Spontaneous intracerebral hemorrhage prognosis

- Neutrophil-to-High density lipoprotein cholesterol ratio predicts early hematoma expansion in patients with spontaneous intracerebral hemorrhage
- Perimesencephalic Subarachnoid Hemorrhage Bleeding Patterns Are Not Always Benign: Prognostic Impact of an Aneurysmal Pathology
- Association between neutrophil-to-lymphocyte ratio and hematoma expansion in spontaneous intracerebral hemorrhage: A systematic review and meta-analysis
- Development and validation of a clinical-radiomics nomogram for predicting 180-day functional outcomes in patients with spontaneous thalamic hemorrhage
- Prediction of etiology and prognosis based on hematoma location of spontaneous intracerebral hemorrhage: a multicenter diagnostic study
- Prognostic value of temporalis muscle thickness as a marker of sarcopenia in intracerebral hemorrhage
- Comparative efficacy of urokinase and recombinant tissue-type plasminogen activators in intraventricular hemorrhage
- Cerebral microbleeds and renal dysfunction: Degenerative neurobiological shared mechanisms within intracerebral hemorrhage

ICH is a potentially devastating neurologic emergency with long-term functional independence achieved in only 12-39% of cases and mortality rates of 54% at 1 year [1].

Patients with spontaneous intracerebral hemorrhage have high mortality and poor outcome. It is the most serious, least treatable and more variable in incidence and management compared to other stroke subtypes [2] [3].

Although this is a heterogeneous disorder with a wide range of outcomes, overall mortality at 1 month is approximately 40%, and only 25% of patients have a favorable outcome [4] [5].

Case fatality is extremely high (reaching approximately 60 % at 1 year post event). Only 20 % of patients who survive are independent within 6 months [6].

Anion gap level is a potential predictive biomarker for the long-term outcomes of spontaneous intracerebral hemorrhage patients, and rectifying AG at admission improves the spontaneous intracerebral hemorrhage outcomes [7].

In a cohort (n=1094), there were 306 deaths (per 100 patient-years: absolute event rate 11.7, 95% CI 10.5 to 13.1); 156 were “early” and 150 “late”. In multivariable analyses, early death was independently associated with age (per year increase, HR 1.05, p=0.003), history of hypertension (HR 1.89, p=0.038), pre-event mRS (per point increase, HR 1.41, p<0.0001), admission NIHSS (per point increase, HR 1.11, p<0.0001), and hemorrhage volume > 60ml (HR 4.08, p<0.0001). Late death showed independent associations with age (per year increase, HR 1.04, p=0.003), pre-event mRS (per point increase, HR 1.42, p=0.001), prior anticoagulant use (HR 2.13, p=0.028) and the presence of intraventricular hemorrhage (HR 1.73, p=0.033) in multivariable analyses. In further analyses where

time was treated as continuous (rather than dichotomized), the hazard ratio of previous cerebral ischaemic events increased with time, whilst those for GCS, NIHSS and ICH volume decreased over time.

They provided new evidence that not all baseline factors associated with early mortality after intracerebral hemorrhage are associated with mortality after 6 months, and that the effects of baseline variables change over time. The findings could help design better prognostic scores for later death after intracerebral hemorrhage [8].

As with other types of hemorrhages within the skull, intraparenchymal bleeds are a serious medical emergency because they can produce intracranial hypertension, which if left untreated can lead to coma and death.

Intracerebral hemorrhage (ICH) is a cerebrovascular disease with high mortality and morbidity, and the effective treatment is still lacking.

It is more likely to result in death or major disability than ischemic stroke or subarachnoid hemorrhage, and therefore constitutes an immediate medical emergency. Intracerebral hemorrhages and accompanying edema may disrupt or compress adjacent brain tissue, leading to neurological dysfunction. Substantial displacement of brain parenchyma may cause intracranial hypertension and potentially fatal brain herniation syndromes.

They have high rates of morbidity and rates of mortality of up to 50%. Initial hematoma size and subsequent hematoma expansion are among the most important predictors of poor outcome.

Efforts to improve clinical outcome through mitigation of hematoma expansion have so far been unsuccessful.

Data suggest that outcomes can be improved with standardized medical care.

A strong association exists between the amount of intraventricular hemorrhage (IVH) and poor outcome in intracerebral hemorrhage. An IVH volume of 5 to 10 mL emerges as a significant threshold for decision making on prognosis in these patients [9].

