Tidsskriftet Tidsskrift for Den norske legeforening

We need mobile stroke units

OPINIONS

KARIANNE LARSEN

karianne.larsen@norskluftambulanse.no
Karianne Larsen, specialist in neurology and PhD scholar at the Department of Research and Development, Norwegian Air Ambulance Foundation and the Institute of Basic Medical Sciences, University of Oslo
The author has completed the ICMJE form and declares the following conflicts of interest: She is a researcher in Treat-NASPP and board member of PRESTO (PRE-hospital Stroke Treatment Organization).

MAREN R. HOV

Maren R. Hov, associate professor in the training programme for paramedics at Oslo Metropolitan University, doctor and senior researcher at the Department of Neurology, Oslo University Hospital and Department of Research and Development, Norwegian Air Ambulance Foundation.
The author has completed the ICMJE form and declares no conflicts of interest.

ELSE C. SANDSET

Else C. Sandset, senior consultant and senior researcher at the Department of Neurology, Oslo University Hospital, and Department for Research and Development, Norwegian Air Ambulance Foundation
The author has completed the ICMJE form and declares the following conflicts of interest: She has received lecture fees from Boston Scientific.

CHRISTIAN G. LUND

Christian G. Lund, MD, PhD, specialist in neurology, senior medical officer/senior consultant for cerebrovascular diseases, Oslo University Hospital Rikshospitalet.
The author has completed the ICMJE form and declares no conflicts of interest.

KRISTI G. BACHE

Kristi G. Bache, M.Sc., PhD, pro-rector at Østfold University College and associated with the Institute of Basic Medical Sciences, University of Oslo.

The author has completed the ICMJE form and declares no conflicts of interest.

Mobile stroke units save time from symptom onset to treatment in cases of acute ischaemic stroke, have a sustainable cost-benefit profile and are now recommended in European guidelines. We should investigate the use of mobile stroke units in the pre-hospital healthcare service in Norway as well.

The Norwegian mobile stroke unit. Photo: Thomas T. Kleiven

The idea to introduce mobile stroke units first came in the early 2000s as a measure to give thrombolytic treatment as soon as possible to patients who had suffered an ischaemic stroke, since the effect is highly time-dependent (1, 2). The first mobile stroke unit rolled out onto German roads in 2008, and the results showed that the time from symptom onset to thrombolytic treatment was halved when compared with a regular treatment chain (3). Studies in other countries have since shown that mobile stroke units make for a significant reduction in the time to treatment, an increased thrombolysis rate and a better prognosis for the patients (4).

A mobile stroke unit is equipped with a CT scanner, a haematology analyser and medical emergency equipment (1), with a team that can perform advanced pre-hospital diagnostics and initiate treatment. In case of large artery

occlusion, where mechanical thrombectomy will often be indicated (5), mobile stroke units can also transport patients directly to a thrombectomy centre without undue delay (6). Nor does thrombolytic treatment provided in a mobile stroke unit cause any increase in complications such as intracranial haemorrhage (7).

> ***«Mobile stroke units make for a significant reduction in the time to treatment, an increased thrombolysis rate and a better prognosis for the patients»***

In other countries, mobile stroke units are staffed by a stroke specialist/neurologist, paramedics/nurses and a radiographer or a radiologist (8). The model that has been tested in Norway differs from this set-up by being staffed similarly to a helicopter ambulance, with an anaesthesiologist trained in prehospital emergency care and two paramedics (9). The team has been given structured training in emergency diagnostics and treatment of stroke, the technical use of CT and interpretation of CT images, as well as certification in the clinical National Institutes of Health Stroke Scale (NIHSS). By building the model on existing pre-hospital staffing, the mobile stroke unit may be easier to implement, and it can also be used for other medical emergency missions.

Norwegian study of mobile stroke units

The first Norwegian study of mobile stroke units, the Norwegian Acute Stroke Prehospital Project (NASPP), showed that anaesthesiologists could independently interpret CT images and perform an NIHSS score with a high degree of consistency with hospital doctors (10, 11).

The Treat-NASPP study showed that thrombolytic treatment was provided 17 minutes earlier when managed by a mobile stroke unit as compared to the standard treatment chain. 22 % more stroke patients were given thrombolysis, and 13 times as many were treated within 'the golden hour' after symptom onset, when the treatment is most effective (9). Although the study did not have sufficient statistical power to permit any definite conclusions about functional outcome in the patients, the results indicated that more patients were discharged to their homes after hospitalisation when compared to the regular treatment pathway.

The results of the study also indicated that more patients with large artery occlusion or cerebral haemorrhage could be diagnosed at the prehospital stage and transported directly to a regional hospital for specialised treatment, such as thrombectomy or surgery (7). The results are consistent with international studies of mobile stroke units.

