Correlation and agreement between observed ETCO2 and predicted ETCO2 calculated from EEG signals in out-of-hospital cardiac arrest: a pilot trial

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Background

- Brain cell viability was not measured directly during cardiopulmonary resuscitation (CPR) in out-of-hospital cardiac arrest (OHCA)
- We developed the EEG-based Brain Resuscitation Index (EBRI) which is an expected value of end-tidal CO2 calculated from EEG
- We compared the observed ETCO2 and EBRI during CPR.

Methods

- OHCA patients who received CPR at one tertiary emergency department were enrolled for this study
- Convenient sampling & exclude if head trauma or deformity
- All CPR procedures were provided without any change, but the single EEG electrode was attached on the forehead of OHCA patients
- The EEG signals were transmitted via designed wireless Bluetooth technology to an independent mobile computer

- Computation formula to calculate the expected ETCO2 using multiple EEG signal values (2 model)

EBRI (Expected ETCO2) = a + b1 x BSR + b2 x BetaR + b3 x SynchFastSlow + b4 x DeltaR

* BSR : Beta-SEF95 ratio, BetaR : β -ratio, DeltaR : δ -ratio

- It was developed in previous animal study and validated for human EEG in former observation study
- Data collection was conducted till return of spontaneous circulation or termination of CPR
- Each data was continuously collected by 0.5 second intervals and extremely deviated values such as observed ETCO2 level lower than 5 or higher than 60, were excluded
- After 1-minute averaging, Pearson Correlation Analysis and Bland-Altman agreement plot between observed ETCO2 and EBRI were performed
- We tested the repeated ANOVA for change of trend

Results

- Total 5 patients with EEG signals during CPR of eligible 13 OHCA patients were enrolled and analyzed (November 2017 – April 2018)
- Total 4989 observed ETCO2 and EBRI values were collected after data cleaning
- Average ETCO2 value per minute were used for correlation and agreement analysis
- Positive correlation (Pearson correlation coefficient 0.53, p-value <0.01) was found in EBRI model 2

- The agreement by the Bland-Altman plot showed only 4/48 (8.3%) observations were not within agreement (in both model)

- There was no significant difference in trend according to CPR duration between observed ETCO2 and EBRI

Conclusion

- We found positive correlation and higher agreement between observed ETCO2 and expected ETCO2 from EEG signals during CPR in OHCA patients