

## SUMMARY

**Introduction:** Induction of therapeutic hypothermia to target body temperature of 32 – 34 °C for 12 – 24 hours may reduce post-cardiac arrest brain injury in patients resuscitated from out-of-hospital cardiac arrest (OHCA). It has been recommended that the target therapeutic temperature should be reached as soon as possible. Thus, prehospital initiation of cooling appears to be a method of choice.

**Aim of the study:** We performed three studies to assess a feasibility and clinical effectiveness of prehospital therapeutic hypothermia in the setting of emergency medical service in the Czech republic and to optimize cooling procedure. The selected cooling method was rapid intravenous administration of 4 °C cold normal saline.

**Materials and methods:** Forty consecutive cardiac arrest patients were treated by prehospital administration of 4°C cold normal saline with the target dose of 15 – 20 ml/kg in a prospective multicenter study PRE-COOL (Pre-Hospital Cooling in Cardiac Arrest Patients). The results were compared with 40 retrospective control group patients who did not undergo any cooling attempt in the field. Twelve different application regimens of cold normal saline were investigated for infusion temperature changes during administration in a PRE-COOL 3 experimental „ex vivo“ study to find the regimen burdened with the least spontaneous rewarming. In an experimental randomised PRE-COOL 4 study we investigated the cooling effect of cold normal saline compared to colloid solution in a porcine model of cardiac arrest with subsequent successful cardiopulmonary resuscitation.

**Results:** In the PRE-COOL study, administration of  $12,6 \pm 6,4$  ml/kg of 4 °C cold normal saline was followed by a prehospital decrease of body temperature of  $1,4 \pm 0,8^{\circ}\text{C}$  (from  $36,2 \pm 1,5$  to  $34,7 \pm 1,4$  °C,  $p < 0,001$ ). The procedure was safe and the coupling of pre-hospital cooling with subsequent in-hospital therapeutic hypothermia predicted a favorable neurological outcome at hospital discharge (OR 4.1, CI95% 1.1-18.2,  $p = 0.046$ ). In the PRE-COOL 3 study, the use of 500 or 1000 ml bags of 4 °C cold normal saline applied at an infusion rate of  $\geq 4000$  ml/hour and termination of the infusion when 80% of the infusion volume has been administered was regarded as optimal. The PRE-COOL 4 experimental study revealed that intravenous infusion of cold normal saline resulted in more intense cooling than colloid infusion.

**Conclusions:** Prehospital induction of TH by the rapid intravenous administration of cold normal saline in the dose of 10 – 20 ml/kg in successfully resuscitated OHCA patients has been shown to be feasible and safe method. When coupled with in-hospital continuation of cooling, it can potentially improve the prognosis of patients. The results of all studies contributed to optimisation of this cooling method.