

Early Mobilization After Stroke Early Adoption but Limited Evidence

Julie Bernhardt, PhD; Coralie English, PhD; Liam Johnson, PhD; Toby B. Cumming, PhD

In the last decade, increasing attention has been paid to understanding the components of care that might contribute to the stroke unit effect. Early mobilization, in its many guises, is one component of care proposed to contribute to the survival and recovery benefits of stroke unit care.¹ This topical review provides an overview of the current evidence, research, and practice recommendations for early mobilization after stroke.

We Need to Define Early Mobilization

As a term, early mobilization is problematic. There is no common understanding of the meaning of early (eg, hours, days, weeks, months) or mobilization (movement of, eg, cells, joints, limbs, people). A recurring theme in this review, inadequate definition currently limits our ability to synthesize information on the topic. For example, in some clinical trials of mobility interventions started soon after stroke, mobilization is used to describe a program of task-specific standing and walking retraining (rehabilitation) delivered by therapists or nurses and continued throughout the acute hospital stay.^{2,3} In other cases, mobilization refers simply to moving a patients' limbs in bed or sitting them out of bed. The timing of commencement of activity is also highly variable and often hard to determine. As both what we do (intervention type, intensity, frequency, amount), and when we do it, may confer benefit or harm, we highlight variations in definition where relevant. We have focused our review on out-of-bed interventions commencing in the first 24 to 72 hours after stroke, as this is the period of greatest clinical uncertainty.

Brief History of Early Mobilization After Stroke

Early mobilization was first discussed at a Swedish consensus conference on stroke care in the mid-1980s (Bo Norving and Bent Indredavik, personal communication, 2014) with several local guidelines in Norway and Sweden recommending the practice. Early mobilization became more prominent in the

literature in the early 1990s when Indredavik and colleagues reported their clinical trial results showing marked reduction in death and disability in patients managed in a stroke unit with a focus on early rehabilitation and mobilization when compared with general medical ward care.⁴ This trial formed part of the seminal Cochrane review by Langhorne and colleagues⁵ that clearly demonstrated the benefits of organized stroke unit care. Early mobilization/rehabilitation was incorporated into subsequent discussions as an important component of stroke unit care¹ and began to appear in national clinical guidelines around 1994.⁶ The first randomized controlled trial of early mobilization commenced in 2004 (A Very Early Rehabilitation Trial [AVERT] Phase II),³ testing the feasibility and safety of starting task-specific mobility training, in a stroke unit context, within 24 hours of stroke onset. The intervention protocol was informed by observational studies, which highlighted that in Indredavik's Norwegian stroke unit, a philosophy of early mobilization did result in patients, even those with severe stroke, being more physically active throughout the day.⁷ The sub-24 hour timing of intervention commencement in AVERT Phase II was selected to better inform clinical practice, given the uncertainty about the potential harms and benefits of starting activity, particularly in the first day(s) after stroke. This will be covered in more depth below.

Trials Evidence

Only 4 completed trials (AVERT Phase II, n=71³; Very Early Rehabilitation or Intensive Telemetry After Stroke [VERITAS], n=32⁸; Akershus Early Mobilization in Stroke Study [AKEMIS], n=56⁹; and Lausanne trial, n=42¹⁰; total n=201) have tested an early mobilization intervention commenced within 24 to 72 hours of stroke, against a usual care (later mobilization±monitoring) control in a stroke unit environment (Table 1). Generally, inclusion criteria have been broad with a wide range in age, stroke severity, and stroke type (only the Lausanne trial excluded patients with intracerebral

Received December 22, 2014; final revision received December 22, 2014; accepted January 8, 2015.

From the Florey Institute of Neuroscience and Mental Health, University of Melbourne, Australia (J.B., C.E., L.J., T.B.C.); International Centre for Allied Health Evidence, University of South Australia, Australia (C.E.); Institute of Sport, Exercise and Active Living, Victoria University, Melbourne, Australia (L.J.).

The online-only Data Supplement is available with this article at <http://stroke.ahajournals.org/lookup/suppl/doi:10.1161/STROKEAHA.114.007434/-/DC1>.

Correspondence to Julie Bernhardt, PhD, The Florey Institute of Neuroscience and Mental Health, 245 Burgundy St, Heidelberg, Victoria, Australia 3084. E-mail julie.bernhardt@florey.edu.au

(*Stroke*. 2015;46:1141-1146. DOI: 10.1161/STROKEAHA.114.007434.)

© 2015 American Heart Association, Inc.

Stroke is available at <http://stroke.ahajournals.org>

DOI: 10.1161/STROKEAHA.114.007434

Table 1. Completed Trials of Early and Very Early Mobilization After Stroke

Publication (Trial Name)	Randomized Sample	Intervention Protocol	Time (Hours) Between Stroke and Mobilization	Outcome*
Bernhardt et al 2008 ³ (AVERT)	71	<ul style="list-style-type: none"> Recruited within 24 h of stroke, goal to start mobilization within 24 h of stroke Emphasis on patient being upright and out of bed (sitting or standing) At least twice a day for first 14 days or until discharge 	Intervention (n=38): Median=18.1, IQR=12.8–21.5 Control (n=33): Median=30.8, IQR=23.0–39.9	Complications/safety Deaths: intervention=8/38, SC=3/33, absolute risk difference=12%, ns. Serious adverse events†: intervention=15, control=14, ns. Nonserious adverse events: intervention=61, control=76, P=0.04 Falls: intervention=27, SC=28, ns. Functional outcome mRS 0–2: intervention=39.5%, control=30.3%, adjusted‡ OR=4.10, P=0.05
Langhorne et al 2010 ⁶ (VERITAS)	32	<ul style="list-style-type: none"> Recruited within 24 h of admission, with goal to start mobilization within 24 h of stroke Goal for patient to be sitting, standing or walking (adjusted to patient needs) Continued at least four times a day, during the inpatient stay, or for one week after recruitment 	Intervention (n=16): Mean=27.3 Range=26–29 Control (n=16): Mean=32.0 Range=22.5–47.3	Complications/safety Deaths: EM=0%, control=6% Complications§: EM=8, control=17 Complications (days 5–90): EM=8, control=8 Complications of immobility (days 0–5): intervention=0, control=3 Functional outcome mRS 0–2: intervention=75%, control=44%, adjusted OR=2.3, (P=0.44)
Diserens et al 2011 ¹⁰ (Lausanne trial)	50 (42 included in analysis)	<ul style="list-style-type: none"> Recruited within 12 h of admission, with protocol started 24 h after stroke Patient's head of the bed kept at 0° for first 24 h poststroke, followed by 45° for 24 h, then 90° for 4 h At 52 h poststroke, patients were moved out of the bed to either sitting or standing 	Intervention (n=25): Not reported Control (n=17): Not reported	Complications/safety Deaths: intervention=0%, control=6% Severe complications including death¶ (during hospitalization): intervention=8%, control=47% Minor complications (during hospitalization): intervention=20%, control=0%, ns. Functional outcome mRS 0–2: intervention=40%, control=30%, ns.
Sundseth et al 2012 ⁹ (AKEMIS)	65 (56 included in analysis)	<ul style="list-style-type: none"> Recruited if admitted to hospital within 24 h of stroke, with mobilization out of bed within 24 h of admission No predefined mobilization protocol. Mobilization, defined as any out of bed activity, followed the stroke unit's standard routine for mobilization, adjusted to patients' needs Mobilization occurred several times per day 	Intervention (n=27): Median=13.1 IQR=8.5–25.6 Control (n=29): Median=33.3 IQR=26.0–39.0	Complications/safety Deaths: intervention=7/27, control=2/29, adjusted# OR=5.26, ns. Patients who experienced ≥1 complication: intervention=67%, control=66%, ns. Functional outcome mRS 0–2: intervention=40%, control=60.7%, adjusted** OR=2.7, ns.

IQR indicates interquartile range; mRS, modified Rankin Scale; ns, nonsignificant; and OR, odds ratio.

*Outcome data are at 3 months, unless otherwise stated.

†Serious adverse events included stroke progression, pneumonia, recurrent stroke, myocardial infarction, atrial fibrillation, and other (does not include death).

‡Adjusted for age, baseline National Institutes of Health Stroke Scale (NIHSS), premorbid mRS (modified Rankin Scale).

§Complications included chest infection, falls, fatigue, and stroke progression. Complication of immobility was a subset including deep vein thrombosis, urinary tract infection.

||Adjusted for age, baseline NIHSS, cointervention.

¶Severe complications included hospital acquired pneumonia, acute coronary syndrome, and pulmonary embolism. Minor complications were those that did not affect the autonomy of the patient (eg, allergic reactions, bed sores).

#Adjusted for age, NIHSS on admission, and mortality.

**Adjusted for age and admission NIHSS.

hemorrhage). The interventions tested have varied; with some focused on frequent and ongoing mobility training supported by therapist or nurse (AVERT, VERITAS), and others testing a graduated head-raising protocol in bed then out of bed after 52 hours (Lausanne trial). Importantly, no trial has demonstrated

significant effect on complications, mortality, or global disability (modified Rankin Scale). AVERT Phase II investigators did report faster return to unassisted walking¹¹ and reduced costs of care.¹² An individual patient meta-analysis, including data from AVERT and VERITAS, suggested some significant

improvement in function at 3 months poststroke¹³; however, sample size remains small (n=103). Increasingly, we are seeing early rehabilitation trials from China. A systematic review and meta-analysis of 37 Chinese trials (n=5916) found significant functional benefits with earlier, highly varied interventions compared with no/little intervention; however, trial quality was often low.¹⁴ A more recent early rehabilitation trial by Liu and colleagues¹⁵ included 243 patients with intracerebral hemorrhage, randomized to commence rehabilitation (no mobility component specified) within 48 hours of stroke onset, or receive usual care (rehabilitation starting >7 days of bed rest). A higher risk of death (hazard ratio, 4.44; 95% confidence interval, 1.24–12.87) and a 6-point deficit (95% confidence interval, 4.2–8.7) in SF-36 (physical) was reported in patients with prolonged bed rest. Uncertainty remains about how to integrate findings from Chinese rehabilitation trials into reviews, but improved reporting should help.^{14,16} Two large ongoing trials, AVERT Phase III (n=2104) and Ischemic Stroke and Early Vertical Positioning (SEVEL) (n=400) are currently underway (Table 2). These trials will substantially increase the evidence base in this field.

Early Mobilization Recommendations Now Common in Guidelines

Despite the limited evidence for early mobilization, guidelines have changed considerably in recent years. We reviewed 30 acute stroke guidelines worldwide for recommendations related to early mobilization (see Table I in the online-only Data Supplement). Although 22 (73%) contained recommendations to mobilize early, only 8 (36%) defined the intervention, with most recommending a start within 24 hours of stroke onset. The primary justification for mobilizing early was to prevent complications (13/22 guidelines), not promote recovery. The pool of evidence on which the recommendations are based is small. Variation in what is recommended (standing and sitting out of bed, walking, actively engaging in activities of daily living, etc) and when it should begin (after stabilization, within 24 hours, within 72 hours, etc) highlights the ongoing uncertainty surrounding best practice care in the first days after stroke.

Potential Mechanisms: Benefit

Reducing Complications

The main rationale given for early mobilization is to prevent or reduce immobility-related complications, such as infections, deep vein thromboembolism, and falls.¹⁷ Further secondary changes associated with stroke-related inactivity include loss of cardiovascular fitness, muscle atrophy, a shift in muscle fiber type to a greater predominance of fast-fatigable, insulin-resistant fibers, and increased intramuscular fat.¹⁸ Currently, there is no clear evidence that early mobilization reduces complications, and although physical activity and exercise can mediate secondary fitness and muscle changes in patients in the later phase of stroke,¹⁸ studies in the acute phase are lacking. We do know that patients managed in organized stroke units experience fewer immobility-related complications,¹⁹ and this has been attributed to earlier and better management, including early mobilization and early rehabilitation.¹ Our group and others have used structured observation of patient activity over the active day (0800–1700 hours) and shown that patients managed in stroke units that practice early rehabilitation have a short time to first mobilization (median 18 hours poststroke; interquartile range, 7.3–43.0), spend only 30% of the day time in bed, 46% out of bed, and 20% standing and walking,²⁰ which is different to patients managed in acute stroke units with a median inactive time of 65.5% (interquartile range, 6.3–87.8).²¹ Whether earlier activity can independently influence the incidence or severity of immobility-related or other complications is uncertain.

Promoting Brain Recovery

Preclinical studies show a critical sensitive period of enhanced neuroplasticity early after stroke.^{22,23} Areas ipsilesional and contralesional to the ischemic infarct are hyperexcitable; genes responsible for axonal sprouting, dendritic spine formation, and synaptogenesis are upregulated in peri-infarct areas; long-term potentiation is enhanced; and maladaptive plasticity and excitotoxic processes are subdued.^{22,23} Rehabilitation efficacy declines over time,²⁴ suggesting that earlier initiation of training may enhance recovery. Poststroke exercise reduces infarct volume in stroke-affected animals, particularly when

Table 2. Ongoing Trials of Early and Very Early Mobilization After Stroke

	Estimated Enrollment	Interventions	Recruitment Time Frame	Primary Outcome
AVERT Phase III (Florey Institute of Neuroscience and Mental Health) NCT01846247 Active, not recruiting	2104	Intervention: usual care + very early mobilization Patient will receive standard stroke unit care with earlier and additional physiotherapy and nursing sessions as per an intervention protocol Comparator: usual care	Recruited <24 h of onset of stroke symptoms	mRS at 3 months after stroke
SEVEL Trial (Nates University Hospital) NCT01573299 Terminated*	400	Intervention group 1: early vertical positioning The patient can sit outside of the bed, the day after stroke onset Intervention group 2: progressive vertical positioning The patient is progressively verticalized and is allowed to sit outside of the bed on the third day after the stroke onset	No time frame specified	mRS at 3 months after stroke

Source: <http://www.clinicaltrials.gov> (December 4, 2014). mRS indicates modified Rankin Scale.

