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Monitoring following acute stroke should be improved

PERSPECTIVES

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Many serious complications following acute stroke can be prevented and treated. This requires close and systematic monitoring following stroke.

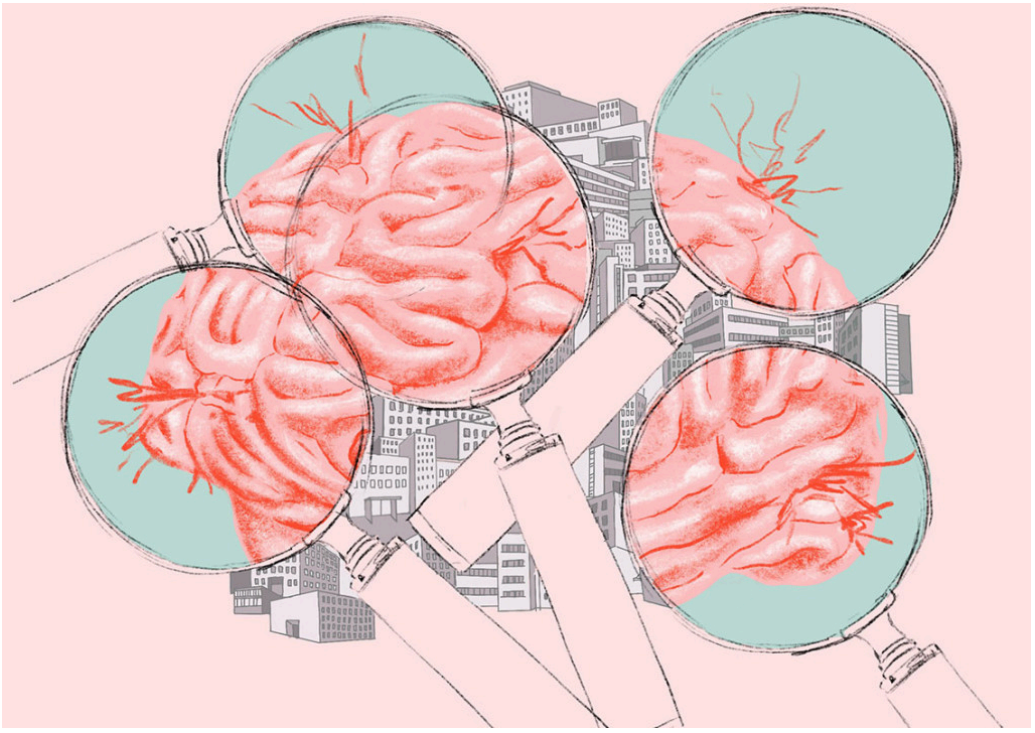

Illustration: Sylvia Stølan

Modern acute stroke treatment means that patients with severe stroke have a greater chance than ever before of survival without major sequelae. However, effective stroke treatment that mitigates against injury must be started rapidly after the event. Therefore, continuous monitoring is often required following stroke.

The admission of patients with acute stroke to a stroke unit is a well-documented effective treatment, and as many as 95 % of patients with acute stroke are treated in stroke units in Norway (1, 2).

> ***«One study demonstrated that one in four stroke patients had a complication detected by continuous monitoring»***

A good stroke unit will also be able to monitor patients (3). Compared to repeated observations, continuous measurements can reduce the risk of death and increase the chance of detecting cardiac arrhythmias and infections (4). One study demonstrated that one in four stroke patients had a complication detected by continuous monitoring (5).

Observation or monitoring?

Up to now, monitoring in stroke units in Norway has largely consisted of standardised regular recording of neurological function using the National Institutes of Stroke Health Scale (NIHSS) score and intermittent measurement

of physiological parameters for the first 2–5 days following stroke. Effective (but time-sensitive) treatment to restore cerebral circulation requires continuous monitoring of signs associated with cerebral function and circulation, general circulation and respiration. Therefore, it is necessary and timely to discuss the content of the monitoring routines for stroke.

A good-sized stroke unit should have capacity to accommodate all the stroke patients arriving at hospital. Some of the acutely unwell patients will require continuous observation of consciousness, mental and neurological function, circulation and respiration, as well as temperature, blood glucose, electrolytes and fluid balance. In addition to doctors and nurses who are knowledgeable about acute brain injury, the stroke unit should have dedicated bed spaces for these patients.

Some patients require monitoring and treatment in the intensive care unit with more advanced and specialised expertise, for example if intracranial pressure measurement is to be performed, for monitoring following cerebrovascular interventions, for patients undergoing neurosurgical treatment or if general intensive care is needed.

Who requires continuous monitoring?

