Telemedicine in acute stroke management: systematic review

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CRD summary
This review concluded that telemedicine technologies by means of of telephone or videoconferencing appeared safe and feasible in acute stroke management. Telestroke interventions were associated with increased delivery of tPA. Shortcomings in the included studies, a limited synthesis and potential for bias in the review mean that the authors' conclusions should be interpreted with caution.

Authors' objectives
To assess the clinical and cost effectiveness of telemedicine technologies in the management of acute stroke patients.

Searching
MEDLINE, EMBASE, DARE, NHS EED and The Cochrane Library were searched from 1995 to 2008 for peer reviewed articles. Search terms were reported. Reference lists were searched manually for additional relevant articles.

Study selection
Studies were eligible for inclusion if they evaluated the effects of telestroke service (telemedicine for stroke; defined in the review) on health outcomes in acute stroke patients, the process of care, user/patient satisfaction/acceptance or resource utilisation.

Most of the included studies were conducted in USA; some were conducted in Germany, Canada and China. Settings included hospitals (university, community, district, regional and rural) and specialist stroke centres. Where reported, mean age of patients ranged from 60 to 71 years and slightly more than half were male. Most studies used two-way real-time audio video conferencing systems; others compared telephone consultation with video consultation or used telephones to support community hospitals in acute stroke management. Some patients received intravenous tissue plasminogen activator (tPA) by means of telemedicine. Some patients were transported to a stroke centre after telephone or video consultation. Outcomes assessed were mortality and rates of intracerebral haemorrhage; a few studies reported on length of stay and discharge destination (home, rehabilitation centre or nursing home).

Two reviewers screened studies for inclusion.

Assessment of study quality
The authors did not state that they assessed study quality.

Data extraction
The authors did not state how data were extracted.

Methods of synthesis
Data were presented as a narrative synthesis and in tables.

Results of the review
Eighteen studies were included in the review: two randomised controlled trials, one controlled clinical trial and 13 case series (four reported as prospective and two as retrospective). One study was described as a prospective study and one as a retrospective observational study. The total number of patients included in the review was not reported; 739 patients were treated with tPA.

All studies reported a positive experience and improved quality of care. One study reported better health outcomes, which included reduced dependency compared with conventional stroke care; 52 patients had intracerebral haemorrhage and 63 died. Three studies reported on satisfaction with telemedicine interventions, and overall, patients and healthcare providers reported high levels of satisfaction and acceptance.
One study reported on the diagnostic accuracy of videoconferencing versus telephone systems.

**Cost information**
One study reported higher mean costs per patient in a videoconference group ($16,300) compared to a telephone group ($14,000) and a teleradiology group ($14,000), but the differences were not statistically significant. A second study reported that telestroke service was only cost-effective when video consultation was used for screening tPA patients.

**Authors' conclusions**
Telemedicine technologies by means of telephone or videoconferencing appeared safe and feasible in acute stroke management. Telestroke interventions were associated with increased delivery of tPA and can provide a means of enabling dedicated stroke teams at specialist stroke centres to support community hospitals without pre-existing neurological services.

**CRD commentary**
The review question and inclusion criteria were broadly defined. A satisfactory search of the literature was undertaken, but it was limited to peer-reviewed articles and potentially relevant studies may have been missed. It was unclear whether any language restrictions were applied. Publication bias was not formally assessed. The authors did not assess study quality; as most of the included studies were observational, the robustness of the findings may have been limited. Study selection was undertaken in duplicate; it was unclear whether the same was true for data extraction and so reviewer error and bias could not be ruled out. Clinical and methodological heterogeneity among studies made a narrative synthesis appropriate. However, the synthesis was somewhat limited and only a small number reported on health outcomes, patient and provider satisfaction and acceptance and no studies reported on resource utilisation.

Shortcomings in the included studies, a limited synthesis and potential for bias in the review mean that the authors' conclusions should be interpreted with caution.

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

**Research:** The authors stated that standardised measures were needed to enable the comparison of telestroke services with standard care and facilitate comparisons across telestroke studies. More research is needed to explore clinical and economic impacts of telemedicine technologies in stroke management to support policy makers in making informed decisions.

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