

Single Photon Emission Computerized Tomography as a Predictor of Early Dementia

Omar, ANM, EL Sayed, N and Moustafa N

Abstract

We examined 40 elderly patients presenting with different psychiatric manifestations for the first time after the age of 50 years . Dementia was considered an exclusion criteria confirmed by MMSE ,memory subscale of the Computerized Sermion Programme and the ICD10 criteria. All subjects were examined for cognitive functions using the above tests and for SPECT scanning using 99m Tc-HMPAO once at the beginning of the study and after 1 year follow up. We found that CBF levels correlates negatively with cognitive impairment thus raising neuropsychological tests and SPECT as early predictors of dementia.

Introduction

Dementia is a clinical syndrome characterized by slowly progressive social breakdown ,changes in personality and language function .

Psychotic symptoms such as delusions and hallucinations and mood changes may be the presenting feature. Neuropsychological investigations may reveal cognitive deficits which become more pronounced later in the course of the illness.

Thus, memory complaints especially in elderly patients must not be viewed as totally secondary to psychiatric symptoms (Wilson& Evans ,1996).

These observation underline the importance of taking elderly patient's psychiatric complaints seriously ,and consider it an indication for thorough physical and neuropsychological examination focusing on memory disorders (Schmand et al, 1997).Much research interest and effort have been directed towards the identification of measures that help in predicting future dementia These included neuropsychological assessment (Charles et al,1991) ,cranial computed tomography (CT) and brain magnetic resonance (MRI) (Carletta et

al,1995),and event related evoked' potentials (P300) (Klaus et al,1990). However, few studies have examined how cognitive functions might parallel SPECT findings along the course of dementia.

Aim of the Work

The aim of our work was to examine the correlation between neuropsychological impairment in elderly psychiatric nondemented patients and regional cerebral blood flow using single photon emission computed tomography (SPECT) .

A second aim was to re-examine these patients after 1 year to detect changes in cognitive functions and assess the role of SPECT in predicting early dementia.

Materials and Methods

We examined 40 elderly psychiatric patients ranging from age 50 to 80 years Both sexes were included.All subjects were recruited from the in and outpatients attending the Institute of psychiatry ,Ain Shams University Hospitals. They were diagnosed according to the ICD 10 Research and Diag-

nostic criteria and received comprehensive medical, neurological and psychiatric evaluations. None had past history of psychiatric disorder before. Exclusion criteria included significant medical or neurological illness, drug abuse and the presence of white matter lesions as detected by hypodensities on CT. All patients undergo cognitive tests and SPECT assessment, and gave informed consent to share in the study after full explanation of the purpose of the work to the patients and their relatives..

Cognitive Tests

The tests included assessments needed to choose elderly subjects as average intelligent, nondemented to be included in the study. Follow up examination was performed to predict future cognitive status in our subjects. Patients with scores above 6 on the block design and similarities subsets of the Wechsler Adult Intelligence Scale (Wechsler, 1958) were included in the study. Those with subnormal score (<23) on the Mini Mental State Examination were excluded from the study. The same test and the memory subscale of the computerized serinion programme were used once at the beginning of the test and repeated to reassess the cognitive functions in our subjects after 1 year.

SPECT Scanning

SPECT studies were carried out using 480mbq ^{99m}Tc -HMPAO, given by bolus injection into the brachiocephalic vein at the elbow and prepared according to the manufacturer's instructions. Images were obtained using a rotating single head rectangular Sophy XRT gamma camera. Transverse, sagittal and coronal planes were reconstructed using appropriate filter. SPECT scans were assessed and grad-

ed visually on basis of the number of affected areas, the predominant area and the severity score (0-4) which represent the degree of hypoperfusion.

Results

The demographic and clinical characteristics of our subjects were presented in table 1.

Their age ranged between 55 and 80 years with a mean of 67.2 ± 5.5 . The sample group included 27 males and 13 females.

They presented for the first time with psychiatric symptoms and were diagnosed according to the ICD10. 18 patients fulfilled the criteria for unipolar depression, 9 patients were diagnosed as paranoid delusional disorder and 3 patients obsessive symptoms.

The MMSE ranged between 25 and 30 with a mean of 27.2 ± 2.1 . The results of the memory test showed a mean of 85.0 ± 14.8 . CT scans done for all patients showed no focal hypodensities. Cognitive tests and SPECT scanning were repeated 1 year later. Out of the 40 patients 35 were regular on follow up visits every 2 weeks, but 4 of them refused to have SPECT scanning again. Table 2 shows comparison between results of MMSE and memory tests across longitudinal studies. We found significant decreased scores on both tests with the mean for the MMSE 20.1 ± 3.4 and for the memory tests 61.2 ± 13.8 , which indicate definite cognitive impairment.

