Blood gas analyses to predict subsequent recovery of spontaneous circulation in out-of-hospital cardiac arrest patients fulfilling prehospital termination of resuscitation criteria: A diagnostic accuracy study

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Background

Prehospital termination of resuscitation (pTOR) criteria including unwitnessed, no shock administered, and no prehospital return of spontaneous circulation (ROSC) in out-of-hospital cardiac arrest (OHCA) patients was widely accepted¹⁾²⁾. However, patients who met the pTOR criteria had small but non-ignorable chance to achieve ROSC in the emergency department. We hypothesized that test values that could be obtained from blood gas analysis could improve the negative prediction of ROSC after the hospital arrival in OHCA patients fulfilling the pTOR criteria.

Methods

- A retrospective observation of a multicenter (73 centers) prospective registry of OHCA patients in Japan³⁾
- Between Jun. 2014 and Dec. 2015
- Inclusion: patients fulfilling the pTOR criteria who underwent following index tests
- The study index tests:
  - potassium level (mEq/L)
  - pH
  - partial oxygen pressure (mmHg)
- The study reference standard:
  - not achieving ROSC in the ED
- Receiver operating characteristic (ROC) analysis used to assess the following indices
  - area under the ROC curve (AUROC)
  - threshold at the given sensitivity of 0.99
  - specificity at the estimated threshold

Flow of the patients in the study

Baseline characteristics	ROSC(+) N=256	ROSC(-) N=1480
Age	73 [60, 81]	74 [58, 83]
Male sex	158 (61.7)	876 (59.2)
Possible cardiogenic cause	101 (39.5)	813 (54.9)
Prehospital information		
Advanced airway management	91 (35.5)	554 (37.4)
IV epinephrine	217 (84.8)	1215 (82.1)
In-hospital information		
First documented rhythm at ED		
VF/pVT	4 (1.6)	9 (0.6)
PEA/asystole	252 (98.4)	1471 (99.4)
IV epinephrine at ED (mg)	3 [2, 5]	3 [2, 5]
Index tests		
potassium level (mEq/L)	5.8 [5.0, 7.1]	8.1 [6.5, 10.0]
pH	6.87 [6.77, 6.98]	6.80 [6.67, 6.91]
pO2 (mmHg)	44.6 [21.0, 85.8]	27.3 [15.5, 54.9]

VF: ventricular fibrillation, pVT: pulseless ventricular tachycardia, PEA: pulseless electric activity, ED: emergency department, pO2: partial pressure of oxygen
Nominal and numeric variables are displayed as count with percentage and median with interquartile range, respectively.

Prediction of ROSC			
Index tests	AUROC	Threshold (sensitivity: 0.99)	Specificity
potassium level	0.788	> 10.6 mEq/L	0.19
pH	0.633	< 6.38	0.01
pO2	0.623	< 5.5 mmHg	0.03
AUROC: area under the receiver operating characteristic curve			
pO2: partial pressure of oxygen			

Conclusion

Blood gas analyses did not sufficiently rule out subsequent ROSC in OHCA patients fulfilling the pTOR criteria.

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2) ML Ruygrok, et al. (2009). Validation of 3 termination of resuscitation criteria for good neurologic survival after out-of-hospital cardiac arrest. *Ann Emerg Med.* 54(2):239-47
3) T Kitamura, et al. (2018). The profile of Japanese Association for Acute Medicine - out-of-hospital cardiac arrest registry in 2014-2015. *Acute Med Surg.* 5:249–258