

A RETROSPECTIVE STUDY OF THE USE OF NEUROIMAGING IN THE ASSESSMENT OF DEMENTIA IN ADULTS WITH LEARNING DISABILITY

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Introduction

The association between Down syndrome and Alzheimer's diseases is well noted in the literature (Holland *et al.*, 2000; Holland, 2000; Zigman *et al.*, 1997). There is also a high prevalence of dementia in people with learning disability in general (Cooper, 1997). Clinicians face a number of challenges in establishing the diagnosis of dementia in people with learning disability. Atypical presentation and unreliability of a direct cognitive assessment make the diagnosis difficult. Diagnosis of dementia is therefore based on a longitudinal picture of progressive deterioration of skills. A report of an international work group (Report of the AAMR-IASSID workgroup 1995) emphasised the need to observe a well-documented progression of symptoms substantiated by appropriate clinical test results. Neuroimaging is mentioned as one of the useful investigations in this context.

The three main reasons for using neuroimaging in dementia are detection of

treatable/reversible causes of deterioration, cerebrovascular disease and finally atrophic change (Frisoni, 2001). The use of neuroimaging for the first reason has been evaluated in people without learning disability (Gifford *et al.*, 2000). Since the actual prevalence of such reversible causes identified using neuroimaging is low (Clarfield, 1999; Hejl *et al.*, 2002), guidelines have been developed to identify patients who are more likely to benefit from neuroimaging (Dietch, 1983; Royal College of Psychiatrists, 1995). Usefulness of such clinical prediction rules in people without learning disability has been studied (Fielding, 2005, Gifford *et al.*, 2000). Use of neuroimaging in the assessment of dementia in people with learning disability however remains largely unexplored.

Although none of the neuroimaging findings is regarded as an absolute diagnostic marker of dementia, there is an increasing reliance on neuroimaging to diagnose and classify dementia (O'Brien and Barber, 2000). Presence of

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multiple infarcts is one of the criteria for the diagnosis of vascular dementia and identification of medial temporal atrophy plays an important role in early diagnosis of Alzheimer's disease (Lee *et al.*, 2003; Lehtovirta *et al.*, 1996; O'Brien *et al.*, 1996). A similar use of neuroimaging, as an aid for the diagnosis and classification of dementia, in people with learning disability however raises a number of issues. There is a high prevalence of abnormal scan results in people with learning disabilities in general. An average prevalence of 30-60% in unselected patients with learning disability was reported in a review (Deb *et al.*, 1997). Both volumetric and non-volumetric studies have revealed reduction in size of frontal cortex, cerebellar volume and hippocampus in people with Down syndrome (Aylward *et al.*, 1997). Lack of normative data is therefore a problem in interpreting the clinical significance of the scan findings (Kates *et al.*, 1997).

A number of studies using volumetric analysis explored the usefulness of neuroimaging in the assessment of dementia in learning disability (Aylward *et al.*, 1997; Prasher *et al.*, 1996). A review on the use of magnetic resonance imaging in the diagnosis of dementia in people with Down syndrome highlighted its potential (Strydom *et al.*, 2002). However its use in clinical practice remains largely unexplored.

Aims and Method

Aim of this retrospective study is to explore the use of neuroimaging in the assessment of dementia in adults with learning disability. This includes indications for the scan, practical issues in undertaking the scan, abnormal findings revealed by the scan and the clinical

usefulness of these abnormal findings. The information then can be used for developing guidelines for the use of neuroimaging in this population.

Leicestershire Learning Disability services cover the whole of Leicestershire and Rutland, UK, with a population of approximately 900,000. The Psychiatry of Learning Disability service based at Leicester Frith Hospital has an active caseload of approximately 1200. All patients with a clinical diagnosis of dementia referred for Computed Tomographic (CT) scans or Magnetic Resonance Imaging (MRI) scans from this service in a two-year period (between years 2000 and 2002) were included. Ethical approval was obtained from the local ethics committee. Information was collected from the psychiatric case notes and the scan referral forms in a systematic way using a semi-structured proforma. This included information on socio-demographic details (age, sex, and place of residence), clinical features (degree of learning disability, cause of learning disability, diagnosis, presence of epilepsy, and presence of neurological symptoms), type of the scan undertaken, and the result of the scan.

Results

Thirty-three people had scans (MRI or CT scan) for the assessment of dementia in the two-year period. It is not always possible to establish the presence of cognitive impairment in people with learning disability. Diagnosis of dementia is considered when there is a general deterioration of skills, in the absence of other obvious psychiatric or physical problems that can justify the deterioration. All the individuals in this group had deterioration of skills in more than one areas

of functioning for six months or more and a clinical diagnosis of dementia. The areas affected include communication, general living skills; interpersonal skills, ability to take care of personal hygiene etc. Mean age of the group is 53.8 (SD=10.696; range 33 years to 78 years). Further information is given in TABLE I.

We then used information collected from case notes and the scan referral forms to find out if there were any additional indications for a scan other than the diagnosis of dementia. The following two groups of symptoms / signs emerged from the information.

