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Computed Tomography in the Elderly:
Changes over Time in a Normal Population

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The clinical, psychometric, and computed tomographic (CT) status of previously fit elderly volunteers is described at follow-up for up to four years. A number of relationships were found between psychometric and CT scores, but a dementing group could not be determined on the basis of a single scan. However, a subtle reduction in cognition over time was significantly related to CT changes, and occurred in 10%. Larger ventricles were also found in a small sub-group, who developed late-onset depressive disorders; recent bereavement was related to ventricular size. Thus a single CT scan may not be a useful discriminatory test in early dementia, but a repeat demonstrating ventricular enlargement, is likely to be significant. In the elderly, cognitive and CT scan deterioration should not be expected unless a disease process is occurring; this may be indicated by subtle cognitive impairment or by late-onset depressive disorder.

The computed tomographic (CT) brain scan is a harmless, non-invasive procedure, offering the possibility of following changes in the radiological presentation of the brain over time with ease and considerable safety. It is surprising, therefore, that few long-term follow-up studies of either psychiatric patients or controls have been carried out. Ron (1983) commented that her study of alcoholics appeared to be the largest follow-up to date; Naguib & Levy (1982a,b) followed a group of dementing patients and were able to re-scan ten patients.

We are not aware of any previous CT follow-up studies of fit elderly people, which is perhaps in part due to the technical difficulties of assessing scan changes over time. Du Boulay *et al* (1978) pointed out that differences of head positioning between scans constitute the major technical problem, which is only partly solved with the use of expensive equipment and a considerable increase in radiation dose. Other technical problems (Bird, 1982) cause a variation of up to 20% in measures taken from the same scanning machine. However, in a large group, there is no reason to suppose that technical factors would lead to error in any particular direction. Individual errors should cancel each other out, or their effects may be taken into account, using partial correlation techniques.

To understand the significance of CT changes over time in elderly patients, it would seem necessary to know whether the scan normally changes in the fit elderly population. The significance of "atrophy" (ventricular dilatation or sulcal widening) is unclear, and there is considerable overlap between patients with dementia and controls (Jacoby & Levy, 1980a). The scan appears to be an important prognostic indicator of mortality both in depression in the elderly (Jacoby *et al*, 1981) and in dementia (Naguib & Levy, 1982a), but the importance of CT appearances in the prognosis of the fit elderly population is not clear.

In this paper, we report the cognitive status and CT scan appearance at follow-up of a group of initially healthy elderly people, assessed after a period of up to four years. Our intention has been, firstly, to gather further data in an area which has not been widely investigated to date, and secondly, to test a number of hypotheses concerning changes in clinical and CT status as well as the relationships of these changes over time.

Method

Subjects

These consisted of 50 volunteers over the age of 60, who formed the basis of an earlier CT study (Jacoby *et al*, 1980). All had been carefully screened then to ensure the absence of detectable psychiatric and neurological disorder.

Initial clinical data

For the earlier study, a psychiatric and neurological history was obtained, general personal data collected, and brief mental state and neurological examinations performed. In addition, the Mental Test Score (Hodkinson,

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1973)—a test of memory and orientation—was administered.

Follow-up clinical data

All subjects were successfully traced. At two years, three had died, and before testing could be completed, altogether five had died. All subjects (45) still alive were seen; one refused to be interviewed fully. The mean follow-up period was 136 weeks (range 62–200 weeks); 27 subjects agreed to undergo a repeat CT scan, on the same scanner as was originally used (EMI CT 1010).

At follow-up, we carried out: (1) history update (marital status, physical or psychiatric illness, medication, recent bereavement or life change); (2) psychiatric examination; (3) the Mental Test Score (MTS—Hodkinson, 1973); (4) the Parieto-Temporal Score (PTS—Jacoby & Levy, 1980a); (5) the Digit Copying Test (DCT—Kendrick, 1984); (6) The Digit Symbol Substitution sub-test of the WAIS (DST—Wechsler, 1955); (7) the Paired Associate Learning Test (PALT—Inglis, 1959); and (8) the Benton Visual Retention Test (Benton, 1973—both the score of correct results, BVRTS, and of errors, BVRTE).

