

Delayed Cerebral Ischemia Predicts Neurocognitive Impairment Following Aneurysmal Subarachnoid Hemorrhage

Martin N. Stienen¹, Nicolas R. Smoll³, Rahel Weisshaupt⁴, Javier Fandino⁵, Gerhard Hildebrandt¹, Aline Studerus-Germann², Bawarjan Schatlo^{5,6}

Key words

- Aneurysm
- Cognitive impairment
- Intracranial aneurysm
- Neuropsychological outcome
- Neuropsychology
- Subarachnoid hemorrhage
- Vasospasm

Abbreviations and Acronyms

aSAH: Aneurysmal subarachnoid hemorrhage
CERAD: Consortium to Establish A Registry for Alzheimer's Disease
CVS: Cerebral vasospasm
DCI: Delayed cerebral ischemia
EVD: External ventricular drainage
GCS: Glasgow Coma Scale
MMSE: Mini-Mental State Examination
NPD: Neuropsychological deficits
TICS: Telephone Interview of Cognitive Status
WFNS: World Federation of Neurological Surgeons Grading System



From the ¹Department of Neurosurgery and ²Neuropsychology Unit, Department of Neurology, Kantonsspital St. Gallen, St. Gallen, Switzerland; ³Department of Neurosurgery, University Hospital Geneva, Geneva, Switzerland; ⁴Neuropsychology Unit, Department of Neurology, and ⁵Department of Neurosurgery, Kantonsspital Aarau, Aarau, Switzerland; and ⁶Department of Neurosurgery, Georg-August-University, Göttingen, Germany

To whom correspondence should be addressed:
 Martin N. Stienen, M.D.
 [E-mail: mnstienen@gmail.com]

Citation: *World Neurosurg.* (2014) 82, 5:e599-e605.
<http://dx.doi.org/10.1016/j.wneu.2014.05.011>

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

1878-8750/\$ - see front matter © 2014 Elsevier Inc.
 All rights reserved.

INTRODUCTION

Aneurysmal subarachnoid hemorrhage (aSAH) is associated with high mortality and morbidity occurring during the early and later stages of onset (19). Early brain injury can be attributed to the initial bleeding and rebleeding before occlusion therapy and can be a complication of aneurysm treatment itself. The subacute phase after aSAH carries the risk of delayed neurologic deterioration

■ **BACKGROUND:** Prior studies have shown that the incidence of neuropsychological deficits (NPDs) after aneurysmal subarachnoid hemorrhage (aSAH) is high despite excellent outcome according to neurologic grading scales. Delayed cerebral ischemia (DCI) occurs in 30% of patients after aSAH and significantly contributes to the mortality and morbidity of aSAH. We tested the hypothesis that DCI is associated with neuropsychological outcome.

■ **METHODS:** Files of patients treated between January 2009 and August 2012 at 2 neurovascular centers were reviewed. Neuropsychological outcome was assessed in a face-to-face-interview of 2–2.5 hours' duration and graded as no (regular), minimal, moderate, or severe deficit according to normative population data by an experienced, independent neuropsychologist. The test battery was applied with consideration of the patients' individual premorbid level of workload and social activities and accounted for the following cognitive domains: memory, attention, executive function, visual and spatial perception, language and calculation, and behavior.

■ **RESULTS:** Of 226 patients treated at 2 centers, 187 were discharged alive. Full neuropsychological outcome assessment was available in 92 patients. DCI developed in 28 (30.4%) patients; 24 of these patients (85.7%) showed moderate to severe NPD. From a univariate perspective, patients with DCI were 6.38 times as likely to experience moderate to severe NPD after aSAH as patients without DCI (odds ratio [OR]; 95% confidence interval [CI], 1.98–20.50; $P = 0.002$), which remained statistically significant after correction for admission World Federation of Neurological Surgeons Grading System and Fisher scores, patient age, hydrocephalus, and further potential confounders (OR, 4.9; 95% CI, 1.26–19.58; $P = 0.022$). Of all factors analyzed, DCI was the strongest predictor of NPD in the multivariate analysis, followed by chronic hydrocephalus (OR, 4.85; 95% CI, 1.26–18.63; $P = 0.022$) and patient age ≥ 50 years (OR, 4.06; 95% CI, 1.39–11.92; $P = 0.001$).

■ **CONCLUSIONS:** Patients with evidence of DCI during their hospital course have a 5-fold increased risk of experiencing moderate to severe NPD compared with patients who do not develop DCI after aSAH. Secondary events occurring during acute hospitalization (DCI, hydrocephalus) may be more important to the overall neuropsychological outcome than hemorrhage (Fisher) and clinical severity (World Federation of Neurological Surgeons Grading System) scores at admission.

secondary to cerebral vasospasm (CVS) and delayed cerebral ischemia (DCI). CVS is the delayed narrowing of one or more basal arteries of the brain after aSAH, which may go in line with radiographic evidence of diminished cerebral perfusion distal to the affected arteries (4). DCI may

occur as a consequence of CVS and may manifest as focal neurologic deficit or as worsening Glasgow Coma Scale (GCS) score (24). After aSAH, angiographic CVS is seen in 30%–70% of patients and typically occurs 3–5 days after the bleed, with maximal vessel narrowing during

days 5–14 and gradual resolution over 2–4 weeks (4). Although some patients with CVS do not develop symptoms, about half of patients deteriorate and develop neurologic deficits, which have an equal likelihood of resolving later or progressing to cerebral infarction. The incidence of CVS and DCI is higher in patients with worse admission scores according to Fisher, World Federation of Neurological Surgeons Grading System (WFNS), and GCS scores and a higher amount of intracranial blood (24).