1. Recent onset of seizures
2. Presence of neurological symptoms or signs

On the whole, 16 people (49%) had an additional indication (onset of seizures or another neurological symptom). Ten people had a neurological symptom, 3 people had late onset seizures and another 3 people had both. The neurological symptoms included sudden onset of gait disturbances, dysarthria and weakness of limbs. For the rest of the sample (17 people), no such additional indications could be identified from the records.

Neuroimaging

A scan was completed for 28 people. This includes 10 people who had a CT scan and 18 people who had a MRI scan. Twelve people required medications (diazepam or lorazepam) before the procedure to reduce the anxiety and agitation. The actual number of people who received the oral sedation may be higher than 12 as the data is collected retrospectively from psychiatric notes. Experience of the authors suggests that some of the patients required more than one appointment. However the actual number of people who required this is difficult to estimate. Normally when a person is not cooperative with the procedure, oral sedation is tried after consultation with the carers and other professionals such as community nurses. When this fails, a discussion between the radiology and psychiatry team would explore the need for a scan under general anaesthesia. Only one person however had a scan under general anaesthesia in this group. This person with severe learning disability and autism had a sudden onset of gait disturbance in addition to the general deterioration. A scan could not be completed for 5 people (15%). All of them had severe learning disability.

TABLE I
Characteristics of adults with learning disability and dementia, referred for neuroimaging

| Total number | | 33 |
|------------------------------------|--------------------|------------|
| Gender | Male | 22 (67%) |
| | Female | 11 (33%) |
| Degree of Learning Disability (LD) | Mild LD | 6 (18%) |
| | Moderate/Severe LD | 27 (82%) |
| Primary cause of LD | Down syndrome | 16 (48.5%) |
| | Other causes | 1 (3%) |
| | Cause unknown | 16 (48.5%) |

Scan Findings

An abnormal finding in the scan was reported in 15 people (54%). The commonest abnormality however was general atrophy of the brain (12 people). Eleven out of 12 people with general atrophy had moderate or severe learning disability. Medial temporal atrophy was noted in seven people. While in six people the medial temporal atrophy was associated with general atrophy, one person had medial temporal atrophy alone. Medial temporal atrophy, however, is mainly a finding from MRI scans. Sixteen people with Down syndrome had a scan for the assessment of dementia. Fifteen people from this group had the scan completed. A comparison between those with Down syndrome and others are given in Table II.

Two people had clinically significant lesions (changing diagnosis and or management). This included evidence of multiple vascular lesions (1 person)

and evidence of normal pressure hydrocephalus (1 person). The person with normal pressure hydrocephalus was referred to the neurosurgeon for shunt surgery and the person with the infarct, had the diagnosis revised to vascular dementia (leading to a change in the medication regime). Both these findings therefore had an impact on management.

Discussion

Despite a number of practical difficulties, neuroimaging was completed successfully in the majority of cases. While oral sedation has been used for nearly one third of the sample, only one person had a scan under general anaesthesia. Some of the patients required more than one appointment, as they were not cooperative in the initial attempt. A good working relationship with the neuroradiology

TABLE II
Comparison between Down syndrome with dementia, and learning disability due to other/unknown causes with dementia

| Variable | | Down syndrome n = 16 | Other causes/ Unknown n = 17 |
|---|-------------------------------|-------------------------|------------------------------------|
| Gender | Male | 12 | 10 |
| | Female | 4 | 7 |
| Degree of Learning Disability | Mild | 0 | 6 |
| | Moderate/Severe | 16 | 11 |
| Presence of additional indications for scan | Seizure | 4 | 2 |
| | Neurological symptoms | 7 | 6 |
| Type of scan undertaken | People who had CT scan | 4 | 6 |
| | People who had MRI scan | 11 | 7 |
| Total number of completed scans | | 15 | 13 |
| Scan findings | General atrophy | 9 | 3 |
| | Medial temporal atrophy | 6 | 1 |
| | Clinically significant lesion | 0 | 2 |

department was helpful in achieving this. In 15% of the sample a scan could not be completed in spite of these measures. All of these individuals had severe learning disability. The consultants who initiated the referral in these situations made the decision that it was not in the best interest of the patient to undertake the scan under general anaesthesia.

The traditional use of neuroimaging in dementia is to rule out potentially reversible conditions. For neuroimaging to be directly useful in the management, identification of these abnormalities should lead to an appropriate surgical treatment. If we define the usefulness of neuroimaging by this standard, there is only one patient in this sample (normal pressure hydrocephalus) where a referral for a surgical treatment has been made following the findings from the scan. However if we take a broader view, radiological evidence of vascular lesions in another person have also contributed to the overall management. This includes a change in the management strategy (evidence of an infarct leading to careful evaluation of cerebro-vascular risk and use of appropriate medications to reduce it) and a better understanding of the prognosis. If we define the yield of a scan by the impact on management in general, 7% of the total sample had clinically significant findings in the scan. Both these findings are similar to the results from studies of the population without learning disability (Gifford *et al.*, 2000).

