Intracerebral Hemorrhage care bundle management relates to hematoma expansion and 30-days mortality: 2018-2024 data from a prospective Italian registry

Paola Colantuono[1], Lucio D'Anna[2,3], Matteo Foschi[1], Leondino Mammarella[4], Simona Sacco[1], Raffaele Ornello[1]
[1]Department of Biotechnological and Applied Clinical Sciences – University of L'Aquila, Via Vetoio 1, L'Aquila, Italy
[2]Department of Stroke and Neuroscience, Charing Cross Hospital, Imperial College London NHS Healthcare Trust, London, United Kingdom (UK)
[3]Department of Brain Sciences, Imperial College London, London, United Kingdom (UK)
[4]Servizio Flussi Informativi e Statistica Sanitaria, Azienda Sanitaria Locale Avezzano-Sulmona-L'Aquila, L'Aquila, Italy

Introduction

Bundles of care now represent the best standard of care for patients with intracerebral hemorrhage (ICH). These bundles include rapid hypertension control, anticoagulation reversal, neurosurgical referral, and management of other parameters, such as blood glucose or body temperature. While studies have demonstrated the potential benefits of bundles of care[1], their implementation and outcomes in clinical practice remain unclear.

This study aimed to investigate whether the control of bundle of care parameter in intracerebral hemorrhage management is obtained and if the achievement of therapeutic targets is linked to hematoma expansion (HE) - a major determinant of neurologic deterioration and poor outcome - and mortality at 30-days follow-up.

Methods

This study, designed on a prospective population-based stroke registry focused on ICH cases occurring from January 1st, 2018, to March 31st, 2024. Data collected included demographics, clinical information, and specific parameters like systolic blood pressure (SBP), blood glucose levels, and body temperature. The study also recorded anticoagulation reversal therapy, neurosurgical referrals and ICH volume, which has been measured on the first and second neuroimaging available; hematoma expansion volume has been measured as volume growth more than 33% of the initial volume on serial neuroimagings. 30-day case-fatality was also assessed. Data collected were later classified into three periods: 2018-2019, 2020-2022, and 2023-2024, reflecting the evolution of the "bundle of care" approach to ICH.

We assessed the management of SBP ≥140 mmHg, hyperglycemia (blood glucose levels ≥108 mg/dl), hyperpyrexia (body temperature ≥37°C), and anticoagulant reversal within 24 hours from ICH onset; the implementation of surgery was also assessed. We recorded whereas hematoma expanded or not. Secondarily, we assessed the time trends in control of parameters over time and the impact of hypertension, hyperglycemia, hyperpyrexia, anticoagulant reversal, surgery, and hematoma expansion on 30-day survival via log-rank tests.

Results

We included 545 patients with ICH (55.4% male, median age 75.4 years, interquartile range 69-85). After 24 hours from ICH, the proportion of patients with blood pressure control (systolic blood pressure <140 mg/dl) improved from 35.4% in the 2018-2019 period, to 36.7% in the 2020-2022 period, and to 47% in the 2023-2024 period (p=0.126); the proportion of patients with blood glucose control (blood glucose <108 mg/dl) after-24 hours from ICH increased from 20.9%, to 22.7%, to 37.3% (p<0.001); the proportion of patients with normal body temperature (body temperature <37.0*C) increased from 54.4% to 61.3%, to 79.5% (p<0.001). Relative hematoma expansion improved: it was shown in 21.4% of ICH cases in 2018-2019, in 15.6% in 2020-2022, in 13.3% in 2023-2024 (p=0.008); also the proportions of patients who maintained stable hematoma volume increased from 38.3% in 2018-2019 to 61.4% in 2023-2024. These changes had an impact on 30-day survival after ICH, which changed from 66% in the 2018-2019, to 64.1% in the 2020-2022, to 73.5% in the 2023-2024 period (p=0.286).

Conclusions

This real-world study demonstrates suboptimal control in parameters of acute ICH management, such as blood pressure control, anticoagulation reversal, and blood glucose, in the L'Aquila district; nevertheless, improvement has been shown. Greater volume hematoma control, meant as stability as well as reduction of proportions of ICH increasing volumes, has been demonstrated. All these aspects had a positive impact on early prognosis.

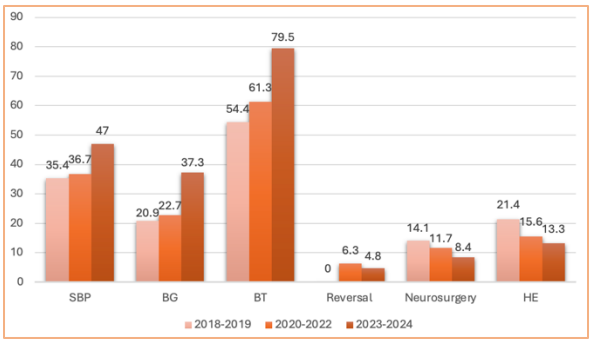

Figure n.1.
Care bundle parameters across the three time periods.
SBP Systolic Blood Pressure; BG Blood Glucose; BT Body Temperature; HE Hematoma Expansion. It is showed the percentage of patients who achieved SBP control (SBP <140mmHg), BG control (BG <108 mg/dl), BT control (BT <37°C); administration of reversal therapy in anticoagulated patients; ICH that were treated with surgery; hematoma expansion.

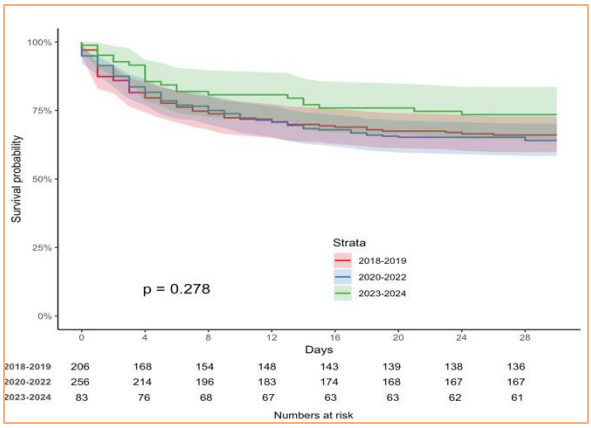

Figure n.2
30-day mortality in the three time periods of the study.

Bibliography
1. Ma L, Hu X, Song L, et al. The third Intensive Care Bundle with Blood Pressure Reduction in Acute Cerebral Haemorrhage Trial (INTERACT3): an international, stepped wedge cluster randomised controlled trial. *Lancet*. 2024