Summaries showing Distance Correlation in Case of Kashmiri Spatial Relation Test.

Table 3:

Case Summaries

	Control Group	Mild AD	Moderate AD	Advanced AD
Mean	41.3333	31.7222	18.0625	1.1667
Std. Deviation	2.09307	1.73405	4.62476	0.75277
Time	129	241	415	600

Table 3 indicates that the average score taken by a Control Group in Kashmiri Spatial Relation test is 41.3 while as score taken by the Subjects in Mild, Moderate and Advanced Stage are 31.7, 18 and 1.1 respectively, also the time taken by a Control Group in this test is 129 seconds while as time taken by Subjects in Mild, Moderate and Advanced Stages are 241, 415 and 600 seconds respectively.

Table 4:

Proximity Matrix

	Euclidean Distance			
	Control Group	Mild AD	Moderate AD	Advanced AD
Control Group	0	29.385	62.674	102.973
Mild AD	29.385	0	34.022	74.428
Moderate AD	62.674	34.022	0	43.052
Advanced AD	102.973	74.428	43.052	0

Table 4 is called a Proximity matrix/Distance Matrix/ Dissimilarity Matrix which is used to predict the differences in the variables, more value between the variables corresponds to the severity of the case. Whereas, 0 value indicates that variables are same.
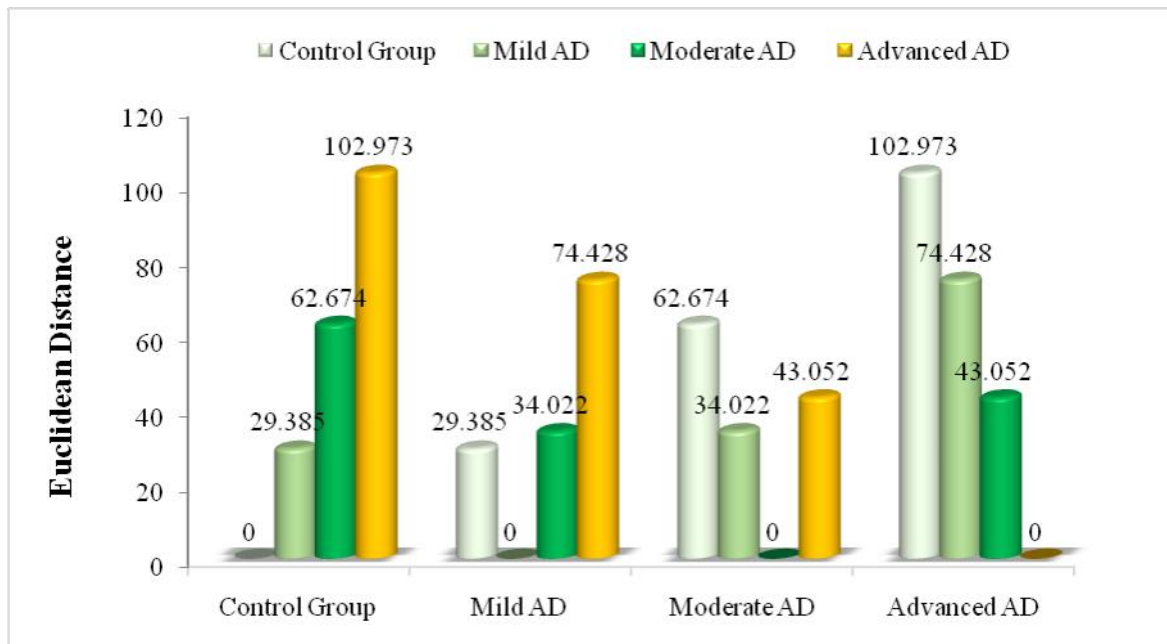
Fig 6: Euclidean distance showing the difference between Mild, Moderate and Advanced Female AD Patients in case of Kashmiri Spatial Relation Test.

