Routine serial computed tomographic scans in mild traumatic brain injury: when are they cost-effective?

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
This study assessed the cost-effectiveness of routine serial scanning of the head, compared with a strategy of awaiting clinical deterioration before repeating the diagnostic study, in patients with mild traumatic brain injury. It was concluded that a modest efficacy gain made the strategy of routine scanning cost-effective, especially in younger patients. The study was well conducted, but some aspects of the analysis were not extensively reported, especially for the clinical data. Thus, the authors’ conclusions should be interpreted with caution.

Type of economic evaluation
Cost-utility analysis

Study objective
This economic evaluation assessed the cost-effectiveness of routine serial scanning of the head in comparison with a strategy of awaiting clinical deterioration before repeating the diagnostic study.

Interventions
The two interventions were an expectant strategy, which was waiting for clinical deterioration before repeating the diagnostic study, and a more active strategy, which was routine serial computed tomography (CT). The study involved patients with mild traumatic brain injury (TBI) who, on admission, demonstrated at least one intracranial abnormality on their CT scan, that revealed an intracranial lesion, which did not require immediate surgery.

Location/setting
USA/emergency department.

Methods
Analytical approach:
This economic evaluation was based on a decision analytic model for a 20-year-old patient. The time horizon of the analysis appears to have been lifetime. The authors stated that the analysis was carried out from a societal perspective.

Effectiveness data:
A systematic review of the MEDLINE database was carried out to identify the relevant sources for clinical data. The search covered the period 1980 to 2006. Supplementary data came from a large database of mild TBI patients. Statistical tests were carried out to ensure the homogeneity of data retrieved from multiple sources. No details on the type of studies retrieved were given. The key clinical endpoint was the probability of development or growth of an intracranial haematoma requiring surgery.

Monetary benefit and utility valuations:
The utility valuations were derived from published studies identified in MEDLINE and no other details were provided.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at 3% per annum.

Cost data:
The economic analysis included the direct medical costs of the CT scan, craniotomy (for complicated or uncomplicated
haematoma), rehabilitation, and nursing home care. Rehabilitation and nursing home care costs depended on the severity of the condition as measured by the Glasgow Outcome Scale. Costs were derived from Medicare national average reimbursement and Medicaid reimbursement (for custodial care of permanent disability). They were in US dollars ($) and were discounted at 3% per annum. The price year was 2006.

Analysis of uncertainty:
A deterministic sensitivity analysis was undertaken to identify the most influential model inputs. Ranges of values were derived from the literature or were based on authors’ opinions. A simulation analysis was carried out using a second-order Monte Carlo simulation that assigned pre-defined probability distributions to model inputs and generated confidence interval (CI)s around the model outcomes. Various patient ages were also considered; 20 years in the base-case analysis and 40, 60, and 80 years in the sensitivity analysis.

Results
The expected costs were $1,563 (95% CI: 871 to 2,680) with routine CT and $1,321 (95% CI: 566 to 3,023) with the expectant strategy. The QALYs were 28.8937 with CT and 28.8746 without CT. The incremental cost per QALY gained with CT over without CT was $12,670 (95% CI: -76,038 to 80,693).

The deterministic sensitivity analysis showed that the most influential model inputs were the probability that prompt haematoma evacuation was successful, the incidence of delayed haematoma, and the probability that delayed haematoma surgery could be done before deterioration led to coma.

The cost-effectiveness of routine CT decreased with increasing age; higher ages led to higher cost-effectiveness ratios.

Authors’ conclusions
The authors concluded that the modest efficacy gain made the strategy of routine scanning cost-effective, in comparison with a strategy of awaiting clinical deterioration, especially in younger patients.

CRD commentary
Interventions:
The selection of an expectant strategy as the comparator was appropriate as it represented the diagnostic strategy in the authors’ setting.

Effectiveness/benefits:
The clinical data were identified through a literature review, which is a valid approach. Some search criteria were reported, but no information was provided on the design and other characteristics of the primary sources of data. This precludes the possibility of objectively assessing the internal validity of the clinical data. The authors investigated the potential heterogeneity among the published studies, but the results of these statistical tests were not reported. Details of the assessment of utility valuations were also not reported. The instruments used to elicit preferences and the individuals (patients, general population, and health care professionals) who provided this data were not described.

Costs:
The cost categories did not reflect the perspective stated by the authors, in that they included only direct medical costs, which suggests that the viewpoint was that of the third-party payer. The authors noted that the inclusion of lost wages of haematoma patients, who received delayed surgery, would increase the costs associated with a delayed diagnosis, and would improve the cost-effectiveness of routine CT. All costs were derived from Medicare or Medicaid rates and so were not broken down into individual items. This limits the transparency and transferability of the economic analysis. The price year and the use of discounting were reported.

Analysis and results:
The costs and benefits were appropriately synthesised using an incremental approach. The expected model outcomes were reported. The issue of uncertainty was extensively addressed by means of both a deterministic and a probabilistic approach, the findings of which were presented. However, a key issue of the analysis was the large confidence intervals around the mean cost-effectiveness values, which were due to very small differences in costs and effects between the two options. The study should be considered to be specific to the authors’ setting and will not easily transfer to other
settings.

Concluding remarks:
The study was well conducted, but some aspects of the analysis were not extensively reported, especially for the clinical data. Thus, the authors’ conclusions should be interpreted with some caution.

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