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The impact of pre-hospital transfer strategies on clinical outcomes: A systematic review comparing direct transfer to specialist care centres with initial transfer to the nearest local hospital

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Criteria for inclusion

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1.1 Contributions of authors

Alastair Pickering (Clinical Lecturer in Emergency Medicine) coordinated the project (except the clinical review) and was responsible for concept development and design of the project, acquisition, analysis and interpretation of data (patient satisfaction) and drafting/revising of the final report

Katy Cooper (Research Fellow) coordinated the clinical review and was responsible for the acquisition, analysis and interpretation of data (clinical review) and drafting/revising of the final report

Susan Harnan (Research Associate) was responsible for the acquisition, analysis and interpretation of data for the clinical review and drafting/revising the final report

Michael Holmes (Operational Research Analyst) was responsible for the acquisition of data (cost-effectiveness review), the generation of a hypothetical model framework and drafting/revising the final report

Anthea Sutton (Information Specialist) was responsible for the development and undertaking of electronic database literature searches

Suzanne Mason (Professor of Emergency Medicine) helped with the concept development and design of the project, sat on the project steering group and contributed to the drafting/revising of the final report

Jon Nicholl (Professor of Health Services Research, Dean of ScHARR) was responsible for the initial concept for this project and for providing expertise and guidance throughout the review

Executive Summary

Background

The development of regional specialist care centres for major trauma and stroke is high on the political agenda within the National Health Service (NHS). Evidence from international studies clearly demonstrates improved clinical outcomes in areas where regional networks exist when compared to the model of care currently in place in the UK. This report makes a fundamental assumption, based on background evidence, that management in a specialist centre results in the best outcomes for patients. However, the decision to bypass the nearest hospital in order to transfer a patient directly to the specialist centre is difficult and dependent on the clinical priority, especially when faced with a time-critical condition.

From the trauma and head injury literature, specialist centres (SC) for major trauma have reported improved clinical outcomes when compared with care in a non-specialist centre (NSC). The benefits of early correction of hypoxia and hypotension are also recognised for improving outcomes. Seemingly, this would be best achieved by delivery of patients to the nearest hospital to resolve such physiological abnormalities as quickly as possible. Current opinion supports the direct transfer of major trauma and head injured patients to the SC from the point of injury, which is the guiding principle for major trauma reconfiguration in the UK, but the evidence for this strategy remains unclear.

For ischaemic stroke patients, the phrase 'Time is Brain' reflects the knowledge that early thrombolysis improves both mortality and morbidity outcomes. The transfer of patients over longer distances to a specialist centre may extend the time period before treatment can be started and adversely affect their outcome. The current evidence is yet to identify the optimal site to begin treatment and, as such, starting thrombolysis in the nearest hospital with subsequent transfer to the specialist centre for on-going care may represent the best pathway for these patients.

Aims

The aims of this study were to use secondary research methods to determine the clinical and cost effectiveness of two pre-hospital triage strategies for delivery to specialist care centres.

The objectives of this study were:

1. To perform a systematic review of the evidence for a policy of triage and direct transfer to specialist care centres compared with initial transfer to the local hospital in three clinical conditions. These are:

- Multi-system trauma (classed as major/severe)
- Head injury (moderate to severe)
- Ischaemic stroke

2. To perform a cost-effectiveness analysis comparing each decision-making strategy using previous reviews and data from the clinical review.

3. To perform a review of the evidence investigating patient satisfaction and experience with the regionalisation of care.

4. To provide recommendations for areas of primary research.

Methods

We performed a systematic review of key electronic databases and relevant bibliographies for articles from 1988 to December 2012. This was initially completed in December 2010 with a subsequent update performed, following peer review recommendations, that identified a further eleven relevant articles that strengthened the conclusions drawn.

Articles were included if they investigated:

1. Major trauma (defined as an Injury Severity Score of >15), moderate-to-severe head injury (defined as Glasgow Coma Scale <13) and ischaemic stroke.

2. A comparison of triage decisions for direct transfer to a specialist centre (SC) with initial delivery to the nearest non-specialist centre (NSC) and subsequent transfer if necessary.

3. Outcomes including mortality, validated morbidity data, patient satisfaction and available length of stay data.

Studies were only included if they provided a comparison between two groups of patients with different triage routes. Includable studies could be randomised or non-randomised (though in fact no randomised studies were identified).

Study data were meta-analysed using Review Manager. Random effects models were used where clinical or statistical heterogeneity existed between studies. Data were converted where necessary so that all odds ratios (ORs) compared initial triage to NSC versus direct triage to SC (rather than vice versa); similarly, ORs for survival were converted to mortality.

Results

Results of systematic review

In total, forty-four relevant studies were identified for this review, nineteen for major trauma, eleven for moderate-to-severe head injury and fourteen for ischaemic stroke.

The significant heterogeneity between studies limited the generalisability of these findings. Key factors contributing to this heterogeneity included selective population sampling, inconsistent adjustments for confounders, variation in the capabilities of specialist and non-specialist centres and timing of outcome assessments.