The psychometric tests were chosen to assess a wide range of cognitive abilities, including general orientation and memory (MTS), parieto-temporal functioning (PTS), speed at copying (DCT), symbol substitution (DST), new verbal learning (PALT) and new visual learning (BVRT).

Radiological data

The original scans (Jacoby *et al*, 1980) were reassessed for ventricular size by planimetric Ventricular Brain Ratio (VBR) measurement and for measurement of the Anterior Horn Index (AHI)—(Haug, 1977); this is also called the Evans Ratio (Evans, 1942). The neuroradiologist's original ratings of cortical atrophy and ventricular size were also used.

All of these measures were also taken for the 26 repeat CT scans, and an analysis of regional brain density was carried out on the original and follow-up scans. The method used for regional brain density measurement was described by Bondareff *et al* (1981) and by Naguib & Levy (1982a). To control for any variations in regional brain density measurements due to the date of scanning, partial correlation techniques were used.

Results

Catamnestic and clinical data

Mean age at follow-up was 76 (range 64–92): 23% aged 70–79, and 14% aged 80 and over; 10% had died over a three-year period. When the 27 survivors who agreed to have a repeat CT scan were compared with the 18 who refused, the only significant difference was that the refusers had a larger original planimetric VBR ($P = .029$). All other catamnestic data, original and current cognitive data and original CT data showed no significant differences.

Of those still alive, 24 had remained physically well, 13 had had a new physical illness and were treated at home, and 13 had been admitted to a hospital. None had suffered a severe intracranial disorder, 6% had been prescribed psychotropic medication, and one referred to a psychiatrist for depression. Sixteen were not receiving any medication at the time of follow-up. Of the remainder, one was receiving an antidepressant and 16 wesre receiving night sedation. Six subjects had suffered the loss of a spouse within the previous year.

Cognitive and psychological data

The means and standard deviations for these are presented in Table I.

TABLE I
Scores on psychometric tests at follow-up

	Mean	*S.D.*	*Range*
Mental test score at initial testing	32.1	(1.7)	(28–34)
Mental test score at follow-up	31.9	(2.2)	(25–34)
"Parieto-temporal score"	1.9	(2.1)	(0–9)
Digit copying test	90.0	(26.4)	(27–145)
Digit symbol substitution test	29.2	(10.7)	(4–55)
Paired associate learning test	22.9	(17.6)	(1–64)
Benton visual retention test (score)	4.4	(2.2)	(0–8)
Benton visual retention test (errors)	9.4	(3.9)	(3–18)

Intercorrelation between cognitive scores

Significant correlations at the 1% level were found between MTS and all cognitive measures except PALT ($P<0.001$ in the case of DCT, DST, and BVRTS). All other cognitive scores related significantly ($P<0.01$) with each other, again except for PALT. The correlation between PALT and other results did not reach the 1% significance in any case, and only in the cases of PTS and BVRTS did it reach a significance of 5%. The total PTS was made up of six sub-scores; of these, copying a series of asymmetrical drawings correlated in a highly significant fashion ($P<0.001$) with the other psychological test scores except PALT. Other sub-scores did not perform as well.

Relationship of cognitive data to CT data at follow-up

Mental test score. At follow-up, MTS related in a significant inverse fashion ($r = -.54$ and $-.48$, $P<0.01$) to ventricular size (VBR and AHI). It also related to thalamic brain densities on both sides ($r = .37$ and $.45$, $P<0.01$) and to frontal and occipital brain densities on both sides ($P<0.05$). In these calculations, age was controlled for, using partial correlation techniques.

It was also found, on assessing the previous scans, that the initial MTS correlated with occipital brain densities ($P<0.05$), although, as previously reported (Jacoby *et al*, 1980), it did not correlate with ventricular size.

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Other cognitive tests: Further significant correlations ($P<0.05$) were found at follow-up between the Digit Copying Test and right frontal density; between the Digit Symbol Substitution Test and cortical atrophy score; between the Paired Associate Learning Test and both occipital brain densities; between the Benton Visual Retention Test (BVRT) score and VBR, AHI, and left occipital brain density; and between BVRT errors and VBR, cortical atrophy score and left parietal brain density.

