Pre-treatment with trans-nasal cooling for the induction of therapeutic hypothermia in patients with cardiac arrest leads to a significant faster achievement of target temperature during systemic cooling

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Introduction

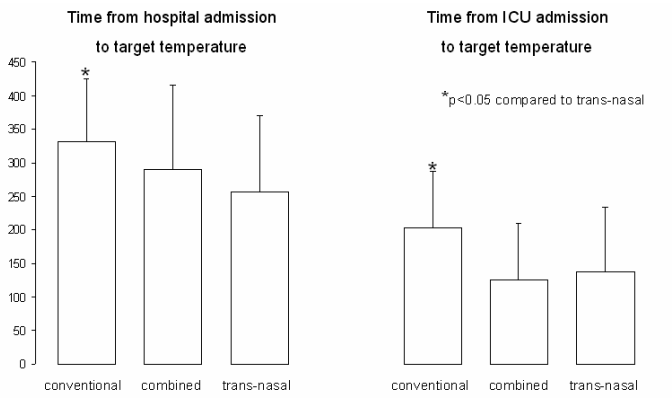
In industrialized countries out-of-hospital sudden cardiac death (SCD) is a frequent cause of death and occurs in 375 000 - 500 000 citizens per year in Europe. Survival rates remain low, despite increasing efforts in intensive care. Clinical and experimental investigations have demonstrated improved neurological outcome following the treatment with therapeutic mild hypothermia after successful resuscitation. Behind the presentation of controlled studies, therapeutic hypothermia moved into the topical international guidelines. Time course, duration to achieve target temperature and control of temperature are important factors to influence patient's outcome. Recent investigations showed improved neurological short-term outcome after an accelerated cooling time. In the pre-hospital setting, immediately cooling is difficult to realise. For immediately induction of therapeutic hypothermia we tested a new trans-nasal cooling device after cardiac arrest and compared this new method with our standard cooling procedures.

Methods

A total of 70 patients were examined after successful CPR. In 19 patients a new trans-nasal cooling device to induce therapeutic hypothermia was used. Retrospective data of 51 patients served as historic control groups. After admission in the university hospital of Freiburg initial temperature, course of temperature and duration of cooling to achieve target temperature was documented. After admission to the ICU, both groups were immediately connected to an endovascular cooling device and were cooled to a target temperature of 33°C (bladder or rectal temperature).

	conventional group n=10	combined group n=41	trans-nasal group n=19
Age [years]	63 ± 10	67 ± 14	67 ± 14
No flow time [min]	1 ± 1.5	3.6 ± 4	6.4 ± 6.1
Time to ROSC [min]	14 ± 7	19 ± 12	28 ± 18
Initial Temperature [C°]	35 ± 0.9	35.5 ± 1	35.7 ± 0.8
Cardiac Cause	7 (70%)	33 (80%)	15 (79%)
VT/VF	5 (50%)	29 (71%)	11 (59%)

	after seven days	discharge hospital
all patients (n=19)		
survival	15 (79%)	9 (48%)
CPC	2.2 ± 0.9	1.3 ± 0.5
VT/VF (n=11)		
survival	9 (81%)	7 (64%)
CPC	1.9 ± 0.6	1.2 ± 0.5



Results:

The average temperature at admission did not differ in the historic control group compared to the trans-nasal cooling group (35.7±0.8 °C vs. 35.4±1 °C, p=n.s.). In the control group 41 patients (80%) were cooled in a combined method with initial 4°C cold saline infusions followed by endovascular cooling. In 10 patients (20%) only endovascular cooling was performed. Patients treated with cold saline before, target temperature could be reached significant faster (-38%) compared to conventional cooled patients (125 ± 85 vs. 203 ± 84min; p=0.03). Pre-treatment with the trans-nasal device showed a comparable decrease of systemic temperature (-32%) to the combined method after start of systemic cooling (138 ± 96 vs. 125 ± 85min; p=n.s.). In the group treated with trans-nasal cooling target temperature in the brain, measured via tympanic temperature, could reached in 80 ± 51 min without any documented severe adverse events.

Conclusions:

Pre-treatment with trans-nasal cooling or cold saline for the induction of therapeutic hypothermia in patients with cardiac arrest leads to a significant faster achievement of target temperature during systemic cooling. The combined methods are feasible, safe and offer the possibility for immediately introduction and realisation of mild hypothermia in the field. Pre-hospital cooling could be beneficial for these critical ill patients and probably affects the outcome of these patients.