Comprehensive Pre- and In-Hospital Near-Infrared-Spectroscopy can predict Outcome Parameters in Patients after Out-of-Hospital Cardiac Arrest

S Schnaubelt¹; C Wallmueller, MD¹; A Zajicek²; FB Mayr, MD, MPH³; H Losert, MD¹; C Testori, MD¹; G Ruzicka¹; N Graf, MD⁴; F Sterz, MD¹; T Uray, MD, MPH¹

1: Department of Emergency Medicine, Medical University of Vienna, Austria

2: Municipal Ambulance Service Vienna, Austria

3: CRISMA Center, Department of Critical Care Medicine, University of Pittsburgh, Pittsburgh, USA

4: Department of Anaesthesia, Intensive Care Medicine and Pain Medicine, Medical University of Vienna, Austria

Background

The increase of regional brain oxygen saturation (rSO₂) levels measured with Near-infrared-Spectroscopy during advanced life support in patients with out-of hospital cardiac arrest (OHCA) is associated with a higher likelihood of Return of Spontaneous Circulation (ROSC) and can predict neurological outcome.

However, optimal procedures and values remain vague, since several studies have yielded varying results. The need for continuous data analysis is important and has to be linked to in-hospital measurements in order to obtain outcome values.

Methods

Regional oxymetry measurements were obtained using two oximetry systems for the out-of-hospital and in-hospital settings (SenSmart Model X100, Nonin Medical, Amsterdam; and Foresight Elite, Casmed, Branford, USA). Patients were included upon ambulance arrival at the OHCA-site or after hospital admission. Neurological outcome parameters such as Cerebral Performance Category (CPC) was assessed directly after ROSC and up to 6 months after.

	Total (n = 27)	ROSC (n = 18)	no ROSC (n = 9)	p-value
Male	20 (74)	11 (61)	9 (100)	.033
Age	60 (±3)	58 (±18)	64 (±5)	.359
Initial ECG-rhythm				
VF	12 (44)	9 (50)	3 (33)	.480
pVT	1 (4)	1 (6)	0 (0)	.493
Asystole	5 (19)	3 (17)	2 (22)	.674
PEA	6 (22)	4 (22)	2 (22)	.937
Witnessed CA	22 (82)	16 (89)	6 (67)	.169
Bystander CPR	21 (78)	14 (78)	7 (78)	1
Bystander Defibrillation	2 (7)	1 (6)	1 (11)	.610
Endotracheal Intubation	20 (74)	14 (78)	6 (67)	.542
Adrenalin (total mg)	4 (±1)	2 (±1)	8 (±2)	.002
Cardiac Origin	18 (67)	12 (67)	6 (67)	1
Mean rSO ₂	52 (±5)	70 (±16)	44 (±7)	.004

Table 1: Patient characteristics. Data are presented as numbers (percentages) and means (± standard deviation).

Table 1: Patient characteristics. Data are presented as numbers (percentages) and means (± standard deviation).

Results

From November 2016 until September 2017, 27 OHCA patients were included. Of those, 10 were enrolled out of hospital, 17 after hospital admission (70% cardiac origin), Eighteen patients (67%) obtained ROSC. At the last observational interval, 11 patients (41%) were alive (7 or 26% with CPC 1-2). Higher mean rSO₂-values in the out-of-hospital setting were associated with a significantly higher likelihood of ROSC (rSO₂ 69.9% ±15.6% vs. 43.7% ±6.5%, p= .004). We observed a similar trend in the in-hospital setting (69.5% ±7.1% vs. 66.2% ±7.5%, p= .673). In addition, we observed a trend towards higher mean rSO₂-values, better neurological outcome, and reduced mortality in patients receiving targeted-temperature-management in the out-of-hospital and in-hospital setting.

Figure 1: Screens of out-of-hospital (A) and in-hospital (B) devices.

Figure 2: Applied NIRS-optodes.

Figure 3: NIRS-measurement.

Figure 4: RsO₂-values over time during CPR (example of one patient).

Conclusion

Combined measurement of regional cerebral oximetry in the out-of-hospital and in-hospital settings is feasible. Higher rSO₂ values were associated with a higher probability of ROSC in both settings. The association of higher rSO₂ values and improved neurologic outcomes needs to be confirmed in a larger study.