**Editorial: How Do We Ensure That More Patients Receive Stroke Thrombectomy in the UK?**

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**Introduction**

Stroke is the fourth leading cause of death in the UK and largest cause of long term disability.1 In about 10% of acute ischaemic strokes there is occlusion of a large vessel and in these cases percutaneous mechanical thrombectomy (MT) is the most effective treatment since, unlike intravenous thrombolysis, it removes thrombus from the cerebral circulation to restore blood flow and thereby mitigates the extent of brain damage.2 Despite the proven effectiveness of thrombectomy from multiple randomised clinical controlled trials, only 2% of ischaemic stroke patients in the UK currently receive MT treatment, which means that over 7000 eligible patients per year are unable to access this treatment.2 In this editorial, we explore the main barriers to provision of MT in the UK and potential mechanisms to overcome them.

**The evidence**

The recent (April 2019 to March 2020) Sentinel Stroke National Audit Programme (SSNAP) report contained 89,280 strokes in the UK, with 87% due to cerebral infarction (i.e. ischaemic).2 It is estimated that approximately 10-12% of these strokes would have been eligible for MT according to the current evidence base, whereas only 1.57% actually received thrombectomy.2 Up until around 2014, intravenous thrombolysis was the mainstay of treatment for ischaemic stroke. However, depending on thrombus location in the cerebral circulation, successful vessel recanalization was only achieved in up to 10% of cases.3 Data from randomised trials then showed significant benefits of MT over conventional treatment, with a NNT to treat of just 2.6 for a one point improvement in the modified Rankin score (0= no disability; 6 = dead).4 As a result, the NHS Long Term Plan has made it a priority to expand access to MT, with the stated aim to make the UK the best in Europe at delivering timely, appropriate thrombectomy services by 2025.5 Several important barriers to achieving this ambition remain in place in the UK, which will now be explored in turn.

**Barrier 1: Rapid diagnosis by CT imaging**

NICE guidelines currently recommend that thrombolysis / thrombectomy should be offered to all anterior circulation strokes within 6 hours (or 6-24 hours if there is salvageable brain tissue on specialised imaging).6 One of the most significant barriers to the delivery of MT is the capability to achieve a diagnosis and confirm anatomical suitability very rapidly. Traditional pathways involve the transfer of a FAST (face, arm, speech, test) positive patient via an ambulance to the nearest emergency department to undergo a CT scan to exclude intracerebral haemorrhage. However, eligibility for MT is based on a combination of: (i) clinical presentation and (ii) dedicated CT angiography to visualise the cerebral vasculature and localise the culprit blood vessel. Therefore, rapid access to CT angiography is key, but is not currently performed on a 24/7 basis at all hospitals to which acute stroke patients will be conveyed.7 Furthermore, the availability of specialised expertise required to report the scans is limited. This barrier could therefore be overcome by a combination of: (a) more widely available CT angiography in potential MT candidate patients and (b) more staff trained in CT reporting and/or greater use of AI software for this reporting task. The national optimal stroke imaging pathway, which includes training and AI support at a national level, has been developed with a view to all parts of the UK having access to the appropriate imaging required.8

**Barrier 2: Streamlined stroke pathway to enable interhospital transfer**

Currently, there are 24 neuroscience centres that could be capable of performing MT.9 Therefore, for most potentially eligible patients the first presentation will be to a hospital without these facilities. The receiving clinical team at the first hospital therefore is critically important in identification, referral, and transfer of suitable patients so that they achieve MT within the required timeframe. Specifically, prompt diagnosis of the clinical signs of large vessel occlusion, the severity of the stroke (prestroke mRS and National Institutes of Health Stroke Scale scores) and any contraindications to thrombectomy/thrombolysis are needed, on arrival, prior to CT scan diagnosis. This facilitates the speed for referral for MT at the nearest specialist centre. The metric, “door in, door out” time, is a useful way to summarise the speed with which diagnosis of suitable stroke patient, referral to local MT centre and transfer is achieved, critical for optimal reperfusion.9 Recommended ways of enabling optimal transfer times include immediate clinical assessment of potential stroke patients, rapid communication with and acceptance by the thrombectomy centre. Throughout this process the patient remains on the original ambulance trolley in the first hospital so that once the patient has been accepted, transfer can be initiated immediately by the same ambulance crew.

**Barrier 3: Infrastructure**

Currently, very few of the MT centres provide a continuous 24/7service. Planning is therefore ongoing to provide 24/7 provision of MT at all 24 established neuroscience centres. However, modelling suggests that a further 4 to 7 MT centres are needed to achieve adequate geographical coverage of the United Kingdom.7 This will require significant investment in training and infrastructure, particularly in rural and remote areas, in order to achieve equity of access to MT. Currently, patients in London are much more likely to receive thrombectomy compared to other regions (8% versus 0-3%).2