Tables 3, 4 and 5 show the differences between SPECT findings in relation to both cognitive states. There were significant increased number of affected areas, severity of affection more in the frontoparietal regions bilaterally as shown in Figs. (1.2.3).

Table (1)
Demographic and clinical characteristics of patients

Variable	No. of patients
Sex	
- male	27
- female	13
Age range	55 - 80
mean +/- SD	67.2 +/- 5.5
Psychiatric presentation	
- unipolar depression	18
- delusional disorder	9
- obsessive symptoms	3
Cognitive tests	
- MMSE	27.2 +/- 2.1
- Memory tests	85.0 +/- 14.8

Table (2)
Comparison between cognitive tests before and after one year follow up.

Variable	At the onset	After one year	P- value
Number	40	35	
MMSE	27.25 2.1	20.1± 3.4	significant
Memory tests	85.0 ± 14.8	61.2 ± 13.8	significant

Table (3)

SPECT findings at the onset and after one year (number of affected areas).

Variable	At the onset	After one year	P- value
Number	40	31	
Number of affected areas	4.7 ± 3.8	9.1 ± 5.3	significant

Variable	At the onset	After one year	P- value
Number	40	31	
Severity of affection.	9.9 ± 16	17.5 ± 13.6	significant

Table (5)

Predominant affected area.

Variable	At the onset	After one year	P- value
Number	40	31	
Rt cortex	42.1%	85.5%	
Lt cortex	49.9%	90.1%	significant
Rt frontal	35.2%	74.4%	significant
Lt frontal	52.75	86.9%	
Rt parietal	32.4%	67.3%	significant
Lt parietal	45.2%	70.8%	significant
Rt temporal	15.5%	35.0%	
Lt temporal	14.8%	42.2%	
Rt & Lt cerebellar	15.6%	28.3%	

Fig. 1 shows bilateral fronto-temporal hypoperfusion.

The last row shows extensive level of hypoperfusion after one year.

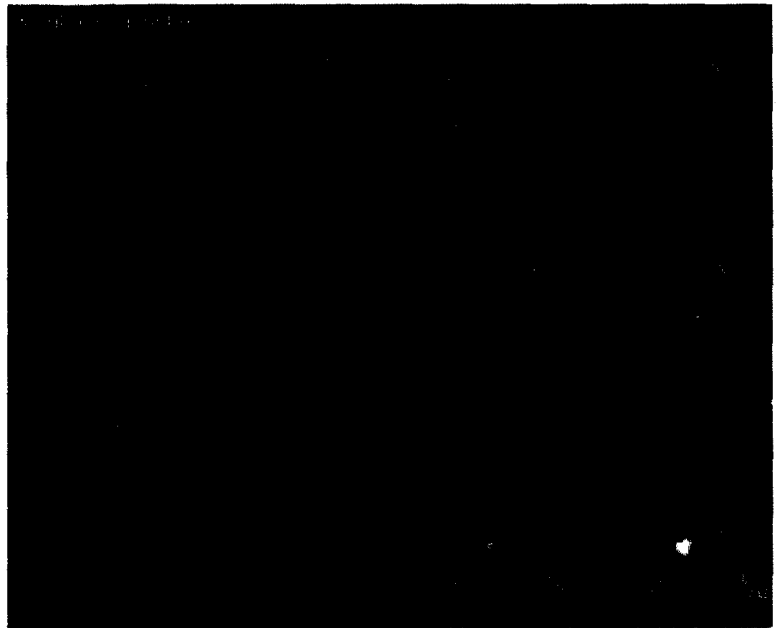


Fig. 2: shows bilateral assymeterical cerebral deficits.

The 4th row shows increased number of cerebral deficits representing the severity of affection-