*Trial stopped because of slow enrollment rate (Fanny Herisson, personal communication, 2014).

exercise begins soon after stroke onset.²⁵ These findings provide a biological basis for early training in humans, but when to start and how much training remains unclear.

Potential Mechanisms: Harm

Some clinicians have concerns that upright activity early might inhibit reperfusion of salvageable penumbral tissue. A systematic review of studies (n=57) in which transcranial Doppler was used to measure cerebral blood flow velocity during head position changes reported that elevating the head-of-the-bed to 30° in patients with large middle cerebral artery occlusion reduces cerebral blood flow velocity,²⁶ particularly in those with ongoing occlusion. The associations between these changes and clinical outcomes were not examined. Horizontal positioning may support newly established leptomeningeal or transcortical collateral channels, which have been associated with preservation of the ischemic penumbra and smaller infarct size.²⁷ A recent study found no significant differences in cerebral blood flow velocity between patients assessed at 6 to 16 hours postischemic middle cerebral artery stroke and controls in any tested position (70°, 45°, 0°, -15°), and there was no relationship between cerebral blood flow velocity and favorable neurological outcome.²⁸ Nevertheless, these concerns underpin the Lausanne and SEVEL trials, which test gradual verticalization by day 3 (see Tables 1 and 2), as well as a new large cluster randomized controlled Head Position in Stroke Trial (HeadPoST, <http://www.clinicaltrials.gov>: NCT02162017) comparing a head flat or head elevated 30° protocol for the first 24 hours after diagnosis.

Optimal blood pressure management in acute stroke (ischemic and hemorrhagic) remains uncertain.²⁹ It is possible that the effect of mobilization on blood pressure concerns some clinicians. Physical activity does increase mean blood pressure, but this is transient, returning to baseline once activity has ceased.³⁰ Blood pressure drop (postural hypotension) may also be a concern; however, even in patients with moderate to severe stroke, large drops (systolic blood pressure >30 mm Hg) seem to occur in <10% of patients.³⁰ Clinicians seem more concerned about starting out of bed activity within 24 hours of onset in patients with hemorrhagic (59% concerned) than ischemic (23% concerned) stroke,³¹ possibly because of fear of further bleeding. Increased risk of symptomatic ICH also underlies concerns about early mobilization of patients treated with recombinant tissue-type plasminogen activator (r-tPA).³² Factors such as infection of uncertain cause, severe chest infection, severe stroke (National Institutes of Health Stroke Scale >20), drowsiness, and confusion also seem to influence clinicians' decisions about the timing of mobilization after r-tPA.³² Evidence to guide early mobilization after r-tPA is scarce. A small trial of 29 patients mobilized 12 to 24 hours after r-tPA found 75% of patients had no adverse response to mobilization, with the remainder experiencing nonserious events.³³ AVERT Phase III includes over 500 patients treated with r-tPA. These data should help inform clinical guidelines.

Safety Criteria Needed

Establishing safety criteria for this intervention is an important next step. Clearly, not all patients admitted with stroke should

start out-of-bed activity or training within hours, or even days, of stroke onset. Currently, there are no clear safety guidelines to guide initiation or progress of treatment. Within the context of a trial, trialists seem willing to include adults (no upper age limit) with ischemic or hemorrhagic stroke, who are rouseable, with no early deterioration, no signs of secondary intracerebral hemorrhage, acute coronary syndromes, or severe heart failure. Patients treated with r-tPA were excluded from earlier trials,^{3,8-10} but are included in AVERT Phase III. Additional broad physiological safety criteria include systolic blood pressure between 120 and 220 mmHg and heart rate between 40 and 100 beats per minute.³ Physiological monitoring before each out-of-bed episode over the first 1 to 3 days, particularly targeting systolic blood pressure and consciousness, was practiced in several trials using a range of regimes. At present, cerebral imaging is not used to select patients or guide treatment.

Early Mobilization in Practice

Increasingly, we see early mobilization incorporated into stroke care audits as a quality indicator (see Table II in the online-only Data Supplement), although mobilization is largely undefined, and early is either not quantified or ranges from within 24 hours of stroke onset³⁴ to day 2 of hospital admission.^{35,36} Only first mobilization is recorded. Reports on compliance vary and range from 49% in Spain³⁷ to 85% in Australia.³⁵ Does compliance with early mobilization have an effect on patient outcomes? Stroke audit data from Catalonia, Spain, showed that early mobilization was significantly associated with reduced mortality at 30 days (OR, 2.05; 95% confidence interval, 1.31–3.19) and 12 months (OR, 1.54; 95% confidence interval, 1.05–2.24).³⁸ Others have found early mobilization to be independently associated with a lower risk of medical complications³⁹ and shorter hospital stay.³⁶ These indicators hinge on the timing of first mobilization. It is, therefore, likely that rather than indicate the effect of a specific intervention, the indicator serves as a proxy for how efficiently early team care is coordinated, which may include access to rehabilitation-focused staff.

Conclusions

Early mobilization has become a regular topic of workshops and scientific sessions at stroke conferences around the world. It seems like a simple activity that could improve the quality of acute care. This review highlights the early acceptance and, in some cases, adoption of starting some form of mobilization early, despite concerns. What is currently missing from the discussion is a shared understanding of what an early mobilization intervention is, evidence to help us decide which patients can safely start mobilizing early, and the mechanism by which early mobilization might aid recovery or cause harm as a treatment in the first hours or days of stroke. It was this uncertainty, on the back of promising Phase II results, that prompted us to conduct the soon to be completed international AVERT Phase III trial. On the sliding scale of mobilization interventions, our intervention protocol is firmly at the rehabilitation (training) end of the spectrum, and we will be able to examine who received treatment, how often and when over the course of their acute hospital stay. This large trial will help inform clinical guidelines about who might benefit or be harmed by starting

mobility training within 24 hours of stroke onset and will provide a detailed evaluation of care costs. As with all research, it is also likely to generate new research questions. Increasingly, we are trying to understand how to enhance and accelerate recovery after stroke using multimodal approaches, including rehabilitation therapies. Improving rehabilitation interventions through better understanding of the neurobiology of recovery and when (and what) training may offer the most benefit, as well as determining who we should target, is an important part of this endeavor. Our new Center of Research Excellence in Rehabilitation and Recovery, funded by the National Health and Medical Research Council, is focused on these important goals. The model aligns with recommendations from the 2010 prioritizing a world agenda synergium,⁴⁰ and we look forward to linking with other international rehabilitation and recovery research initiatives from around the globe.

Acknowledgments

We thank Audrey Raffelt for sourcing guidelines, extracting recommendations, and preparing tables. We also thank the following people for their assistance in translating Good Clinical Practice Guidelines: Wen Wen Zhang, Atte Meretoja, Tina Kaffenberger, Thomas Linden, Torunn Askim, Marie Dagonnier, and Sharon Kramer. The Victorian State Government provides infrastructure support to The Florey for which we are grateful.

Sources of Funding

Dr Bernhardt is funded by a National Health and Medical Research Council (NHMRC) Senior Research Fellowship. Dr English is funded by an NHMRC Early Career Fellowship.

Disclosures

Dr Bernhardt is Principal Investigator for AVERT Phase III. The other authors report no conflicts.

References

- Langhorne P, Pollock A; Stroke Unit Trialists' Collaboration. What are the components of effective stroke unit care? *Age Ageing*. 2002;31:365–371.
- Indredavik B, Bakke F, Slordahl SA, Rokseth R, Håheim LL. Treatment in a combined acute and rehabilitation stroke unit: which aspects are most important? *Stroke*. 1999;30:917–923.
- Bernhardt J, Dewey H, Thrift A, Collier J, Donnan G. A very early rehabilitation trial for stroke (AVERT): phase II safety and feasibility. *Stroke*. 2008;39:390–396. doi: 10.1161/STROKEAHA.107.492363.
- Indredavik B, Bakke F, Slordahl S, Rokseth R, Haheim L, Holme I. Benefits of a stroke unit: a randomized controlled trial. *Stroke*. 1991;22:1026–1031.
- Stroke Unit Trialists Collaboration. Organised inpatient (stroke unit) care for stroke (Review). *Cochrane Database Syst Rev*. 2007;(4):CD000197.
- Adams HP Jr, Brott TG, Crowell RM, Furlan AJ, Gomez CR, Grotta J, et al. Guidelines for the management of patients with acute ischemic stroke. A statement for healthcare professionals from a special writing group of the Stroke Council, American Heart Association. *Circulation*. 1994;90:1588–1601.
- Bernhardt J, Chitravas N, Meslo IL, Thrift AG, Indredavik B. Not all stroke units are the same: a comparison of physical activity patterns in Melbourne, Australia, and Trondheim, Norway. *Stroke*. 2008;39:2059–2065. doi: 10.1161/STROKEAHA.107.507160.
- Langhorne P, Stott D, Knight A, Bernhardt J, Barer D, Watkins C. Very early rehabilitation or intensive telemetry after stroke: a pilot randomised trial. *Cerebrovasc Dis*. 2010;29:352–360. doi: 10.1159/000278931.
- Sundseth A, Thommessen B, Rønning OM. Outcome after mobilization within 24 hours of acute stroke: a randomized controlled trial. *Stroke*. 2012;43:2389–2394. doi: 10.1161/STROKEAHA.111.646687.
- Diserens K, Moreira T, Hirt L, Faouzi M, Grujic J, Bieler G, et al. Early mobilization out of bed after ischaemic stroke reduces severe complications but not cerebral blood flow: a randomized controlled pilot trial. *Clin Rehabil*. 2012;26:451–459. doi: 10.1177/0269215511425541.
- Cumming TB, Thrift AG, Collier JM, Churilov L, Dewey HM, Donnan GA, et al. Very early mobilization after stroke fast-tracks return to walking: further results from the phase II AVERT randomized controlled trial. *Stroke*. 2011;42:153–158. doi: 10.1161/STROKEAHA.110.594598.
- Tay-Teo K, Moodie M, Bernhardt J, Thrift AG, Collier J, Donnan G, et al. Economic evaluation alongside a phase II, multi-centre, randomised controlled trial of very early rehabilitation after stroke (AVERT). *Cerebrovasc Dis*. 2008;26:475–481. doi: 10.1159/000155984.
- Craig LE, Bernhardt J, Langhorne P, Wu O. Early mobilization after stroke: an example of an individual patient data meta-analysis of a complex intervention. *Stroke*. 2010;41:2632–2636. doi: 10.1161/STROKEAHA.110.588244.
- Zhang WW, Speare S, Churilov L, Thuy M, Donnan G, Bernhardt J. Stroke rehabilitation in China: a systematic review and meta-analysis. *Int J Stroke*. 2014;9:494–502. doi: 10.1111/ijs.12029.
- Liu N, Cadilhac DA, Andrew NE, Zeng L, Li Z, Li J, et al. Randomized controlled trial of early rehabilitation after intracerebral hemorrhage stroke: difference in outcomes within 6 months of stroke. *Stroke*. 2014;45:3502–3507. doi: 10.1161/STROKEAHA.114.005661.
- Pollock A, Campbell P, Baer G, Choo PL, Forster A, Morris J, et al. Challenges in integrating international evidence relating to stroke rehabilitation: experiences from a Cochrane systematic review. *Int J Stroke*. 2014;9:965–967. doi: 10.1111/ijs.12339.
- Bamford J, Dennis M, Sandercock P, Burn J, Warlow C. The frequency, causes and timing of death within 30 days of a first stroke: the Oxfordshire Community Stroke Project. *J Neurol Neurosurg Psychiatry*. 1990;53:824–829.
- Ivey FM, Hafer-Macko CE, Macko RF. Exercise rehabilitation after stroke. *NeuroRx*. 2006;3:439–450. doi: 10.1016/j.nurx.2006.07.011.
- Govan L, Langhorne P, Weir CJ; Stroke Unit Trialists Collaboration. Does the prevention of complications explain the survival benefit of organized inpatient (stroke unit) care?: further analysis of a systematic review. *Stroke*. 2007;38:2536–2540. doi: 10.1161/STROKEAHA.106.478842.
- Askim T, Bernhardt J, Løge AD, Indredavik B. Stroke patients do not need to be inactive in the first two-weeks after stroke: results from a stroke unit focused on early rehabilitation. *Int J Stroke*. 2012;7:25–31. doi: 10.1111/j.1747-4949.2011.00697.x.
- West T, Bernhardt J. Physical activity in hospitalised stroke patients. *Stroke Res Treat*. 2012;2012:1–13. doi: 10.1155/2012/813765.
- Murphy TH, Corbett D. Plasticity during stroke recovery: from synapse to behaviour. *Nat Rev Neurosci*. 2009;10:861–872. doi: 10.1038/nrn2735.
- Zeiler SR, Krakauer JW. The interaction between training and plasticity in the poststroke brain. *Curr Opin Neurol*. 2013;26:609–616. doi: 10.1097/WCO.000000000000025.
- Biernaskie J, Chernenko G, Corbett D. Efficacy of rehabilitative experience declines with time after focal ischemic brain injury. *J Neurosci*. 2004;24:1245–1254. doi: 10.1523/JNEUROSCI.3834-03.2004.
- Egan KJ, Janssen H, Sena ES, Longley L, Speare S, Howells DW, et al. Exercise reduces infarct volume and facilitates neurobehavioral recovery: results from a systematic review and meta-analysis of exercise in experimental models of focal ischemia. *Neurorehabil Neural Repair*. 2014;28:800–812. doi: 10.1177/1545968314521694.
- Olavarría VV, Arima H, Anderson CS, Brunser AM, Muñoz-Venturelli P, Heritier S, et al. Head position and cerebral blood flow velocity in acute ischemic stroke: a systematic review and meta-analysis. *Cerebrovasc Dis*. 2014;37:401–408. doi: 10.1159/000362533.
- Christoforidis GA, Mohammad Y, Kehagias D, Avutu B, Slivka AP. Angiographic assessment of pial collaterals as a prognostic indicator following intra-arterial thrombolysis for acute ischemic stroke. *AJNR Am J Neuroradiol*. 2005;26:1789–1797.
- Aries MJ, Elting JW, Stewart R, De Keyser J, Kremer B, Vroomen P. Cerebral blood flow velocity changes during upright positioning in bed after acute stroke: an observational study. *BMJ Open*. 2013;3:e002960. doi: 10.1136/bmjopen-2013-002960.
- Saver JL. Blood pressure management in early ischemic stroke. *JAMA*. 2014;311:469–470. doi: 10.1001/jama.2013.282544.
- Indredavik B, Løge AD, Rohweder G, Lydersen S. Early mobilisation of acute stroke patients is tolerated well, increases mean blood pressure and oxygen saturation and improves consciousness. *Cerebrovasc Dis*. 2007;23:65.
- Skarin M, Bernhardt J, Sjöholm A, Nilsson M, Linden T. 'Better wear out sheets than shoes': a survey of 202 stroke professionals' early mobilisation practices and concerns. *Int J Stroke*. 2011;6:10–15. doi: 10.1111/j.1747-4949.2010.00534.x.

