Diagnostic accuracy of post-mortem magnetic resonance imaging in fetuses, children and adults: a systematic review


CRD summary
This review concluded that the published data was limited to small, heterogeneous and poorly designed studies of the diagnostic accuracy of post-mortem magnetic resonance imaging (MRI) in foetuses, children and adults; insufficient data were available on the acceptability of post-mortem MRI. These cautious conclusions appear justified.

Authors’ objectives
To compare the diagnostic accuracy, acceptability and cost-effectiveness of post-mortem magnetic resonance imaging (MRI) with conventional autopsy in foetuses, children and adults.

Searching
MEDLINE and EMBASE were searched from 1990 to March 2009 without language restrictions. Search terms were reported. Reference lists of retrieved studies were screened. Conference abstracts were excluded.

Study selection
Studies that evaluated post-mortem MRI (index test) compared with conventional autopsy (reference standard) in foetuses, children or adults were eligible for inclusion. Studies that reported data on patient acceptability of post-mortem MRI were also eligible. Studies had to report sufficient data to allow extraction of 2x2 tables of test performance. Studies of less than five patients were excluded. The target condition was the most significant pathology in foetuses, or cause of death in children and adults. Qualitative data on next of kin views on less invasive autopsy were also evaluated.

Included studies were conducted in Switzerland, the Netherlands, UK and USA. Included studies evaluated foetuses (terminations and miscarriages), newborns, children with suspected non-accidental injury, sudden unexpected death in adults, and hospital deaths in adults. Organs examined included whole body, brain, spine and kidneys. Lesions reported included congenital malformations, subdural, subarachnoid haemorrhages, contusions, ischaemic heart disease, pneumonia, left ventricular failure, bronchial carcinoma, perforated viscera, ischaemic heart disease, adult respiratory distress syndrome, lung cysts, and cirrhosis.

The authors did not state how many reviewers assessed studies for inclusion.

Assessment of study quality
Study quality was assessed using the 14-item QUADAS (Quality Assessment of Diagnostic Accuracy Studies) criteria.

The authors did not state how many reviewers performed the quality assessment.

Data extraction
Two reviewers independently extracted data to populate 2x2 tables of test performance. If any of the cells contained 0 counts, 0.5 was added to each cell in the 2x2 table. These data were used to calculate sensitivity and specificity, with 95% confidence intervals (CIs). Authors were contacted for additional data where necessary.

Methods of synthesis
Summary estimates of sensitivity and specificity, with 95% confidence intervals, were calculated using multi-level models with centre as a random effect. Heterogeneity was assessed using the $I^2$ statistic.

Publication bias was assessed using funnel plots.
Results of the review
Nine studies (n=181 cases) were included that evaluated diagnostic accuracy and one that assessed parental acceptability. Studies were of poor to moderate quality. All studies fulfilled QUADAS criteria for appropriate reference standard, time between index test and reference standard, avoidance of partial verification bias, description of index test and reference standard execution, availability of clinical information and reporting of withdrawals. Only 40% of studies included an appropriate patient spectrum; only 40% reported blinded interpretation of the reference standard.

Foetuses (five studies): Diagnostic sensitivity of post-mortem MRI ranged from 21% to 91%. Summary (pooled) sensitivity was 69% (95% CI 56 to 80). Diagnostic specificity ranged from 50% to 98%. Summary specificity was 95% (95% CI 88 to 98). There was substantial heterogeneity for sensitivity ($I^2=82.5\%$), but little heterogeneity for specificity ($I^2=18\%$).

Children and adults (four studies): Diagnostic sensitivity of post-mortem MRI ranged from 7% to 43%. Summary sensitivity was 28% (95% CI 13 to 47). Diagnostic specificity ranged from 50% to 75%. Summary specificity was 64% (95% CI 23 to 94). There was moderate heterogeneity for sensitivity ($I^2=24.9\%$), but no heterogeneity for specificity ($I^2=0\%$).

One study reported very positive responses from parents in relation to post-mortem MRI.

Cost information
One study was included for the analysis of costs. The mean cost (in US dollars) of minimally invasive post-mortem (MRI and computed tomography and ultrasonography guided needle biopsy) was $1,497 (range $1,190 to $1,792). The mean cost of conventional autopsy was 70% more expensive at $2,274 (range $2,056 to $2,491).

Authors’ conclusions
The published data was limited to small, heterogeneous and poorly designed studies. Insufficient data were available on the acceptability and costs of post-mortem MRI.

CRD commentary
The review addressed a clear objective. Inclusion criteria were not specified, but could be deduced from the objective and flow-charts. The literature search was adequate for published studies; no language restrictions were applied. However, specific attempts were not made to identify unpublished studies, so there was a possibility of publication bias. This was assessed in the review, but the methods used were not appropriate for diagnostic data. Appropriate steps were taken to minimise bias and errors when extracting data, but it was unclear whether such steps were also taken when selecting studies and assessing quality.

Details on methods used to pool data were limited, but appeared adequate. Results were clearly presented with the aid of forest plots.

Given the small number, small size and methodological limitations of the included studies, the authors' cautious conclusions appear justified.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that well designed, large, prospective studies are required to evaluate the accuracy of post-mortem MRI before it can be offered as a clinical tool.

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