The ICH score is a simple and reliable clinical grading scale that is used for predicting the early mortality of patients with ICHs.

Neurological deterioration (ND) occurs frequently and predicts poor outcomes. Hematoma expansion and intraventricular hemorrhage in early ND, and cerebral edema, fever, and medical complications in later ND [10].

Hematoma expansion is a potentially modifiable predictor of poor outcome following an acute intracerebral hemorrhage (ICH). The ability to identify patients with ICH who are likeliest to experience hematoma expansion and therefore likeliest to benefit from expansion-targeted treatments remains an unmet need. Hypodensities within an ICH detected by noncontrast computed tomography (NCCT) have been suggested as a predictor of hematoma expansion.

Advances

There have been no dramatic advances in the development of interventions to improve the functional outcomes after ICH [11].

Nomogram

The purpose of a study was to establish and validate a nomogram to estimate the 30-day probability of death in patients with spontaneous intracerebral hemorrhage.. From January 2015 to December 2017, a cohort of 450 patients with clinically diagnosed cerebral hemorrhage was collected for model development. The minimum absolute contraction and the selection operator (lasso) regression model were used to select the strongest prediction of patients with cerebral hemorrhage. Discrimination and calibration were used to evaluate the performance of the resulting nomogram. After internal validation, the nomogram was further assessed in a different cohort containing 148 consecutive subjects examined between January 2018 and December 2018. The nomogram included five predictors from the lasso regression analysis, including Glasgow coma scale (GCS), hematoma location, hematoma volume, white blood cells, and D-dimer. Internal verification showed that the model had good discrimination, (the area under the curve is 0.955), and good calibration [unreliability (U) statistic, p = 0.739]. The nomogram still showed good discrimination (area under the curve = 0.888) and good calibration [U statistic, p = 0.926] in the verification cohort data. Decision curve analysis showed that the prediction nomogram was clinically useful. The current study delineates a predictive nomogram combining clinical and imaging features, which can help identify patients who may die of a cerebral hemorrhage [12].

Grading Scales

The ICH Score is a valid clinical grading scale for long-term functional outcome after acute intracerebral hemorrhage (ICH) [13].

Blood Pressure

Based on the viewpoint that increased BP causes greater tearing of blood vessels and flow-out of blood through these vessels and eventually leads to the expansion of the hematoma, high BP is considered to be associated with hematoma expansion and poor outcomes, especially early neurological deterioration, mortality, and dependency [14] [15] [16].

The 2015 American Heart Association/American Stroke Association guidelines for the management of spontaneous ICH recommend early BP reduction with an SBP target of 140 mmHg for patients with ICH presenting with an SBP between 150 and 220 mmHg and without any contraindication to acute BP treatment [17].

Readmissions

Spontaneous intracerebral hemorrhage (SICH) survivors are at risk of hospital readmissions. Data on readmissions after SICH is scarce. We aimed to study the frequency and predictors of readmissions after SICH in Algarve, Portugal.

A retrospective study of a community representative cohort of SICH survivors (2009-2015). The first unplanned readmission in the first year after discharge was the outcome. Cox regression analysis was performed to identify predictors of 1-year readmission.

Of the 357 SICH survivors followed, 116 (32.5%) were readmitted within the first-year. Sixty-seven (18.8%) of the survivors were early readmitted (<90 days), corresponding to 57.8% or all readmissions. Common causes were pneumonia, endocrine/nutritional/metabolic and cardiovascular complications. The risk of readmission was increased by prior to index SICH history of ≥ 3 previous emergency department visits (hazards ratio (HR) = 2.663 (1.770-4.007); P < 0.001), pneumonia during index hospitalization (HR = 2.910 (1.844-4.592); P < 0.001) and reduced in patients discharge home (HR = 0.681 (0.366-0.976); P = 0.048).

The rate of readmissions after SICH is high, predictors are identifiable and causes are potentially preventable. Improvement of care can potentially reduce this burden [18].

Prospective observational cohort studies

Acute ischemic lesions seen on brain magnetic resonance imaging (MRI) are associated with poor spontaneous intracerebral hemorrhage prognosis, but drivers for these lesions are unknown. Rapid hemoglobin decrements occur in the initial days after ICH and may impair brain oxygen delivery. Poyraz et al. investigated whether acute hemoglobin decrements after ICH are associated with MRI ischemic lesions and poor long-term ICH outcomes.