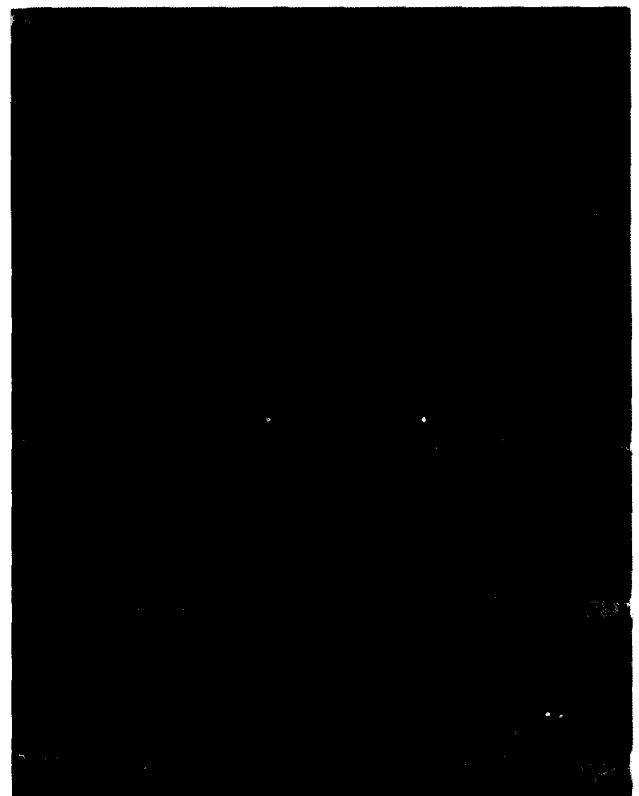


Fig. 3: shows left frontal and right posterior cerebral deficits .
After one year follow up global hypoperfusion predominate.



Discussion

Studying the natural course of dementia is one of the most important, but difficult tasks of clinical research, which faced numerous methodological problems. This may explain the discrepancies and inconsistencies in the results (Little & Burns, 1993). Psychiatric symptoms may proceed cognitive dysfunction in dementia. Yvonne et al, 1994 studied the prevalence of psychiatric symptoms to clarify psychiatric predictors of dementia. They found that the most frequent symptoms were irritability, apathy, insomnia, agitation, impatience and emotional lability. However, they considered these symptoms as independent predictors of dementia when cognitive tests appear to be normal.

In our study, we reviewed the psychiatric presentation in our patients and found most of them presenting with depressive and paranoid symptoms. Those complaining of depression were the majority expressing their feelings in somatic terms, agitated behaviour and death thoughts. Fortunately, this group of patients showed marked improvement on treatment. While other patients presenting with paranoid delusions towards their family members, continued with suspicious and aggressive attitude. In 1 year follow up, 30 % of our patient reported visual hallucination and repeated delirious states.

These symptoms coincide with recent memory impairment observed in 82% of our sample. The significant decrease in the MMSE and memory test scores point to the level of functioning and suggest objective psychological tests as predictors of dementia. Charles et al 1991 found that verbal recall, visuospatial recall, object function recognition and object identification are four psychological tests exhibit high sensitivity and specificity

in distinguishing between subjects with and without a decline in cognitive impairment. On the other hand, attempts have been made to evaluate the influence of CT and EEG findings on the cause of dementia. During the follow up, Patients clinically diagnosed as mild cognitive impairment show greater deterioration in cognitive performance, decrease of alpha and increase of theta activity and enlargement of cerebrospinal fluid spaces. These findings can be considered a strong evidence of an underlying degenerative brain changes and raises these investigations as markers of greater importance for the distinction between patients who will and who will not develop dementia (Forstl et al, 1996).

Various studies have addressed the relationships between neuropsychological test performance and regional cerebral blood flow (rCBF) in dementia using SPECT. Significant negative correlation were found between the overall impairment score and the level of rCBF, meaning that a high impairment score is associated with a low rCBF (Elfgrén et al, 1996). In our work, the visual analysis of SPECT findings, guided by the colour scale was helpful to detect small regional changes. Aging by itself has its effect on rCBF changes, as Costa et al, 1993 confirmed a global decrease in glucose metabolism and CBF with age. They found cortical asymmetries, particularly in the fronto-parietal regions to be a characteristic feature of SPECT studies of normal aging in patients above 70 years old. For this reason we don't consider our finding of bilateral affection in the frontoparietal region to be specific to dementia, but what concerns us here is the significant increase in the number of affected areas and severity of perfusion

deficits that is positively correlated with cognitive impairment. Other studies using the MMSE to explore the relation between cortical blood flow and cognitive functioning in demented patients reported a significant relationship in the posterior parietal areas (Miller & Cummings, 1991) and inferior frontal and parietal cortex (Jagust et al, 1989). However, the correlation found in these two studies can be questioned with the regard to the different radiopharmaceutical (^{133}Xe) used and the limited number of patients examined (less than 10). Elfgren et al (1996) examined 16 patients with Frontal lobe dementia with a selection of tests from Luria's neuropsychological investigation (Christensen, 1974) and found strong relationship between verbal fluency and blood flow levels in the frontal and left temporal anterior inferior areas. Also, O'Brien et al, 1992 found correlation between visuospatial constructional ability (Block Design) and right parietal blood flow levels in Alzheimer dementia. Reviewing the above results we can conclude that the predominant affected area in dementia is related mostly to the type of cognitive impairment and the specific type of dementia.

