

Volume expansion

Volume expansion and [hypertension](#) are widely used for the hemodynamic management of patients with [subarachnoid hemorrhage](#).

[Hemorrhagic shock](#) (HS) is one of the severe type of [traumatic brain injury complications](#) (TBI) that doubles [mortality](#) due to severely compromised microvascular [cerebral blood flow](#) (mvCBF) and [oxygen](#) delivery reduction, as a result of [hypotension](#). [Volume expansion](#) with [resuscitation](#) fluids (RF) for HS does not improve microvascular CBF (mvCBF); moreover, it aggravates [brain edema](#). Bragin et al. showed that the addition of [drag-reducing polymers](#) (DRP) to [crystalloid](#) RF (lactated Ringer's) significantly improves mvCBF, oxygen supply, and neuronal survival in rats suffering TBI+HS.

They compared the effects of colloid RF (Hetastarch) with DRP (HES-DRP) and without (HES). Fluid percussion TBI (1.5 ATA, 50 ms) was induced in rats and followed by controlled HS to a mean arterial pressure (MAP) of 40 mmHg. HES or HES-DRP was infused to restore MAP to 60 mmHg for 1 h (prehospital period), followed by blood reinfusion to a MAP of 70 mmHg (hospital period). In vivo two-photon microscopy was used to monitor cerebral microvascular blood flow, tissue hypoxia (NADH), and neuronal necrosis (i.v. propidium iodide) for 5 h after TBI+HS, followed by postmortem Dil vascular painting. Temperature, MAP, blood gases, and electrolytes were monitored. Statistical analyses were done using GraphPad Prism by Student's t-test or Kolmogorov-Smirnov test, where appropriate. TBI+HS compromised mvCBF and tissue oxygen supply due to capillary microthrombosis. HES-DRP improved mvCBF and tissue oxygenation ($p < 0.05$) better than HES. The number of dead neurons in the HES-DRP was significantly less than in the HES group: 76.1 ± 8.9 vs. 178.5 ± 10.3 per 0.075 mm^3 ($P < 0.05$). Postmortem visualization of painted vessels revealed vast microthrombosis in both hemispheres that were $33 \pm 2\%$ less in HES-DRP vs. HES ($p < 0.05$). Thus, resuscitation after TBI+HS using HES-DRP effectively restores mvCBF and reduces hypoxia, microthrombosis, and neuronal necrosis compared to HES. HES-DRP is more neuroprotective than lactated Ringer's with DRP and requires an infusion of a smaller volume, which reduces the development of [hypervolemia](#)-induced [brain edema](#) ¹⁾

¹⁾

Bragin DE, Bragina OA, Berliba L, Kameneva MV, Nemoto EM. Addition of Drag-Reducing Polymers to Colloid Resuscitation Fluid Enhances Cerebral Microcirculation and Tissue Oxygenation After Traumatic Brain Injury Complicated by Hemorrhagic Shock. Adv Exp Med Biol. 2021;1269:283-288. doi: 10.1007/978-3-030-48238-1_45. PMID: 33966231.

From:

<https://neurosurgerywiki.com/wiki/> - **Neurosurgery Wiki**

Permanent link:

https://neurosurgerywiki.com/wiki/doku.php?id=volume_expansion

Last update: **2024/06/07 02:55**

