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Title **A Systematic Review of the Effectiveness and Cost-Effectiveness of Neuroimaging Assessments Used to Visualize the Seizure Focus in People with Refractory Epilepsy Being Considered for Surgery**

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Aim

To review: the effectiveness and/or accuracy of different methods to image the cerebral cortex to visualize the seizure focus in people with refractory epilepsy being considered for surgery; the ability of different neuroimaging techniques to predict post-surgical outcomes; and the cost effectiveness of imaging the cerebral cortex to visualize the seizure focus in people with refractory epilepsy being considered for surgery.

Conclusions and results

No RCTs were identified. Most studies evaluated the diagnostic accuracy of various imaging techniques in localizing epileptic seizure foci and were generally of poor quality. The included studies investigated the following imaging techniques: SPECT (39 studies, 68 evaluations); MRI (30 studies, 40 evaluations); PET (18 studies, 25 evaluations); SISCOM (7 studies, 11 evaluations); MRS (6 studies); CT (5 studies); NIRS (1 study); combinations of more than one test (3 studies). We found no studies evaluating fMRI or diffusion tensor imaging. It was difficult to draw any overall conclusions regarding the accuracy of any imaging technique due to the differences between studies. Test performance was more promising in studies restricted to patients with temporal lobe epilepsy. Ictal SPECT generally had more correctly localizing and fewer non-localizing scans than other techniques evaluated. Results for CT and inter-ictal SPECT suggest that these tests are relatively poor at localizing the seizure focus. Results for volumetric MRI and PET appear promising, but have been assessed in fewer studies than ictal SPECT. SISCOM and MRS have been assessed in fewer studies, but results are less promising than ictal SPECT. T2 relaxometry was reported in only one small study with inconclusive results.

Nine studies used multivariate analysis to investigate the association of various imaging techniques with the outcome following surgery. The imaging techniques evaluated included MRI (7 studies), MRS and volumetric MRI (1 study), PET (3 studies), SPECT (1 study) and SISCOM (3 studies). There was a trend for positive localization of abnormalities to be associated with a beneficial outcome.

Recommendations

Due to the limitations of the included studies, the results of this review do little to inform clinical practice. Studies investigating the prognostic importance of imaging results for the outcome following epilepsy surgery suggest that abnormalities on imaging are associated with a better clinical outcome. However, the data do not allow an accurate prediction for patient outcome.

Methods

A systematic review was undertaken according to published guidelines. Studies were identified by searching electronic databases, Internet searches, handsearching, scanning reference lists of included papers, and consultation with experts. Two reviewers screened titles and abstracts for relevance. Full papers of potentially relevant studies were obtained and assessed for inclusion by one reviewer and checked by a second. Published and unpublished studies in any language were eligible for inclusion. Data extraction and quality assessment were performed by one reviewer and checked by a second.

Further research/reviews required

- Investigate the utility of imaging techniques in the workup for epilepsy surgery.
- RCTs to examine the influence of single tests or combinations of tests on patient outcomes. Health economic data could be collected in parallel, allowing a thorough examination of cost effectiveness.
- We suggest that it is important that clinicians, patient groups, policy makers and healthcare/research funders meet and debate the most appropriate way to investigate these technologies.

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