32. Ha J, Churilov L, Linden T, Bernhardt J. Bed rest or mobilization after rt-PA? A case-crossover study of factors influencing clinical decision making in stroke services. *Int J Stroke*. 2013;8:172–179. doi: 10.1111/j.1747-4949.2011.00660.x.
33. Davis O, Mooney L, Dinkins M, Freeman WD, Arnold S. Early mobilization of ischemic stroke patients post intravenous tissue plasminogen activator. *Stroke*. 2013;44:A121.
34. Ribera A, Abilleira S, Permanyer-Miralda G, Tresserras R, Pons JMV, Gallofré M. Evaluating the quality of in-hospital stroke care, using an opportunity-based composite measure: a multilevel approach. *Clinical Audit*. 2014;6:11–20.
35. Cadilhac D, Lannin N, Anderson C, Andrew N, Kim J, Kilkenny M, et al. *AuSCR Annual Report 2013*. Heidelberg, Australia: The Florey Institute of Neuroscience and Mental Health; 2013:1–58.
36. Svendsen ML, Ehlers LH, Andersen G, Johnsen SP. Quality of care and length of hospital stay among patients with stroke. *Med Care*. 2009;47:575–582. doi: 10.1097/MLR.0b013e318195f852.
37. Abilleira S, Gallofré M, Ribera A, Sánchez E, Tresserras R. Quality of in-hospital stroke care according to evidence-based performance measures: results from the first audit of stroke, Catalonia, Spain. *Stroke*. 2009;40:1433–1438. doi: 10.1161/STROKEAHA.108.530014.
38. Abilleira S, Ribera A, Sánchez E, Tresserras R, Gallofré M. The Second Stroke Audit of Catalonia shows improvements in many, but not all quality indicators. *Int J Stroke*. 2012;7:19–24. doi: 10.1111/j.1747-4949.2011.00638.x.
39. Ingeman A, Andersen G, Hundborg HH, Svendsen ML, Johnsen SP. Processes of care and medical complications in patients with stroke. *Stroke*. 2011;42:167–172. doi: 10.1161/STROKEAHA.110.599738.
40. Hachinski V, Donnan GA, Gorelick PB, Hacke W, Cramer SC, Kaste M, et al. Stroke: working toward a prioritized world agenda. *Int J Stroke*. 2010;5:238–256. doi: 10.1111/j.1747-4949.2010.00442.x.

KEY WORDS: acute ■ early ■ mobilization ■ rehabilitation ■ stroke

Early Mobilization After Stroke: Early Adoption but Limited Evidence

Julie Bernhardt, Coralie English, Liam Johnson and Toby B. Cumming

Stroke. 2015;46:1141-1146; originally published online February 17, 2015;

doi: 10.1161/STROKEAHA.114.007434

Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

Copyright © 2015 American Heart Association, Inc. All rights reserved.

Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://stroke.ahajournals.org/content/46/4/1141>

Data Supplement (unedited) at:

<http://stroke.ahajournals.org/content/suppl/2015/02/19/STROKEAHA.114.007434.DC1>

<http://stroke.ahajournals.org/content/suppl/2016/04/10/STROKEAHA.114.007434.DC2>

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Stroke* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the [Permissions and Rights Question and Answer](#) document.

Reprints: Information about reprints can be found online at:

<http://www.lww.com/reprints>

Subscriptions: Information about subscribing to *Stroke* is online at:

<http://stroke.ahajournals.org/subscriptions/>

Supplemental Table I. Summary of 30 guidelines across the world. Recommendations regarding early mobilization and early rehabilitation by country

Publication	Country	Recommendation regarding early mobilization	Definition of EM	Evidence for recommendation of EM	Recommendation regarding early rehabilitation	Definition of Early Rehabilitation	Evidence for recommendation of ER
Clinical Guidelines for Stroke Management 2010 ¹	Australia	<p>Patients should be mobilized as early and as frequently as possible</p> <p>Early mobilization and adequate hydration should be encouraged in all acute stroke patients to help prevent DVT and PE</p> <p>##</p>	Sitting out of bed, standing and walking within 24 hours of stroke onset	<p>(Bernhardt et al 2009)²</p> <p>(Langhorne et al 2010)³ *</p>	No recommendations for early rehabilitation [^]	Not defined	<p>(Dromerick et al 2009, Godecke 2009)^{4 5}</p> <p>(National Stroke Foundation 2009, Stroke Unit Trialists Collaboration 2007)^{6 7} *</p>
Proposal of Guidelines for Acute Stroke Treatment and Management, ^{8 9}	Belgian	<p>Early mobilization is helpful to prevent numerous complications after stroke including aspiration pneumonia, DVT and decubitus ulcers</p> <p>Mobilization [should occur] as soon as possible. Special care for the paralyzed limb: the hand of the paralyzed upper limb must be placed above the elbow; ergonomic boots for the paralyzed lower limb to avoid "equine foot"</p> <p>##</p>	Not defined	-	No recommendations for early rehabilitation [^]	-	-

Guidelines for Acute Ischemic Stroke Treatment – Part I and Part 2	Brazil	No recommendations for mobilization	-	-	No recommendations for rehabilitation	-	-
10 11							
Canadian Stroke Best Practice Recommendations, 4 th Edition. Chapter 4: Acute Inpatient Stroke Care ¹² Canadian Stroke Best Practice Recommendations, 4 th Edition. Chapter 5: Stroke Rehabilitation ¹³	Canada	Early mobilization and adequate hydration should be encouraged for all acute stroke patients to help prevent venous thromboembolism All patients admitted to hospital with acute stroke should be mobilized as early and as frequently as possible and ideally within 24 hours of stroke symptom onset, unless contraindicated. Contraindications to early mobilization include, but may not be restricted to, patients who have had an arterial puncture for an interventional procedure, unstable medical conditions, low oxygen saturation, and lower limb fracture or injury.	Mobilization is defined as ‘the process of getting a patient to move in the bed, sit up, stand, and eventually walk.’	(Arias & Smith 2007, Bernhardt et al 2009, Bryer et al 2010, Craig et al 2010, Diserens et al 2006, Langhorne & Pollock 2002, Masters et al 2007, National Stroke Foundation 2005, Scottish Intercollegiate Guidelines Network (SIGN) 2008, Sorbello et al 2009, Sundseth et al 2012, The European Stroke Organization (ESO) Executive Committee and the ESO Writing Committee 2008b, Tyedin et al 2010) ^{2 14-25}	All patients with stroke should receive rehabilitation therapy within an active and complex stimulating environment as early as possible once they are determined to be rehabilitation ready and they are medically able to participate in active rehabilitation.	Stroke Rehabilitation is a progressive, dynamic, goal orientated process aimed at enabling a person with impairment to reach their optimal physical, cognitive, emotional, communicative, and/or social functional level.	(Bernhardt et al 2008a, Craig et al 2010, Horn et al 2005, Kwakkel et al 1997, Wang et al 2011) ^{15 26-29} *
				*			

Nova Scotia Guidelines for Stroke Care ³⁰	Canada (Nova Scotia)	Patients should be mobilized as early and as frequently as possible [For prevention of venous thromboembolism] early mobilization of the patient is recommended	Not defined	(National Stroke Foundation 2007) ³¹	All patients with stroke should begin rehabilitation therapy as early as possible once medical stability has been reached	Not defined	(Adams et al 2007) ³²
--	----------------------------	--	-------------	---	--	-------------	-------------------------------------

Recommendations for Stroke Management 2006 Update ³³	Croatia	The incidence of venous thromboembolism may be reduced through early rehydration and mobilization and graded compression stockings [For patients with ICH] early mobilization is recommended unless intracranial hypertension is present. ##	Not defined	-	[For patients with ICH] early rehabilitation is recommended; the same principles may be applied as in patients with ischemic stroke	Not defined	-
Guidelines for Management of Ischaemic Stroke and Transient Ischaemic Attack 2008 ³⁴	Europe	Early mobilization is recommended to prevent complications such as aspiration pneumonia, DVT and pressure ulcers The optimal timing of first mobilization is unclear, but mobilization within the first few days appears to be well tolerated ##	Not defined	(Bernhardt et al 2004, Diserens et al 2006, Langhorne et al 2000) ^{16 35 36}	Early initiation of rehabilitation is recommended	Not defined	(Barbay et al 2001, Baron et al 2004, Bernhardt et al 2004, Biernaskie et al 2004, Diserens et al 2006, Langhorne et al 2000, Salter et al 2006) ^{16 35-40}

Stroke ⁴¹	Finland	All stroke patients should be mobilized as soon as possible, but only after their clinical condition has stabilised. Before that, there is a risk of enlargement of the ischemia and recurrent embolization	Not defined	(Kaste & Roine 2004) ^{42 *}	Active rehabilitation will be started as soon as the patient is stable enough	Not defined	(Musicco et al 2003, Salter et al 2006, The European Stroke Organization (ESO) Executive Committee and the ESO Writing Committee 2008b) ^{24 40 43}
Stroke: Early Management (Alert, Pre-hospital Phase, Initial Hospital Phase, Indications for Thrombolysis), Guidelines ⁴⁴ [TRANSLATED]	France	No recommendations for mobilization	-	-	No recommendations for rehabilitation	-	-

Clinical practice guidelines Early management of adult stroke patients, Medical aspects ⁴⁵	France	No recommendations for mobilization	-	-	No recommendations for rehabilitation	-	-
Acute Treatment of Ischemic Stroke ⁴⁶ [TRANSLATED]	Germany	Mobilization should start early to avoid numerous complications, including pneumonia by aspiration, deep vein thrombosis of the leg and decubitus ulcers	Not defined	-	The medical treatment of a stroke patient consists of five components. [Number five is] early rehabilitation	Not defined	-

Stroke: German Society for General Practice Medicine Guidelines, no. 8 ⁴⁷ [TRANSLATED]	Germany	The aim of gait training is the improvement of mobility. The therapy starts in the early phase	Change of position, practise of movement transitions, balance, making steps, in order to facilitate walking.	(Dean et al 2007) ⁴⁸	No recommendations for early rehabilitation^	-	
Stroke Management ⁴⁹	India	Early mobilization and optimal hydration should be maintained for all acute stroke patients Patients with paralyzed legs (due to ICH), routine physiotherapy and early mobilization should be carried out to prevent leg vein thrombosis.	Passive full-range-of-motion exercises for paralyzed limbs can be started during the first 24 hours	(Fang et al 2003, Richards et al 1993) ^{50 51}	No recommendations for early rehabilitation^	Not defined	(Fang et al 2003, Richards et al 1993) ^{50 51}
The Italian Guidelines for Stroke Prevention ⁵²	Italy	For the management of patients with acute stroke, the following basic interventions are recommended: (a) early mobilization... Early mobilization of patients with acute stroke is recommended, unless clinically contraindicated.	Not defined	-	No recommendations for early rehabilitation^	-	-

Outline of the Japanese Guidelines for the Management of Stroke 2004 and Subsequent Revision ⁵³	Japan	No recommendations for mobilization	-	-	Aggressive rehabilitation can reduce the incidence of pneumonia and other complications	Not defined	-
Clinical Practice Guidelines, Management of Ischaemic Stroke, 2 nd Edition 2012 ⁵⁴	Malaysia	Mobilize early to prevent complications Summary of evidence in text: ...mobilization should begin as soon as the patient's condition is judged to be stable. Mobilization of acute stroke patients, in bed and out of bed as early as possible is currently recommended to prevent general and neurological complications. Helping patients to get out of bed very early is recommended, with other mobilization ##	Mobilization includes passive and full-range of motion exercise, transfer from bed to chair, balance and trunk support are done in stages Very early mobilization is within 48 hours	(Hamidon & Raymond 2003, Langhorne 1999, Linn et al 1999, Tutuarima et al 1997) ⁵⁵⁻⁵⁸ *	No recommendations for early rehabilitation^ ##	-	-

New Zealand Clinical Guideline for Stroke Management 2010 ⁵⁹	New Zealand	Patients should be mobilized as early and as frequently as possible Early mobilization and adequate hydration should be encourage in all acute stroke patients to help prevent DVT and PE ##	Not defined	(Bernhardt et al 2009) ² (Cumming et al 2008, Indredavik et al 1999, Langhorne & Pollock 2002, Langhorne et al 2010) ^{3 17 60 61*}	To ensure all stroke patients receive early, active rehabilitation by a dedicated stroke team, DHBs should have comprehensive services, which include and link the fundamentals of acute and rehabilitation care	-	(Foley et al 2006, Stroke Unit Trialists Collaboration 2007) ^{7 62} (Intercollegiate Stroke Working Party 2012) ^{63 *}
Diagnosis, Treatment and Care Stroke Patients ⁶⁴	Netherlands	Patients should be mobilized within 24 hours of stroke occurring	[Early mobilization] is started within 72 hours of stroke. The term "mobilization" is used for interventions aimed at facilitating the client in actively engaging in ADL	(Govan et al 2007, Indredavik et al 1991) ^{65 66} Indredavik et al 1998, Indredavik et al 1999, Langhorne 2000, Langhorne & Duncan 2001, Langhorne et al 1996) ^{61 67-70 *}	No recommendations for early rehabilitation^	-	-

