Mild Therapeutic Hypothermia with LRS Thermosuit™ after Prolonged Cardiac Arrest in Pigs

Andreas Janata¹, Wolfgang Weihs¹, Keywan Bayegan¹, Alexandra Schratter¹, Oliver Robak¹, Robert B. Schock², Marc Coté², Robert J. Freedman², Udo M. Losert³, Anton N. Laggner¹, Fritz Sterz¹

¹Department of Emergency Medicine, Medical University of Vienna, Austria; ²Life Recovery Systems, Kinnelon, USA; ³Core Centre of Biomedical Research, Medical University of Vienna, Austria

Background: Devices for rapid induction of mild resuscitative hypothermia, which improves outcomes after cardiac arrest, are needed. The safety and effectiveness of LRS Thermosuit™ (fig. 1) providing highly efficient cooling of the skin by pumping a thin layer of ice water over most of the skin surface was assessed in a post-resuscitation animal model.

Methods: Pigs were anaesthetized and mechanically ventilated. After stabilization of pulmonary artery temperature (Tpa) at 38.5±0.2 °C, ventricular fibrillation (VF) was induced and 10 min of untreated VF were followed by 8 min of cardiopulmonary resuscitation (CPR), including mechanical chest compressions, and two doses of vasopressin (0.4 IE/kg at min 3 and 6 of CPR). At 8 min of CPR, up to 3 countershocks were delivered (fig. 2). Pigs that had return of spontaneous circulation (ROSC) were then randomized to one of 2 groups (control, hypothermia). Pigs in the hypothermia group were surface cooled with ice cold water circulating in the Thermosuit™ until a target temperature of Tpa 34.0 °C was achieved. They were kept at Tpa 33.0±1.0 °C for 14 hours and then rewarmed with warm air. Pigs in the control group were kept at 38.5±1.0 °C throughout the experiment. After 20 hours of intensive care, pigs were weaned and brought to the stable. At day 9 of the experiment, final neurologic examination was performed. An overall performance category (OPC) score (1 = normal; 2, slightly handicapped; 3, severely handicapped; 4, comatose; 5, dead, brain dead) and a neurologic damage score (0 %, normal; 100 %, brain dead) were used. Data are presented as median and interquartile range, group comparison was done with a Mann-Whitney-U test.

Results: Out of 20 animals 16 (29-35 kg) achieved ROSC and could be randomized. The time to reach target temperature in the cooling group (n = 8) was 9.0 (5.3; 11.9) min, which equals a cooling rate of 0.4 (0.3; 0.8) °C/min. All animals of the skin by pumping a thin layer of ice water over most of the skin surface was assessed in a post

Conclusions: The LRS Thermosuit™ was safe and effective in inducing therapeutic hypothermia in pigs after cardiac arrest. Neurologic performance scores after prolonged cardiac arrest were improved significantly in cooled animals compared to control animals.