Cognitive aftermath of ischemic stroke
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Introduction
Stroke is a catastrophic event with a wide variety of possible long-term consequences for patients and their partners. The present study investigated cognitive functioning after ischemic stroke and the impact of changes in cognition on daily life.

Definition

The World Health Organisation (WHO) defines stroke as “a focal (or at times global) neurological impairment of sudden onset, and lasting more than 24 hours (or leading to death) and of presumed vascular origin” (Hatano, 1976). Annually, about 30,000 people in the Netherlands develop a stroke (Van Oers, 2002). Stroke can be ischemic (about 80%) in which case the blood supply to a part of the brain is obstructed. The occlusion can be caused by a thrombus formed in a local blood vessel within the brain (thrombotic ischemic stroke), or by a remote thrombus formed in another part of the circulatory system that is subsequently transported via the blood stream into the brain arteries (embolic ischemic stroke). A minority of the strokes is caused by a subarachnoidal or intracerebral haemorrhage. The present study is limited to ischemic strokes. Increasing age is one of the main risk factors for ischemic stroke. Other risk factors include TIA, vascular disorders, diabetes mellitus, hypertension, smoking, alcohol abuse, obesity and lack of physical exercise (Wachters-Kaufman, 2004).

Cognition and emotion after stroke

For years the focus of medical care and research in stroke has been on elucidating the clearly visible physical consequences and the conspicuous specific cognitive disorders like aphasia, apraxia and neglect. However, in the past decade increasing evidence became available for the presence of global cognitive impairment after stroke (Hochstenbach, Mulder, Van Limbeek, Donders, & Schoonderwaldt, 1998; Hom & Reitan, 1990; Madureira, Guerreiro, & Ferro, 2001; Tatemichi, et al., 1994; Van Zandvoort, De Haan, & Kappelle, 2001), that was related to recovery of daily higher level activities (Zinn et al., 2004) and independent living (Pedersen, Jorgensen, Nakayama, Raaschou, & Olsen, 1996; Pohjasvaraa, Erkinjuntti, Vataja, & Kaste, 1998). A few studies have demonstrated that improvement in cognitive function may occur within the period between three months and the chronic stage post stroke (at least one year after stroke). However, these studies did not longitudinally assess and compare these findings with the course of cognitive function within a control group. This recovery appeared to be incomplete and the findings are incongruous with respect to the percentage of patients that improved (Ballard, Rowan, Kalaria, & Kenny, 2003; Hochstenbach, Den Otter, & Mulder, 2003). Apart from cognitive deficits, or perhaps related to cognitive deficits, depressive mood is the most common emotional change after stroke that occurs in 25 – 79 % of the patients. The wide range in prevalence alone
indicates that, despite the implementation of numerous studies in this field, many important issues on this topic remain unaddressed (Provinciali & Coccia, 2002).

**Scope of the present study**

The purpose of this study is to carefully examine cognitive functioning after stroke. To date, most studies in this field are conducted on patients in a hospital or rehabilitation setting. This may cause a selection bias towards the more severe strokes. An important distinguishing aspect of the present study was that it incorporated a community-based stroke patient group, since little is known about this population, which generally receives less (para)medical care than the patients in a hospital or rehabilitation setting. The patient group was recruited with the assistance of General Practitioners (GPs) in the Northern part of the Netherlands and the stroke unit of the University Hospital Groningen. Moreover, control subjects were also invited by their GPs to participate in the study, a randomised stratified selection procedure was applied. This procedure serves to optimise comparability of the two study groups, as will be demonstrated in chapter 2.

Little is known about the course of cognitive functioning after stroke; therefore both the stroke patients and the control subjects were examined twice with a one-year time interval. The first assessment of the patients took place within the so called ‘subacute or rehabilitation stage’ at about three months post stroke. In this phase the most dramatic recovery is expected to have taken place, but more spontaneous improvement can still be anticipated. At 15 months post stroke, in the ‘chronic stage’, the second examination was conducted.

Three main cognitive domains were considered essential, namely speed of information processing, learning and reasoning. In chapter 3 the impact of unilateral stroke on speed of information processing at three months post stroke will be outlined. Four reaction time tasks were used, two visuomotor and two cognitive, measuring both movement times and decision times. The test measured the visuomotor reaction times in both visual fields separately, and incorporated different levels of complexity. The complexity effect, which was demonstrated by Miller (1970) and Van Zomeren & Deelman (1976) in patients with closed head injury, was investigated as well as the effects of the side of the stroke, aphasia and neglect. Moreover, psychometric aspects of the test were considered.

To investigate (the course of) learning after stroke in left and right hemispheric stroke patients the Couples Test was constructed as will be discussed in chapter 4. Left hemispheric stroke patients were hypothesised to demonstrate impaired memory mainly in the verbal modality, while right hemispheric stroke patients were expected to show most decline in non-verbal memory functioning. On the other hand, implicit learning, as measured with a picture-priming task, was expected to be intact after stroke. Moreover, the effect of age on explicit memory functioning will be considered.
The third cognitive domain was reasoning and is outlined in chapter 5. Reasoning can be considered an aspect of executive functioning, and was expected to have considerable influence on the capacities of patients that are required to overcome the new challenges presented as a consequence of the stroke. The Snijders-Oomen Non-verbal Intelligence Test (SON-R 5½ -17) was adjusted and used to measure reasoning after stroke. Impairment, relation to other cognitive disorders, course and impact on complex daily activities will be investigated.

Population-based studies have shown that in stroke-free elderly silent brain infarcts and white matter lesions are common radiological findings. In chapter 6 the presence of asymptomatic ischemic brain lesions and their influence on cognitive functioning in stroke patients will be examined and discussed.

Many studies have been conducted attempting to elucidate the relation between depression and cognition after stroke, but so far hardly any consensus on this topic has been reached. In chapter 7 we will try to further unravel this problem, using two different measures of depressive mood: a self-rated and an observer-rated depression scale.

Finally, in chapter 8 the predictive value of cognitive disabilities and activity levels at three months post-stroke for life satisfaction late after stroke will be examined, as well as the role of cognitive disabilities in the level of activity after stroke. The Social Production Functions (SPF) theory describes the participation in activities as an important mean to obtain well being, and was considered a framework for the prediction of stroke outcome (Ormel, Lindenber, Steverdink, & Vonkorff, 1997).

The main questions addressed in this thesis are:
1. What is the impact of stroke on cognitive functioning in a community-based patient group? What is the role of side of stroke, aphasia and neglect in this respect?
2. Does recovery of cognitive function take place within the subacute and chronic phases after stroke?
3. What is the impact of cognitive dysfunction on mood and daily life of the stroke patients?
References


