Telestroke: a concept in practice

The national challenge for stroke services is to deliver evidence-based interventions in a timely fashion [1]. A key component of this strategy is the use of fast-track systems with stroke-specific assessment tools to rapidly evaluate patients presenting with suspected stroke [2]. This leads to patients being prioritised and the early initiation of appropriate clinical assessments and medical investigations. This facilitates early diagnosis and determination of the aetiology of the stroke in addition to planning treatment strategies aimed at reducing the brain damage caused by the stroke and preventing complications.

Although rapid, specialist assessment for stroke patients has been shown to be effective, inequalities for care of stroke patients has been demonstrated between different hospitals and at different times of the week. Traditionally, on-site acute stroke specialist care has only been available during ‘working hours’ in a minority of hospitals with expertise unavailable at some urban and most rural centres [3, 4]. In order to overcome this gap in the availability of and access to stroke specialists, Levine and Gorman [5] developed the concept of ‘telestroke (telemedicine for stroke)’ to use state-of-the-art video telecommunications to maximise the number of patients being given effective acute stroke treatment irrelevant to where and when they presented. They proposed that ‘telestroke’ could facilitate remote stroke specialist assessment within minutes of attempted contact and suggested that paradigms be developed to provide ‘around-the-clock’ specialist clinical-radiological evaluation of stroke patients in all settings.

Over the last decade, computer-based technology has been harnessed to transform a concept into reality with different models for providing audiovisual interaction between patient and stroke physician being developed to meet the local needs of a variety of populations [4, 6–8]. Most systems feature a high-resolution camera in the emergency department (remotely controlled by the stroke specialist) with a microphone, speaker and screen for the patient to view the stroke specialist, linked usually via internet-based connections to the stroke specialist’s computer. Brain imaging transmission is usually via a picture and archiving communication system. Privacy and security of the system may be maintained by secure socket layer conditional access, data encryption and intruder alerts.

Telemedicine allows a stroke physician to provide remote specialist assessment of patients with real-time clinical evaluation (by two-way audiovisual communication) and interpretation of brain imaging. The National Institute of Health Stroke Scale has been shown to be a swift, accurate, reproducible and reliable remote clinical instrument for acute stroke teleconsultations and the accuracy and reliability of teleradiological assessment of acute brain imaging has also been demonstrated [9, 10]. Using telemedicine, a stroke specialist can assess a patient within minutes of arrival to the hospital helping to meet the demands of the ‘time is brain’ concept in acute stroke care. The promise of telestroke thus aims to avoid unnecessary patient transfer, bring the specialist to the patient, reduce inequality of healthcare access through stroke consultation and increase the number of patients being treated acutely with thrombolysis. This has been observed in the TEMPIS study involving 3122 patients in an integrated network in Bavaria that demonstrated significant benefits in the use of brain imaging, thrombolysis, earlier rehabilitation therapy and subsequent shortened length of stay [7].

A variety of conditions can mimic acute stroke and the ability to differentiate among these accurately and rapidly can be challenging for physicians without stroke expertise. The misdiagnosis rate is substantial and may be as high as 30% when pre-imaging initial diagnoses by emergency physicians are compared with stroke team final diagnoses [2]. In their randomised controlled trial, Meyer et al. [8] demonstrated correct treatment decisions, with reduced delay in diagnosis, to be made more often with telemedicine than with telephone consultation. Guidelines now recommend that telemedicine may play an important role not only in the delivery of thrombolysis but also in other aspects of stroke care such as pre-hospital emergency assessment, post-stroke rehabilitation, secondary prevention, stroke educational programmes and participation in acute stroke clinical trials [11–13].

Although some telemedicine systems facilitate ‘round-the-clock’ stroke care for a single hospital, it is becoming increasingly common for telemedicine-delivered stroke care to exist and be effective within a ‘hub-and-spoke’ model in a geographically organised network [4]. A stroke centre acts as a hub that provides specialist care for spoke hospitals that lack ‘in-house’ stroke expertise. Twenty-four hour access to stroke specialists may therefore be achieved with a realistic number of clinicians, and unnecessary patient transfer is avoided. Stroke specialists acting as telemedicine practitioners require on-site healthcare professionals’ participation to facilitate the clinical evaluation of the patient and these individuals need to be trained in working with remote specialists to obtain accurate neurological assessments. Within the ‘hub-and-spoke’ service network, models for telemedicine with and without secondary transfer have been advocated but there is no controlled trial data to support either approach [14].

Although the use of telestroke has its advantages, the uptake of such systems is still in its infancy due to a number of barriers preventing its implementation. These include limited stroke awareness in non-specialists, fear of digressing from traditional patterns of practice, medico-legal concerns of remote consultation and technical issues, costs...
of installation and perceived patient preference for physical visits [15]. Furthermore, the evidence base for telestroke is still predominantly observational with limited randomised controlled trial data [8].

The ‘telestroke’ team needs to contain information technologists to ensure that the computer-based technology remains reliable. Telemedicine therefore requires capital investment in equipment, technical support, training of clinical personnel and allowances for on-call coverage. Although no detailed, high-quality economic analyses of the cost-effectiveness of telemedicine for stroke have been performed, budgetary impact and cost-effectiveness of thrombolysis delivery by telestroke network has been estimated to be dominant to conservative management at a national level [4]. Given the potential benefit that telemedicine has to offer stroke services, resolving issues of organisation and delivery appear to be worth investing in. Whether the uptake of this promising technology in the United Kingdom mirrors the expansion observed in Central Europe and North America remains to be seen.

Conflicts of interest

None declared.

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