An audit of dementia MRI reporting standards in a district general hospital in the UK

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Authors: D. I. Wilkinson\textsuperscript{1}, P. Janousek\textsuperscript{2}; \textsuperscript{1}Manchester/UK, \textsuperscript{2}Bury/UK
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Aims and objectives

Introduction

Dementia is a significant problem for our ageing population and places a large burden on health and social care services worldwide (1). Magnetic resonance imaging (MRI) of the brain can assist the clinician with the differential diagnosis, grading and categorising of dementia (2). As such it is recommended as a first line imaging investigation by both the British National Institute for Clinical Excellence (NICE) and the European Federation of Neurological Sciences (EFNS) (3,4).

Referring clinicians in our hospital recently asked radiologists to standardise and improve the reporting of MRI brain scans for patients with dementia. In response to this, an email was sent out by the radiology clinical director to all radiologists with a set of guidelines for which radiological features should be commented on in the report. The inclusion of Fazekas scoring, cerebral atrophy, microhaemorrhages and a conclusion were all highlighted as important components to these reports (5,6,7). Examples of these can be seen in Figure 1.

We performed an audit to examine the content of dementia MRI brain scan reports before and after this email.

Aims and objectives

The aims of this audit were to find out:

1) Are dementia MRI brain reports including the specific criteria recommended in the email?

2) Does circulating an email to radiologists improve adherence to these criteria?
Images for this section:

A: T2 Coronal FLAIR image showing deep and periventricular white matter hyperintensities (arrows)
B: T1 Coronal section showing moderately severe cerebral atrophy, particularly of medial temporal lobe (arrows)
C: T2* Gradient Echo axial section showing microhaemorrhages (arrows)

**Fig. 1:** Figure 1: MRI Images illustrating common findings in dementia neuroimaging

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Methods and materials

Methodology

All MRI brain reports with the terms, 'dementia', 'memory' or 'cognitive impairment' in the clinical request during September/October 2015 and February/March 2016 were gathered from the local PACS database. Reports contained information on axial T2 fast relaxation fast spin echo (FRFSE), axial T2* gradient echo, coronal T1 3D inversion recovery and coronal T2 fluid attenuated inversion recovery (FLAIR) MRI sequences obtained at 1.5T. Thirty reports from each time period were randomised electronically to be analysed for report content. The reports from these scans were analysed retrospectively for adherence to the audit standards (see table below), using $\chi^2$ analysis to assess differences in adherence to audit criteria between the two time periods.

Audit standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Fazekas scoring included in report</td>
<td>100%</td>
</tr>
<tr>
<td>2) Presence or absence of cerebral atrophy included in report</td>
<td>100%</td>
</tr>
<tr>
<td>3) If cerebral atrophy present, whether this is age appropriate or not included in report</td>
<td>100%</td>
</tr>
<tr>
<td>4) If cerebral atrophy disproportionate to age, whether this is lobar or not included in report</td>
<td>100%</td>
</tr>
<tr>
<td>5) If temporal lobe atrophy included in report, whether this involves the hippocampus/medial/lateral temporal lobe included in report</td>
<td>100%</td>
</tr>
<tr>
<td>6) Presence or absence of microhaemorrhages mentioned in report</td>
<td>100%</td>
</tr>
<tr>
<td>7) Conclusion included at end of report</td>
<td>100%</td>
</tr>
</tbody>
</table>
Results

Fazekas scoring

*Standard 1: Fazekas scoring included in report.* Use of Fazekas scoring increased significantly from 3/30 (10%) to 12/30 (40%) (p<0.05) after the email (Table 1, Fig 2).

Cerebral atrophy

*Standard 2: Presence or absence of cerebral atrophy included in report.* Inclusion of cerebral atrophy in the report had a small but non-significant increase from 28/30 (93%) to 30/30 (100%) (p=0.15) after the email (Table 1, Fig 2).

*Standard 3: If cerebral atrophy present, whether this is age appropriate or not included in report.* Inclusion of age appropriateness of cerebral atrophy had a small but non-significant decrease from 18/30 (60%) to 16/30 (53%) (p=0.57) after the email (Table 1, Fig 2).

