The predictors and clinical impact of intraventricular hemorrhage in patients with aneurysmal subarachnoid hemorrhage

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BACKGROUND
Intraventricular hemorrhage is known to complicate the course and outcome of aneurysmal subarachnoid hemorrhage.

AIMS
To identify independent risk factors for intraventricular hemorrhage development and its severity during aneurysm rupture.

METHODS
Six hundred and twenty-five subarachnoid hemorrhage patients treated at our institution between January 2005 and December 2012 were included. The severity of intraventricular hemorrhage was assessed according to the original Graeb score. Clinical and radiographic features of patients present at the bleeding event were tested as potential risk factors for intraventricular hemorrhage. The characteristics of intraventricular hemorrhage were correlated with the clinical course and outcome.

RESULTS
Intraventricular hemorrhage was present in 206 patients (33%) and was independently predicted by patient's age ($p = 0.001$, odds ratio (OR) = 1.02/year of age increase), aneurysm size ($p = 0.031$, OR = 1.05/mm increase), and location ($p < 0.0001$, OR = 3.2 for aneurysms of posterior circulation). The severity of intraventricular hemorrhage was predicted by aneurysm size ($p = 0.023$) and location (higher severity for aneurysms of anterior circulation, $p = 0.01$). The presence of intraventricular hemorrhage ($p < 0.0001$, OR = 4.1) and intraventricular hemorrhage severity of >3 points on the Graeb score ($p = 0.029$, OR = 3.4) was independently associated with poor outcome. Shunt dependency was associated only with the occurrence of intraventricular hemorrhage ($p < 0.0001$, OR = 2.8) while the severity of intraventricular hemorrhage influenced the timing of shunt placement ($p = 0.0156$).

CONCLUSIONS
Increasing age, aneurysm size, and location in the posterior circulation are the main risk factors for occurrence of aneurysmal intraventricular hemorrhage, which is independently associated with poor outcome. The severity of intraventricular hemorrhage, however, is higher if the aneurysm is located in the anterior circulation and has impact on functional outcome, but not on shunt dependency.

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