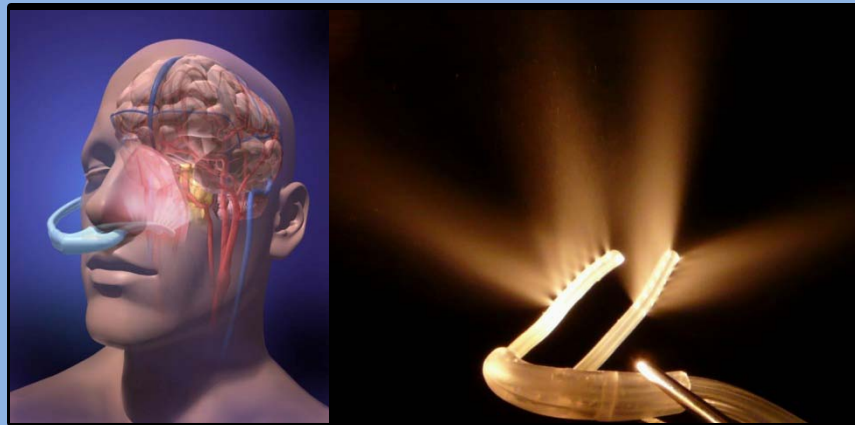


Introduction

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. Survival rates remain low, despite increasing efforts in intensive care. Clinical and experimental investigations have demonstrated improved neurological outcome following treatment with therapeutic mild hypothermia after successful resuscitation. Recent investigations showed improved neurological short-term outcome after accelerated cooling time.



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. Eighty four 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 temperature, course of cooling, 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. Data are presented as mean ± SD or median (interquartile range (25, 75%)).

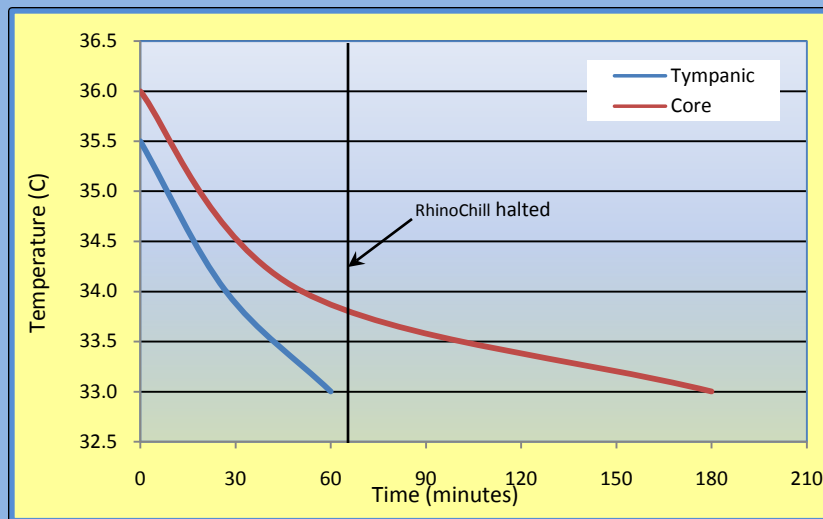
Results

Table 1. Baseline clinical characteristics

• Male gender:	76.2%	• Age (yrs):	69.9 (11.9)
• Cardiac cause:	66.7%	• In-Hospital arrest:	33.3%
• Witnessed:	86.9%	• Bystander CPR:	60.2%
• VF 1 st rhythm:	44%	• Asystole 1 st rhythm:	41%
• Down time:	20 min (med; IQR=14-31 minutes)		
• Time to start cooling:	70 minutes (med; IQR=42-95 minutes)		

Temperatures at admission were 35.5°C tympanic and 36.0°C, core. Time from the start of cooling to target temperature (33°C) was 60 (37-123) minutes tympanic and 180 (120-285) minutes, core. Cooling rate in the brain expressed by tympanic temperature decline was 2.3°C/hr., core cooling rate was 1.4°C/hr and bladder 1.0°C/hr.

Figure. Compartmental cooling rates; tympanic temperature reached the therapeutic temperature zone within 30 minutes.



Adverse events affecting the nasal area occurred in 13/84 patients and resolved in all but 1 of the patients spontaneously. Systemic adverse events were consistent with the patient population being treated.

Table 2. Adverse Events (incident rate, %)

Device-Related Events:	1 Serious (1.2%)	1 Cold-related tissue damage	1.2
	12 Non-Serious (14.3%)	9 White Noses	10.7
		3 Paranasal Bleeds	3.6
		1 Peri-orbital Emphysema	1.2
Systemic Events:	39 Serious (46.4%)	4 Life-threatening Arrhythmia	6.0
		3 Septic Shock	3.6
		2 Re-Arrest	2.4
		6 Pneumonia	7.1
		1 Pulmonary Edema	1.2
		2 Renal Failure	2.4
		1 Right Heart Failure	1.2
		11 Cardiogenic Shock	13.1
		3 MI	3.6
		1 Obstructive Ileus	1.2
		1 Bowel Ischemia	1.2
		1 Cerebral Edema	1.2
		1 Hyperkalemia	1.2
		1 Tracheobronchitis	1.2

Twenty six (31%) had a good neurological outcome. Fifty patients (59.5%) died, none related to the hypothermia procedure. Eight patients (9.5%) had a poor outcome. In patients with VF, sixteen patients (43.6%) had a CPC of 1–2, sixteen patients died and five patients had poor outcome.

Table 3. Outcomes - overall and as a function of 1st rhythm (incident rate, %)

Outcome (%)	All (n=84)	VF (n=37)	Asystole & PEA (n=46)	Outcome after hospital D/C
Good (CPC 1&2)	31.0	43.2	21.7	75
Poor (CPC 3&4)	9.5	13.5	6.5	25
Dead (CPC 5)	59.5	43.2	71.7	0

Conclusions

Trans-nasal cooling for induction of therapeutic hypothermia in patients after successful resuscitation is feasible and highly effective in lowering brain and core temperature rapidly. The method offers the possibility for immediate realization of mild hypothermia in the field. The beneficial effect of earlier cooling on outcome needs to be determined.