Atrophy versus no atrophy—using CT score cut-off points: The data were also examined by dividing cases into those falling on the dementing side of the CT scan cut-off points defined in Jacoby & Levy (1980a) and those falling on the normal side. Cut-off points were as follows: cortical atrophy score of 4, ventricles rated normal or large, VBR of 17 or AHI of 34. There were no significant cognitive differences between the two groups, divided for each CT parameter in this way, using two-tailed t-tests.

Changes in cognitive and CT scores

In the group as a whole, no significant overall changes were seen in MTS, nor in any of the CT scores (including brain density scores), over the period of follow-up. This seems a resilient and stable group of elderly people.

However, in those subjects who showed a drop in MTS score over the follow-up period, there was a highly significant associated increase in ventricular size, both VBR ($r = -.40$, $P = 0.002$) and AHI ($r = -.40$, $P = 0.002$). A reduction in MTS of more than three points was found to be associated with a number of follow-up cognitive test results and initial and follow-up CT measures (Table II). This occurred in five subjects (10%).

TABLE II
Significant associations with a reduction in Mental Test Score (MTS)

	Associated cognitive tests at follow-up	*Associated CT measures*
MTS reduction of >3 points over follow-up period	Low digit symbol substitution test score ($P<0.05$)	Higher follow-up VBR ($P<0.001$)
	Low Benton visual retention test score ($P<0.05$)	Greater increase in VBR ($P<0.05$)
		Lower left thalamic brain density at follow-up ($P<0.05$)

(Significance refers to two-tailed t-test)

Using the cut-off points suggested in Jacoby & Levy (1980a) the group was divided into two subgroups for each initial CT score. Differences in follow-up cognitive scores were assessed using two-tailed t-tests; these cut-off points did not predict any differences in cognitive scores at follow-up.

Multiple regression analyses were carried out in an attempt to build up a predictive model of cognitive abilities at follow-up, based on initial CT scores. The coefficient of determination (r^2) values obtained from the multiple regression programme of SPSS indicate what proportion of the varation of a dependent variable can be explained by the independent variable. This figure is therefore quoted here as an indicator of how successful a predictor of future cognition any individual CT score may be.

Initial CT scores had between 13% and 30% success in predicting variation in future cognitive scores in most cases. This is poor. However, variations in DCT, DST, and PALT were all predicted at a level of more than 50% when brain density scores were included as independent variables. Variation in BVRTE was predicted (52%) by inclusion of initial ventricular and cortical atrophy ratings only. In general, brain density scores were better as predictors of follow-up cognitive scores than were the ventricular and cortical atrophy ratings.

Recent bereavement

The only life-change which related significantly to CT data was the recent death of a spouse; this occurred in six subjects (12%). Bereavement significantly correlated with both measures of ventricular size at follow-up, even when controlling for age (VBR—partial correlation coefficient .35, $P<0.04$, AHI—partial correlation coefficient .45, $P<0.01$). Bereavement did not correlate significantly with initial ventricular size.

Changes in health

Onset of physical illness during follow-up period (occurring in 53%) was related to greater initial AHI ($P<0.05$). Psychiatric disorder between testing had occurred in four cases and consisted entirely of depressive illness (according to hospital and GP notes). Depressive disorder was associated with larger ventricles on initial CT scan (VBR—$P<0.001$, AHI—$P<0.05$, neuroradiologist's assessment—$P<0.001$) and follow-up CT scan (VBR—$P<0.05$), but not with cognitive scores. Only one individual remained significantly depressed at the time of interview.

Discussion

We believe this to be the first report of the re-scanning of a group of fit elderly people. It was hoped that this would give some insight into the normal and pathological changes occurring over time in a larger group of elderly people, some of whom were previously fit (Jacoby *et al*, 1980), some previously depressed (Jacoby & Levy, 1980a; Jacoby *et al*, 1981; Jacoby *et al*, 1983) and some suffering from dementia (Jacoby & Levy, 1980b; Naguib & Levy, 1982a,b). It should be noted that members of each of the three groups (normal, depressed, demented) were chosen so as to make the groups clearly demarcated, so that changes

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occurring in subjects who are initially at the borderlines of these conditions are not being studied. It does, however, mean that if subjects do cross the borders, their associated changes may have a more clear-cut significance. This study refers only to subjects over the age of 60.