NHG Standard Stroke ⁷¹	Netherlands	In the acute phase (the first two days) the focus of rehabilitation is on rapid mobilization; during the rehabilitation phase (the stage where recovery is to be expected, generally the first six months) the focus is to improve the functionality and promote reintegration in the home and society. ##	Not defined	-	No recommendations for early rehabilitation^	-	-
National Guidelines for Treatment and Rehabilitation Following a Stroke ⁷²	Norway	All stroke patients should be mobilized out of bed early, and all members of the multidisciplinary team should contribute to ensure that the patient is mobilized as early and frequent as possible.	Mobilization is defined as getting out of bed in a sitting, standing or walking position	(Indredavik et al 1999, Kalra & Langhorne 2007, Legg et al 2007, Stroke Unit Trialists Collaboration 2007) ^{7 61 73 74 *}	All patients should be assessed by a multidisciplinary team who early should commence an assessment, define goals and begin individually tailored task oriented training	task oriented training commenced within the first 24 hours after onset of stroke	(Indredavik et al 1999, Kalra & Langhorne 2007, Legg et al 2007, Stroke Unit Trialists Collaboration 2007) ^{7 61 73 74 *}
Management of Patients with Stroke or TIA: Assessment, Investigation, Immediate Management and Secondary Prevention: A National Clinical Guideline ²¹	Scotland	Early mobilization, including positioning in bed, sitting on the edge of the bed, or standing up should be considered for patients within the first three days after a stroke.	Positioning in bed, sitting on the edge of the bed, or standing up	(Diserens et al 2006) ^{16 *}	Patients' suitability for early, active rehabilitation should be considered.	Not defined	(Horn et al 2005, Van Peppen et al 2004) ^{27 75 *}

Stroke and Transient Ischaemic Attacks Assessment, Investigation, Immediate Management and Secondary Prevention: Ministry of Health Clinical Practice Guidelines 2/2009 ⁷⁶	Singapore	Good hydration and early mobilization is recommended for all stroke patients to reduce deep venous thrombosis and pulmonary embolism	Not defined	Nil	Stroke patients should receive early rehabilitation	Not defined	(Horn et al 2005, Maulden et al 2005, Salter et al 2006) ^{27 40 77} *
South African guideline for management of ischaemic stroke and transient ischaemic attack 2010: A guideline from the South African Stroke Society (SASS) and the SASS Writing Committee ¹⁹	South Africa	Early mobilization is recommended to prevent complications such as aspiration pneumonia, DVT and pressure ulcers ##	Not defined	Nil	Early initiation of rehabilitation is recommended	Stroke rehabilitation is a goal-orientated process which attempts to obtain maximum function in patients who have had strokes and who suffer from a combination of physical, cognitive and language disabilities. Early intervention by physiotherapists will be concerned with appropriate positioning of hemiplegic patients and attempts at early mobilization and mobility.	Nil

National Guidelines for Stroke: Support for Governance and Management ^{78 79}	Sweden	Early mobilization of persons with stroke is not harmful (some scientific evidence). The gathered evidence of stroke unit care speaks for substantial significance of early mobilization, activation and training ##	Not defined	(Bernhardt et al 2008a, Bernhardt et al 2008b) ^{26 80}	No recommendations for early rehabilitation^ ##	-	-
General Principles for the Management of Acute Ischemic Stroke ⁸¹	Taiwan	No recommendations for mobilization ##	-	-	No recommendations for rehabilitation ##	-	-
Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association ⁸²	USA	Early mobilization of less severely affected patients and measures to prevent subacute complications of stroke are recommended	Not defined	(Bernhardt et al 2008a, Langhorne 1999, Linn et al 1999, Van der Worp & Kappelle 1998, Zorowitz et al 1996) ^{26 56 57 83 84} *	Early rehabilitation not discussed Recommendation for rehabilitation in: ⁸⁵	-	-
National Clinical Guidelines for Stroke - Fourth Edition ^{63 **}	United Kingdom	People with acute stroke should be mobilized within 24 hours of stroke onset, unless medically unstable, by an appropriately trained healthcare professional with access to appropriate equipment.	Not defined	(Bernhardt et al 2008a, Cumming et al 2011) ^{26 86} (Sorbelli et al 2009) ²² *	Every patient [with subarachnoid haemorrhage] who survives and has any residual symptoms or disability should be referred for, and transferred to, specialist rehabilitation as soon as possible after definitive treatment.	Rehabilitation uses a wide variety of treatments and techniques to reduce activity limitation, often through improving motor control.	-

Hemorrhagic Stroke Guidelines							
European Stroke Organisation (ESO) Guidelines for the Management of Spontaneous Intracerebral Hemorrhage ⁸⁷	Europe	No recommendations for mobilization	-	-	No recommendations for rehabilitation	-	-
Guidelines for the Management of Spontaneous Intracerebral Hemorrhage: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association ⁸⁸	USA	No recommendations around mobilization Summary of evidence: specific nursing care required for ICH patients in intensive care units may include.... prevention of complications of immobility through positioning, airway maintenance, and mobilization	Not defined	-	It is reasonable that all patients with ICH have access to multidisciplinary rehabilitation... Where possible, rehabilitation can be beneficial when begun as early as possible and continued in the community as part of a well-coordinated (seamless) program of accelerated hospital discharge and home-based resettlement to promote ongoing recovery.	Not defined	(Rost et al 2008, Chae et al 1996; Kelly et al 2003, Schepers et al 2008, Hemphil et al 2009, Stroke Unit Trialists' Collaboration., 2007; Outpatient Service Trialists 200) ^{7 89-95}
Guidelines for the Management of Spontaneous Intracerebral Hemorrhage in Adults: 2007 Update ⁹⁶ #	USA	As for patients with ischemic stroke, early mobilization and rehabilitation are recommended in patients with ICH who are clinically stable	Not defined	Reference to guidelines for ischemic stroke ³²	As for patients with ischemic stroke, early mobilization and rehabilitation are recommended in patients with ICH who are clinically stable	Not defined	Reference to guidelines for ischemic stroke ³²

[TRANSLATED] = Translations were all completed by native speakers

^ ‘No recommendations for early rehabilitation’ includes cases where: general rehabilitation recommendations were included but with not mention of whether this should start early (or acutely); early rehabilitation was recommended only for a specific intervention which was not related to gait/walking (e.g. dysphasia); recommendations were given around early assessment of rehabilitation, but not recommendations around early commencement.

* When recommendations were supported by text summaries of the literature (without annotations to supportive evidence), supportive evidence has been extracted from in-text referencing

** The NICE guidelines are also available in the UK ⁹⁷. However, as stated within the NICE guidelines, all recommendations are contained in the Intercollegiate Stroke Working Party guidelines Therefore, the NICE guidelines have not been included separately

These guidelines have been superseded by the 2010 version ¹⁹. They have been included in this table to demonstrate that early mobilizations recommendations were included in the previous version, but have been removed in the most recent version.

Definition of a stroke unit has been specified, and includes early mobilization of patients

Supplemental Table II. Audits where early mobilization was included as a process indicator

Publication	Date of data collection Country	Design	N	Definition of early mobilization	Compliance with early mobilization	Outcome
Abilleira et al 2009 ⁹⁸	2005 Spain	Regional Retrospective	1791	No definition	48.7% (95% CI 46 to 51)	Nil outcomes reported
Abilleira et al 2012 ⁹⁹	2007 Spain	Regional Retrospective	1767	Patients mobilized within first 48 hours after stroke onset. (Excludes patients who mobilize without assistance, comatose patients or with progressive strokes, patients with orthostatic hypotension, acute myocardial infarction or DVT before anticoagulation is effective)	77.4% (95% CI 75.1 to 79.6)	Significant reduction in 7-day case fatality compared to first audit Reduced odds of mortality at 3 (OR 2.05 [95%CI 1.31-3.19]) and 12 months (OR 1.54 [95%CI 1.05-2.24])
Ingeman et al 2011 ¹⁰⁰	2003-2008 Denmark	National Prospective	11757	Nurse or physiotherapy/ occupational therapy team performing ... out of bed (sitting standing or walking) mobilization within first day of hospitalisation	>70%	EM was associated with the lowest risk of complications
Bersano et al 2006 ¹⁰¹	2003-2004 Italy	National Retrospective	745 Hospitals	No definition	EM reported to be common practice in 97% of stroke units	Nil outcomes reported
Svendsen et al 2009 ¹⁰²	2003-2005 Denmark	National Prospective	2636	By the second day of admission Assisting patient from bed-rest	65.8%	EM was the strongest predictor of shorter length of hospital stay (OR 0.67 [95%CI 0.61 to 0.73])
Ribera et al 2014 ¹⁰³	2007 Spain	National Retrospective	1697	Within 24 hours of stroke onset No definition	22% (95% CI 20.3 to 24.8) <i>non-compliant</i>	Composite quality score weakly associated with risk-adjusted reduced mortality at 30 days (r=0.24)

References

1. National Stroke Foundation. Clinical Guidelines for Acute Stroke Management 2010. Melbourne: National Stroke Foundation; 2010. 1-167. ISSBNO-978-0-9805933-3-4.
2. Bernhardt J, Thuy MNT, Collier JM, Legg LA. Very early versus delayed mobilisation after stroke. *Cochrane Database Syst Rev* 2009;CD006187.
3. Langhorne P, Stott D, Knight A, Bernhardt J, Barer D, Watkins C. Very early rehabilitation or intensive telemetry after stroke: A pilot randomised trial. *Cerebrovasc Dis* 2010;29:352-60.
4. Dromerick AW, Lang CE, Birkenmeier RL, Wagner JM, Miller JP, Videen TO, et al. Very Early Constraint-Induced Movement during Stroke Rehabilitation (VECTORS): A single-centre RCT. *Neurology* 2009;73:195-201.
5. Godecke E. Efficacy of aphasia therapy in the acute setting. Bently: Curtin University of Technology. 2009.
6. National Stroke Foundation. National Stroke Audit Acute Services Clinical Audit Report 2009; Melbourne: National Stroke Foundation; 2009. 1-46. ISBN0-978-0-9805933-1-0.
7. Stroke Unit Trialists Collaboration. Organised inpatient (stroke unit) care for stroke (Review). *Cochrane Database Syst Rev* 2007;CD000197.
8. Peeters A, Cras P. Proposal of Guidelines for Acute Stroke Treatment and Management. Brussels, Belgian: Belgian Stroke Council; 2002.
9. Desfontaines P, Vanhooren G, Peeters A, Laloux P. Proposal of Guidelines for Stroke Units. Brussels, Belgian: Belgian Stroke Council; 2002.
10. Martins SCO, Rodriguez de Freitas G, Pontes-Neto OM, Pieri A, Moro CHC, Pereira de Jesus PA, et al. Guidelines for acute ischemic stroke treatment - Part 2: Stroke treatment. *Arq Neuropsiquiatr* 2012;70:885-93.
11. Executive Committee from Brazilian Stroke Society and the Scientific Department in Cerebrovascular Diseases of the Brazilian Academy of Neurology, Oliveira-Filho J, Martins SCO, Pontes-Neto OM, Longo A, Evaristo EF, et al. Guidelines for acute ischemic stroke treatment – Part I. *Arq Neuropsiquiatr* 2012;70:621-29.
12. Casaubon LK, Suddes M, Acute Stroke Best Practice Writing Group. Chapter 4: Acute Inpatient Stroke Care. In: Lindsay M, Gubitz G, Bayley M, Phillips S, Canadian Stroke Best Practices and Standards Working Group, editors. *Canadian Best Practice Recommendations for Stroke Care, Fourth Edition*. Ottawa, Ontario Canada: Heart and Stroke Foundation; July 2013. 1-40.
13. Dawson A. S, Knox J, McClure A, Foley N, Teasell R, Stroke Rehabilitation Best Practices Writing Group. Chapter 5: Stroke Rehabilitation. In: Lindsay M, Gubitz G, Bayley M, Phillips S, Canadian Stroke Best Practices and Standards Working Group, editors. *Canadian Best Practice Recommendations for Stroke Care, Fourth Edition*. Ottawa, Ontario Canada: Heart and Stroke Foundation; July 2013. 1-97.
14. Arias M, Smith LN. Early mobilization of acute stroke patients. *J Clin Nurs* 2007;16:282-8.
15. Craig LE, Bernhardt J, Langhorne P, Wu O. Early mobilization after stroke: An example of an individual patient data meta-analysis of a complex intervention. *Stroke* 2010;41:2632-36.
16. Diserens K, Michel P, Bogousslavsky J. Early mobilisation after stroke: Review of the literature. *Cerebrovasc Dis* 2006;22:183-90.
17. Langhorne P, Pollock A. What are the components of effective stroke unit care? *Age Ageing* 2002;31:365-71.
18. Masters L, Barreca S, Ansley B, Waid K, Buckley S. Functional mobility training for individuals admitted to acute care following a stroke: a prospective study. *Top Stroke Rehabil* 2007;14:1-11.
19. Bryer A, Connor M, Haug P, Cheyip B, Staub H, Tipping B, et al. South African guideline for management of ischaemic stroke and transient ischaemic attack 2010: a guideline from the South African Stroke Society (SASS) and the SASS Writing Committee. *South African medical journal* 2010;100:747-78.
20. National Stroke Foundation. Clinical guidelines for stroke rehabilitation and recovery. Melbourne: National Stroke Foundation, 2005.
21. Scottish Intercollegiate Guidelines Network (SIGN). Management of patients with stroke or TIA: assessment, investigation, immediate management and secondary prevention, A national clinical guideline. Edinburgh: Scottish Intercollegiate Guidelines Network; 2008. Guideline No. 108. 1-102.
22. Sorbello D, Dewey HM, Churilov L, Thrift AG, Collier JM, Donnan G, et al. Very early mobilisation and complications in the first 3 months after stroke: Further results from phase II of A Very Early Rehabilitation Trial (AVERT). *Cerebrovasc Dis* 2009;28:378-83.
23. Sundseth A, Thommessen B, Rønning O. Outcome after mobilization within 24 hours of acute stroke : A randomized controlled trial. *Stroke* 2012;43:2389-94
24. The European Stroke Organization (ESO) Executive Committee and the ESO Writing Committee. Guidelines for Management of Ischaemic Stroke and Transient Ischaemic Attack 2008, 2008. 1-120. Version: 16.03.2008
25. Tyedin K, Cumming T, Bernhardt J. Quality of life: An important outcome measure in a trial of very early mobilisation after stroke. *Dis Rehabil* 2010;32:875–84.
26. Bernhardt J, Chitravas N, Lidarende MI, Thrift AG, Indredavik B. Not all stroke units are the same: A comparison of physical activity patterns in Melbourne, Australia and Trondheim, Norway. *Stroke* 2008;39:2059-65.