Conclusion

In general our study show a close coupling between reduced rCBF and global neuropsychological deficits in dementia and that SPECT as a measure might be useful for following elderly patients for future development of dementia.

References:

- Carletta D., Dollear T.J., Freels S. et al (1995):** CT and MRI findings among African-American with Alzheimer's disease vascular dementia and stroke without dementia. *Neurology*, 45(8). 1456-1461.
- Charles F., Steven F., Barry R. (1991):** Mild cognitive impairment in the elderly: Predictors of dementia *Neurology*, 41(7). 1006-1009.
- Christensen A.L.(1974):** Luria's Neuropsychological Investigation. Copenhagen: Nunksgaard.
- Costa D.C., Morgan G. F., and Lassen N.A. (1993):** New trends in nuclear neurology and psychiatry. Edited by D. Costa, G.F. Morgan and N.A. Lasser. London, England, Published by John Libbey T. company.
- Elfgren C.Z. Ryding E., & Passant U. (1996):** Performance on Neuropsychological tests related to SPECT findings in Frontotemporal dementia *B.J. Psych.* 169;416-422.
- Frostl, Sattel h, Besthorn C. et al (1996):** Longitudinal cognitive, EEG, and Morphological Brain changes in Aging and Alzheimer's disease. *B.J. psychiatry* 168.208-286.
- ICD-10 (1992):** classification of Mental and Behavioral disorders World Health Organization.(Geneva),
- Jagust W.J., Reed B.R. Seab P.J., et al (1989):** Clinical physiologic correlates of Alzheimer's disease and frontal lobe dementia. *Am J. Physiological Imaging*, 4.89-96.
- klaus R.D., Deiter S.H., Uwe B. (1990):** P300 latency of the auditory evoked potential in dementia *Int. j. of Neuroscience*, 54(3-4), 291-296.

Little A. & Burns A. (1993): Monitoring change in Alzheimer's disease. In *Aging and Dementia* (ed. A Burns). London: E. Arnold.

Miller B.K. Cummings J.L. (1991): Frontal Lobe degeneration: clinical neuropsychological and SPECT Characteristics. *Neurology*, 41, 1374-1382.

O'Brien J.T., Egger S. et al (1992): A study of regional cerebral blood flow and cognitive performance in Alzheimer's disease. *J Neurology Neurosurgery and Psychiatry*, 55, 1182-1187.

Schmand B., Jonker C., Geerlings M.Z. (1997): Subjective memory complaint in the elderly: depressive feature and future dementia. *B.J. Psychiatry*, 171, 373-376.

Wechsler D. (1958): The measurement and appraisal of Adult Intelligence. Baltimore; Williams and Wilkins.

Wilson R.S. & Evans D.A. (1996): How clearly do we see our memories? *J. Am Geriatric Society*, 44, 93-94.

Yvonne H., Philip G., Donna G. et al (1994): Psychiatric Symptoms in Dementia associated with stroke. *J. of the National Medical association*, 86(9), 697-702.

Authors:

**Omar, ANM.
EL Sayed, N.**
Lecturers of psychiatry
Ain Shams University.

Moustafa, N.
Lecturer of radiodiagnosis
Ain Shams University.

Moustafa, N.
Lecturer of radiodiagnosis
Ain Shams University.

Address of coresspondance:

Moustafa, N.
Lecturer of radiodiagnosis
Ain Shams University.

استخدام الاشعة المقطعية بالنظائر المشعة فى التشخيص المبكر لمرض العته.

تمت هذه الدراسة على اربعين حالة من المرضى النفسيين كبار السن (فوق سن الخمسين لأول مرة) ممن لا يعانون من مرض العته بأستخدام معايير التصنيف العالمي العاشر للأمراض النفسية و اختبارات الذاكرة و درجة التركيز و النظائر المشعة فى الاشعة المقطعية على المخ.

و قد تم اجراء الاختبارات فى بداية الدراسة و بعد عام من المتابعة وجد ان نتائج الاشعة تتناسب سلبيا مع اختبارات الذاكرة و التركيز و يمكن اعتبارهم من ادوات التشخيص فى بدايات مرض العته.

OKASHA LECTURE

IN PSYCHIATRY

**Delivered yearly by an eminent scientist
in Psychiatry or Behavioural Sciences**

**To celebrate the inauguration of the
Institute of Psychiatry
and the Publication of
“Current Psychiatry”**

In recognition of the distinguished efforts of Prof. Okasha