Cognition and CT scan at one time-point

There is general agreement that marked atrophy on CT scan is significantly associated with clinical dementia (Huckman *et al*, 1975; Fox *et al*, 1975; Synek & Reuben, 1976; Synek *et al*, 1976; Jacoby & Levy, 1980a). There is, however, considerable overlap; up to 20% of normal elderly people have ventricles which are larger than expected for their age, and 25% of dements have ventricles which are within the normal range (Jacoby & Levy, 1980a). Some disagreement exists, since Earnest *et al* (1979) found that atrophy and mental impairment are merely accompaniments of normal ageing.

In the present study, results of a general orientation and memory test were found to be related to ventricular size and to frontal, thalamic and occipital brain densities, while a variety of other cognitive scores were related to CT measurements. This scattering of relationships between tests and CT scores might be taken to indicate that many are chance findings, and larger numbers are needed to confirm them. However, it may suggest that tests of supposedly localised functions are in fact assessing a variety of complex abilities—as perhaps indicated by the relationship between a test of new verbal learning (PALT) and both occipital brain densities. There is some debate about whether brain densities are of clinical significance (Naeser *et al*, 1980; Bondareff *et al*, 1981; Naguib & Levy, 1982a,b; Wilson *et al*, 1982), but in this study, the variety and number of significant correlations between brain densities and clinical scores suggest that there are important relationships.

Thus, it appears that even in an apparently fit elderly person, a CT scan taken at one point in time may bear a significant relationship to cognitive abilities. However, it is important not to place undue significance on cut-off points of dementia; it is now clear that those determined in our earlier studies cannot be used in an elderly population to define a dementing group, and that the CT scan forms only part of the investigation of a case of possible dementia. Atrophy does not necessarily indicate dementia; the diagnosis must still be made by means of a global clinical assessment. As our follow-up results demonstrate, it is only over the course of time that a relationship between cognitive condition and CT scores may become clarified.

Changes in cognition and CT scores over time

In the present, initially fit group, the results of a test of memory and orientation (MTS) remained remarkably stable over the follow-up period, as did all the CT scores for the group as a whole. However, a small sub-group (10%) emerged, in whom a reduction in MTS was associated with low scores at follow-up on some other cognitive tests, with larger ventricles and lower left thalamic brain densities, and with an increase in ventricular size over the follow-up period.

These results would seem to indicate that a reduction in scores on a simple test of memory and orientation over a period of two to four years is an important finding, and is likely to be associated with evidence of structural brain changes. This figure of 10% fits well with the expected prevalence of dementing disorders in the elderly in the community (Kay *et al*, 1964), but further follow-up would be required to assess whether this sub-group progressed to a true dementing picture.

In the original study of this group, Jacoby *et al* (1980) commented on the reciprocal relationship between cortical atrophy and memory and orientation score, suggesting that this might be evidence either of a non-progressive impairment—the benign senescent forgetfulness of Kral (1962)—or the beginnings of senile dementia. At follow-up, those designated as having more cortical atrophy were now found to have significantly larger ventricles, but did not differ from the rest on any of the cognitive tests. Contary to Kral's view, this would seem to indicate that whilst some sort of brain degeneration may progress, the cognitive abilities do not necessarily deteriorate. Indeed, the process should perhaps rather be termed benign senescent atrophy. Our data support the view that ventricular enlargement is a better indication of cognitive impairment than is cortical atrophy.

Inter-correlations of cognitive scores

It is interesting that all the cognitive scores, except the PALT, correlated well with each other. This would seem to suggest that MTS, DCT, DST and BVRT were all measuring a similar group of variables, while the PALT assessed some different skill or ability. We observed that a poor result on the PALT might be produced more by a lack of comprehension of the instructions than by memory impairment, whereas in the other four tests used here, the

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instructions to the subject were very simple. A further factor was that in the other four tests, mistakes were not usually obvious to the subject, whilst in the PALT, he was made aware of his mistakes and corrected accordingly, leading at times to increased embarrassment and to loss of concentration.

