

# Delayed cerebral ischemia prediction

The strongest predictors were the clinical condition on admission, amount of blood on computed tomography (both cisternal and intraventricular), and age. A model that combined these 4 predictors had an area under the receiver operating characteristic curve of 0.63 (95% confidence interval, 0.57-0.69). This model improved little by including current smoking and hyperglycemia on admission (area under the receiver operating characteristic curve, 0.65; 95% confidence interval, 0.59-0.71). The risk chart predicted risks of delayed cerebral ischemia-related infarction varying from 12% to 61%. Both low risk (<20% risk) and high risk (>40% risk) were predicted in  $\approx$ 20% of the patients. Validation confirmed that the discriminative ability was adequate (area under the receiver operating characteristic curve, 0.69; 95% confidence interval, 0.61-0.77).

Absolute risks of delayed cerebral ischemia-related infarction can be reliably estimated by a simple risk chart that includes clinical condition on admission, amount of blood on computed tomography (both cisternal and intraventricular), and age <sup>1)</sup>.

## Vasograde

see [VASOGRADE](#)

## Temperature elevation

Temperature elevation of  $\geq 2.5^{\circ}\text{C}$  on day 4 or 5 compared with baseline suggests a greater risk of clinical deterioration owing to DCI <sup>2)</sup>.

[Machine learning](#) approaches, of which feedforward [artificial neural networks](#) (ffANNs) is the most widely used, could contribute to patient-specific outcome prediction.

## Nutshell-Tool

ffANN showed equal performance when compared with [VASOGRADE](#) and SAHIT scoring systems while using fewer individual cases. The web interface launched simultaneously with the publication of this manuscript allows for the usage of the ffANN-based prediction tool for individual data (<https://nutshell-tool.com/>). <sup>3)</sup>

<sup>1)</sup>

de Rooij NK, Greving JP, Rinkel GJ, Frijns CJ. Early prediction of delayed cerebral ischemia after subarachnoid hemorrhage: development and validation of a practical risk chart. *Stroke*. 2013 May;44(5):1288-94. doi: 10.1161/STROKEAHA.113.001125. Epub 2013 Mar 19. Erratum in: *Stroke*. 2013 May;44(5):e61. PMID: 23512975.

<sup>2)</sup>

Saripalli M, Tan D, Chandra RV, Lai LT. Predictive Relevance of Early Temperature Elevation on the Risk of Delayed Cerebral Ischemia Development Following Aneurysmal Subarachnoid Hemorrhage. *World Neurosurg*. 2021 Jun;150:e474-e481. doi: 10.1016/j.wneu.2021.03.031. Epub 2021 Mar 13.

PMID: 33722716.

3)

de Jong G, Aquarius R, Sanaan B, Bartels RHMA, Grotenhuis JA, Henssen DJHA, Boogaarts HD. Prediction Models in Aneurysmal Subarachnoid Hemorrhage: Forecasting Clinical Outcome With Artificial Intelligence. *Neurosurgery*. 2021 Apr 15;88(5):E427-E434. doi: 10.1093/neuros/nyaa581. PMID: 33548918.

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