27. Horn SD, DeJong G, Smout RJ, Gassaway J, James R, Conroy B. Stroke rehabilitation patients, practice, and outcomes: is earlier and more aggressive therapy better? *Arch Phys Med Rehab* 2005;86:101-14.
28. Kwakkel G, Wagenaar R, Koelmam T, Lankhorst G, Koetsier J. Effects of intensity of rehabilitation after stroke. *Stroke* 1997;28:1550-56.
29. Wang H, Camicia M, Terdiman J, Hung YY, Sandel ME. Time to inpatient rehabilitation hospital admission and functional outcomes of stroke patients. *Physical Medicine and Rehabilitation* 2011;34:296-304
30. Cardiovascular Health Nova Scotia. Nova Scotia Guidelines for Stroke Care. Clinical Guidelines. Halifax, Nova Scotia: Cardiovascular Health Nova Scotia; May 2008. 1-52.
31. National Stroke Foundation. Clinical guidelines for acute stroke management. Melbourne, Australia: National Stroke Foundation; September 2007. 1-95.
32. Adams HP, Del Zoppo G, Alberts MJ, Bhatt DL, Brass L, Furlan A, et al. Guidelines for the Early Management of Adults With Ischemic Stroke A Guideline From the American Heart Association/American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, and the Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups: The American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists. *Circulation* 2007;115:478-534.
33. Demarin V, Lovrencic-Huzjan, Trkanjec Z, Vukovic V, Vargek-Solter V, Seric V, et al. Recommendations for Stroke Management 2006 update. *Acta Clin Croat* 2006;45:219-85.
34. The European Stroke Organization (ESO) Executive Committee and the ESO Writing Committee. Guidelines for management of ischaemic stroke and transient ischaemic attack 2008. *Cerebrovasc Dis* 2008;25:457-507.
35. Bernhardt J, Dewey HM, Thrift AG, Donnan GA. Inactive and alone: Physical activity within the first 14 days of acute stroke unit care. *Stroke* 2004;35:1005-09.
36. Langhorne P, Stott D, Robertson L, MacDonald J, Jones L, C M, et al. Medical complications after stroke: A multicenter study. *Stroke* 2000;31:1223-29.
37. Barbay, S., Plautz, E., Friel, K., Frost, F., Stowe, A., Dancause, N., . . . Nudo, R. Delayed rehabilitative training following a small ischaemic infarct in non-human primate primary cortex. *Soc Neurosci abstr*; 2001;27:931-34.
38. Baron J, Cohen L, Cramer S, Dobkin B, Johansen-Berg H, Loubinoux I, et al. Neuroimaging in stroke recovery: a position paper from the First International Workshop on Neuroimaging and Stroke Recovery. *Cerebrovasc Dis* 2004;18:260-67.
39. Biernaskie J, Chernenko G, Corbett D. Efficacy of rehabilitative experience declines with time after focal ischemic brain injury. *The Journal of Neuroscience* 2004;24:1245-54.
40. Salter K, Hartley M, Foley N. Impact of early vs delayed admission to rehabilitation on functional outcomes in persons with stroke. *J Rehabil Med* 2006;38:117.
41. Suomalainen Lääkäri-seura Duodecim ja Suomen Neurologisen Yhdistyksen työryhmä. Aivoinfarkti. Helsinki, Finland: Suomalainen Lääkäri-seura Duodecim. January 2011. 1-31.
42. Kaste, M., & Roine, R. O. General stroke management and stroke units. In J. P. Mohr, D. Choi, J. C. Grotta, B. Weir & P. Wolf (Eds.), *Stroke, Pathophysiology, Diagnosis and Management*. Philadelphia: Churchill Livingstone. 2004. ISBN 978-1-4160-5478-8.
43. Musicco M, Emberti L, Nappi G, Caltagirone C. Early and long-term outcome of rehabilitation in stroke patients: The role of patient characteristics, time of initiation, and duration of interventions. *Arch Phys Med Rehab* 2003;84:551-58.
44. Haute Autorité de Santé. Stroke: Early Management (alert, prehospital phase, initial hospital phase, indications for thrombolysis). Clinical Practice Guidelines. France: Haute Autorité de Santé, Communication and Public Information Department; May 2009. 1-20.
45. French National Agency for Accreditation and Evaluation in Healthcare. Early Management of Adult Stroke Patients: Medical Aspects. Clinical Practice Guidelines. Cedex, France: French National Agency for Accreditation and Evaluation in Healthcare; September 2002. 1-13
46. Deutsche Gesellschaft für Neurologie. Akuttherapie des ischämischen Schlaganfalls. Heidelberg, Germany: Deutsche Gesellschaft für Neurologie; September 2012. 1-17.
47. Deutsche Gesellschaft für Allgemeinmedizin und Familienmedizin (DEGAM). Schlaganfall: DEGAM Leitlinie Nr. 8. Frankfurt, Germany; 2012. 1-192. AWMF-Register-Nr. 053-011.
48. Dean CM, Channon EF, Hall JM. Sitting training early after stroke improves sitting ability and quality and carries over to standing up but not to walking: a randomised controlled trial. *Aust J Physiotherapy* 2007;53:97-102.
49. Prasad K, Kaul S, Padma MV, Gorthi SP, Khurana D, Bakshi A. Stroke management. *Ann Indian Acad Neurol* 2011;14:S82-86.
50. Fang Y, Chen X, Li H, Huang R, Zeng J. A study on additional early physiotherapy after stroke and factors affecting functional recovery. *Clin Rehab* 2003;17:608-17.
51. Richards CL, Malouin F, Wood-Dauphinee S, Williams JI, Bouchard J, D B. Task-specific physical therapy for optimization of gait recovery in acute stroke patients. *Arch Phys Med Rehab* 1993;74:612-20.

52. The Stroke Prevention and Educational Awareness Diffusion (SPREAD) Collaboration. The Italian Guidelines for stroke prevention. *Neurological Sciences* 2000;21:5-12.
53. Shinohara Y, Yamaguchi T. Outline of the Japanese Guidelines for the Management of Stroke 2004 and subsequent revision. *Int J Stroke* 2008;3:55-62.
54. Malaysian Society of Neurosciences. *Clinical Practice Guidelines, Management of Ischaemic Stroke: 2nd Edition*. Salangor, Malaysia: Malaysian Society of Neurosciences; 2012. 1-64. MH/P/PAK/235.12(GU).
55. Hamidon B, Raymond A. Risk factors and complications of acute ischaemic stroke patients at Hospital Universiti Kebangsaan Malaysia (HUKM). *Medical Journal of Malaysia* 2003;58:499-505.
56. Langhorne P. Measures to improve recovery in the acute phase after stroke. *Cerebrovasc Dis* 1999;9:2-5.
57. Linn SL, Granat MH, Lees KR. Prevention of shoulder subluxation after stroke with electrical stimulation. *Stroke* 1999;30:963-68.
58. Tutuarima JA, van der Meulen JHP, de Haan RJ, A. vS, Limburg M. Risk factors for falls of hospitalized stroke patients. *Stroke* 1997;28:297-301.
59. Stroke Foundation of New Zealand. *New Zealand Clinical Guideline for Stroke Management 2010*. Wellington, New Zealand: Stroke Foundation of New Zealand; 2010. 1-347. ISBN: 978-0-9582619-6-8
60. Cumming TB, Collier J, Thrift AG, Bernhardt J. The effect of very early mobilisation after stroke on psychological well-being. *Journal of Rehabilitation Medicine* 2008;40:609-14.
61. Indredavik B, Bakke RPT, Slordahl SA, Rokseth R, Haheim LL. Treatment in a combined acute and rehabilitation stroke unit: Which aspects are most important? *Stroke* 1999;30:917-23.
62. Foley N, Salter K, Teasell R. Specialized stroke services: a meta-analysis comparing three models of care. *Cerebrovasc Dis* 2006;23:194-202.
63. Intercollegiate Stroke Working Party. *National Clinical Guideline for Stroke, Fourth Edition*. London: Royal College of Physicians; September 2012. 1-208. ISBN 978-1-86016-492-7.
64. Nederlandse Vereniging voor Neurologie. *Richtlijn: Diagnostiek, behandeling en zorg voor patiënten met een beroerte*. Netherlands: Nederlandse Vereniging voor Neurologie; 2008. 1-213.
65. Govan L, Langhorne P, Weir CJ. Does the prevention of complications explain the survival benefit of organized inpatient (stroke unit) care?: further analysis of a systematic review. *Stroke* 2007;38:2536-40.
66. Indredavik B, Bakke F, Slordahl S, Rokseth R, Haheim L, Holme I. Benefits of a stroke unit: A randomized controlled trial. *Stroke* 1991;22:1026-31.
67. Indredavik B, Bakke F, Slordahl S, Rokseth R, Haheim L. Stroke unit treatment improves long-term quality of life: A randomized controlled trial. *Stroke* 1998;29:895-99.
68. Langhorne P, Wagenaar R, Partridge C. Physiotherapy after stroke: more is better? *Physiotherapy Research International* 1996;1:75-88.
69. Langhorne P, Duncan P. Does the organization of postacute stroke care really matter? *Stroke* 2001;32:268-74.
70. Langhorne P. Organisation of acute stroke care. *British Medical Bulletin* 2000;56:436-43.
71. Nederlands Huisartsen Genootschap. *NHG-Standaard Beroerte*. Netherlands: Nederlands Huisartsen Genootschap; December 2013. URL: <https://www.nhg.org/standaarden/samenvatting/beroerte#idp82032>
72. Indredavik B, Salvesen R, Næss H, Thorsvik D. *Nasjonalt retningslinje for behandling og rehabilitering ved hjerneslag*. Oslo, Netherlands: Helsedirektoratet; 2010. IS-1688.
73. Kalra L, Langhorne P. Facilitating recovery: evidence for organized stroke care. *Journal of Rehabilitation Medicine* 2007;39:97-102.
74. Legg L, Drummond A, Leonardi-Bee J, Gladman J, Corr S, Donkervoort M, et al. Occupational therapy for patients with problems in personal activities of daily living after stroke: systematic review of randomised trials. *BMJ* 2007;335:922.
75. Van Peppen R, Kwakkel G, Wood-Dauphinee S, Hendriks H, Van der Wees P, Dekker J. The impact of physical therapy on functional outcomes after stroke: what's the evidence? *Clin Rehabil* 2004;18:833-62.
76. Ministry of Health. *Stroke and Transient Ischaemic Attacks Assessment, Investigation, Immediate Management and Secondary Prevention. MOH Clinical Practice Guidelines 2/2009*. Singapore: Ministry of Health; July 2009. 1-63. ISBN 978-981-08-3686-3.
77. Maulden SA, Gassaway J, Horn SD, Smout RJ, DeJong G. Timing of Initiation of Rehabilitation After Stroke. *Arch Phys Med Rehab* 2005;86:S34-S40.
78. Socialstyrelsen. *Nationella riktlinjer för strokesjukvård 2009: Stöd för styrning och ledning*. Sweden: Socialstyrelsen; November 2009. 1-90. ISBN: 978-91-86301-59-0.
79. Socialstyrelsen. *Nationella riktlinjer för strokesjukvård 2014: Diagnostik vid åskknallshuvudvärk och trombolysbehandling vid ischemisk stroke Vetenskapligt underlag*. Sweden: Socialstyrelsen, 2014. 1-24.
80. Bernhardt J, Dewey H, Thrift A, Collier J, Donnan G. A Very Early Rehabilitation Trial for stroke (AVERT): Phase II safety and feasibility. *Stroke* 2008;39:390-96.
81. Xiangren L. *General Principles of Mangement*. 2014. http://www.stroke.org.tw/guideline/guideline_2.asp