Prediction of cognition from CT scan

The finding that future cognitive impairment could not be predicted by using initial CT cut-off scores further underlines the need for caution in the use of such measures. In particular, it demonstrates that in the elderly, a single finding of large ventricles may not be an indication of a dementing process. If, however, ventricles are enlarging over time (even if they are still not excessively large), then this may well be a pointer to some organic brain disease. This confirms results found in clearly dementing patients who were re-scanned (Brinkman & Largen, 1984). Predictive attempts, using multiple regression analysis, demonstrated that variation in future cognitive abilities is determined largely by factors other than those which can be measured on a CT scan. However, in a few tests (DCT, DST, PALT), it was found that initial brain density measurements, when added together, could predict more than half of the variation in future cognitive scores. In general, brain density measurements had much greater predictive value than ventricular or cortical atrophy scores.

Changes in health and life circumstances

Almost 9% of subjects had apparently suffered a first episode of depressive illness but the criteria for admission to the study excluded any person with a previous history of depression. This depressive group had significantly larger ventricles, both initially and at follow-up, but did not have abnormalities on psychometric testing. Thus, this small group of late-onset depressives with larger ventricles would seem to bear out a number of our previous findings, including the existence of a sub-group of late-onset depressives with larger ventricles who, at follow-up, appeared to have a higher mortality rate than those with normal ventricles. We also found that ventricular enlargement was not apparently associated with a worse clinical course of depression. In the present sub-group of late onset depressives, the clinical course did not seem to be severe, since three out of the four had fully recovered at follow-up, and only one required hospitalisation. Late-onset depression was also not associated with markedly decreased cognitive abilities at follow-up. It is of interest that the ventricular enlargement appears to predate the onset of depression, which would further confirm the hypothesis, suggested by Post (1968) and by ourselves, that an ageing process facilitates the emergence of depression in late life and that ventricular enlargement is another, apparently earlier, manifestation of this. A larger prospective study would further elucidate these findings and it will be important to carry out further follow-up studies of this group.

A relationship was also found between bereavement and ventricular size at follow-up (but not initially). This is difficult to explain, and the sub-group of bereaved were not the same subjects as the sub-group of depressives. Since the recently bereaved suffer an increased mortality (Parkes *et al*, 1969), ventricular enlargement may be part of some general process in this group, but a larger study would be needed to confirm this finding.

Our results suggest two main conclusions. The first is that evidence of atrophy on a single CT scan need not indicate present or future dementia. The second is that, in a group of initially fit elderly people, there is no reason to expect a deterioration in cognitive abilities or CT scan results, unless some disease process is occurring. Our results suggest that such a disease process may be indicated by fairly subtle cognitive deterioration or by the late onset of a depressive illness, both of which seem to be associated with ventricular enlargement. Taken together, these clinical and CT changes indicate a pathological process, and are not part of normal ageing.

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References

BENTON, A. L. (1973) The revised visual retention test. Iowa City, State University of Iowa Press.

BIRD, J. M. (1982) Computerized tomography, atrophy and dementia: a review. *Progress in Neurobiology*, **19**, 91–115.

BONDAREFF, W., BALDY, R. & LEVY, R. (1981) Quantitative computed tomography in senile dementia. *Archives of General Psychiatry*, **38**, 1365–1368.

https://doi.org/10.1192/bjp.148.1.80 Published online by Cambridge University Press

BRINKMAN, S. D. & LARGEN, J. W. (1984) Changes in brain ventricular size with repeated CAT scans in suspected Alzheimer's Disease. *American Journal of Psychiatry*, **141**, 81–83.

DU BOULAY, G., FAIRBAIRN, D. & PADEN, R. S. (1978) Precise repositioning of the head for serial CT examinations. *Neuroradiology*, **16**, 625–626.

EARNEST, M. P., HEATON, R. K., WILKINSON, W. E. & MANKE, W. F. (1979) Cortical atrophy, ventricular enlargement and intellectual impairment in the aged. *Neurology*, **29**, 1138–1143.

EVANS, W. A. (1942) An encephalographic ratio for estimating enlargement and cerebral atrophy. *Archives of Neurology and Psychiatry*, **47**, 931–937.

FOX, J. H., TOPEL, J. L. & HUCKMAN, M. S. (1975) Use of computerized tomography in senile dementia. *Journal of Neurology, Neurosurgery, and Psychiatry*, **38**, 948–953.