The level of monitoring required should be assessed on admission, based on criteria related to the severity of the stroke and potential interventions (5). More than one in four stroke patients receive reperfusion therapy with thrombolysis and/or thrombectomy (2). These therapies are effective, but require continuous and standardised monitoring following the procedures. One complication of these therapies is intracerebral haemorrhage. In 2020, around 6 % of patients receiving thrombolytic therapy developed intracerebral haemorrhage and deterioration in function (2). Most of these haemorrhages occur within 12 hours of thrombolysis (6).

Patients admitted to stroke units who have not received reperfusion therapy may develop sudden changes in cerebral function, with loss of function and an indication for thrombolytic therapy. Unstable patients also have a particular requirement for maintenance of optimal blood pressure, circulation and respiration. Recent knowledge gained about the importance of good blood pressure control in preventing complications has increased the focus on closer monitoring of blood pressure (7). Cerebral blood circulation can be monitored by repeated ultrasound scans, which makes it possible, for instance, to observe whether reperfusion occurs following intravenous thrombolysis or whether a revascularised vessel becomes reoccluded (8). Cardiac arrhythmias such as atrial fibrillation are common in the acute phase and may be seen in approximately 10 % of patients. Atrial fibrillation with rapid heart rate may have an adverse effect on cerebral circulation (9). Infarction of some areas of the brain, e.g. left insular region, increases the risk of cardiac arrhythmias, and patients with these infarctions should receive continuous heart rhythm monitoring for several days.

«The level of monitoring required should be assessed on admission, based on criteria related to the severity of the stroke and potential interventions»

Dysphagia is seen in 42–67 % of patients and poses a risk of aspiration (10, 11). Pneumonia is one of the main causes of poor prognosis following stroke. Impaired consciousness or paresis of the respiratory and swallowing muscles also increases the risk of acute respiratory difficulties due to accumulation of saliva and mucus formation in the pharynx. These patients often require continuous monitoring of respiration and frequent removal of saliva and mucus to avoid serious respiratory problems.

Some patient groups may have unstable neurological function, regardless of reperfusion treatment. These patients include those with stenosis of the carotid or intracranial arteries and those with critical circulation in cerebral microvessels not accessible for intervention. Patients with oedema in and around the infarction who are at risk of raised intracranial pressure or with neurological deficit that may impact consciousness, swallowing function and respiration may also require continuous monitoring. In case of major and moderate cerebral infarction, oedema is an independent risk factor for poorer outcomes following stroke (12). In some patients, the infarction with oedema may result in elevated intracranial pressure and require surgical treatment with craniectomy or drainage of cerebrospinal fluid. For major cerebellar infarctions (> 1/3 of cerebellar hemisphere), there is a risk of both sudden obstructive hydrocephalus and brainstem compression. Craniectomy, both hemicraniectomy and suboccipital craniectomy, improves survival and reduces loss of function (13, 14). Optimal function following infarction depends on craniectomy being performed promptly once treatment has been found to be indicated.

In a few cases of intracerebral haemorrhage, acute neurosurgical treatment may be appropriate, such as external drainage or evacuation of the haematoma. The vast majority of patients with intracerebral haemorrhage do not require surgery, but other acute treatment and monitoring is essential. Suboptimal physiological parameters are also associated with poorer function and increased mortality in acute intracerebral haemorrhage (7).

The size of the haemorrhage is influenced by blood pressure in the first few hours following stroke (15). Therefore, it is absolutely essential to monitor blood pressure and to initiate rapid and targeted treatment with intravenous antihypertensive therapy. This should take place under continuous monitoring. A Danish study from 2021 has demonstrated that around half of patients with intracerebral haemorrhage were using antithrombotic treatment at onset of the haemorrhage (16). Rapid reversal of the anticoagulant effect is appropriate for many of these patients. Complications may also arise suddenly in intracerebral haemorrhage, and neurosurgical treatment may be decisive for the outcome (7).

Other patients requiring close monitoring in the stroke unit are patients with repeated serious transient ischaemic attacks (TIAs). They may suddenly require reperfusion treatment due to carotid artery dissection and stroke with worsening of neurological symptoms.

Cerebral monitoring for stroke patients

Cerebral monitoring for acute stroke patients should involve more than beds equipped with extra monitoring equipment. A survey of monitored bed spaces in Norwegian stroke units conducted by the Norwegian Stroke Organisation in 2020 revealed wide variations between the hospitals in terms of the provision of monitoring for stroke patients (17), both in capacity and the monitoring that could be provided. Only 13 out of 48 hospitals had acute stroke units with the capacity for close and continuous monitoring.

> ***«Cerebral monitoring in stroke units should probably be developed as an intermediate unit integrated in the stroke unit with the capacity to manage around 20–25 % of the patients admitted»***

Cerebral monitoring in stroke units should probably be developed as an intermediate unit integrated within the stroke unit with the capacity to manage around 20–25 % of the patients admitted. In the majority of places, this type of unit is unlikely to be able to rely on doctors and nurses with formal intensive care expertise. Therefore, stroke doctors and stroke nurses must develop the unit collaboratively by using competency plans, proper procedures, secondments and training.

