

While significant progress has been made in the treatment of acute cerebral infarction, this is not the case for treatment of acute cerebral haemorrhage.

## Treatment of stroke

The treatment of stroke has changed greatly over the past 25 years, partly as a result of the establishment of dedicated stroke units (1). This issue of the Journal of the Norwegian Medical Association features two important articles on cerebral haemorrhage and cerebral infarction. In a large prospective study in Vestfold county, Hole & Kloster calculated the incidence of first-time cerebral haemorrhage (2). They found the annual incidence to be 20.5 cases per 100 000 persons in the period 2010–14. This is lower than that reported in a study from Innherred municipality in Trøndelag county in 1994–96 (3), but higher than in a study from the southernmost region of Norway in 2005–09 (4). As in other studies, mortality was found to be high, with almost 40 % of patients deceased within 30 days. However, many of those who do survive have a good prognosis. Roughly half returned to their own homes and did not require supervision or additional assistance. Almost a quarter of the patients took warfarin, most often because of atrial fibrillation. The use of warfarin is now decreasing after the so-called NOACs (novel oral anticoagulants) were approved for thrombosis prophylaxis. NOAC therapy is associated with a lower risk of cerebral haemorrhage than warfarin therapy, and we can therefore expect a reduction in the incidence of cerebral haemorrhage in years to come.

As Hole & Kloster point out, most patients with cerebral haemorrhage are treated conservatively and prognosis has not changed substantially for many years. There is therefore a need for further research to improve the acute treatment of cerebral haemorrhage. With the exception of major cerebellar haemorrhage, randomised controlled trials have not shown an improvement in prognosis with neurosurgery. Nor have such trials shown an improvement with haemostatic therapy. A nationwide randomised controlled trial known as the NOR-ICH study is currently underway. In the trial, which is being coordinated from Bergen, tranexamic acid or placebo are being administered to patients with acute cerebral haemorrhage within three hours of symptom onset. Several studies suggest that blood pressure reduction may improve prognosis in cases of acute cerebral haemorrhage (5).

Significant advances have, however, been made in recent years in the treatment of acute cerebral infarction. Intravenous thrombolytic therapy was first introduced with a time window for use of up to three hours from symptom onset, but this has subsequently been extended to 4.5 hours (6). The past ten years have seen increasing use of thrombectomy with mechanical removal of blood clots from the major intracranial arteries. The first randomised trial showing that thrombectomy is efficacious in patients with known symptom onset was published in 2014, and in 2015 four further studies were published showing that thrombectomy improves functional outcome after 90 days (7). Many hospitals offer thrombolytic therapy or thrombectomy to patients who wake or are found with an acute cerebral infarction if there is normal FLAIR MRI but pathological diffusion-weighted MRI.

The sooner thrombolytic therapy or thrombectomy can be initiated after symptom onset, the greater the likelihood of good results. Norwegian hospitals have therefore worked in recent years to improve logistics from when the patient arrives in the emergency department to when they undergo thrombolysis or thrombectomy: one aspect of this has been the establishment of stroke teams. All patients must first undergo a CT or MRI scan to exclude cerebral haemorrhage. For many patients, the so-called door-to-needle time is now less than ten minutes. Because patients must be evaluated quickly, there

is always a risk of giving thrombolytic therapy to persons who do not have an acute cerebral infarction. However, experience now indicates that thrombolytic therapy entails very little risk of severe haemorrhage for such patients (8).

Prehospital delay is the main reason that patients with acute stroke arrive at hospital too late. Faiz et al. present an important study on factors that extend the prehospital phase (9). They found that transport to hospital takes longer when the patient contacts a general practice or Accident and Emergency department than when they contact the Emergency Medical Communication Centre; almost all of the latter patients are taken to hospital by ambulance compared to less than half of those who contact a general practice or Accident and Emergency department. They conclude that general practitioners should receive better training in the prompt management of patients with acute stroke. There should also be greater emphasis on awareness campaigns to educate the general public about simple symptoms of acute stroke and about the need to contact the Emergency Medical Communication Centre as quickly as possible in the event of stroke symptoms. Previous awareness campaigns have been effective, but the effect lasted only a few months. This type of awareness campaign must therefore be repeated at regular intervals.

In Norway as a whole, about 15 % of patients with acute cerebral infarction receive intravenous thrombolytic therapy, and in some hospitals the proportion is over 25 % (10). The time of symptom onset is unknown for a number of patients, and for these persons intravenous thrombolysis is often not indicated. If prehospital delay could be reduced to a minimum through new awareness campaigns, there is reason to believe that as many as half of those who might benefit from intravenous thrombolysis could be treated in time. This is an important and achievable goal.

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