Hemorrhage Control and Resuscitation

Treatment Using Soluble Drag Reducing Polymers in Resuscitation Fluid Following Traumatic Brain Injury with Concomitant Hemorrhagic Shock

A serious complicating factor in traumatic brain injury (TBI) is low arterial blood pressure due to hemorrhagic shock caused by extremity of injuries and/or shrapnel after explosion. Current immediate treatments for TBI with concomitant hemorrhagic shock (TBI/HS) are based on volume restoration to raise arterial pressure by resuscitation fluids (RF). While these fluids may be effective in restoring arterial pressure and improving blood circulation in large vessels, they do not target impaired circulation within small vessels (capillaries) in the brain, leading to neuronal death. Small quantities of blood soluble, drag reducing polymers (DRP) can improve oxygen supply to the brain by enhancing blood flow in capillaries, thus reducing death of neurons near sites of injury following TBI/HS.

To test this theory, investigators at the University of New Mexico Health Sciences Center (Albuquerque, NM) and University of Pittsburgh (Pittsburgh, PA) evaluated the acute and prolonged beneficial effects of adding nanomolar quantities of blood soluble DRPs to the resuscitation fluid (DRP-RF) for up to six hours after TBI/HS in rats. The animals sustained a TBI followed by controlled HS. The rats were infused with DRP-RF or RF followed by blood reinfusion. It was determined that modulation of blood flow using DRP-RF effectively restores cerebral microcirculation and protects neurons after TBI complicated by hemorrhagic shock by preventing blood clot formation in capillaries in the brain and thus, reducing hypoxia. In addition, DRP-RF requires infusion of a lower volume to improve tissue perfusion and oxygen utilization, which reduces brain swelling due to excess fluid in the blood, which often occurs with a standard fluid resuscitation.

In summary, immediate treatment with DRP-RF improves neurological outcomes and may reduce mortality and post-traumatic neurological disabilities.

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