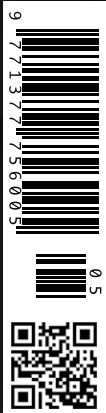




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Does Mechanical Thrombectomy Provide Economic Benefit In Ischaemic Stroke?

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The impact of COVID-19 on stroke services and using mechanical thrombectomy and best medical management, as per national guidelines, for patients with large vessel occlusion-related acute ischaemic stroke.

In the last 20 years, death rates from stroke have fallen mostly due to successful prevention strategies such as hypertension control and smoking cessation (<https://strokeeurope.eu/>).

Although it is positive to see the decreasing numbers of deaths from stroke, there is paradoxically an increase in stroke events, meaning more people are surviving but with the consequences of stroke. In Europe, it is estimated that by 2047, there will be an additional 2.58 million cases (+27%) of stroke compared to cases observed in 2017 (Wafa et al. 2020). That said, stroke is still a leading cause of death and disability (Wilkins et al. 2017).

The Impact of COVID-19

Stroke services, like so many specialties, have been adversely affected by the impact of COVID-19 (Bersano et al. 2020). In delivering stroke services, the additional complications of working around COVID-19 has put further strain on staff and resources – regular staff testing, supplementary protocol and pathways for emergencies, physical discomfort from wearing restrictive PPE, more cleaning requirements, etc (Baracchini et al. 2020).

In light of the changes forced upon health services globally by the COVID-19 pandemic, the need to deploy finite resources efficiently and smartly is even more pressing. That certainly applies in stroke medicine where mechanical thrombectomy (MT) plus best medical management is recommended in national guidelines for patients with large vessel occlusion-related acute ischaemic stroke (Turc et al. 2019).

What are the Benefits of MT?

MT has been proven to improve long-term outcomes compared with intravenous thrombolysis alone (Turc et al. 2019; Ziadat et al. 2018a; Goyal et al. 2015). In particular, achieving complete or near complete perfusion in a single pass (first-pass effect, or FPE) has been shown to have clinical advantages over multiple

attempts to remove thrombi (Ziadat et al. 2018b; Ziadat et al. 2020). Importantly for patients, FPE results in improved outcomes in terms of time spent in hospital, disability and functional independence compared with patients who did not achieve first-pass success. More recent analysis has highlighted economic advantages as well (Ziadat et al. 2020).

Therefore, not only is it important to optimise resource deployment, but it is also critical to use the resources optimally to achieve the best outcome for patients in the most cost-efficient way possible.

Cost Benefit of MT

Analyses suggest MT in combination with intravenous thrombolysis is cost-effective compared to intravenous thrombolysis alone when viewed in terms of the incremental cost per quality-adjusted life year (QALY) gained. Costs vary from one health system to another and differ according to the costs studies took into account and the time horizon considered, so the results from the different studies cannot be directly compared. For example,

- In Sweden, in 2015, the incremental cost-effectiveness ratio (ICER) per QALY was calculated as \$-223 over a patient's lifetime (Aronsson et al. 2016).
- In Canada, in a 2015 study, the ICER calculated was \$11,990 per QALY over a five-year time horizon (Xie et al. 2016).
- In the US, the ICER was determined to be \$3,096 per QALY over a 30 year period, in a 2015 study (Kunz et al. 2016), and \$14,137 in a second study (Leppert et al. 2015).
- In a 2013 UK study, over a 20 year period, the ICER of the technology gained was \$11,651 per QALY (Ganesalingam et al. 2015) and was dominant compared with intravenous t-PA alone, in another study conducted in 2016 (Lobotesis et al. 2016).



Better Patient Outcomes From Achieving FPE

The benefits of thrombectomy to patients are substantial: for every 100 patients treated, 38 have a less disabled outcome than with best medical management, and 20 more achieve functional independence (mRS 0–2) (Patel et al. 2018). Thus higher treatment costs associated with MT in the short-term can be offset in the longer term (Lobotesis et al. 2016).

A *post hoc* analysis of ARISE II study data assessed the

the two groups (3.39 [IQR=2.0–4.0] versus 3.58 [IQR=2.0–4.0], $p=0.70$) (Ziadat et al. 2020).

Patients who achieved FPE were discharged significantly sooner with a shorter length of hospital stay (6.10 [IQR=3.00–8.00] days) than patients in the group who did not achieve FPE (9.48 [IQR=3.00–11.00] days, $p<0.01$) (Ziadat et al. 2020).

The proportion of deaths and patients who had symptomatic intracranial haemorrhage (sICH) were lower in the FPE group

Mechanical thrombectomy has been proven to improve long-term outcomes compared with intravenous thrombolysis alone

economic impact of achieving complete or near complete reperfusion after first pass compared with multiple passes – the first study to look at this topic. Three-quarters (76%; $n=172$) of patients in ARISE II achieved complete or near-complete reperfusion (mTICI 2c–3) and among those FPE was seen in 53% ($n=91$) (Ziadat et al. 2020).

Clinical improvements seen in patients who achieved FPE resulted in better functional outcomes and fewer days in hospital compared with patients who did not achieve FPE: 80.5% achieved good (mRS 0–2) and 63.2% achieved excellent (mRS 0–1) functional outcomes compared with 61% ($p<0.01$) and 46.8% ($p=0.03$), respectively, of patients who did not achieve FPE. Patients in the FPE group also spent significantly fewer days in a standard bed ([mean] 3.05 [interquartile range {IQR}=0.0–5.0] versus 6.13 [IQR=1.0–8.0], $p<0.01$), whereas the mean number of days spent in ICU was similar between

than among patients who did not achieve FPE, but not significantly so – 90-day mortality: 5.68% versus 13.75%, $p=0.08$; sICH within 24 hours: 2.20% versus 4.94%, $p=0.42$) (Ziadat et al. 2020).

These improvements led to reduced healthcare resource use and therefore lower annual care costs. The analysis compared costs in FPE and non-FPE groups in the USA, France, Germany, Italy, Spain, Sweden and the UK. Country-specific healthcare resource costs were taken from peer-reviewed publications and market research reports validated by interviews with clinical experts (Ziadat et al. 2020).

Ziadat et al. (2020) conclude that ‘FPE represents a relevant procedural goal for endovascular treatment of acute ischaemic stroke. Moreover, the first-line treatment should ideally involve a thrombectomy technique that provides the best chance of succeeding in the first pass’. ■

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