

Subarachnoid hemorrhage prognosis

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Mortality Prediction

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Predicting mortality in cases of subarachnoid hemorrhage involves assessing various clinical and demographic factors. Here are some key factors commonly considered in mortality prediction for subarachnoid hemorrhage:

[Hunt and Hess Stroke Scale](#)

[Fisher Scale](#)

[Glasgow Coma Scale \(GCS\)](#)

A lower GCS score is generally associated with a poorer prognosis and increased mortality.

[Age](#)

Advanced age is a known risk factor for increased mortality in subarachnoid hemorrhage. Older individuals may have additional health considerations that impact outcomes.

Clinical Complications:

The presence of complications such as [hydrocephalus](#), [rebleeding](#), [vasospasm](#), and [cerebral ischemia](#) can influence mortality. Monitoring and managing these complications are crucial in predicting outcomes.

Coexisting Medical Conditions:

Pre-existing medical conditions, such as [hypertension](#), [diabetes](#), and cardiovascular disease, can contribute to increased mortality risk in patients with subarachnoid hemorrhage.

CT Angiography Findings:

Assessing the anatomy of cerebral blood vessels through techniques like CT angiography helps identify the source of the bleeding and may impact mortality predictions.

[Delayed Cerebral Ischemia](#) (DCI):

The development of delayed cerebral ischemia, often due to vasospasm of blood vessels, is a significant factor in predicting mortality. Prompt detection and management of vasospasm can impact outcomes.

Treatment Modalities:

The type and timing of treatments, including surgical interventions (such as aneurysm clipping or coiling) and medical management, can influence mortality predictions. Predicting mortality in subarachnoid hemorrhage is a complex process that involves considering a combination of clinical, radiological, and demographic factors. Healthcare professionals typically use multiple tools and scoring systems to assess the severity and prognosis of subarachnoid hemorrhage patients, allowing for more personalized care and treatment strategies. It's important to note that predicting outcomes in individual cases can still be challenging due to the variability in patient responses and the dynamic nature of the condition.

[Subarachnoid hemorrhage](#) (SAH) entails high [morbidity](#) and [mortality](#) rates. [Convolutional neural networks](#) (CNN) are capable of generating highly accurate predictions from imaging data. The objective of García-García et al. was to predict [mortality](#) in SAH patients by processing initial CT scans using a CNN-based [algorithm](#).

They conducted a retrospective multicentric study of a consecutive cohort of patients with SAH. Demographic, clinical and radiological variables were analyzed. Preprocessed baseline CT scan images were used as the input for training using the AUCMEDI framework. The model's architecture leveraged a DenseNet121 structure, employing transfer learning principles. The output variable was mortality in the first three months.

Images from 219 patients were processed; 175 for training and validation and 44 for the model's evaluation. Of the patients, 52% (115/219) were female and the median age was 58 (SD = 13.06) years. In total, 18.5% (39/219) had idiopathic SAH. The mortality rate was 28.5% (63/219). The model

showed good accuracy at predicting mortality in SAH patients when exclusively using the images of the initial CT scan (accuracy = 74%, F1 = 75% and AUC = 82%).

Modern image processing techniques based on AI and CNN make it possible to predict mortality in SAH patients with high accuracy using CT scan images as the only input. These models might be optimized by including more data and patients, resulting in better training, development and performance on tasks that are beyond the skills of conventional clinical knowledge ¹⁾.

Subarachnoid hemorrhage (SAH) has a substantial impact on [quality of life](#) and future risk for mortality in patients who survive the initial injury and hospitalization. Poor neurological status and advanced age on admission have been recognized as poor clinical prognostic factors and is one of the life-threatening diseases with high morbidity and mortality rate ²⁾.

A neurological disease that was disgraceful fifty years ago has lost any disquieting and embarrassing significance in the present time to the light of evolution of vascular neurosurgery ³⁾

[Hospital case volume](#) may be associated with improved outcomes after [subarachnoid hemorrhage](#) (SAH)

High SAH patient volume is robustly and strongly associated with lower inpatient mortality, fewer poor outcomes, and more discharges to home. The observed SAH patient volume association does not plateau until facilities are treating more than 100 SAH patients per year. This is a considerably higher patient volume threshold than the 20 SAH/year/facility set forth by the Joint Commission for CSC Certification.

Short-term SAH outcomes have improved. High-volume hospitals have more favorable outcomes than low-volume hospitals. This effect is substantial, even for hospitals conventionally classified as high volume. ⁴⁾

Using the [Get With The Guidelines Stroke registry](#), Prabhakaran et al., analyzed patients with a discharge diagnosis of SAH between April 2003 and March 2012 and assessed the association of annual SAH case volume with in-hospital mortality by using [multivariate logistic regression](#) adjusting for relevant patient, hospital, and geographic characteristics.

Among 31,973 patients with SAH from 685 hospitals, the median annual case volume per hospital was 8.5 (25th-75th percentile, 6.7-12.9) patients. Mean in-hospital [mortality](#) was 25.7%, but was lower with increasing annual SAH volume: 29.5% in quartile 1 (range, 4-6.6), 27.0% in quartile 2 (range, 6.7-8.5), 24.1% in quartile 3 (range, 8.5-12.7), and 22.1% in quartile 4 (range, 12.9-94.5). Adjusting for the patient and hospital characteristics, hospital SAH volume was independently associated with in-hospital mortality (adjusted odds ratio 0.79 for quartile 4 vs 1, 95% confidence interval, 0.67-0.92). The quartile of SAH volume also was associated with length of stay but not with discharge home or independent ambulatory status.

In a large nationwide registry, they observed that patients treated at hospitals with higher volumes of SAH patients have lower in-hospital mortality, independent of patient and hospital characteristics suggesting that experienced centers may provide more optimized care for SAH patients. ⁵⁾

¹⁾

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Kooijman E, Nijboer CH, van Velthoven CT, Kavelaars A, Kesecioglu J, Heijnen CJ. The rodent endovascular puncture model of subarachnoid hemorrhage: mechanisms of brain damage and therapeutic strategies. J Neuroinflammation. 2014;11:2.

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