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Physiological effects of resuscitation fluids on tissue perfusion and cardiovascular parameters

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Trauma is the leading cause of death in people under the age of 45. Patients presenting with circulatory shock on arrival at the hospital have significantly higher mortality from trauma than those with stable cardiovascular condition. Shock is the cause of death in 30% to 40% of all fatal traumatic injuries, following only central nervous system injuries. Unlike most CNS injuries, shock is a treatable condition. Therefore restoring and maintaining cardiovascular stability through resuscitation from circulatory shock is of top priority.

Keratose solution is a fluid with increased viscosity, compared to lactated Ringer's, made from human hair. It provides a cheap and practical source of an inert and highly bio-compatible material that offers a variety of processing possibilities and thus a variety of applications. It is hypothesized that because of it chemical and biological properties, Keratose solution could be a viable alternative to Hetastarch when used as a resuscitation fluid. Preliminary experiments have shown a dilation of microvessels under treatment with Keratose. Increased vascular diameter implies improved microvascular perfusion. Thus, in combination with its suspected oncotic properties, patients suffering from hypoperfusion due to hemorrhage would benefit from Keratose induced dilation.

Our study has shown that Keratose is superior in inducing microvascular dilation when compared to Phosphate Buffered Saline and Hetastarch. In a following study keeping to the previous methods we identified a Keratose formulation with a minimal molecular weight of 30kDa to be most effective in inducing microvascular dilation.

To further evaluate the applicability of Keratose as a resuscitation fluid, we investigated the influence of Keratose infusions on hemorrhaged rats. Both, the microvascular and the systemic response to the treatment were measured.

Keratose was not able to reproduce the promising results in hemorrhaged animals as they were shown in the top-load study. Microvascular dilation associated with Keratose infusion was not significantly different to the dilation associated with Hetastarch. A systemic evaluation was performed by investigating mean arterial blood pressure, blood gases, base deficit and blood lactic acid concentrations and their reaction to treatment with saline, Hetastarch and Keratose in combination with lactic acid contents of obtained tissue samples. This investigation yielded an inferiority of Keratose to Hetastarch in restoring physiological values in all parameters.

The obtained data suggest that the present formulation of Keratose is not a viable alternative to Hetastarch when applied as a volume replacement agent. Whether said shortcomings root in the biochemical properties of Keratose or the reaction of the animals to infusion remains unclear. Further investigations of the biochemical features of Keratose are needed, as are investigations of the kinetics of Keratose molecules in the animal's body.