HAUG, G. (1977) Age and sex dependence of the size of normal ventricles on computed tomography. *Neuroradiology*, **14**, 201–204.

HODKINSON, H. M. (1973) Mental impairment in the elderly. *Journal of the Royal College of Physicians of London*, **7**, 305–317.

HUCKMAN, M. S., FOX, J. & TOPEL, J. (1975) The validity of criteria for the evaluation of cerebral atrophy by computed tomography. *Radiology*, **116**, 85–92.

INGLIS, J. (1959) A paired-associate learning test for use with elderly psychiatric patients. *Journal of Mental Science*, **105**, 440–443.

JACOBY, R. J. & LEVY, R. (1980a) Computed tomography in the elderly 2. Senile dementia: diagnosis and functional impairment. *British Journal of Psychiatry*, **136**, 256–269.

—— & —— (1980b) Computed tomography in the elderly 3. Affective disorder. *British Journal of Psychiatry*, **136**, 270–275.

——, —— & DAWSON, J. M. (1980) Computed tomography in the elderly 1. The normal population. *British Journal of Psychiatry*, **136**, 249–255.

——, —— & BIRD, J. M. (1981) Computed tomography and the outcome of affective disorder: A follow-up study of elderly patients. *British Journal of Psychiatry*, **139**, 288–292.

——, DOLAN, R. J., LEVY, R. & BALDY, R. (1983) Quantitative computed tomography in elderly depressed patients. *British Journal of Psychiatry*, **143**, 124–127.

KENDRICK, D. C. (1984) Speed and learning in the diagnosis of diffuse brain damage in elderly subjects: Bayesian statistical approach. *British Journal of Social and Clinical Psychology*, **4**, 141–148.

KRAL, V. A. (1962) Senescent forgetfulness: benign and malignant. *Canadian Medical Association Journal*, **86**, 257–260.

KAY, D. W. K., BEAMISH, P. & ROTH, M. (1964) Old age mental disorders in Newcastle upon Tyne: Part I: a study of prevalence. *British Journal of Psychiatry*, **110**, 146–158.

MEESE, W., KLUGE, W., GRUMME, T. & HOPFENMULLER, W. (1980) CT evaluation of the CSF spaces of healthy persons. *Neuroradiology*, **19**, 131–136.

NAESER, M. A., GEBHARDT, C. & LEVINE, H. L. (1980) Decreased computerized tomography numbers in patients with pre-senile dementia. *Archives of Neurology*, **37**, 401–409.

NAGUIB, M. & LEVY, R. (1982a) Prediction of outcome in senile dementia: a computed tomography study. *British Journal of Psychiatry*, **140**, 263–267.

—— & —— (1982b) CT scanning in senile dementia: a follow-up of survivors. *British Journal of Psychiatry*, **141**, 618–620.

PARKES, C. M., BENJAMIN, B. & FITZGERALD, R. G. (1969) Broken heart: a statistical study of increased mortality among widowers. *British Medical Journal*, **1**, 740–743.

POST, F. (1968) The function of ageing in affective illness. In *Recent Developments in Affective Disorders* (eds. A. Coppen & A. Walk). Ashford, Kent: Headley Brothers.

ROBERTS, M. A. & CAIRD, F. I. (1976) Computerized tomography and intellectual impairment in the elderly. *Journal of Neurology, Neurosurgery and Psychiatry*, **39**, 986–989.

RON, M. A. (1983) The alcoholic brain: CT scan and psychological findings. *Psychological Medicine*, Supplement 3.

SYNEK, V. & REUBEN, J. R. (1976) The ventricular-brain ratio using planimentric measurements of EMI scans. *British Journal of Radiology*, **49**, 233–237.

——, —— & DU BOULAY, G. H. (1976) Comparing Evans index and CAT in assessing relationship of ventricular size to brain size. *Neurology*, **26**, 231–233.

WECHSLER, D. (1955) *The Wechsler Manual*. New York: The Psychological Corporation.

WILSON, R. S., FOX, J. H., HUCKMAN, M. S., BACON, L. D. & LOBICK, J. K. (1982) Computed tomography in dementia. *Neurology*, **32**, 1054–1057.

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