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The Diagnosis of Vascular Dementia in the Light of the New Criteria

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Summary

Recently new criteria for diagnosing vascular dementia (VaD) have been suggested by (a) the State of California Alzheimer's Disease Diagnostic and Treatment Centres (ADDTC), and (b) the NINDS–AIREN group after an international workshop convened by the National Institute for Neurological Disorders and Stroke (NINDS), with support from the Association Internationale pour la Recherche et l'Enseignement en Neurosciences (AIREN). We have retrospectively applied the new criteria to two groups of patients who are thought by us to be suffering from VaD. The first group (20 patients) had a raised Hachinski Ischaemic Score, i.e. 7 or more (mean HIS = 9.5), and a second group (20 patients) with an HIS between 4 and 6 points (mean HIS = 4.9).

In group 1, 19 patients fulfilled the ADDTC criteria for probable or possible VaD, compared with 16 patients who fulfilled the NINDS–AIREN criteria. In group 2, 11 patients fulfilled the ADDTC criteria for probable or possible VaD, compared with only five patients who fulfilled the NINDS–AIREN criteria. This suggests that the ADDTC criteria may be more sensitive than the NINDS–AIREN criteria and the HIS. However, post-mortem validation studies of the new criteria are needed to determine if the improved sensitivity of the ADDTC criteria is at the expense of their specificity.

Introduction

The exact incidence of Vascular dementia (VaD) is unknown since the diagnosis has been based on different diagnostic criteria in different epidemiological studies. VaD, however, is considered by many to be the second commonest cause of dementia in the western world, after Alzheimer's disease, although some authorities believe that Senile Dementia of Lewy body type may challenge this concept [1, 2]. A recent study has even suggested that vascular dementia occurs more frequently than Alzheimer's Disease in those aged 85 years and over [3]. The high prevalence and incidence of VaD is important as, unlike Alzheimer's disease, it is potentially preventable, especially in its early stages [4, 5].

Traditionally, the diagnosis has often been made using the Hachinski ischaemic scale (HIS), or the DSM III R criteria of the American Psychiatric Association [6, 7]. Neither of these two methods is satisfactory, and many doctors still use a clinical assessment of the patient rather than a cut-off score on the ischaemic scale or the DSM criteria for diagnosing VaD. The Hachinski ischaemic scale is more useful in excluding VaD at a low score, while a high score fails to differentiate between VAD and the coexistence of vascular and degenerative dementia [8, 9]. The DSM III R has not been validated and is considered by many to be very subjective [10].

The need for reliable and up-to-date criteria, similar to the successful McKhann's criteria for diagnosing Alzheimer's disease, was therefore widely recognized [11]. In 1992 Chui *et al.* [12] proposed the State of California Alzheimer's Disease Diagnostic and Treatment Centres (ADDTC) criteria for diagnosing VaD, which were soon followed in 1993 by the NINDS–AIREN criteria, proposed at an international workshop convened by the National Institute for Neurological Disorders and Strokes (NINDS), with support from the Association Internationale pour la Recherche et l'Enseignement en Neurosciences (AIREN) [13]. Both sets of criteria are summarized in Table I. Although these new criteria are very welcome, they will need to be tested clinically and validated pathologically before we regard them as being successful.

We aimed to discover: (a) how the new criteria compare with the HIS; and (b) if there are any practical problems in applying them. In order to do so we retrospectively applied both new sets of criteria to two groups of patients. The first group (20 patients) had a raised HIS (7 or more) and were considered highly likely to have VaD. The second group (20 patients) had an HIS between 4 and 6 points and although VaD was considered to be the most likely cause for their cognitive impairment, the diagnosis was less secure than in group 1 patients.