Both CVS and DCI are associated with the presence of infarcts and worse neurologic outcome (17). Despite maximal therapy, 15%–20% of patients with CVS have a stroke or die. CVS and DCI account for nearly 50% of deaths in patients with aSAH surviving until after aneurysm repair (4). However, an increasing number of patients survive aSAH today, and functional aspects of the clinical outcome become increasingly important. Although often ignored in clinical studies and outcome reports (21), neuropsychological deficits (NPD) in patients surviving aSAH are frequent (14). Reasons for impaired neurocognitive function remain to be identified and must be confirmed by further investigations. In the present study, our aim was to test the hypothesis that DCI has a negative impact on neuropsychological outcome in patients with aSAH.

METHODS

In a retrospective 2-center approach, a cohort study was performed analyzing patients with aSAH who were treated at the Kantonsspital St. Gallen or Kantonsspital Aarau between January 2009 and August 2012. The clinical data, including the presence or absence of CVS and DCI, were extracted from the Swiss study on aneurysmal subarachnoid haemorrhage database (19) by 2 neurosurgeons from both centers according to predefined criteria. Both local ethical committees consented to the study. The study conformed to the Declaration of Helsinki, and written informed consent was obtained from all participants or their next of kin.

This study sought to assess the relationship between DCI (independent variable) and NPD (dependent variable and primary outcome). An additional analysis was performed with regard to the

occurrence of CVS. CVS was defined as mean blood flow velocity >140 cm/second or increase in mean blood flow velocity >50 cm/second/24 hours or as a Lindgaard index >3 on transcranial Doppler sonography or confirmation by computed tomography angiography or digital subtraction angiography. DCI was defined as occurrence of focal neurologic impairment, with a decrease of at least 2 points on the GCS after ruling out other causes (hydrocephalus, electrolyte disturbance, epilepsy, infection). According to a consensus paper suggesting occurrence of new cerebral infarctions on imaging at discharge as a surrogate marker, this was

also regarded as DCI (24). Neurologic deterioration within 24 hours after aneurysm occlusion therapy was considered as DCI only if the condition was not a therapy complication of aneurysm occlusion. CVS and DCI were treated by induced arterial hypertension and normovolemia; patients with DCI received additional endovascular angioplasty or chemical vessel dilation, if feasible and deemed meaningful by the treating neurosurgeons and neuroradiologists (6).

Acute hydrocephalus was treated with ventriculostomy (external ventricular drainage [EVD]) or a lumbar drain. Chronic hydrocephalus was suspected if

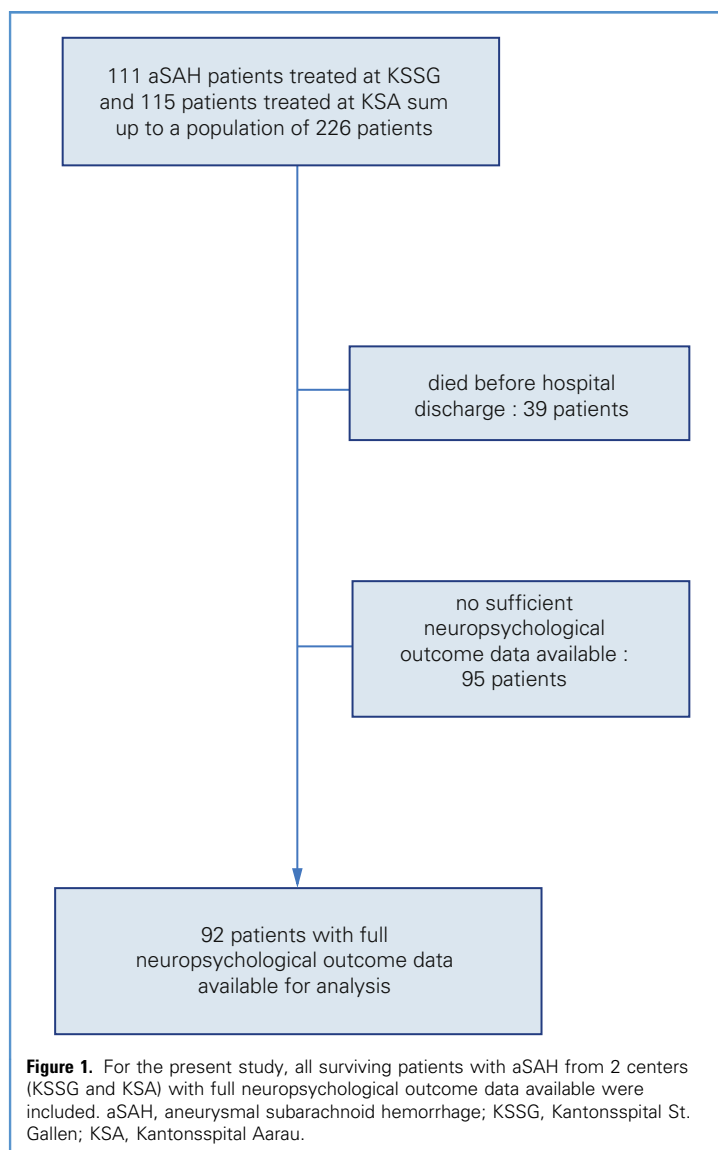


Figure 1. For the present study, all surviving patients with aSAH from 2 centers (KSSG and KSA) with full neuropsychological outcome data available were included. aSAH, aneurysmal subarachnoid hemorrhage; KSSG, Kantonsspital St. Gallen; KSA, Kantonsspital Aarau.

Download English Version:

<https://daneshyari.com/en/article/3095356>

Download Persian Version:

<https://daneshyari.com/article/3095356>

[Daneshyari.com](https://daneshyari.com)