A recent health economics study undertaken in cooperation with the Norwegian Institute of Public Health shows that treatment by mobile stroke unit is potentially cost-effective in areas where at least 125–260 patients can be treated per mobile stroke unit per year (12). This could be realistic in many places in Norway (13), and the rendezvous method (meeting up with a regular

ambulance) allows for an extension of the catchment area. The health economics analysis is conservative and has not estimated other possible cost-saving effects beyond prehospital thrombolytic treatment, such as better resource use in terms of transport, admissions and hospital examinations. Further identification of the full potential inherent in mobile stroke units should be undertaken.

Mobile stroke units in Norway

European guidelines based on analyses of 14 controlled trials (including the Norwegian Treat-NASPP study) now recommend mobile stroke units rather than standard treatment pathways for patients with a suspected stroke. This includes sub-recommendations for ischaemic stroke, cerebral haemorrhage and stroke imitators (patients with stroke symptoms who end up with a different hospital diagnosis) (7). Management of ischaemic stroke in mobile stroke units has the strongest evidence.

> ***«The time has come to consider this model with a view to streamlining and improving the prehospital management of stroke in Norway»***

Mobile stroke units should not be seen as a replacement for other measures at the prehospital stage or in hospital, but as a supplement that will operate in parallel and in synergy with the ambulance service, the air ambulance service and stroke teams in hospitals. The Norwegian mobile stroke unit model is potentially cost-effective in urban and suburban areas, and the model may therefore be relevant for several health regions in Norway and the Nordic countries. With solid research results, a health economics analysis of data from Norwegian studies and European guidelines that recommend the use of mobile stroke units, the time has come to consider this model with a view to streamlining and improving the prehospital management of stroke in Norway.

REFERENCES

1. Fassbender K, Walter S, Liu Y et al. "Mobile stroke unit" for hyperacute stroke treatment. Stroke 2003; 34: e44. [PubMed][CrossRef]

2. Kim JT, Fonarow GC, Smith EE et al. Treatment With Tissue Plasminogen Activator in the Golden Hour and the Shape of the 4.5-Hour Time-Benefit Curve in the National United States Get With The Guidelines-Stroke Population. Circulation 2017; 135: 128–39. [PubMed][CrossRef]

3. Walter S, Kostopoulos P, Haass A et al. Diagnosis and treatment of patients with stroke in a mobile stroke unit versus in hospital: a randomised controlled trial. Lancet Neurol 2012; 11: 397–404. [PubMed][CrossRef]

4. Turc G, Hadziahmetovic M, Walter S et al. Comparison of Mobile Stroke Unit With Usual Care for Acute Ischemic Stroke Management: A Systematic

Review and Meta-analysis. JAMA Neurol 2022; 79: 281–90. [PubMed] [CrossRef]

5. Enriquez BA, Tennøe B, Nome T et al. Mekanisk trombektomi ved akutt hjerneinfarkt. Tidsskr Nor Legeforen 2022; 142: 612-6. [PubMed]

6. Zhao H, Coote S, Easton D et al. Melbourne Mobile Stroke Unit and Reperfusion Therapy: Greater Clinical Impact of Thrombectomy Than Thrombolysis. Stroke 2020; 51: 922–30. [PubMed][CrossRef]

7. Walter S, Audebert HJ, Katsanos AH et al. European Stroke Organisation (ESO) guidelines on mobile stroke units for prehospital stroke management. Eur Stroke J 2022; 7: XXVII–LIX. [PubMed][CrossRef]

8. Fassbender K, Merzou F, Lesmeister M et al. Impact of mobile stroke units. J Neurol Neurosurg Psychiatry 2021; 92: 815–22. [PubMed][CrossRef]

9. Larsen K, Jaeger HS, Tveit LH et al. Ultraearly thrombolysis by an anesthesiologist in a mobile stroke unit: A prospective, controlled intervention study. Eur J Neurol 2021; 28: 2488–96. [PubMed][CrossRef]

10. Hov MR, Røislien J, Lindner T et al. Stroke severity quantification by critical care physicians in a mobile stroke unit. Eur J Emerg Med 2019; 26: 194–8. [PubMed][CrossRef]

11. Hov MR, Zakariassen E, Lindner T et al. Interpretation of Brain CT Scans in the Field by Critical Care Physicians in a Mobile Stroke Unit. J Neuroimaging 2018; 28: 106–11. [PubMed][CrossRef]

12. Lund UH, Stoinska-Schneider A, Larsen K et al. Cost-Effectiveness of Mobile Stroke Unit Care in Norway. Stroke 2022; 53. doi: 10.1161/STROKEAHA.121.037491. [PubMed][CrossRef]

13. Medisinsk kvalitetsregister. Norsk hjerneslagregister. St. Olavs hospital. https://stolav.no/fag-og-forskning/medisinske-kvalitetsregistre/norsk-hjerneslagregister Accessed 29.3.2022.

Publisert: 5 September 2022. Tidsskr Nor Legeforen. DOI: 10.4045/tidsskr.22.0444
Received 23.6.2022, accepted 12.8.2022.