Consecutive patients with acute spontaneous intracerebral hemorrhage enrolled into a single-center prospective cohort study were assessed. Change in hemoglobin levels from admission to brain MRI was defined as the exposure variable. The presence of MRI ischemic lesions on diffusion-weighted imaging was the primary radiographic outcome. Poor 6-month modified Rankin Scale score (4-6) was assessed as our clinical outcome. Separate regression models assessed relationships between exposure and outcomes adjusting for relevant confounders. These relationships were also assessed in a separate prospective single-center cohort of patients with ICH receiving minimally invasive hematoma evacuation.

Of 190 patients analyzed in our primary cohort, the mean age was 66.7 years, the baseline hemoglobin level was 13.4 g/dL, and 32% had MRI ischemic lesions. Greater hemoglobin decrements were associated with MRI ischemic lesions (adjusted odds ratio [OR] 0.77 for every 1 g/dL change, 95% confidence interval [CI] 0.60-0.99) and with poor 6-month outcomes (adjusted OR 0.73, 95% CI 0.55-0.98) after adjusting for demographics, ICH and medical disease severity, and antithrombotic use. In our separate cohort of 172 surgical patients with ICH, greater hemoglobin concentration decrements similarly associated with MRI ischemic lesions (adjusted OR 0.74, 95% CI 0.56-0.97) and poor 6-month outcomes (adjusted OR 0.69, 95% CI 0.48-0.98).

Greater hemoglobin decrements after acute ICH are associated with ischemic lesions on brain MRI and poor long-term outcomes. Further work is required to clarify drivers for these relationships and whether anemia treatment and prevention can be used to improve ICH outcomes [19].

This study's design enables researchers to establish associations between hemoglobin changes and outcomes in ICH, but it does not determine causality, as it is observational. Further experimental or interventional studies would be required to clarify causal mechanisms or assess the efficacy of anemia treatment in improving outcomes.

1)
van Asch CJ, Luitse MJ, Rinkel GJ, van der Tweel I, Algra A, Klijn CJ. Incidence, case fatality, and functional outcome of Intracerebral hemorrhage over time, according to age, sex, and ethnic origin: a systematic review and meta-analysis. Lancet Neurol. 2010 Feb;9(2):167-76. doi: 10.1016/S1474-4422(09)70340-0. Epub 2010 Jan 5. PMID: 20056489.
2)
Van Asch CJ, Luitse MJ, Rinkel GJ, et al. Incidence, case fatality, and functional outcome of Intracerebral hemorrhage over time, according to age, sex, and ethnic origin: a systematic review and meta-analysis. Lancet Neurol 2010;9:167–76.
3)
Krishnamurthi RV, Feigin VL, Forouzanfar MH, et al. Global and regional burden of first-ever ischaemic and haemorrhagic stroke during 1990–2010: findings from the Global Burden of Disease Study 2010. Lancet Glob Health 2013;1:e259–81.
4)
van Asch CJ, Luitse MJ, Rinkel GJ, van der Tweel I, Algra A, Klijn CJ. Incidence, case fatality, and functional outcome of Intracerebral hemorrhage over time, according to age, sex, and ethnic origin: a systematic review and meta-analysis. Lancet Neurol. 2010;9(2):167–176.
5)
Feigin VL, Lawes CM, Bennett DA, Anderson CS. Stroke epidemiology: a review of population-based studies of incidence, prevalence, and case-fatality in the late 20th century. Lancet Neurol. 2003;2(1):43–53.
6)
de Oliveira Manoel AL, Goffi A, Zampieri FG, Turkel-Parrella D, Duggal A, Marotta TR, Macdonald RL, Abrahamson S. The critical care management of spontaneous intracranial hemorrhage: a contemporary review. Crit Care. 2016 Sep 18;20:272. doi: 10.1186/s13054-016-1432-0. Review. PubMed PMID: 27640182; PubMed Central PMCID: PMC5027096.
7)
Shen J, Li DL, Yang ZS, Zhang YZ, Li ZY. Anion gap predicts the long-term neurological and cognitive outcomes of spontaneous intracerebral hemorrhage. Eur Rev Med Pharmacol Sci. 2022 May;26(9):3230-3236. doi: 10.26355/eurrev_202205_28741. PMID: 35587074.
8)
Banerjee G, Ambler G, Wilson D, Hostettler IC, Shakeshaft C, Lunawat S, Cohen H, Yousry T, Al-Shahi Salman R, Lip GYH, Houlden H, Muir KW, Brown MM, Jäger HR, Werring DJ; CROMIS-2 collaborators. Baseline factors associated with early and late death in Intracerebral hemorrhage survivors. Eur J Neurol. 2020 Mar 29. doi: 10.1111/ene.14238. [Epub ahead of print] PubMed PMID: 32223078.
9)
Chan E, Anderson CS, Wang X, Arima H, Saxena A, Moullaali TJ, Heeley E, Delcourt C, Wu G, Wang J, Chen G, Lavados PM, Stapf C, Robinson T, Chalmers J, Huang Y; INTERACT2 Investigators. Significance of intraventricular hemorrhage in acute intracerebral hemorrhage: intensive blood pressure reduction in acute cerebral hemorrhage trial results. Stroke. 2015 Mar;46(3):653-8. doi: 10.1161/STROKEAHA.114.008470. Epub 2015 Feb 12. PubMed PMID: 25677598.
10)

