Clinical Radiology xxx (2017) 1–8

Contents lists available at ScienceDirect

Clinical Radiology

journal homepage: www.clinicalradiologyonline.net

Association of imaging abnormalities of the subcallosal septal area with Alzheimer's disease and mild cognitive impairment

C.L. Gan [a,*], M.J. O'Sullivan [b,c], C. Metzler-Baddeley [b], S. Halpin [a]

[a] Department of Neuroradiology, University Hospital of Wales, Cardiff, UK
[b] Cardiff University Brain Research Imaging Centre, School of Psychology, Cardiff, UK
[c] Department of Clinical Neuroscience, Institute of Psychiatry, King's College London, London, UK

ARTICLE INFORMATION

Article history:
Received 4 January 2017
Accepted 12 April 2017

AIM: To evaluate the use the distance between the adjacent septal nuclei as a surrogate marker of septal area atrophy seen in Alzheimer's disease (AD).

MATERIALS & METHODS: Interseptal distance (ISD) was measured, blind to clinical details, in 250 patients who underwent computed tomography (CT) of the brain at University Hospital of Wales. Clinical details including memory problem history were retrieved. An ISD cut-off value that discriminated those with and without memory symptoms was sought. ISD measurements were also made in 20 AD patients. To test both the method and the defined cut-off, measurements were then made in an independent cohort of 21 mild cognitive impairment (MCI) patients and 45 age-matched healthy controls, in a randomised and blinded fashion.

RESULTS: ISD measurement was achieved in all patients. In 28 patients with memory symptoms, the mean ISD was 5.9 mm compared with 2.3 mm in those without overt symptoms (p=0.001). The optimum ISD cut-off value was 4 mm (sensitivity 85.7% and specificity 85.8%). All AD patients had an ISD of >4 mm (mean ISD= 6.1 mm). The mean ISD for MCI patients was 3.84 mm compared with 2.18 mm in age-matched healthy controls (p=0.001). Using a 4 mm cut-off correctly categorised 10 mild cognitive impairment patients (47.6%) and 38 healthy controls (84.4%).

CONCLUSION: ISD is a simple and reliable surrogate measurement for septal area atrophy, applicable to CT and magnetic resonance imaging (MRI). It can be used to help select patients for further investigation.

© 2017 Published by Elsevier Ltd on behalf of The Royal College of Radiologists.

Introduction

Alzheimer's disease (AD) is the commonest cause of dementia and it affects around 5.4 million people in the US.[1] Patients typically present with progressive memory impairment and involvement of other cognitive domains or skills, which impair social function and activities of daily living.[2] The diagnosis of AD is often difficult especially near the onset of symptoms. Recent diagnostic guidelines have

DOI of original article: http://dx.doi.org/10.1016/j.crad.2017.06.119.
* Guarantor and correspondent: C. L. Gan, Department of Neuroradiology, University Hospital of Wales, Cardiff, UK. Tel.: +44 02921848653; fax: +44 02920743357.
E-mail address: cheelingan@yahoo.com (C.L. Gan).

http://dx.doi.org/10.1016/j.crad.2017.04.021
0009-9260/© 2017 Published by Elsevier Ltd on behalf of The Royal College of Radiologists.

Please cite this article in press as: Gan CL, et al., Association of imaging abnormalities of the subcallosal septal area with Alzheimer's disease and mild cognitive impairment, Clinical Radiology (2017), http://dx.doi.org/10.1016/j.crad.2017.04.021

attempted to integrate neuroimaging and other biomarkers. The majority of the neuroimaging research in AD has centred around mesial temporal lobe atrophy, which shows volume loss in hippocampi, amygdala, entorhinal cortex, and posterior cingulate cortex[3–6]; however, none of these markers are straightforward to measure and evaluate and many are suitable only for magnetic resonance imaging (MRI). Very few studies have focused on the subcallosal grey matter in relation to AD despite the fact that atrophy of this region occurs early and is just as characteristic of AD.[7]

Although the imaging diagnosis for AD is difficult, various studies have shown that hippocampal or mesial temporal lobe atrophy can be quantified by volumetric MRI[5,6] or visual rating methods[8,9]; however, volumetric MRI requires rigorous standards for image acquisition and analysis and is not suitable for routine clinical use. Thus far, visual rating methods for measurement have been found to be relatively insensitive for identifying mild AD or mild cognitive impairment (MCI) and often introduce problems of reliability especially when protocols are complex. An increased cella media index has also been described in AD patients, but is relatively non-specific and greatly influenced by the general atrophy state of the brain.[10]

It has been the authors' clinical experience that atrophy of the septal nuclei can commonly be seen in conditions associated with hippocampal atrophy, principally in AD, but also following head injury or in chronic alcohol excess. It was hypothesised that a widening of the interseptal distance (ISD), defined as the minimal distance between the nuclei of each hemisphere, could act as a surrogate marker for atrophy within core regions implicated in AD and other memory disorders. This distance can be measured accurately and easily on axial computed tomography (CT) or MRI at the level of AC-PC (anterior commissure to posterior commissure) line, as the distance between the medial convexities of the septal nuclei, posterior to the anterior cerebral arteries (Fig 1). It was hypothesised that by simple measurement of the ISD, patients with memory disorders can be differentiated from the normal population, so that it can be used as a simple but useful screening tool for AD.