*Standard 4: If cerebral atrophy disproportionate to age, whether this is lobar or not included in report.* Mention of specific lobes affected by cerebral atrophy increased significantly from 5/30 (17%) to 11/30 (37%) (p<0.05) after the email (Table 1, Fig 2).

*Standard 5: If temporal lobe atrophy included in report, whether this involves the hippocampus/medial/lateral temporal lobe or not included in report.* Specific mention of the hippocampus or medial/lateral temporal lobe showed a significant decrease from 24/30 (80%) to 16/30 (53%) (p<0.05) after the email (Table 1, Fig 2).

Microhaemorrhages

*Standard 6: Presence or absence of microhaemorrhages mentioned in report.* Inclusion of microhaemorrhages showed a small but non-significant increase from 4/30 (13%) to 6/30 (20%) (p=0.49) after the email (Table 1, Fig 2).

Conclusions

*Standard 7: Conclusion included at end of report.* Inclusion of a conclusion or summary at the end of the report remained at 23/30 (77%) before and after the email (Table 1, Fig 2).
<table>
<thead>
<tr>
<th>Standard</th>
<th>Before email (n=30)</th>
<th>After email (n=30)</th>
<th>$\chi^2$</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Fazekas scoring included in report</td>
<td>3 (10%)</td>
<td>12 (40%)</td>
<td>0.01</td>
<td>100%</td>
</tr>
<tr>
<td>(2) Presence or absence of cerebral atrophy included in report</td>
<td>28 (93%)</td>
<td>30 (100%)</td>
<td>0.15</td>
<td>100%</td>
</tr>
<tr>
<td>(3) If cerebral atrophy present, whether this is age appropriate or not included in report</td>
<td>18 (60%)</td>
<td>16 (53%)</td>
<td>0.57</td>
<td>100%</td>
</tr>
<tr>
<td>(4) If cerebral atrophy disproportionate to age, whether this is lobar or not included in report</td>
<td>5 (17%)</td>
<td>11 (37%)</td>
<td>0.01</td>
<td>100%</td>
</tr>
<tr>
<td>(5) If temporal lobe atrophy included in report, whether this involves the hippocampus/medial/lateral temporal lobe included in report</td>
<td>24 (80%)</td>
<td>16 (53%)</td>
<td>0.02</td>
<td>100%</td>
</tr>
<tr>
<td>(6) Presence or absence of microhaemorrhages mentioned in report</td>
<td>4 (13%)</td>
<td>6 (20%)</td>
<td>0.48</td>
<td>100%</td>
</tr>
<tr>
<td>(7) Conclusion included at end of report</td>
<td>23 (77%)</td>
<td>23 (77%)</td>
<td>n/a</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Table 1:** Table 1: Adherence to audit standards for dementia MRI reports before and after email. Statistical significance is demonstrated when chi squared < 0.05. Significant increases are displayed in green, significant decreases are displayed in orange. N = 30 before, 30 after.

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Fig. 2: Figure 2: Percentage of dementia MRI reports including audited criteria before and after email (n=60)

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Conclusion

Our audit has shown that email circulation of reporting guidance for dementia MRI brains has improved some aspects of reporting standards in our hospital. Specifically, the number of reports using Fazekas scoring and mentioning lobar atrophy increased after the email. Fewer reports commented on medial temporal atrophy, possibly due the increase in reports commenting on a more generalised temporal atrophy, or the small sample size.

However there remains room for improvement with reporting standards, in line with recommendations laid out by the EFNS \(^4\). Reports often lack precise details on which lobes are affected by cerebral atrophy, whether this atrophy is appropriate for the patient's age and whether or not microhaemorrhages can be seen on the images.

Despite the relatively low sample size in this audit, we suggest that the email had the desired effect of spreading the message to general radiologists about standard criteria to be included in MRI brain scan reports for dementia patients. These results were presented to radiologists in a local meeting where we discussed the findings and considered introduction of a report template to improve standards further. The use of report templates as well as the combined impact and relative contributions of the email and presentation at the local meeting could be the focus of future audit.
Personal information

(1) Dr David Wilkinson, Academic Foundation Year 2, Pennine Acute Hospitals NHS Trust, Manchester, United Kingdom. david.wilkinson@doctors.org.uk

(2) Dr Pavel Janousek, Consultant Radiologist, Bury, United Kingdom. paveljan@doctors.org.uk
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