Lord AS, Gilmore E, Choi HA, Mayer SA; VISTA-ICH Collaboration. Time course and predictors of neurological deterioration after intracerebral hemorrhage. Stroke. 2015 Mar;46(3):647-52. doi: 10.1161/STROKEAHA.114.007704. Epub 2015 Feb 5. PubMed PMID: 25657190.
11) , 17)

Hemphill JC 3rd, Greenberg SM, Anderson CS, Becker K, Bendok BR, Cushman M, Fung GL, Goldstein JN, Macdonald RL, Mitchell PH, Scott PA, Selim MH, Woo D; American Heart Association Stroke Council; Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology. Guidelines for the Management of Spontaneous Intracerebral Hemorrhage: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2015 Jul;46(7):2032-60. doi: 10.1161/STR.0000000000000069. Epub 2015 May 28. PubMed PMID: 26022637.
12)

Han Q, Li M, Su D, Fu A, Li L, Chen T. Development and validation of a 30-day death nomogram in patients with spontaneous cerebral hemorrhage: a retrospective cohort study. Acta Neurol Belg. 2021 Feb 10. doi: 10.1007/s13760-021-01617-1. Epub ahead of print. PMID: 33566335.
13)

Hemphill JC 3rd, Farrant M, Neill TA Jr. Prospective validation of the ICH Score for 12-month functional outcome. Neurology. 2009 Oct 6;73(14):1088-94. doi: 10.1212/WNL.0b013e3181b8b332. Epub 2009 Sep 2. PubMed PMID: 19726752; PubMed Central PMCID: PMC2764394.
14)

Rodriguez-Luna D, Pineiro S, Rubiera M, Ribo M, Coscojuela P, Pagola J, et al. Impact of blood pressure changes and course on hematoma growth in acute intracerebral hemorrhage. Eur J Neurol. 2013;20:1277–1283.
15)

Sakamoto Y, Koga M, Yamagami H, Okuda S, Okada Y, Kimura K, et al. Systolic blood pressure after intravenous antihypertensive treatment and clinical outcomes in hyperacute intracerebral hemorrhage: the stroke acute management with urgent risk-factor assessment and improvement-intracerebral hemorrhage study. Stroke. 2013;44:1846–1851.
16)

Zhang Y, Reilly KH, Tong W, Xu T, Chen J, Bazzano LA, et al. Blood pressure and clinical outcome among patients with acute stroke in Inner Mongolia, China. J Hypertens. 2008;26:1446–1452.
18)

Nzwalo H, Nogueira J, Guilherme P, Abreu P, Félix C, Ferreira F, Ramalhete S, Marreiros A, Tatlisumak T, Thomassen L, Logallo N. Hospital readmissions after spontaneous intracerebral hemorrhage in Southern Portugal. Clin Neurol Neurosurg. 2018 Apr 12;169:144-148. doi: 10.1016/j.clineuro.2018.04.015. [Epub ahead of print] PubMed PMID: 29665499.
19)

Poyraz FC, Rossitto CP, Ridha M, Simonetto M, Kumar A, Hess E, White E, Mao E, Sieh L, Ghoshal S, Agarwal S, Park S, Claassen J, Connolly ES, Mocco J, Kellner CP, Roh DJ. Hemoglobin Decrements are Associated with Ischemic Brain Lesions and Poor Outcomes in Patients with Intracerebral Hemorrhage. Neurocrit Care. 2025 Jan 22. doi: 10.1007/s12028-024-02206-9. Epub ahead of print. PMID: 39843877.