Structural neuroimaging in psychosis

Structural neuroimaging in psychosis: a systematic review and economic evaluation

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Executive summary

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Executive summary

Background

Psychosis is a term used to describe a group of conditions in which severe symptoms of mental illness such as delusions and hallucinations occur, accompanied by the inability to distinguish between subjective experience and reality, and usually there is a lack of insight. Psychosis can be categorised as organic or functional. Organic psychoses can be caused by a variety of conditions including strokes, brain injury, encephalitis, Alzheimer's disease, Parkinson's disease, multiple sclerosis, temporal lobe epilepsy and brain tumours. Functional psychoses include schizophrenia and mood disorders such as mania, bipolar disorder and puerperal psychosis.

The prevalence of organic causes of psychosis varies with age, being lower in younger than older patients. Patients with psychosis may also have additional pathology such as space-occupying brain lesions. The main factors that would lead the clinician to suspect an organic cause of psychosis or additional pathology should be discovered during the initial clinical history and examination.

Indications that an organic cause is more likely include an acute onset, features of delirium such as clouding of consciousness, disorientation in time and place, disturbance of memory, impaired attention, fluctuation of conscious awareness and visual hallucinations. A neurological history and examination would look for a recent history of malignancy and/or focal neurological symptoms or signs, but these are not always present. Additional confirmatory tests would be used, depending on the diagnosis hypothesised. However, structural neuroimaging can also be used in all patients presenting with psychosis, irrespective of clinical suspicion, to screen for any additional pathology that would affect the clinical management of the patient. This may include structural magnetic resonance imaging (MRI) or computed tomography (CT) scanning, but frequently this is not undertaken in the UK.

Objectives

The objectives were to establish the clinical effectiveness and cost-effectiveness of structural neuroimaging (structural MRI and CT scanning) for all patients with psychosis, particularly a first episode of psychosis, relative to the current UK practice of selective screening only where it is clinically indicated.

Methods

A systematic review of studies (of any study design) reporting the additional diagnostic benefit of structural MRI, CT or combinations of these in patients with psychosis was conducted. The comparator was any current standard practice of diagnostic workup without structural neuroimaging. Only studies reporting clinically relevant outcomes were included. MEDLINE, EMBASE, the Cochrane Library, PsycINFO and CINAHL were searched from inception to November 2006. Inclusion, quality assessment and data extraction were undertaken in duplicate. Studies were assessed qualitatively only. The economic assessment consisted of a systematic review of economic evaluations and the development of a threshold analysis to predict the gain in quality-adjusted life-years (QALYs) required to make neuroimaging cost-effective at commonly accepted threshold levels (£20,000 and £30,000 per QALY). Sensitivity analyses of several parameters including prevalence of psychosis were performed.

Results

Effectiveness

A total of 25 studies were included in this systematic review. There were 24 studies of a diagnostic before–after type of design evaluating the clinical benefit of CT, structural MRI or combinations in treatment-naïve, first-episode or unspecified psychotic patients, including one in schizophrenia patients resistant to treatment. Also included was a review of published case reports of misidentification syndromes. Almost all evidence was in patients aged less than 65 years. In most studies, structural neuroimaging identified very little that would influence patient management that was not suspected based on a medical history and/or physical examination and there were more

incidental findings. In the four MRI studies, approximately 5% of patients had findings that would influence clinical management, whereas in the CT studies, approximately 0.5% of patients had these findings. The review of misidentification syndromes found that 25% of CT scans affected clinical management, but this may have been a selected and therefore unrepresentative sample.

Cost-effectiveness

The objective of the economic analysis was to measure the difference in costs and benefits of scanning all patients with CT or MRI compared with selective scanning under standard care as any benefit from scanning all patients would only be realised in cases where organic causes were **not** immediately obvious to the clinician as the treatment pathway would only be altered in these patients.

A decision-analytic model was not possible as it required information on the differential response to treatment by cause and the impact upon quality of life (QoL) from having an early diagnosis as opposed to a late diagnosis of an organic cause, which could not be found in the literature.
A threshold analysis with a 1-year time horizon was undertaken. This combined the incremental cost of routine scanning with a threshold cost per QALY value of £20,000 and £30,000 to predict the QoL gain required to meet these threshold values.

Routine scanning versus selective scanning appears to produce different results for MRI and CT. With MRI scanning the incremental cost is positive, ranging from £37 to £150; however, when scanning routinely using CT, the result is cost saving, ranging from £7 to £108 with the assumption of a 1% prevalence rate of tumours/cysts or other organic causes amenable to treatment. This means that for the intervention to be viewed as cost-effective, the QALY gain necessary for MRI scanning is 0.002–0.007 and with CT scanning the QALY loss that can be tolerated is between 0.0003 and 0.0054 using a £20,000 threshold value. These estimates were subjected to sensitivity analysis. With a 3-month time delay, MRI remains cost-incurring with a small gain in QoL required for the intervention to be cost-effective; routine scanning with CT remains cost-saving. When the sensitivity of CT is varied to 50%, routine scanning is both cost-incurring or cost-saving depending on the scenario. Finally, we have shown that, not surprisingly, the results are sensitive to the assumed prevalence rate of brain tumours in a psychotic population.

Discussion and conclusions

First-episode psychosis is not clearly defined or universally accepted. There is a paucity of good-quality evidence on the clinical benefits of structural neuroimaging in psychosis on which to base this health technology assessment. The evidence to date suggests that if screening with structural neuroimaging was implemented in all patients presenting with psychotic symptoms under 65 years old, little would be found to affect clinical management in addition to that suspected by a full clinical history and neurological examination. From an economic perspective, the outcome is not clear. The strategy of neuroimaging for all is either cost-incurring or cost-saving (dependent upon whether MRI or CT is used) if the prevalence of organic causes is around 1%. However, these values are nested within a number of assumptions, meaning that they have to be interpreted with caution.

Recommendations for further research

The main research priorities are to monitor the current use of structural neuroimaging in psychosis in the NHS to identify clinical triggers to its current use and subsequent outcomes. In addition, well-conducted diagnostic before and after studies on representative populations are required to determine the clinical utility of structural neuroimaging in this patient group. There also needs to be research to determine whether the most appropriate structural imaging modality in psychosis should be CT or MRI.

Publication

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NIHR Health Technology Assessment Programme

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