Title: The cost-effectiveness of improving the timeliness of endovascular thrombectomy by direct access to angiography: making time equal money

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Words: 950

In the treatment of acute ischemic stroke (AIS), time is a key factor in increasing the chance of good outcomes. For large vessel occlusion (LVO), which makes up 15-30% of all AIS,[1] there is clear evidence for the effectiveness of endovascular thrombectomy (EVT). The effectiveness is time-dependent, so that for every 9-minute delay in treatment, one out of every one hundred patients will have greater disability at 90-days.[2] Early identification of patients with LVO is critical in this setting.

Public stroke awareness campaigns and organisational changes to improve conveyance of suspected stroke patients to specialist centres have led to reductions in time from symptom onset to treatment. Less work has been done to improve the efficiency of hospital processes, including the optimization of vascular imaging required to identify patients who are eligible for EVT. One such intervention was evaluated in ANGIOCAT,[3] a randomised control trial conducted in Spain. In this study, instead of getting a computed tomography angiography (CTA) in the emergency department before proceeding to the angiography suite, patients with suspected LVO were taken there directly to the angiography suite (DTAS) and the flat-bed CT in the room was used to obtain the CTA. In the ANGIOCAT trial the time from hospital door to EVT went from a median time of 42-minutes in standard care to 18-minutes when the DTAS protocol was used. This translated to a significant reduction in the modified Rankin Scale (mRS) at 90-days for the DTAS group[3].In this issue of Neurology, Nguyen et al (2023)[4] report the cost-effectiveness of DTAS in suspected stroke patients in the Netherlands using data from the ANGIOCAT trial and other published sources. The aim was to evaluate if the potential additional cost of DTAS through increased use of angiography suites, was offset by long-term cost savings, as well as potential health related quality of life gains to patients, since faster treatments are associated with better outcomes, and reductions in hospital door to needle time potentially leads to patient benefits and cost-savings

One issue with evaluating the long-term benefits in stroke is that most stroke trials only follow patients for 90-days to determine key mortality and disability outcomes. To address this Nguyen et al simulated patient costs and outcomes 10 years into the future based on published evidence from a prospective, observational cohort of EVT in the Netherlands[5].They used patient status at 90 days in the ANGIOCAT trial as the starting point with the mRS at 90-days being a significant predictor of long-term costs.[6]

The results of their model were that DTAS cost $16,089 United States Dollars (USD) more than current practice over 10 years, but also resulted in an additional 0.65 quality adjusted life years (QALYS) for each suspected patient that went through DTAS, where 1 QALY represents 1 year in perfect health and 0 represents death. The base-case cost per QALY was $24,925 USD per QALY gained, which falls below the pre-specified cost-effectiveness decision threshold of $94,616 USD per QALY gained.

These findings are in contrast to those of the Spanish cost-effectiveness analysis of the ANGIOCAT trial, using Spanish data for the 10-year modelling. This assessment found that DTAS was both more effective and cost-saving over 10-years, with most of the cost-savings resulting from reduced

community rehabilitation costs.[7] Nguyen et al hypothesise that the reason for the difference in results between the two studies is the way the mRS is modelled after 90-days.

The weakness of the model is that it hinges on the results of the Spanish ANGIOCAT trial being generalisable to a Dutch context. The authors chose ANGIOCAT specifically because it is a trial where patients with suspected stroke went straight to a specialist stroke centre, rather than to non-specialist centres and then transferred. ANGIOCAT was the only trial to meet this criterion. As a result these findings are only applicable in a context where other efficiencies in the system have already occurred.

Another key issue is how well suspected stroke patients can be identified as being eligible for EVT, and hence the DTAS protocol, prior to any investigations taking place. Although the authors found that sending all FAST (face, arms, speech, time) positive patients via the DTAS protocol was cost-effective, this is unlikely to be viable in clinical practice due to the burden on the angiography suite. This highlights that just because an intervention is cost-effective, it does not mean that it is practical or affordable. Instead a balance needs to be struck between identifying as many patients as quickly as possible for DTAS and the finite capacity of the angiography suite.

The organisation of acute hospital stroke care is an important area of research, given that marginal efficiencies gained in the timeliness of stroke care delivery can make significant differences to patients' long term outcomes. These efficiencies in time may come at a monetary cost. Nguyen et al conclude that the cost of this additional time is justified given the additional benefits and assuming a cost per QALY gained below $94,616 per QALY is cost-effective . It's important to note that decision thresholds are mostly used at a national level when making decisions about approving new pharmaceuticals, and may not hold at a local level and for process and organisational changes. The results of this study are based on a model, and further research is needed to determine the true costs of implementation. More implementation science research is needed on how best to put these efficiency measures into practice, how to balance the competing needs of the potentially wide range of stakeholders involved, and what the true financial cost is to the hospital and wider system.

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