

Alzheimer and other dementias diagnosis by ¹H-MRS at different locations with short and medium Echo Times

M. Martinez-Bisbal^{1,2}, E. Arana², B. Martinez-Granados³, E. Molla^{2,4}, L. Marti-Bonmati², B. Celda¹

¹Departamento de Quimica Fisica and SCSIE, Universitat de Valencia, Burjassot, Valencia, Spain, ²Servicio de Radiologia, Clinica Quiron, Valencia, Spain,

³Departamento de Quimica Fisica, Universitat de Valencia, Burjassot, Valencia, Spain, ⁴Servicio de Radiologia, Hospital de la Ribera, Alzira, Valencia, Spain

Purpose: The study of biochemical differences between common Dementias and Depression in elderly by means of MRI and ¹H MRS

Subjects and Methods: We prospectively studied 64 (45 women and 19 men) patients with cognitive impairment, age 69.5 ± 9.4 years. All subjects underwent laboratory tests, including a chest radiograph, ECG, chemistry profile, CBC count, thyroid function tests, vitamin B-12 and folic acid levels, syphilis serology and structural MR imaging.

Major depression and probable Alzheimer's disease diagnoses were made if they fulfilled the inclusion criteria of Diagnostis and Statistical Manual, revision 4 (DSM-IV). Also, probable or possible dementia were tested with the local version of Mini-Mental State Examination (MMSE). The criteria for minimal cognitive impairment: were memory complaint from the patient and a close relative, normal activities of daily living, normal general cognitive functions, and memory performance abnormal for age, but no dementia according to the DSM IV. Exclusion criteria were structural abnormalities that could produce demential, cortical infarction, tumor subdural hematoma, major sensory loss, confusional syndrome, intoxication, hypovitaminosis, normal pressure hydrocephalus or intoxication. Subjects were not excluded for the presence of leukoaraiosis. Analysis (MCMB, BC) were unaware of the individuals clinical details.

The studies of 1H MRS were done with Single Volume with TE 31 and 136 ms in parietal grey matter and in temporal lobes (figures 1 and 2).

Results: There were 31 patients with Alzheimer's disease (AD), 18 with major depression (MD), 9 presented mild cognitive impairment (MCI) and 6 with vascular dementia (VD). For distinguishing subjects with dementia, the metabolite ratios with higher values on demented subjects were on TE 31 ms, Co/Cr and mI/Cr (Studentt-test, $p:0.011$ and $p:0.001$), respectively. Conversely, patients with dementia showed lower levels on NAA/Cr with TE 136 ms (Student t-test, $p:0.034$) and NAA/Co (U-Mann Whitney, $p=0.015$) than non demented. When the four diseases were classified, the only ratios which revealed inter-groups differences were Co/Cr, mI/Cr ratios. So, patients with AD presented the highest values of Co/Cr ratios (0.75 ± 0.19 unities, Anova test, $p=0.05$) and mI/Cr (0.85 ± 0.19 unities, Anova test, $p=0.001$) on posterior parietal with TE 31 ms compared to other diseases. The mI/Cr and NAA/mI ratios were compared for discriminating between AD and the other three entities. ROC curves showed that both metabolites obtained good discrimination ($p<0.0001$) with a minimal superiority of NAA/mI over mI/Cr but without statistical relevance ($p=0.5$). NAA/mI ratio had the highest sensitivity (81.5%) and specificity (72.7%) with a value of 2.32

Conclusion: To a better differentiation and discrimination among dementia and other pathologies and the diagnostic of Alzheimer Disease, two different locations, temporal lobe and parietal grey matter need to be studied. A more precise characterisation also includes the acquisition of at least one short echo time experiment and a middle or long echo time to optimise the results.

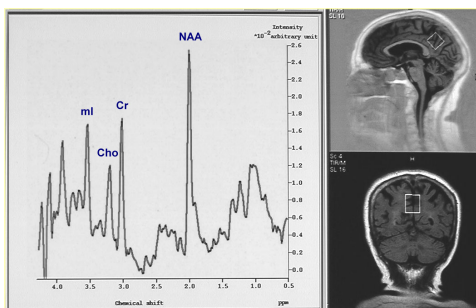


Figure 1: Single voxel spectrum at TE 31 ms. Parietal posterior gray matter location.

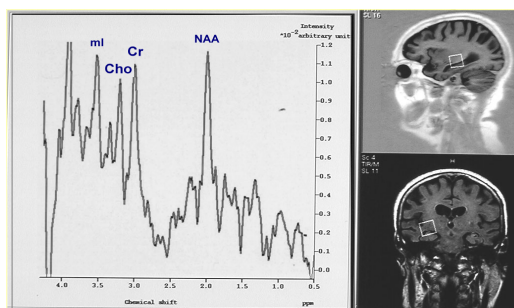


Figure 2: Single voxel spectrum at TE 31 ms. Right temporal lobe location.

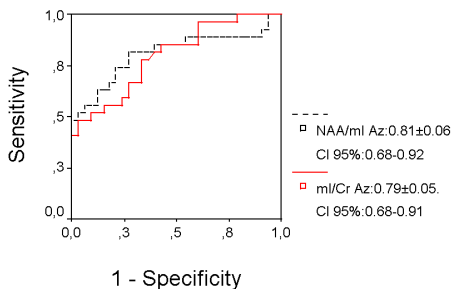


Figure 3: ROC curves discriminating AD vs. non-Alzheimer at posterior cingulate gyrus (PCG) with TE 31ms.