Methods

Patients seen in our Memory Disorders Clinic are usually

Table I. Summary of the main ADDTC and NINDS-AIREN criteria

	The ADDTC criteria	The NINDS-AIREN criteria
Dementia definition	Deterioration from a known level of intellectual function sufficient to interfere with the patient's customary affairs of life, and which is not isolated to a single category of intellectual performance	Impairment of memory plus at least two other areas of cognitive domains, which should be severe enough to interfere with activities of daily living and not due to physical effects of stroke alone
Probable VaD	Requires all the following: 1. Dementia 2. Evidence of two or more strokes by history, neurological signs, and/or neuroimaging, or a single stroke with a clear temporal relationship to the onset of dementia 3. Evidence of at least one infarct outside the cerebellum by CT or T1-weighted MRI	Requires all the following: 1. Dementia 2. Cerebrovascular disease: focal signs on examination + evidence of relevant CVD by brain imaging (CT/MRI) 3. A relationship between the above two disorders, manifested by one or more of the following: (a) dementia onset within 3 months of a stroke (b) abrupt deterioration in cognitive functions, or fluctuating stepwise course
Possible VaD	1. Dementia and one or more of the following: 2a. History or evidence of a single stroke without a clear temporal relationship to dementia onset or 2b. Binswanger's disease that includes all the following: (i) early onset of urinary incontinence or gait disturbance; (ii) vascular risk factors; (iii) extensive white mater changes on neuroimaging.	May be made in the presence of dementia and focal neurological signs in patients with: 1. No evidence of CVD on neuroimaging; or 2. In the absence of clear temporal relationship between stroke and dementia; or 3. In patients with subtle onset and variable course of cognitive deficit and evidence of CVD.

referred by their general practitioners for investigation, diagnosis and treatment (when possible) of their cognitive impairment. We have retrieved the case notes of the last 20 patients on our computer records with a diagnosis of VaD and an HIS greater than 6, together with a further 20 patients with an HIS of 4, 5, or 6 points. All the patients had a definite intellectual deterioration from a known or estimated prior level of intellectual function. This was enough to interfere with daily activities and was not limited to one cognitive domain. All information is entered in the clinic's database, and the new criteria were applied retrospectively to the cases studied.

One investigator (K.A.) extracted the information from the case notes and verified the HIS on all patients. Two investigators (K.A. and G.W.) retrospectively interpreted and applied the new criteria to all the patients. Information available to the investigators included; exact history of cognitive impairment, findings on examination, psychometric assessment, laboratory results and neuroimaging reports.

Patients referred to our memory Disorders Clinic are assessed with a history from the patient and carers, examination including cardiovascular and neurological examination, and assessment with a neuropsychological test battery, testing; attention and concentration (digit span forward and backward), memory (story recall and visual recognition), language (Frenchay aphasia test and FAS fluency test, concept formation (comparisons and differences) and logical relationships (groups–examples–opposites–categories), speed (Kendrick digit copying test), and visuospatial skills (cube analysis) [14–19]. The reader is referred to the references for the cut-off point on these tests, and their mode of application.

All patients are investigated with a laboratory dementia screen as well as a brain CT and, where appropriate, an MRI and/or SPECT scan, EEG and psychiatric assessment. Diagnosis is made after reviewing the information on each subject (including the HIS) in a case conference which involves at least two physicians with considerable experience in dementia, a psychiatrist and several psychologists working in this field.

Results

Table II lists the demographic characteristics of both groups of patients (group 1 = patients with raised HIS, and group 2 = patients with an HIS of 4–6). As can be seen, the mean age for all patients is 75.8 years but the age range is from 50 years to 88 years. There was no significant difference in the Mini Mental State Examination (MMSE) score between the two groups. MMSE varied from 10 to 26 points in group 1 (mean = 19.2), and from 7 to 26 points in group 2 (mean = 19.8). Mean MMSE score for all the patients was 19.5 points.

On applying the ADDTC criteria to group 1 patients, eight patients fulfilled a diagnosis of probable VaD, and 11 patients a diagnosis of possible VaD. Applying the NINDS–AIREN criteria to the same group showed that eight patients fulfilled the criteria for probable VaD, and a further eight patients possible VaD (Table III).