Materials and methods

Assessment of normal variation of ISD within an unselected hospital population

To observe the distribution of the ISD within a general population, the ISDs in 250 consecutive patients who had undergone CT of the brain were measured. The CT brain protocol included axial imaging using a GE 750 Discover HD (General Electric Healthcare Milwaukee, IL, USA) 64-slice multidetector CT system of 2.5 mm sections from foramen magnum to vertex (120 kV and 265 mA; 32 cm field of view [FOV]; allowing for a maximum of 2.3 noise factor; 860 mGy average dose). The CT examinations were requested either by general practitioners or hospital doctors for a variety of indications, but not specifically for the diagnosis of memory disorder. All patients' identifiable details were anonymised. Patients with intracranial mass lesions, large infarcts including the middle cerebral artery territory, and a history of neurosurgery that might affect the ISD were excluded. The measurements were done independently by an experienced neuroradiologist and a radiology trainee. Details recorded from the request forms including patient's age, any known diagnosis of AD, dementia, MCI, history of confusion or chronic memory problems as well as excess alcohol use were then recorded after blinded measurement of the ISD of these patients.

The measurements were then compared between the two for reproducibility analysis by using the analysis of variance method (ANOVA). Both inter-rater coefficient of variation and an intraclass correlation coefficient were calculated. The statistics were performed using the software, SPSS 17.0 (SPSS, Chicago, IL, USA).

Using the measurements done by the neuroradiologist, the range and mean of the ISD for patients with known AD,

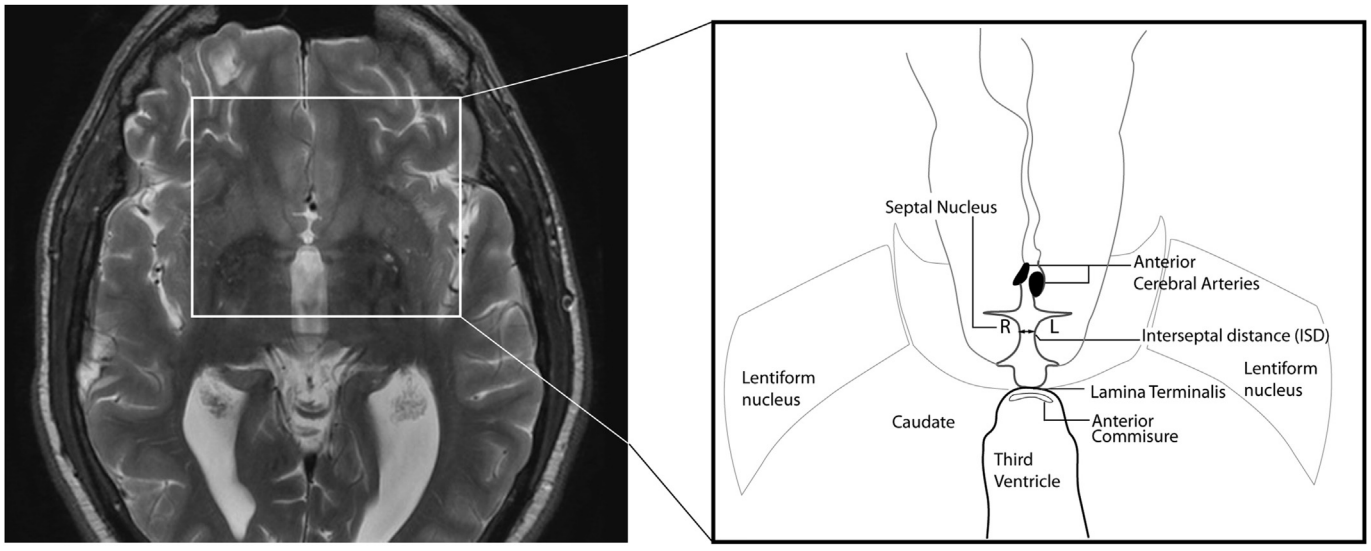

Figure 1 Axial T2-weighted image of an adult brain demonstrating anatomical landmarks for ISD measurement.

Please cite this article in press as: Gan CL, et al., Association of imaging abnormalities of the subcallosal septal area with Alzheimer's disease and mild cognitive impairment, Clinical Radiology (2017), http://dx.doi.org/10.1016/j.crad.2017.04.021

Download English Version:

https://daneshyari.com/en/article/5700338

Download Persian Version:

https://daneshyari.com/article/5700338

Daneshyari.com