From the table and the bar chart given above, the following conclusions can be drawn:

1. Compared to the performance of Control group, Mild AD group shows better performance in Kashmiri Spatial Relation test. Hence, Mild AD subjects have well-kept knowledge of Spatial Relations

2. In case of the Moderate AD and Advanced AD subjects, there is a drastic fall of result which leads to increase in Euclidean distance. Hence, there is a visible loss of control over spatial judgment.

3. As compared to Control Group, the Euclidean distance shows an increase from Mild AD to the Moderate AD and from Moderate AD to Advanced AD subjects. The Euclidean distance between Control Group and Mild AD subjects is 29.3 whereas, the Euclidean distance between Control Group -Moderate AD subjects and Control Group-Advanced AD subjects is 62.6 and 102.9 respectively. The Euclidean distance is least for Mild AD subjects and greater for Advanced subjects.

4. As compared to Mild AD subjects, the Euclidean distance between Mild AD-Moderate AD subjects and Mild AD -Advanced AD subjects is 34 and 74.4 respectively.

5. As compared to Moderate AD subjects, the Euclidean distance between Mild AD-Moderate AD subjects and Moderate AD -Advanced AD subjects is 34 and 43 respectively.

6. As compared to Advanced AD subjects, the Euclidean distance between Mild AD-Advanced AD subjects and Moderate AD -Advanced AD subjects is 74.4 and 43 respectively.

CONCLUSION

Loss of a sense of visual perception greatly interferes with the ability to accurately perceive objects in space with reference to other objects. As dementia progresses, visual perception errors become more frequent, suggesting that the spatial relation disorder in Alzheimer's disease involves loss of information about the specific object. Our findings support the view that spatial relation disorder

occurs early in the AD and progresses gradually from Mild to the Advanced stage of the AD. Whereas, patients with Advanced AD showed almost complete loss of spatial relation ability due to the severity of the disease. Moreover, results also show that male AD subjects show better performance in Spatial Relation Test as compared to female AD subjects.

REFERENCES

1. Aronson, M. K., Ooi, W. L., Morgenstern, H., Hafner, A., Masur, D., Crystal, H., ... &Katzman, R. (1990). Women, myocardial infarction, and dementia in the very old. *Neurology*, *40*(7), 1102-1102.

2. Evans, Denis A., et al. "Prevalence of Alzheimer's disease in a community population of older persons: higher than previously reported." *Jama* 262.18 (1989): 2551-2556.

3. Fratiglioni, L., Ahlbom, A., Viitanen, M., &Winblad, B. (1993). Risk factors for late‐onset Alzheimer's disease: A population‐based, case‐control study. *Annals of Neurology*, *33*(3), 258-266.

4. Fratiglioni, L., Viitanen, M., von Strauss, E., Tontodonati, V., Herlitz, A., &Winblad, B. (1997). Very Old Women at Highest Risk of Dementia and Alzheimer's Disease Incidence Data from the Kungsholmen Project, Stockholm. *Neurology*, *48*(1), 132-138.

5. Peaslee, D. C. (1998). *Science as a Cultural Expression*. Nova Publishers.

6. Rocca, W. A., Van Duijn, C. M., Clayton, D., Chandra, V., Fratiglioni, L., Graves, A. B., ...& Mortimer, J. A. (1991). Maternal age and Alzheimer's disease: a collaborative re-analysis of case-control studies. *International Journal of Epidemiology*, *20*(Supplement_2), S21-S27.

7. Rocca, W. A., Amaducci, L. A., & Schoenberg, B. S. (1987). Epidemiology of clinically diagnosed Alzheimer's disease. *Alzheimer Disease & Associated Disorders*, *1*(2), 105.

8. Scarmeas, N., & Stern, Y. (2003). Cognitive reserve and lifestyle. *Journal of clinical and experimental neuropsychology*, *25*(5), 625-633.

9. Schacter, D. L., Savage, C. R., Alpert, N. M., Rauch, S. L., & Albert, M. S. (1996). The role of hippocampus and frontal cortex in age-related memory changes: a PET study. *Neuroreport*, *7*(6), 1165-1169.

10. Stern, Y. (2002). What is a cognitive reserve? Theory and research application of the reserve concept. *Journal of the International Neuropsychological Society*, *8*(3), 448-460.

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