Table II. Demographic features of the patients

	All patients	Group 1	Group 2
Number	40	20	20
Mean age (years)	75.8	75.3	76.4
Men/Women	18/22	10/10	8/12
Mean MMSE	19.5	19.2	19.8

When the ADDTC criteria were applied to group 2 patients, four patients fulfilled the criteria of probable VaD and seven patients for possible VaD. Applying the NINDS–AIREN criteria to these patients resulted in only one patient being classified as suffering from probable VaD, and four patients as possible VaD.

Discussion

It would have been ideal to try to validate the new criteria using post-mortem diagnosis as standard, but this was not possible in our study. Our purpose was not to validate the new criteria, but to test their application from a clinical and practical viewpoint and to compare them with the Hachinski Ischaemic Scale.

In group 1 patients (patients who are likely to be suffering from VaD), more patients fulfilled the ADDTC criteria than the NINDS–AIREN's for VaD. The difference was due to three patients fulfilling the ADDTC criteria for possible VaD but not the NINDS–AIREN criteria.

One of those three patients had a clear history of a small stroke (transient hemiparesis) which was completely resolved by the time of his referral with no remaining focal neurological signs on examination and a negative CT scan. It is debatable whether this is the cause of this patient's cognitive impairment since there was no clear temporal connection between the stroke and the onset of dementia. Such history however is absent in most patients with VaD (in our sample, a clear temporal connection was present in only four patients in group 1 and one patient in group 2).

Table III. Number of patients fulfilling a diagnosis of VaD in each group

	Group 1 (n=20) HIS ⩾ 7	Group 2 (n=20) HIS 4–7
ADDTC criteria		
Probable VaD	8	4
Possible VaD	11	7
Possible or probable VaD	19	11
NINDS–AIREN criteria		
Probable VaD	8	1
Possible VaD	8	4
Probable or possible VaD	16	5

The other two patients did not fulfil the diagnosis of dementia according to the NINDS–AIREN criteria, which requires the presence of memory loss together with at least two other areas of cognitive domain impairment, since both patients had in total only two areas of cognition involved. The ADDTC criteria in comparison requires 'a deterioration from a known or estimated level of intellectual function which is enough to interfere with the conduct of the patient's customary affairs of daily life, which is not limited to a single narrow category of intellectual performance'. The ADDTC definition of dementia is therefore more flexible and probably more suited to vascular dementia which frequently involves fewer areas of cognition than occurs in Alzheimer's disease. When Lopez *et al.* examined the inter-observer reliability of the NINDS–AIREN criteria, they detected a similar problem with one of their patients who was misdiagnosed as VaD (in spite of only two areas of cognition affected) by all the raters who used their clinical judgement rather than following the criteria [20]. This variability in interpretation of the NINDS–AIREN criteria between the two studies presents a potential source of misdiagnosis.

Overall a diagnosis of probable or possible VaD was made in 95% of group 1 patients using the ADDTC criteria, and in 80% of patients using the NINDS–AIREN criteria, suggesting that the ADDTC criteria are more sensitive than the NINDS–AIREN criteria although not necessarily specific.

In group 2 patients (patients with an HIS of 4, 5, or 6 points) the diagnosis of VaD was based on a clinical judgement rather than a cut-off point on the HIS or the DSM criteria and is therefore less certain. In this group also, more patients fulfilled the ADDTC criteria for probable and possible VaD (11 patients), than the NINDS–AIREN criteria (five patients). The difference here between the two sets of criteria was due to six patients who fulfilled the ADDTC criteria for probable (three patients) and possible VaD (three patients), but not the NINDS–AIREN's.

As in the first group, two patients did not fulfil the NINDS–AIREN's definition of dementia because both patients had only a total of two areas of cognitive domain involvement. The other four patients had evidence of previous infarction on neuroimaging but no focal neurological signs on examination, which could imply that their strokes were small and not large enough to result in a detectable neurological deficit. One of these four patients had a history of stroke with a clear temporal connection to the onset of dementia, in spite of the lack of abnormal neurological signs. The three other patients had a strong evidence of subcortical vascular disease on neuroimaging in the form of lacunar infarction or leukoaraiosis or both.

