Systematic review of clinical prediction rules for neuroimaging in the evaluation of dementia

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Authors' objectives
To review systematically primary research studies on clinical prediction rules for neuroimaging in the evaluation of dementia, and to assess the sensitivity, specificity and diagnostic performance of the rules.

Searching
MEDLINE was searched from January 1, 1983, to December 31, 1998. The keywords used were described in the paper. In addition, the authors identified articles from an in-depth review of bibliographies of textbooks, review articles and guidelines on dementia.

Study selection
Diagnostic accuracy studies were eligible for inclusion.

Specific interventions included in the review
Studies in dementia with every patient undergoing a neuroimaging study, i.e. computed tomography (CT) or magnetic resonance imaging (MRI scan), were eligible for inclusion. The clinical characteristics included in the prediction rules were: age, duration of symptoms, dementia severity, acute change in cognitive functions, focal signs or symptoms, ocular or vision abnormalities, headache, trauma, history of malignant tumour, speech disorder, seizures, history of stroke, urinary incontinence, and gait disturbance. The clinical variables in the prediction rule were explicit and presented in sufficient detail to apply consistently in clinical practice. COMPARED>> MRI or CT scans were used to classify patients as having or not having a potentially reversible cause of dementia. Dementia was measured by the Mini-Mental Status Examination. All patients had to receive the reference standard for the studies to be included.

Reference standard test against which the new test was compared
MRI or CT scans were used to classify patients as having or not having a potentially reversible cause of dementia. Dementia was measured by the Mini-Mental Status Examination. All patients had to receive the reference standard for the studies to be included.

Participants included in the review
Studies where every patient had a diagnosis of dementia were included. The average age of the patients included in the review ranged from 63 to 76 years. In three studies the gender of the patients was not specified; in the four remaining studies, the proportion of females ranged from 53 to 71%.

Outcomes assessed in the review
The sensitivity and specificity of neuroimaging prediction rules for patients with dementia were assessed. Studies had to include sufficient data to calculate the sensitivity and specificity of the clinical prediction rule.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
The authors do not state that they assessed quality.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data
The following data were extracted: age, gender, dementia severity and clinical setting of the sample, as well as the clinical variables in each prediction rule, who performed the clinical evaluation, and whether the clinical variables were collected prospectively or retrospectively. The type of neuroimaging used, and whether the physicians applying the prediction were aware of the neuroimaging findings, was also recorded. For each study the authors abstracted or calculated the numbers of patients:

- with or without a potentially reversible cause of dementia, as defined by the neuroimaging results;
- who had at least one of the clinical characteristics (rule-positive findings); and
- who did not have any of the clinical characteristics contained in the prediction rule (rule-negative findings).

**Methods of synthesis**

**How were the studies combined?**
The sensitivity, specificity and 95% confidence interval (CI) were calculated for each rule. The authors then used a hypothetical cohort of 1,000 patients with dementia to estimate the positive and negative predictive values for each clinical prediction rule at different prevalences of neuroimaging defined potentially reversible disorders (i.e. 1, 5, 100 and 15%).

**How were differences between studies investigated?**
Heterogeneity between studies that evaluated the same prediction rule was tested for by constructing a summary receiver operating characteristics curve, comparing the 95% CIs for the sensitivity plotted against specificity for each rule, and by comparing sensitivities for each rule using chi-squared or the Fisher exact test.

**Results of the review**
Seven studies containing 6 different prediction rules, with 1,505 patients, were included in the review.

Only one rule demonstrated a high sensitivity (greater than 85%) across all studies; none had a high specificity (85%). Depending on the study, the sensitivity varied widely (from 12.5 to 100%); specificity also ranged widely (from 37.2 to 85.7%). Studies were too heterogeneous to allow pooling. Six of the seven studies included less than 15 cases of potentially reversible dementia; thus, the sensitivity and specificity for each rule had relatively wide CIs. The Canadian Consensus Conference and Dietch rules performed the best, missing the fewest number of patients with potentially reversible causes of dementia. However, this does mean that more patients are subject to imaging, compared with the other five rules. The positive predictive value of all six rules was low regardless of the prevalence of potentially reversible causes of dementia. Of patients with rule negative findings, most would not have a potentially reversible cause of dementia. However, the Dietch and Canadian Consensus Conference rules had the lowest proportion of patients with rule negative findings and a potentially reversible cause of dementia. In the hypothetical cohort, at a 5% prevalence of potentially reversible dementia, all rules had a low positive predictive value (less than 15%). Depending on the rule, the analysis predicts that between 6 and 44 of the 50 patients with potentially reversible dementia (5% prevalence in a cohort of 1,000 patients) would not, therefore, undergo imaging.

**Authors’ conclusions**
The authors note that ‘there is considerable uncertainty in the evidence underlying clinical prediction rules to identify which patients with dementia should undergo neuroimaging’. Application of these rules may miss patients with causes of dementia, which have the potential to be reversed.

**CRD commentary**
This review gave limited information on the process of the review. The objectives were clearly stated. The literature search was not extensive, with only one electronic database being searched, although handsearches were undertaken. No details were given on the study selection and data extraction processes, i.e. the methods used and the number of
reviewers involved. There were also no details on whether any quality assessment was undertaken. Relevant details of the included studies were presented in tabular format and in the text. The results and conclusion seem to follow from the data presented. The authors commented upon the paucity of studies available.

**Implications of the review for practice and research**
Practice: The authors did not state any implications for practice.
Research: The authors state that there is an urgent need for large well-designed studies evaluating the utility of neuroimaging in patients with dementia.

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