

# **Safety and feasibility of a new innovative cooling approach for immediate induction of therapeutic hypothermia in patients after successful resuscitation**

## **– Trans-nasal cooling after cardiac arrest –**

H.-J. Busch<sup>1</sup>, A. Janata<sup>2</sup>, F. Eichwede<sup>3</sup>, M. Födisch<sup>4</sup>, G. Wöbker<sup>5</sup>, M. Stefan<sup>6</sup>, T. Schwab<sup>1</sup>, E. Karassimos<sup>3</sup>, H. Fritz<sup>6</sup>, B. Inderbitzen<sup>7</sup>, D. Barbut<sup>7</sup>, F. Sterz<sup>2</sup>

<sup>1</sup>Albert Ludwigs University Freiburg, Department of Cardiology and Angiology, Freiburg i. Br., Germany

<sup>2</sup>Medical University of Vienna, Department of Emergency Medicine, Vienna, Austria

<sup>3</sup>Medizinisches Zentrum Kreis Aachen gGmbH, Department of Anesthesia and Intensive Care, Würselen Germany

<sup>4</sup>Evangelisches Waldkrankenhaus, Department of Anesthesia and Intensive and Emergency Care, Bonn, Germany

<sup>5</sup>Helios Klinikum Wuppertal, Department of Intensive Care, Wuppertal, Germany

<sup>6</sup>Krankenhaus Martha-Maria Halle-Dörlau gGmbH, Department of Anesthesia and Intensive Care, Halle/Salle, Germany

<sup>7</sup>BeneChill Inc, San Diego, USA

### **Methods**

We assessed safety and feasibility of trans-nasal cooling in a multi-centre, single-arm descriptive study of comatose patients who had been successfully resuscitated after cardiac arrest. Forty three patients were treated with a non-invasive cooling device through which cooling was achieved via trans-nasal delivery of an evaporative coolant into the nasopharynx. Initial temperatures, course of cooling, and systemic and local adverse events during cooling were documented. Patients were treated with nasal cooling until they either reached target temperature or were transitioned to treatment according to local standard protocols. Primary outcome was speed of cooling. Survival and cerebral performance category (CPC) at hospital discharge were recorded.

### **Results**

Data are presented as mean  $\pm$  SD or median (interquartile range (25, 75%)). Mean age was 71.1  $\pm$  10.8 years. VF was the first documented rhythm in 52.4% of the patients, asystole in 31.0%. Temperatures at admission were 35.2 $\pm$ 1.2°C tympanic, 35.5 $\pm$ 1.1°C, core (arterial or esophageal), and 35.9 $\pm$ 1.0°C, bladder. Time from the start of cooling to target temperature (33°C) was 50.0 (35.0-68.3) minutes tympanic, and 72.5 (17.3-146.3) minutes, core. Cooling rate of tympanic temperature was 2.4°C/hr., core cooling rate was 1.4°C/hr and bladder 0.9°C/hr.

Adverse events affecting the nasal area occurred in 9/43 patients, resolved in 8 (78%) patients spontaneously. One had persistent damage at death, 18 hours later. Systemic adverse events were consistent with the patient population being treated. Twelve patients (30%) had a CPC of 1–2. Twenty-three patients (57.5%) died, none related to the hypothermia procedure, and five patients (12.5%) had a poor outcome. In patients with VF, eight patients (40%) had a CPC of 1–2, eight patients died and four patients had poor outcome.

### **Conclusions**

Trans-nasal cooling for induction of therapeutic hypothermia in patients after successful resuscitation from cardiac arrest is feasible and effective in lowering temperature rapidly in a hospital emergency setting. This method of cooling now needs to be investigated in a field setting.