82. Jauch EC, Saver JL, Adams HP, Jr., Bruno A, Connors JJ, Demaerschalk BM, et al. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2013;44:870-947.
83. Zorowitz RD, Hughes MB, Idank D, Ikai T, Johnston MV. Shoulder pain and subluxation after stroke: correlation or coincidence? *American Journal Of Occupational Therapy* 1996;50:194-201.
84. Van der Worp H, Kappelle L. Complications of acute ischaemic stroke. *Cerebrovasc Dis* 1998;8:124-32.
85. Miller EL, Murray L, Richards L, Zorowitz RD, Bakas T, Clark P, et al. Comprehensive Overview of Nursing and Interdisciplinary Rehabilitation Care of the Stroke Patient: A Scientific Statement From the American Heart Association. *Stroke* 2010;41:2402-48.
86. Cumming T, Thrift A, Collier J, Churilov L, Dewey H, Donnan G, et al. Very early mobilisation after stroke fast tracks return to walking: Further results from the phase II AVERT randomized controlled trial. *Stroke* 2011;42:153-58.
87. Steiner T, Al-Shahi Salman R, Beer R, Christensen H, Cordonnier C, Csiba L, et al. European Stroke Organisation (ESO) guidelines for the management of spontaneous intracerebral hemorrhage. *Int J Stroke* 2014;9:840-55.
88. Morgenstern LB, Hemphill JC, Anderson C, Becker K, Broderick JP, Connolly ES, et al. Guidelines for the Management of Spontaneous Intracerebral Hemorrhage A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke* 2010;41:2108-29.
89. Rost NS, Smith EE, Chang Y, Snider RW, Chanderraj R, Schwab K, et al. Prediction of functional outcome in patients with primary intracerebral hemorrhage. The FUNC Score. *Stroke* 2008;39:2304-09.
90. Chae J, Zorowitz RD, Johnston MV. Functional outcome of hemorrhagic and nonhemorrhagic stroke patients after in-patient rehabilitation. *American Journal of Physical Medicine & Rehabilitation* 1996;75:177-82.
91. Kelly PJ, Furie KL, Shafqat S, Rallis N, Chang Y, Stein J. Functional recovery following rehabilitation after hemorrhagic and ischemic stroke. *Arch Phys Med Rehab* 2003;84:968-72.
92. Schepers VP, Ketelaar M, Visser-Meily AJ, de Groot V, Twisk JW, Lindeman E. Functional recovery differs between ischaemic and haemorrhagic stroke patients. *Journal of Rehabilitation Medicine* 2008;40:487-89.
93. Hemphill JC, 3rd, White DB. Clinical nihilism in neuroemergencies. *Emergency medicine clinics of North America* 2009;27:27-37.
94. Outpatient Service Trialists. Therapy-based rehabilitation services for stroke patients at home. *Cochrane Database Syst Rev* 2003:CD002925.
95. West T, Bernhardt J. Physical activity in hospitalised stroke patients. *Stroke Res Treat* 2012;2012:1-13.
96. Broderick J, Connolly S, Feldmann E, Hanley D, Kase C, Krieger D, et al. Guidelines for the Management of Spontaneous Intracerebral Hemorrhage in Adults 2007 Update: A Guideline From the American Heart Association/American Stroke Association Stroke Council, High Blood Pressure Research Council, and the Quality of Care and Outcomes in Research Interdisciplinary Working Group: The American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists. *Stroke* 2007;38:2001-23.
97. The National Collaborating Centre for Chronic Conditions. *STROKE National clinical guideline for diagnosis and initial management of acute stroke and transient ischaemic attack (TIA)*. London: Royal College of Physicians, 2008.
98. Abilleira S, Gallofre M, Ribera A, Sanchez E, Tresserras R. Quality of in-hospital stroke care according to evidence-based performance measures: results from the first audit of stroke, Catalonia, Spain. *Stroke* 2009;40:1433-8.
99. Abilleira S, Ribera A, Permanyer-Miralda G, Tresserras R, Gallofre M. Noncompliance with certain quality indicators is associated with risk-adjusted mortality after stroke. *Stroke* 2012;43:1094-100.
100. Ingeman A, Andersen G, Hundborg HH, Svendsen ML, Johnsen SP. Processes of care and medical complications in patients with stroke. *Stroke* 2011;42:167-72.
101. Bersano A, Candelise L, Sterzi R, Micieli G, Gattinoni M, Morabito A. Stroke Unit care in Italy. Results from PROSIT (Project on Stroke Services in Italy). A nationwide study. *Neuro Sci* 2006;27:332-39.
102. Svendsen ML, Ehlers LH, Andersen G, Johnsen SP. Quality of care and length of stay among patients with stroke. *Medical Care* 2009;47:575-82.
103. Ribera A, Abilleira S, Permanyer-Miralda G, Tresserras R, Pons JMV, Gallofré M. Evaluating the quality of in-hospital stroke care, using an opportunity-based composite measure: a multilevel approach. *Clinical Audit* 2014;6:11-20.

Ранняя мобилизация после инсульта: применение при ограниченных доказательствах

Источник: J. Bernhardt, C. English, L. Johnson, T.B. Cumming. Early mobilization after stroke. Early adoption but limited evidence. *Stroke*. 2015;46:4:1141–1146

Florey Institute of Neuroscience and Mental Health, University of Melbourne, Australia; International Centre for Allied Health Evidence, University of South Australia, Australia; Institute of Sport, Exercise and Active Living, Victoria University, Melbourne, Australia.

Дополнительные данные доступны on-line по адресу:

<http://stroke.ahajournals.org/lookup/suppl/doi:10.1161/STROKEAHA.114.007434/-/DC1>.

Ключевые слова: острый (acute), ранний (early), мобилизация (mobilization), реабилитация (rehabilitation), инсульт (stroke).

В последнее десятилетие все большее внимание уделялось изучению компонентов оказания медицинской помощи, которые могут способствовать повышению эффективности терапии в отделениях для лечения больных инсультом. Ранняя мобилизация во многих ее проявлениях является одной из составляющих оказания медицинской помощи, которая вносит свой вклад в улучшение выживаемости и восстановления [1]. В этом актуальном обзоре приведены современные доказательства, научно-исследовательские и практические рекомендации для проведения ранней мобилизации после инсульта.

Нам необходимо определение понятия «ранняя мобилизация»

В качестве термина определение «ранняя мобилизация» вызывает затруднение. Не существует общего понимания смысла «ранняя» (например, часы, дни, недели, месяцы) или «мобилизация» (движение, например, клеток, суставов, конечностей, людей). Возвращаясь к этой теме в настоящем обзоре, определение, несовершенное в настоящее время, ограничивает нашу способность к сбору информации по этому вопросу. Например, в некоторых клинических испытаниях методик мобилизации в раннем периоде инсульта термин «мобилизация» использовали для описания программы целенаправленной поддержки положения тела и тренировки ходьбы (реабилитации), которую проводили врачи или медсестры во время пребывания пациента в стационаре в остром периоде инсульта [2, 3]. В других случаях термин «мобилизация» подразумевал под собой движение конечностей пациента в положении лежа или сидя в кровати. Сроки начала таких вмешательств также достаточно сильно отличаются, и зачастую их трудно определить. Поскольку вред или польза вмешательства зависит от того, что мы назначаем (тип вмешательства, интенсивность, частота, объем) и в какие сроки, мы выделили значимые вариации в определении этого термина. В настоящем обзоре уделили особое внимание вмешательствам, которые проводят вне кровати, начиная

с первых 24–72 часов после развития инсульта, потому что этот период имеет наибольшую клиническую неопределенность.

Краткая история развития методик ранней мобилизации после инсульта

Вопросы ранней мобилизации впервые обсуждали на шведской консенсусной конференции по оказанию медицинской помощи при инсульте в середине 1980-х гг. (Bo Norving и Bent Indredavik, личное общение, 2014 г.). Раннюю мобилизацию стали более часто обсуждать в литературе в начале 1990-х гг., когда B. Indredavik и коллеги опубликовали результаты клинического испытания, продемонстрировавшие заметное снижение уровней летальности и инвалидизации пациентов, лечение которых проводили в отделении для лечения больных инсультом с акцентом на раннюю реабилитацию и мобилизацию по сравнению с лечением в палатах общего профиля [4]. Это испытание стало частью обширного Кокрейновского обзора, проведенного Langhorne и соавт. [5], в котором показали явное преимущество организации медицинской помощи в отделениях по лечению больных инсультом. Ранняя мобилизация/реабилитация была включена в последующие дискуссии в качестве важного компонента оказания медицинской помощи в специализированных отделениях [1], и в 1994 г. эти методы лечения стали появляться в национальных клинических стандартах [6]. В 2004 г. было начато первое рандомизированное контролируемое испытание ранней мобилизации (*AVERT* – A Very Early Rehabilitation Trial Phase II) [3], посвященное изучению целесообразности и безопасности тренировок мобильности, ориентированных на выполнение определенных заданий в условиях отделений для лечения больных инсультом, которые начинали в течение 24 часов после развития учетного события. Протокол вмешательства был основан на данных обсервационных исследований, в которых отметили, что в норвежском отделении по лечению инсульта, в котором работал B. Indredavik, философия ранней мобилизации привела к тому, что пациенты даже при тяжелом инсульте были более физически активными в течение дня [7]. Сроки начала проведения вмешательства в течение первых 24 часов в испытании *AVERT Phase II* были выбраны для луч-

шего соответствия клинической практике, учитывая неопределенность в отношении потенциального вреда и преимуществ начала вмешательства, в частности в первый день после развития инсульта. Эти вопросы будут более подробно обсуждены ниже.

Данные испытаний

Только в 4 завершённых испытаниях (*AVERT Phase II*, $n=713$; *Very Early Rehabilitation or Intensive Telemetry After Stroke – VERITAS*, $n=32$ [8]; *Akershus Early Mobilization in Stroke Study – AKEMIS*, $n=56$ [9] и *Lausanne trial*, $n=42$ [10]; всего $n=201$) изучали эффективность начала ранней мобилизации в период от 24 до 72 часов от начала инсульта по сравнению с традиционным лечением (поздняя мобилизация±мониторинг) в условиях отделений для лечения больных инсультом (таблица 1). В целом в этих испытаниях использовали широкие критерии включения с широким спектром возраста, тяжести и типа инсульта (только в испытании *Lausanne trial* исключили пациентов с внутримозговыми кровоизлияниями). Изучали эффективность самых разных вмешательств; в некоторых испытаниях в основном уделяли внимание частым и продолжительным тренировкам мобильности при поддержке врача или медсестры (*AVERT*, *VERITAS*), в других испытаниях изучали протокол упражнений по поднятию головы в кровати, а затем через 52 часа вне кровати (*Lausanne trial*). Важно отметить, что ни в одном из испытаний не удалось продемонстрировать значимого влияния ранней мобилизации на частоту развития осложнений, показатели летальности или инвалидизации (модифицированная шкала Рэнкина). Исследователи испытания *AVERT Phase II* сообщили о быстром возвращении к тренировкам ходьбы без посторонней помощи [11] и снижении затрат на лечение [12]. При проведении мета-анализа данных отдельных пациентов, в т.ч. данных испытаний *AVERT* и *VERITAS*, выявили некоторые значимые улучшения функциональных показателей через 3 месяца после развития инсульта [13]; однако размер выборки был небольшим ($n=103$). Все чаще появляются публикации об испытаниях ранней реабилитации, проведенных в Китае. Систематический обзор и мета-анализ 37 китайских исследований ($n=5916$) свидетельствовал о значимом функциональном преимуществе проведения более ранних и разнообразных вмешательств по сравнению с отсутствием/незначительным вмешательством; однако качество испытаний зачастую было низким [14]. В последнее испытание ранней реабилитации, проведенное N. Liu и соавт. [15], включили 243 пациента с внутримозговым кровоизлиянием, рандомизированных в группу ранней реабилитации (без указания компонентов мобильности) в течение 48 часов после развития инсульта или группу традиционного лечения (начало реабилитации через >7 дней постельного режима). У пациентов с длительными сроками пребывания на постельном режиме отметили высокий риск развития летального исхода (отношение рисков [ОР]=4,44; 95% доверительный интервал [ДИ] от 1,24 до 12,87) и уменьшение оценки на 6 баллов

(95% ДИ от 4,2 до 8,7) по шкале SF-36 (физической). Остается неопределенность в отношении того, как интегрировать результаты китайских испытаний реабилитации в обзоры, но в решении этого вопроса могут помочь меры по улучшению отчетности испытаний [14, 16]. В настоящее время продолжается проведение двух крупных испытаний, *AVERT Phase III* ($n=2104$) и *Ischemic Stroke and Early Vertical Positioning (SEVEL)* ($n=400$) (таблица 2). Результаты этих испытаний позволят существенно увеличить доказательную базу по этому вопросу.

Распространенные в настоящее время в стандартах по лечению рекомендации по проведению ранней мобилизации

Несмотря на ограниченные доказательства эффективности ранней мобилизации, в последние годы произошло существенное изменение стандартов по лечению. Мы изучили 30 национальных стандартов по лечению острого инсульта с целью изучения рекомендаций по проведению ранней мобилизации (см. таблицу I в дополнительных данных *on-line*). Несмотря на то что в 22 (73%) стандартах были рекомендации по проведению ранней мобилизации, только в 8 (36%) определили вмешательства, проведение которых рекомендовали начинать в течение 24 часов от начала инсульта. Основным обоснованием ранней мобилизации было предотвращение развития осложнений (13/22 стандартов), а не содействие восстановлению. Доказательная база, на которой основаны эти рекомендации, очень мала. Вариации в рекомендуемых вмешательствах (стояние, сидение в постели, ходьба, активное участие в повседневной деятельности и т.д.) и сроках их начала (после стабилизации состояния, в течение 24 часов, 72 часов и т.д.) подчеркивают сохраняющуюся неопределенность относительно наиболее эффективного ведения пациентов в первые дни после инсульта.