It is possible that some of the patients had focal neurological signs that were missed by the physician assessing the patient, although both lacunar infarcts and leukoaraiosis in particular can be present and only result in subtle or no focal neurological signs [21].

The difficulty in diagnosing VaD in patients with

subcortical vascular disease is evident from the fact that such patients can have an insidious onset and progressive course of cognitive impairment (which together with the absence of focal neurological signs would account for their low HIS) [22]. Although significant cognitive impairment can undoubtedly result from subcortical vascular disease, the common occurrence of subcortical changes, especially leukoaraiosis, in degenerative dementia and their occurrence in apparently normal elderly subjects makes it difficult to determine whether they are the cause of cognitive impairment, a contributory factor, or simply a coincidental finding [23, 24]. The presence of dominant subcortical features on neuropsychological assessment (slowness of thought and motor response, impaired concentration, apathy, and the lack of alternative strategies in dealing with problems) in two of those three patients would suggest an important role for subcortical vascular damage in causing their cognitive impairment. It remains to be seen however if the ADDTC criteria are more useful in making the diagnosis in these patients.

It is clear from the results of both groups that a raised HIS is very likely to be associated with a diagnosis of VaD using either the new criteria or a clinical impression. As can be seen in group 2, a reduced HIS (between 4 and 6) however could not be used to exclude VaD. As to the individual items of the HIS, the presence of a history of stroke, focal neurological symptoms and signs were associated more with a diagnosis of VaD using the new criteria in group 2 patients. The HIS is therefore not sensitive enough and the different interpretation of its items by different raters can be a source of considerable confusion [25, 26].

Neuroimaging (CT or MRI) is now widely regarded as essential in making an accurate diagnosis of dementia. Negative findings on neuroimaging would make the diagnosis of VaD unlikely but not impossible as can be seen from group 1 where seven patients had negative neuroimaging yet all had good clinical evidence of cerebrovascular disease (history of a stroke and/or focal neurological symptoms and signs).

Both the ADDTC and NINDS–AIREN criteria are rather similar to the HIS in that they focus on the infarction concept of VaD, although it is possible that other mechanisms such as white matter ischaemia could be more important and common in causing VaD. Although the NINDS–AIREN criteria do recognize significant white matter disease as evidence of cerebrovascular disease on neuroimaging, the essential requirement of focal neurological signs on examination means that those patients must also have a stroke.

How do these findings affect our present diagnoses, based on clinical consensus? We believe that applying one standard, validated and reproducible set of criteria would be preferable. The HIS, however, cannot be replied upon by itself since a low score is compatible with a diagnosis of VaD in some patients, and the routine application of the ADDTC or the NINDS–AIREN criteria will have to await post-mortem validation studies. In the meantime, although the HIS, or one of the more recent protocols, may be used, especially in research studies, in routine clinical practice the common-sense application of the principles inherent in such scales is, in our view, acceptable.

In conclusion, our study shows that although a raised HIS is very likely to be present in VaD, we cannot simply rely on the HIS for excluding VaD at a lower score. The ADDTC criteria are more sensitive than both the HIS and the NINDS–AIREN criteria but histopathological validation is needed to determine specificity. The NINDS–AIREN criteria are too rigid in their current form and will need some clarification and probably modification.

Finally, the NINDS–AIREN criteria have already been criticized for being introduced prematurely, before we know enough about VaD (such as the exact threshold of volume loss or tissue damage needed before dementia develops and the exact role of leukoaraiosis and chronic ischaemia in causing VaD) [10]. We however believe that we should not ignore what we have already learnt about VaD, and that we should always aim to improve and refine our diagnostic methods and continue to benefit from the knowledge gained.

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