Some acute stroke units in Norway have had dedicated monitoring wards with continuous monitoring of patients in the acute phase of stroke for several years. In the authors' opinion, experiences from these units indicate that it should be possible to establish these monitoring wards as intermediate units integrated within stroke units in all large and medium-sized hospitals in Norway that treat stroke patients. In the smallest hospitals with few stroke patients, it would be most appropriate for the monitoring to be added to the intensive care unit rather than setting up a separate intermediate unit for stroke monitoring.

Summary

Few diseases are more dependent on rapid and appropriate treatment than acute stroke. Many patients with acute stroke are unstable in the acute phase. Continuous monitoring of a large proportion of patients may increase their chances of achieving improved outcomes. There are probably wide variations between hospitals in Norway in the extent to which patients with acute stroke receive near-continuous monitoring. Monitoring of stroke patients in Norway should be improved, and standards for cerebral monitoring following stroke should be drawn up.

REFERENCES

1. Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke. Cochrane Libr 2013; 9. doi: 10.1002/14651858.CD000197.pub3. [CrossRef]

2. Norsk hjerneslagregister. Årsrapport for 2021. https://stolav.no/fag-og-forskning/medisinske-kvalitetsregistre/norsk-hjerneslagregister/rapporter Accessed 18.8.2022.

3. Helsedirektoratet. Nasjonal faglig retningslinje for behandling og rehabilitering ved hjerneslag. https://www.helsedirektoratet.no/retningslinjer/hjerneslag Accessed 23.8.2022.

4. Ciccone A, Celani MG, Chiaramonte R et al. Continuous versus intermittent physiological monitoring for acute stroke. Cochrane Database Syst Rev 2013; 5: CD008444. [PubMed][CrossRef]

5. Faigle R, Marsh EB, Llinas RH et al. ICAT: a simple score predicting critical care needs after thrombolysis in stroke patients. Crit Care 2016; 20: 26. [PubMed][CrossRef]

6. Yaghi S, Boehme AK, Dibu J et al. Treatment and outcome of thrombolysis-related hemorrhage: a multicenter retrospective study. JAMA Neurol 2015; 72: 1451–7. [PubMed][CrossRef]

7. Song L, Wang X, Ouyang M et al. Associations of an Abnormal Physiological Score With Outcomes in Acute Intracerebral Hemorrhage: INTERACT2 Study. Stroke 2021; 52: 722–5. [PubMed][CrossRef]

8. Thomassen L, Fromm A, Aarli S et al. Transkranial ultralydovervåking ved hjerneslag. Tidsskr Nor Legeforen 2021; 141. doi: 10.4045/tidsskr.21.0180. [PubMed][CrossRef]

9. Wira CR, Rivers E, Martinez-Capolino C et al. Cardiac complications in acute ischemic stroke. West J Emerg Med 2011; 12: 414–20. [PubMed] [CrossRef]

10. Perry L, Love CP. Screening for dysphagia and aspiration in acute stroke: a systematic review. Dysphagia 2001; 16: 7–18. [PubMed][CrossRef]

11. Kidd D, Lawson J, Nesbitt R et al. The natural history and clinical consequences of aspiration in acute stroke. QJM 1995; 88: 409–13. [PubMed]

12. Battey TW, Karki M, Singhal AB et al. Brain edema predicts outcome after nonlacunar ischemic stroke. Stroke 2014; 45: 3643–8. [PubMed][CrossRef]

13. Back L, Nagaraja V, Kapur A et al. Role of decompressive hemicraniectomy in extensive middle cerebral artery strokes: a meta-analysis of randomised trials. Intern Med J 2015; 45: 711–7. [PubMed][CrossRef]

14. Kim MJ, Park SK, Song J et al. Preventive suboccipital decompressive craniectomy for cerebellar infarction: a retrospectivematched case-control study. Stroke 2016; 47: 2565–73. [PubMed][CrossRef]

15. Tsivgoulis G, Katsanos AH, Butcher KS et al. Intensive blood pressure reduction in acute intracerebral hemorrhage: a meta-analysis. Neurology 2014; 83: 1523–9. [PubMed][CrossRef]

16. Hald SM, Möller S, García Rodríguez LA et al. Trends in Incidence of Intracerebral Hemorrhage and Association With Antithrombotic Drug Use in Denmark, 2005-2018. JAMA Netw Open 2021; 4: e218380. [PubMed] [CrossRef]

17. Rønning OM, Fromm A, Thomassen L et al. Norske slagenheter og slagsentra. En NSO-kartlegging 2020. NSO-rapport nr. 1/2021. Bergen: Norsk slagorganisasjon, 2021.

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