Потенциальные механизмы: польза

Снижение частоты развития осложнений. Основным обоснованием для проведения ранней мобилизации является профилактика или снижение частоты развития осложнений, связанных с длительной иммобилизацией, таких как инфекционные заболевания, тромбоз эмболия из глубоких вен и падения [17]. К вторичным изменениям, связанным с отсутствием активности при инсульте, относятся ухудшение функционального состояния сердечно-сосудистой системы, мышечная атрофия, изменение соотношения типов мышечных волокон в пользу преобладания быстро утомляющихся инсулинрезистентных волокон и увеличение содержания внутримышечного жира [18]. В настоящее время нет четких доказательств того, что ранняя мобилизация позволяет снизить частоту развития осложнений, и хотя физическая активность и упражнения могут вызывать вторичные изменения функционального состояния сердечно-сосудистой и мышечной систем у пациентов в хроническом периоде инсульта [18], исследований, проведенных в остром периоде, нет. Нам хорошо известно, что у пациентов,

Таблица 1. Завершенные испытания ранней и очень ранней мобилизации после инсульта

Публикация (название испытания)	Случайная выборка	Протокол вмешательства	Время (часы) от момента начала инсульта до окончания мобилизации
J. Berghardt и соавт., 2008 [3] (AVERT)	71	Отобраны в течение 24 часов после развития инсульта цель – начало мобилизации в течение 24 часов от начала инсульта Упор на возможность пациента принять вертикальное положение вне кровати (сидение или стояние) Не менее 2 раз в день в течение первых 14 дней или до выписки из стационара	Осложнения/безопасность Летальные исходы: вмешательство=8/38, контроль=3/33, абсолютная разность рисков=12%, НЗ. Серьезные нежелательные явления†: вмешательство =15, контроль=14, НЗ. Несерьезные нежелательные явления: вмешательство=61, контроль=76, p=0,04 Падения: вмешательство=27, контроль=28, НЗ. Функциональный исход оценка по мШР 0–2 балла: вмешательство=39,5%, контроль=30,3%, скорректированное* ОШ=4,10, p=0,05
P. Langhorne и соавт., 2010 [8] (VERTAS)	32	Отобраны в течение 24 часов после госпитализации цель – начало мобилизации в течение 24 часов после развития инсульта Упор на возможность пациента самостоятельно сидеть, стоять или передвигаться (в зависимости от потребностей пациента) Не менее 4 раз в день во время пребывания в стационаре или в течение одной недели после зачисления в испытание	Осложнения/безопасность Летальные исходы: РМ=0%, контроль=6% Осложнения§: РМ=8, контроль=17 Осложнения (5–90 дней): РМ=8, контроль=8 Осложнения иммобилизации (0–5 дней): вмешательство=0, контроль=3 Функциональный исход оценка по мШР 0–2 балла: вмешательство=75%, контроль =44%, скорректированное ОШ=2,3. (p=0,44)
K. Diserens и соавт., 2010 [10] (Lausanne trial)	50 (42 включили в анализ)	Отобраны в течение 12 часов после госпитализации, вмешательство начли в течение 24 часов после развития инсульта Головной конец кровати пациента держали под углом 0° в течение первых 24 часов после развития инсульта, затем под углом 45° в течение 24 часов, а затем под углом 90° в течение 4 часов Через 52 часа после развития инсульта переходили с постельного режима на сидение или стояние	Осложнения/безопасность Летальные исходы: вмешательство=0%, контроль=6%, тяжелые осложнения, включая смерть ¶ (во время госпитализации): вмешательство=8%, контроль=47% Незначительные осложнения (во время госпитализации): вмешательство=20%, контроль=0%, НЗ. Функциональный исход: Оценка по мШР 0–2 балла: вмешательство=40%, контроль=30%, НЗ.
Sundseth и соавт., 2012 [9] (AKEMIS)	65 (56 включили в анализ)	Отобраны при поступлении в стационар в течение 24 часов после развития инсульта, перевод с постельного режима в течение 24 часов после госпитализации Отсутствие заранее определенного протокола мобилизации Критерием мобилизации был любой перевод с постельного режима, с последующей стандартной программой мобилизации в отделении для лечения больных инсультом, скорректированной на потребности пациента Сеансы мобилизации несколько раз в день	Осложнения/безопасность Летальные исходы: вмешательство=7/27, контроль =2/29, скорректированное* ОШ=5,26, НЗ. Пациенты, у которых было >1 осложнения: вмешательство=67%, контроль=66%, НЗ. Функциональный исход: оценка по мШР 0–2 балла: вмешательство=40%, контроль=60,7%, скорректированное** ОШ=2,7, НЗ

Примечание. МКР – межквартильный размах, мШР – модифицированная шкала Рэнкина, нз – не значимо, ОШ – отношение шансов.

* – данные об исходах через 3 месяца, если не указано иное. † – серьезные нежелательные явления – прогрессирующее инсульта, пневмония, повторный инсульт, инфаркт миокарда, фибрилляция предсердий и другие (не включая летальный исход). ‡ – внесение поправок на возраст, исходную оценку по шкале тяжести инсульта Национальных институтов здравоохранения (NIHSS), преморбидную оценку по мШР (модифицированная шкала Рэнкина). § – осложнения: инфекции нижних дыхательных путей, падения, угнетенность и прогрессирующее инсульта. К осложнениям иммобилизации относились тромбоз глубоких вен, инфекция мочевыводящих путей. || – внесение поправок на возраст, исходную оценку по NIHSS, совместное проведение другого вмешательства. ¶ – тяжелые осложнения: нозокомиальная пневмония, острый коронарный синдром, тромбоз мозговых сосудов. ** – внесение поправок на возраст, оценку по NIHSS при поступлении и уровень летальности. ** – внесение поправок на возраст и оценку по NIHSS при поступлении.

лечение которых проводят в организованных отделениях для лечения больных инсультом, реже развиваются осложнения, связанные с длительной иммобилизацией [19], и это связано с ранним и более эффективным лечением, в т.ч. ранней мобилизацией и ранней реабилитацией [1]. Наша группа и другие группы исследователей использовали структурированное наблюдение за деятельностью пациента в течение активного дня (08:00–17:00 часов) и показали, что у пациентов, проходивших лечение в специализированных отделениях, в которых практиковали раннюю реабилитацию, сроки начала первого сеанса мобилизации были более короткими (медиана 18 часов после инсульта; межквартильный размах [МКР] от 7,3 до 43,0), они проводили в постели только 30% дневного времени, 46% — вне постели и 20% времени тратили на стояние и ходьбу [20]. Эти показатели отличались от показателей пациентов, находившихся в отделениях для лечения больных инсультом с медианой времени неактивности 65,5 часа (межквартильный размах от 6,3 до 87,8) [21]. Остается нерешенным вопрос, оказывает ли ранняя активность независимое влияние на частоту развития и тяжесть осложнений, связанных с длительной иммобилизацией, или других осложнений.

Содействие восстановлению головного мозга. В доклинических исследованиях продемонстрировали критический чувствительный период усиления нейропластичности в остром периоде инсульта [22, 23]. Области головного мозга, ипсилатеральные и контралатеральные по отношению к очагу ишемического повреждения, являются гипервозбудимыми. В периинфарктной зоне происходит активация генов, ответственных за спрутинг аксонов, формирование шипиков дендритов и синаптогенез, и подавляются процессы неадекватной пластичности и эксайтотоксичности [22, 23]. Эффективность реабилитации уменьшается с течени-

ем времени [24], и это позволяет предположить, что ранее начало тренировок после инсульта может привести к улучшению восстановления. У животных после инсульта проведение тренировок приводит к уменьшению объема очага ишемии, особенно, если тренировки начинают вскоре после развития инсульта [25]. Эти результаты обеспечивают биологическую основу ранней реабилитации у людей, однако вопросы сроков и объема вмешательств остаются неразрешенными.

Потенциальные механизмы: вред

Некоторые врачи высказывают опасения относительно того, что ранний перевод пациента в вертикальное положение может препятствовать реперфузии жизнеспособной ткани пенумбры. В систематическом обзоре исследований ($n=57$), в которых использовали транскраниальную доплерографию для измерения скорости церебрального кровотока при изменении положения головы, привели данные о том, что при поднятии головного конца кровати на 30° у пациентов с окклюзией средней мозговой артерии снижается скорость церебрального кровотока [26], особенно у лиц со стойкой окклюзией. Ассоциации между этими изменениями и клиническими исходами не изучали. Горизонтальное положение тела может поддерживать вновь образованные лептоменингеальные или транскортикальные коллатеральные каналы, которые ассоциированы с сохранением пенумбры и уменьшением размеров зоны инфаркта [27]. В недавно проведенном исследовании не выявили значимых различий в скорости церебрального кровотока у пациентов, обследованные которых проводили через 6–16 часов после ишемического инсульта в бассейне средней мозговой артерии и лиц контрольной группы при любом изменении положения головного конца кровати (70° , 45° , 0° , -15°), и связи между скоростью церебрального кровотока и

Таблица 2. Продолжающиеся испытания методов ранней и очень ранней мобилизации после инсульта

Испытание	Запланированный объем выборки	Вмешательство	Время включения в испытание	Первичная конечная точка
AVERT Phase III (Florey Institute of Neuroscience and Mental Health) NCT01846247 Продолжается, зачисление не закончено	2104	Вмешательство: традиционное лечение+очень ранняя мобилизация Пациентам будут проводить стандартную терапию в отделении для лечения больных инсультом с ранней и дополнительной кинезитерапией и сеансами работы со средним медперсоналом, согласно протоколу вмешательства Группа сравнения: традиционное лечение	Зачисление в течение <24 часов с момента появления симптомов инсульта	Оценка по мШР через 3 месяца после инсульта
SEVEL Trial (Nates University Hospital) NCT01573299 Приостановлено*	400	Группа вмешательства 1: ранний перевод пациента в вертикальное положение Пациент может сидеть вне кровати через день после развития инсульта Группа вмешательства 2: отсроченный перевод пациента в вертикальное положение Пациенту постепенно придают вертикальное положение и разрешают сидеть вне кровати на 3-й день после развития инсульта	Отсутствие заранее определенных временных рамок	Оценка по мШР через 3 месяца после инсульта

Примечание. Источник: <http://www.clinicaltrials.gov> (4 декабря 2014 г.). мШР — модифицированная шкала Рэнкина. * — испытание было приостановлено по причине медленного набора пациентов (Fanny Herisson, личный контакт, 2014 г.).

благоприятным неврологическим исходом не обнаружили [28]. Тем не менее эти опасения лежат в основе проведения исследований Lausanne study и SEVEL, в которых изучали эффективность постепенной вертикализации на 3-й день после развития инсульта (см. таблицы 1 и 2), а также нового крупного кластерного рандомизированного контролируемого испытания Head Position in Stroke Trial (*HeadPoST*, <http://www.clinicaltrials.gov: NCT02162017>) в котором сравнивали эффективность протоколов сохранения горизонтального положения головы или приподнятого на 30° головного конца кровати в течение первых 24 часов после постановки диагноза инсульта.

Вопросы оптимального контроля уровня артериального давления при остром инсульте (ишемическом и геморрагическом) остаются неопределенными [29]. Вполне возможно, что влияние двигательной активности на артериальное давление (АД) вызывает настороженность у некоторых клиницистов. Физическая активность приводит к повышению среднего АД, но это влияние является транзиторным, и при прекращении физических упражнений уровень АД возвращается к исходному [30]. Снижение уровня АД (постуральная гипотензия) может также вызывать опасения; однако даже у пациентов с умеренным и тяжелым инсультом, резкое падение уровня АД (снижение систолического АД более чем на 30 мм рт.ст.) происходит только у <10% пациентов [30]. Ранний переход с постельного режима в течение 24 часов после развития инсульта вызывает наибольшее опасение у клиницистов в отношении пациентов с геморрагическим (59%), чем ишемическим (23%) инсультом [31], возможно, из-за страха развития повторного кровоизлияния. Повышенный риск развития симптомного внутримозгового кровоизлияния также лежит в основе настороженности в отношении проведения ранней мобилизации у пациентов после лечения рекомбинантным тканевым активатором плазминогена (рТАП) [32]. На решение клиницистов о сроках мобилизации после проведения системного тромболитика также влияют такие факторы, как инфекции неопределенного генеза, тяжелые инфекции нижних дыхательных путей, тяжесть инсульта (оценка по шкале тяжести инсульта Национальных институтов здравоохранения >20 баллов), сонливость и спутанность сознания [32]. Для разработки стандартов по ранней мобилизации после системного тромболитика недостаточно данных. В небольшом исследовании, в котором мобилизацию 29 пациентов начинали в течение 12–24 часов после введения рТАП обнаружили, что у 75% пациентов небыло негативной реакции на мобилизацию, а у остальных пациентов развились не угрожающие жизни события [33]. В испытании *AVERT Phase III* зачислили более 500 пациентов, получавших рТАП. Данные этого испытания должны помочь разработать клинические рекомендации.

Необходимые критерии безопасности

Следующим важным шагом является определение критериев безопасности для данного вмешательства.

Понятно, что не всем пациентам, поступившим с инсультом, показан ранний переход с постельного режима или начало тренировок в течение нескольких часов или даже дней после инсульта. В настоящее время нет четких указаний по безопасности раннего начала или интенсификации терапии. В контексте испытаний исследователи готовы включать в испытания взрослых пациентов (без верхнего возрастного предела) с ишемическим или геморрагическим инсультами, способных самостоятельно подниматься с кровати, без признаков раннего неврологического ухудшения и повторного внутримозгового кровоизлияния, острого коронарного синдрома или тяжелой сердечной недостаточности. В ранее проводившихся испытаниях пациентов, получавших рТАП, исключали [3, 8–10] но их включили в выборку испытания *AVERT Phase III*. К дополнительным широким физиологическим критериям безопасности относятся уровень систолического АД от 120 до 220 мм рт.ст. и частота сердечных сокращений от 40 до 100 ударов в минуту [3]. Физиологический мониторинг до проведения каждой тренировки вне кровати в течение первых 3 дней, в частности контроль систолического АД и сознания, практиковали в нескольких исследованиях с использованием нескольких режимов лечения. В настоящее время нейровизуализацию не используют для отбора пациентов или контроля эффективности лечения.