**Barrier 4: Workforce challenges**

Unlike many countries in the world, thrombectomy in the UK to date has been conducted almost exclusively by interventional neuroradiologists (NIR). There are currently fewer than 100 NIR in the UK. Based on previous modelling, it has been suggested that between 142 and 192 operators would be needed to provide 24-hour MT coverage at all 24 existing neuroscience centres, with up to 240 operators needed to provide full geographical coverage of the UK.7 Based upon the current training model for NIR, these operator numbers cannot be achieved by this group of specialists alone. Other healthcare systems have overcome similar workforce barriers by utilising the percutaneous catheter skillset of trained interventional cardiologists (IC), who already provide 24/7, 365 emergency percutaneous coronary intervention for acute ST elevation myocardial infarctions. For example, in St Petersburg, Russia, an interventional stroke program was developed using their existing ST elevation myocardial infarction network.10 This rapidly improved treatment access, with a 26-fold increase in the number of thrombectomy cases performed (650 versus 25) when IC and NIR worked together to deliver the service.10 In the UK, the emergency primary intervention pathway is mature and offered to almost all ST elevation myocardial infarction patients. Surveys suggest that over 80% of existing trained ICs in the UK would be willing to contribute to a stroke MT rota if they can be trained to do so whilst maintaining their IC commitments. This would involve developing a bespoke MT training program for experienced IC that would provide them with the extra skillset needed to deliver MT, which may be achieved, according to the precedent set-in other countries, within 6 months. The British Cardiovascular Intervention Society endorses this approach, but progress will now require concerted cooperation to facilitate it from the NIR community and National Health Service England.7

**Conclusion**

The clinical effectiveness of MT for large vessel ischaemic stroke is unequivocal and the NHS Long Term Plan has prioritised the management of stroke using a series of timelines with the ultimate aim of providing some of the best stroke services in Europe by 2025. Despite some improvements, the 2022 timeline target of offering MT to 10% of all suitable strokes has already been missed.9 Furthermore, several barriers need to be overcome as outlined in this editorial to enable timely reperfusion therapy to those that are eligible. The success of timely reperfusion in primary PCI has been celebrated and achieved in the UK, so there is no reason as to why this cannot be achieved with stroke management in the near future. Workforce challenges can be most easily overcome by utilising the skillset of willing IC and possibly integrating the stroke pathway with existing acute coronary syndrome pathways that include 24/7 catheterisation laboratory access.

**Key Points**

* Stroke is the fourth leading cause of death in the UK and largest cause of long term disability
* In about 10% of acute ischaemic strokes there is occlusion of a large vessel and in these cases percutaneous mechanical thrombectomy is the most effective treatment
* Data from randomised trials show significant benefits of mechanical thrombectomy over conventional treatment, with a NNT to treat of just 2.6 for a one point improvement in the modified Rankin score
* Despite the proven effectiveness of mechanical thrombectomy, only 2% of ischaemic stroke patients in the UK currently receive the treatment, which means that over 7000 eligible patients per year are unable to access this treatment.
* To increase uptake, coordinated action is needed to increase access to specialised brain imaging to determine eligibility for thrombectomy and a greater number of hospitals need to provide 24/7 stroke thrombectomy services
* In addition, significant workforce planning is needed to increase the number of clinicians able to perform mechanical thrombectomy.

**References**

1. Stroke Association (2018) State of the nation: Stroke statistics. Available from: https://www.stroke.org.uk/system/files/sotn\_2018.pdf.

2. Sentinel Stroke National Audit Programme. Sentinel Stroke National Audit Programme National Results 2020–21. https://www.strokeaudit.org/results/Clinical-audit/National- Results.aspx.

3. del Zoppo, G. J., Poeck, K., Pessin, M. S., Wolpert, S. M., Furlan, A. J., Ferbert, A., Alberts, M. J., Zivin, J. A., Wechsler, L., *et al.* Recombinant tissue plasminogen activator in acute thrombotic and embolic stroke. *Ann. Neurol.* **32**, 78–86 (1992).

4. Goyal, M., Menon, B. K., van Zwam, W. H., Dippel, D. W. J., Mitchell, P. J., Demchuk, A. M., Dávalos, A., Majoie, C. B. L. M., van der Lugt, A., *et al.* Endovascular thrombectomy after large-vessel ischaemic stroke: a meta-analysis of individual patient data from five randomised trials. *Lancet (London, England)* **387**, 1723–1731 (2016).

5. https://www.longtermplan.nhs.uk/online-version/chapter-3-further-progress-on-care-quality-and-outcomes/better-care-for-major-health-conditions/stroke-care/#ref.

6. Stroke and transient ischaemic attack in over 16s: diagnosis and initial management. NICE guidance, [NG 128] london. 2019. Available: www.nice.org.uk/guidance/ng128/resources.

7. Routledge, H., Sharp, A. S. P., Kovac, J., Westwood, M. & Keeble, T. R. Position Statement Can Interventional Cardiologists Help Deliver the UK Mechanical Thrombectomy Interventional Programme for Patients with Acute Ischaemic Stroke ? A Discussion Paper from the British Cardiovascular Interventional Society Stroke Thrombecto. 1–5 (2022).

8. NHS England. National Stroke Service Model. https://www.england.nhs.uk/wp-content/uploads/2021/05/national-stroke-service-model-integrated-stroke-delivery-networks-may-2021.pdf (accessed 19 April 2022).

9. Routledge, H. & Curzen, N. Percutaneous management of acute ischaemic stroke. 1–7 (2023) doi:10.1136/heartjnl-2022-321604.

10. Savello, A. V, Vozniuk, I. A., Fiehler, J. & Orlov, K. Y. How to Set up a Thrombectomy Service : The St. Petersburg Experience. *Clinical neuroradiology* vol. 30 5–7 (2020).