Major Trauma

Individual studies have reported improved clinical outcomes for patients managed exclusively at SC for trauma when compared with management at NSC. This review focused on the initial transfer decision and its impact on outcomes (namely mortality). This demonstrated no significant difference in outcomes for the two pathways. The five highest quality studies accounted for all patients initially triaged to the NSC and adjusted for age and severity. Pooled analysis of these five studies comparing triage to the NSC vs. direct transfer to the SC gave an OR for mortality of 1.03 (95% CI=0.85-1.23, I^2=47%). The OR for six unadjusted studies was 1.04 (95% CI=0.72-1.50, I^2=94%). For studies comparing only transfers from NSC to SC versus direct triage to SC, unadjusted analyses for mortality favoured transfer (OR 0.83, 95% CI 0.68 to 1.01, I^2=86%) while adjusted analyses favoured direct triage to SC (OR 1.18, 95% CI 0.96 to 1.44, I^2=77%).

No morbidity data were reported for major trauma.

Head Injury

The review of head injury literature revealed a paucity of high quality studies, half of which were conducted in rural or remote geographical locations. All studies were restricted to transfer from NSC to SC versus direct triage to SC; none included patients remaining at the NSC. Pooled analyses show little difference between the pathways comparing triage to NSC vs. direct transfer to the SC with an OR for mortality of 0.74 (95% CI=0.31-1.79, I^2=80%) for studies adjusting for injury severity and 0.87 (95% CI=0.62-1.23, I^2=66%) for unadjusted data. Studies in rural areas with long transport distances appeared more likely to favour initial triage to NSC than studies in mixed areas (urban and rural) which showed little difference between groups, though the exclusion of patients dying before SC arrival may skew the results in favour of transfer groups.

Morbidity data was sparse and showed no significant differences in outcomes between triage strategies.

Stroke

The review of relevant stroke literature revealed three different categories of study type. These were:

1. Studies including only thrombolysed patients who received this treatment at the first hospital they were transferred to (NSC or SC)
2. Studies including only thrombolysed patients who only received this treatment after arrival at the SC
3. Studies including all stroke patients arriving within the therapeutic window for thrombolysis but who could only receive this treatment after arrival at the SC

None of the studies identified presented any mortality data adjusted for age, co-morbidities or stroke severity. All studies were restricted to transfer from NSC to SC versus direct triage to SC; none included patients remaining at the NSC.

For four studies with thrombolysis available at both NSC and SC, the unadjusted data comparing triage to NSC vs. direct transfer to the SC showed no significant difference with an OR for mortality of 0.89 (95% CI=0.61-1.30, I^2=0%).

For two studies in which patients could only receive thrombolysis at the SC, and which included data for all stroke patients who arrived at the SC within 4-6 hours of symptom onset (N=140, therapeutic window stipulated by individual study protocols), analysis demonstrated significantly worse outcomes for those initially triaged to the NSC with an OR for mortality of 6.62 (95% CI=2.60-16.82) when compared with direct transfer to the SC.

Morbidity outcomes were compared using the modified Rankin Scale (mRS) and improvement in National Institute for Health Stroke Score (NIHSS). Favourable outcomes were defined by individual studies and contributed significant heterogeneity to the meta-analysis (by including a range of mRS≤1 up to mRS≤3)

For one study with thrombolysis available at both NSC and SC, no significant difference in morbidity outcome was identified with an adjusted OR for favourable mRS of 0.92 (95% CI=0.65-1.30) comparing triage to NSC vs. direct transfer to the SC.

When thrombolysis was only available at the SC, one study which included all stroke patients who arrived at the SC within 6 hours of symptom onset (study protocol), showed significantly worse outcomes for patients initially triaged to the NSC with an adjusted OR for favourable mRS of 0.34 (95% CI=0.15-0.77) when compared with direct transfer to the SC.

Results of cost-effectiveness evaluation

There is currently no literature evaluating the cost-effectiveness of different triage strategies for the delivery of patients to SC for the three clinical conditions in this review.

The review and analysis of current evidence for the clinical effectiveness of either triage strategy produced pooled estimates indicating no significant benefit for either pathway. These pooled estimates were not considered robust due to heterogeneity between studies and limitations in study design, which prevented any comparison of clinical outcomes being translated into a cost-effectiveness analysis.

The parameters required for populating a hypothetical model were not available from the clinical review data. Missing data was predominantly robust outcome data such as mortality and morbidity figures.

Results of patient satisfaction review

There is currently no literature evaluating the impact of local hospital bypass on patient experience or satisfaction for major trauma, head injury or stroke.

A wider review of patient attitudes towards regionalisation of care revealed a general preference for local hospital services but this has not been evaluated for any emergency conditions.

Conclusions

The current literature for major trauma and moderate-to-severe head injury does not demonstrate evidence of improved clinical outcomes for either of the triage pathways to specialist centre care reviewed for this report.

The current literature does demonstrate that outcomes for ischaemic stroke patients, following thrombolysis, are not affected by the location of the initial treatment. However, outcomes are significantly better for those patients transferred directly to a SC, if thrombolysis is only available at such a centre, than if transferred via a local NSC.

These conclusions are based on poor quality data with significant heterogeneity and confounding leading to a need for high quality research in a UK setting. The evidence is not robust enough to draw any definite conclusions about the superiority of either of the two pathways reviewed.

Future research should concentrate on prospective data collection from the point of the event occurring (injury or stroke). It should also evaluate the halo effect of triage decisions and regionalisation of care for patients, staff and pre-hospital services.