In this study we have identified mainly two groups of symptoms, which are likely to point to a clinically significant lesion. These are onset of seizures and other neurological symptoms. There were 16 people with onset of seizures or other neurological symptoms but only two had clinically significant lesions. Both patients with the clinically significant lesions had

other neurological symptoms (ataxia / loss of balance and weakness of one leg in one person and gait disturbance in the other). Although the neurological symptoms such as weakness of limbs or gait disturbances are seen in the later stage of dementia, presence of these in the beginning of dementia should prompt the clinician to do further neurological evaluation including neuroimaging. None of the individuals with seizure as an additional indication for a scan however had a clinically significant lesion.

In our sample (28 people with dementia), 12 people had radiological evidence of general atrophy. General reduction in brain volume however is a non-specific finding reported across most of the syndromes in learning disability (Deb, 1997) and therefore unlikely to be a reliable indicator of dementia. Seven people had medial temporal atrophy in this sample. Medial temporal atrophy was predominantly a finding from the group of Down syndrome and dementia. Studies using volumetric analysis have revealed that medial temporal atrophy in people with Down syndrome and dementia can be identified despite the pre-existing abnormalities (Aylward *et al.*, 1999). There is evidence from some case reports that the changes noted in the MRI correlate well with clinical findings of people with Down syndrome and dementia (Prasher *et al.*, 1996). However, only less than half of the sample with Down syndrome and dementia in our study had medial temporal atrophy. It may be possible however that a proportion of these people had cognitive deterioration due to causes other than dementia, as the diagnosis of dementia is particularly an issue in people with learning disability. However this needs to be established using studies with prospective designs.

Overall, this study shows a low

prevalence of structural lesions other than brain atrophy in people with learning disability and dementia. Presence of general atrophy in itself has not contributed to the diagnosis of dementia. There is however a potential role for medial temporal atrophy associated with general atrophy in the diagnosis of dementia in people with Down syndrome. Although there are methodological limitations such as the lack of clarity on indications for the scan and difficulty in interpreting some of the abnormal findings revealed, neuroimaging should continue to be used in the assessment of dementia. In view of the low prevalence of reversible/treatable lesions and the practical difficulties in undertaking scans, it is important to have guidelines to help clinicians use neuroimaging effectively. The guidelines available for people without learning disability suggest the use of neuroimaging when dementia is associated with a younger age of onset, atypical presentation, neurological symptoms or signs or duration of less than a year (Gifford *et al.*, 2000; Royal College of Psychiatrists, 1995). We explored whether these principles could be applied in people with learning disability as well. People with Down syndrome are likely to develop dementia at an earlier age than the general population (Franceschi *et al.*, 1990). Younger age of onset therefore is unlikely to be a reliable predictor of reversible / treatable brain lesions. As the presentation of dementia in people with learning disability is largely atypical, this can't be used as an indication for a scan either. While the onset of seizure was not found to be a useful indication for a scan in this sample, presence of other neurological symptoms such as gait disturbance in the early stage of dementia could be used to identify reversible / treatable brain lesions. It should be emphasised however that

further evidence is required before clear guidelines can be developed.

Summary

There is very little evidence from the literature on the use or yield of computerised tomographic (CT) or magnetic resonance imaging (MRI) scans in the assessment of dementia in people with learning disability. Practical difficulties in undertaking scans and lack of clear guidelines limit the use of scans in this population. This retrospective study explores the clinical usefulness of neuroimaging for the assessment of dementia in people with learning disability.

Thirty-three adults with learning disability were referred for neuroimaging for the assessment of dementia in the two-year period. While half of the sample had a scan in the context of late onset seizures or neurological symptoms to rule out reversible / treatable brain lesions, scan was undertaken in the other half possibly as an aid in establishing the diagnosis of dementia. A scan was successfully completed in 85% of the sample. Multiple appointments and use of oral sedation were necessary for some individuals. Although half of the sample had an abnormality in the scan, only two people (7%) had lesions that changed the management plan. The low prevalence of reversible / treatable lesions is consistent with the findings from studies conducted in the population without learning disability. The low prevalence of reversible / treatable brain lesions revealed by the scan, uncertainty regarding the clinical usefulness of the general atrophy in the diagnosis of dementia and the practical difficulties in undertaking a scan point to the need

for establishing guidelines in the use of neuroimaging. Factors like age of onset and atypical presentation as highlighted in the guideline for those without learning disability are unlikely to be helpful in the population with learning disability. The presence of neurological symptoms in the early stages of dementia appears to be a fairly sensitive indicator of structural lesions other than atrophy. General atrophy, the commonest abnormality noted in the scan is unlikely to be useful in a population with moderate or severe LD. Medial temporal atrophy especially in people with Down syndrome and dementia however needs further research attention. Further studies with prospective design and information on the impact of scan findings on the management, course and outcome of dementia is required before guidelines for neuroimaging specific to people with learning disability and dementia can be developed.

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