Ранняя мобилизация в клинической практике

Все чаще мы видим, что раннюю мобилизацию включают в аудиты по лечению инсульта в качестве показателя качества (см. таблицу II в дополнительных данных *on-line*), хотя понятие «мобилизация» остается в значительной степени неопределенным, и понятие «ранняя» либо не определено количественно или варьируется от 24 часов от момента появления симптомов инсульта [34] до двух дней от момента поступления в стационар [35, 36]. Регистрируют данные только о первом сеансе мобилизации. Показатели приверженности лечению варьируются от 49% в Испании [37] до 85% в Австралии [35]. Влияет ли приверженность ранней мобилизации на исходы у пациентов? Данные аудита клинических баз данных пациентов с инсультом из Каталони (Испания) показали, что ранняя мобилизация была в значительной степени ассоциирована со снижением летальности в течение 30 дней (ОШ=2,05; 95% ДИ от 1,31 до 3,19) и через 12 месяцев (ОШ=1,54; 95% ДИ от 1,05 до 2,24) [38]. В других исследованиях обнаружили, что ранняя мобилизация была независимо ассоциирована с более низким риском развития осложнений [39] и сокращением сроков пребывания в стационаре [36]. Эти показатели напрямую зависели от сроков первого сеанса мобилизации. В связи с этим вполне вероятно, что эти показатели свидетельствуют больше не об эффективности конкретного вмешательства, а об эффективности координированных действий медицинского персонала лечебного учреждения, в частности привлечения специалистов по реабилитации.

■ ВЫВОДЫ

Ранняя мобилизация стала традиционной темой семинаров и научных сессий на конференциях по вопросам лечения инсульта во всем мире. Согласно распространенным мнениям, это простой метод улучшения качества лечения при остром инсульте. В настоящем обзоре подчеркивается раннее принятие и в некоторых случаях переход на проведение некоторых видов мобилизации в раннем периоде, несмотря на существующие опасения. Тем не менее в настоящее время из дискуссий упускают общее понимание ранней мобилизации, доказательства для облегчения решений об отборе пациентов для проведения ранней мобилизации и механизм, посредством которого ранняя мобилизация как метод лечения в первые часы или дни после развития инсульта может содействовать восстановлению или причинить вред. Именно эта неопределенность на фоне многообещающих результатов испытаний II фазы побудила нас провести международное испытание *AVERT Phase III*, которое будет завершено в ближайшее время. По скользящей шкале вмешательств при мобилизации наш протокол вмешательства находится в самом конце спектра реабилитации, и мы сможем изучить, каким пациентам проводили мобилизацию, как часто и в какие сроки во время пребы-

вания в стационаре. Результаты этого крупного испытания позволят разработать рекомендации, согласно которым можно будет идентифицировать пациентов, у которых проведение ранней мобилизации в течение 24 часов от начала инсульта будет эффективным или причинит вред, а также более детально оценить расходы на лечение. Как и во всех других исследованиях, скорее всего, появятся новые исследовательские вопросы. Все больше и больше мы пытаемся понять, как улучшить и ускорить восстановление после инсульта с помощью мультимодальных подходов, в т.ч. реабилитационных методов лечения. Повышение эффективности реабилитационных мероприятий благодаря лучшему пониманию нейробиологии восстановления и сроков тренировок, а также определение целевой группы пациентов являются важным аспектом в этой области. Наш новый центр исследований передовых технологий в области реабилитации и восстановления, финансируемый Национальным советом по здравоохранению и медицинским исследованиям, ориентирован на эти важные цели. Модель совпадает с рекомендациями приоритетных мировых ассоциаций 2010 г. [40], и мы с нетерпением ждем связи с другими международными научно-исследовательскими инициативами по реабилитации и восстановлению по всему миру.

■ ЛИТЕРАТУРА

- Langhorne P., Pollock A.; Stroke Unit Trialists' Collaboration. What are the components of effective stroke unit care? *Age Ageing*. 2002;31:365–371.
- Indredavik B., Bakke F., Slordahl S.A., Rokseth R., Håheim L.L. Treatment in a combined acute and rehabilitation stroke unit: which aspects are most important? *Stroke*. 1999;30:917–923.
- Bernhardt J., Dewey H., Thrift A., Collier J., Donnan G. A very early rehabilitation trial for stroke (AVERT): phase II safety and feasibility. *Stroke*. 2008;39:390–396. doi:10.1161/STROKEAHA.107.492363.
- Indredavik B., Bakke F., Slordahl S., Rokseth R., Håheim L., Holme I. Benefits of a stroke unit: a randomized controlled trial. *Stroke*. 1991;22:1026–1031.
- Stroke Unit Trialists Collaboration. Organised inpatient (stroke unit) care for stroke (Review). *Cochrane Database Syst Rev*. 2007;(4):CD000197.
- Adams H.P. Jr., Brott T.G., Crowell R.M., Furlan A.J., Gomez C.R., Grotta J., et al. Guidelines for the management of patients with acute ischemic stroke. A statement for healthcare professionals from a special writing group of the Stroke Council, American Heart Association. *Circulation*. 1994;90:1588–1601.
- Bernhardt J., Chitravas N., Meslo I.L., Thrift A.G., Indredavik B. Not all stroke units are the same: a comparison of physical activity patterns in Melbourne, Australia, and Trondheim, Norway. *Stroke*. 2008;39:2059–2065. doi:10.1161/STROKEAHA.107.507160.
- Langhorne P., Stott D., Knight A., Bernhardt J., Barer D., Watkins C. Very early rehabilitation or intensive telemetry after stroke: a pilot randomised trial. *Cerebrovasc Dis*. 2010;29:352–360. doi:10.1159/000278931.
- Sundseth A., Thommessen B., Rønning O.M. Outcome after mobilization within 24 hours of acute stroke: a randomized controlled trial. *Stroke*. 2012;43:2389–2394. doi:10.1161/STROKEAHA.111.646687.
- Diserens K., Moreira T., Hirt L., Faouzi M., Grujic J., Bieler G., et al. Early mobilization out of bed after ischaemic stroke reduces severe complications but not cerebral blood flow: a randomized controlled pilot trial. *Clin Rehabil*. 2012;26:451–459. doi:10.1177/0269215511425541.
- Cumming T.B., Thrift A.G., Collier J.M., Churilov L., Dewey H.M., Donnan G.A., et al. Very early mobilization after stroke fast-tracks return to walking: further results from the phase II AVERT randomized controlled trial. *Stroke*. 2011;42:153–158. doi:10.1161/STROKEAHA.110.594598.
- Tay-Teo K., Moodie M., Bernhardt J., Thrift A.G., Collier J., Donnan G., et al. Economic evaluation alongside a phase II, multi-centre, randomised controlled trial of very early rehabilitation after stroke (AVERT). *Cerebrovasc Dis*. 2008;26:475–481. doi:10.1159/000155984.
- Craig L.E., Bernhardt J., Langhorne P., Wu O. Early mobilization after stroke: an example of an individual patient data meta-analysis of a complex intervention. *Stroke*. 2010;41:2632–2636. doi:10.1161/STROKEAHA.110.588244.
- Zhang W.W., Speare S., Churilov L., Thuy M., Donnan G., Bernhardt J. Stroke rehabilitation in China: a systematic review and meta-analysis. *Int J Stroke*. 2014;9:494–502. doi:10.1111/ijs.12029.
- Liu N., Cadilhac D.A., Andrew N.E., Zeng L., Li Z., Li J., et al. Randomized controlled trial of early rehabilitation after intracerebral hemorrhage stroke: difference in outcomes within 6 months of stroke. *Stroke*. 2014;45:3502–3507. doi:10.1161/STROKEAHA.114.005661.
- Pollock A., Campbell P., Baer G., Choo P.L., Forster A., Morris J., et al. Challenges in integrating international evidence relating

- to stroke rehabilitation: experiences from a Cochrane systematic review. *Int J Stroke*. 2014;9:965–967. doi: 10.1111/ij.s.12339.
17. Bamford J., Dennis M., Sandercock P., Burn J., Warlow C. The frequency, causes and timing of death within 30 days of a first stroke: the Oxfordshire Community Stroke Project. *J Neurol Neurosurg Psychiatry*. 1990;53:824–829.
 18. Ivey F.M., Hafer-Macko C.E., Macko R.F. Exercise rehabilitation after stroke. *NeuroRx*. 2006;3:439–450. doi: 10.1016/j.nurx.2006.07.011.
 19. Govan L., Langhorne P., Weir C.J.; Stroke Unit Trialists Collaboration. Does the prevention of complications explain the survival benefit of organized inpatient (stroke unit) care?: further analysis of a systematic review. *Stroke*. 2007;38:2536–2540. doi: 10.1161/STROKEAHA.106.478842.
 20. Askim T., Bernhardt J., Løge A.D., Indredavik B. Stroke patients do not need to be inactive in the first two-weeks after stroke: results from a stroke unit focused on early rehabilitation. *Int J Stroke*. 2012;7:25–31. doi: 10.1111/j.1747-4949.2011.00697.x.
 21. West T., Bernhardt J. Physical activity in hospitalised stroke patients. *Stroke Res Treat*. 2012;2012:1–13. doi: 10.1155/2012/813765.
 22. Murphy T.H., Corbett D. Plasticity during stroke recovery: from synapse to behaviour. *Nat Rev Neurosci*. 2009;10:861–872. doi: 10.1038/nrn2735.
 23. Zeiler S.R., Krakauer J.W. The interaction between training and plasticity in the poststroke brain. *Curr Opin Neurol*. 2013;26:609–616. doi: 10.1097/WCO.0000000000000025.
 24. Biernaskie J., Chernenko G., Corbett D. Efficacy of rehabilitative experience declines with time after focal ischemic brain injury. *J Neurosci*. 2004;24:1245–1254. doi: 10.1523/JNEUROSCI.3834-03.2004.
 25. Egan K.J., Janssen H., Sena E.S., Longley L., Speare S., Howells D.W., et al. Exercise reduces infarct volume and facilitates neurobehavioral recovery: results from a systematic review and meta-analysis of exercise in experimental models of focal ischemia. *Neurorehabil Neural Repair*. 2014;28:800–812. doi: 10.1177/1545968314521694.
 26. Olavarría V.V., Arima H., Anderson C.S., Brunser A.M., Muñoz-Venturelli P., Heritier S., et al. Head position and cerebral blood flow velocity in acute ischemic stroke: a systematic review and meta-analysis. *Cerebrovasc Dis*. 2014;37:401–408. doi: 10.1159/000362533.
 27. Christoforidis G.A., Mohammad Y., Kehagias D., Avutu B., Slivka A.P. Angiographic assessment of pial collaterals as a prognostic indicator following intra-arterial thrombolysis for acute ischemic stroke. *AJNR Am J Neuroradiol*. 2005;26:1789–1797.
 28. Aries M.J., Elting J.W., Stewart R., De Keyser J., Kremer B., Vroomen P. Cerebral blood flow velocity changes during upright positioning in bed after acute stroke: an observational study. *BMJ Open*. 2013;3:e002960. doi: 10.1136/bmjopen-2013-002960.
 29. Saver J.L. Blood pressure management in early ischemic stroke. *JAMA*. 2014;311:469–470. doi: 10.1001/jama.2013.282544.
 30. Indredavik B., Løge A.D., Rohwedder G., Lydersen S. Early mobilisation of acute stroke patients is tolerated well, increases mean blood pressure and oxygen saturation and improves consciousness. *Cerebrovasc Dis*. 2007;23:65.
 31. Skarin M., Bernhardt J., Sjöholm A., Nilsson M., Linden T. 'Better wear out sheets than shoes': a survey of 202 stroke professionals' early mobilisation practices and concerns. *Int J Stroke*. 2011;6:10–15. doi: 10.1111/j.1747-4949.2010.00534.x.
 32. Ha J., Churilov L., Linden T., Bernhardt J. Bed rest or mobilization after rt-PA? A case-crossover study of factors influencing clinical decision making in stroke services. *Int J Stroke*. 2013;8:172–179. doi:10.1111/j.1747-4949.2011.00660.x.
 33. Davis O., Mooney L., Dinkins M., Freeman W.D., Arnold S. Early mobilization of ischemic stroke patients post intravenous tissue plasminogen activator. *Stroke*. 2013;44:A121.
 34. Ribera A., Abilleira S., Permanyer-Miralda G., Tresserras R., Pons J.M.V., Gallofré M. Evaluating the quality of in-hospital stroke care, using an opportunity-based composite measure: a multilevel approach. *Clinical Audit*. 2014;6:11–20.
 35. Cadilhac D., Lannin N., Anderson C., Andrew N., Kim J., Kilkenny M., et al. AuSCR Annual Report 2013. Heidelberg, Australia: The Florey Institute of Neuroscience and Mental Health; 2013:1–58.
 36. Svendsen M.L., Ehlers L.H., Andersen G., Johnsen S.P. Quality of care and length of hospital stay among patients with stroke. *Med Care*. 2009;47:575–582. doi: 10.1097/MLR.0b013e318195f852.
 37. Abilleira S., Gallofré M., Ribera A., Sánchez E., Tresserras R. Quality of in-hospital stroke care according to evidence-based performance measures: results from the first audit of stroke, Catalonia, Spain. *Stroke*. 2009;40:1433–1438. doi: 10.1161/STROKEAHA.108.530014.
 38. Abilleira S., Ribera A., Sánchez E., Tresserras R., Gallofré M. The Second Stroke Audit of Catalonia shows improvements in many, but not all quality indicators. *Int J Stroke*. 2012;7:19–24. doi:10.1111/j.1747-4949.2011.00638.x.
 39. Ingeman A., Andersen G., Hundborg H.H., Svendsen M.L., Johnsen S.P. Processes of care and medical complications in patients with stroke. *Stroke*. 2011;42:167–172. doi: 10.1161/STROKEAHA.110.599738.
 40. Hachinski V., Donnan G.A., Gorelick P.B., Hacke W., Cramer S.C., Kaste M., et al. Stroke: working toward a prioritized world agenda. *Int J Stroke*. 2010;5:238–256. doi: 10.1111/j.1747-4949.2010.00442.x.