Perioperative cerebral oxygen saturation complexity in predicting cardiac surgical outcomes

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Background and Goal of Study

By using brain as a vital organ, cerebral near-infrared spectroscopy (NIRS) is widely studied for its association with major organ morbidity and mortality (MOMM). The complexity of biosignals, such as heart rate or intracranial pressure, was applied to predict poor clinical outcomes. The cerebral NIRS signals complexity is proved to correlate with mortality in critically ill preterm infants. However, we had little information about the prognostic effect of cerebral oxygen saturation complexity. The aim of this study is to determine whether the complexity of the cerebral NIRS signals can better predict the clinical outcomes in cardiac surgery.

Materials and Methods

Total 80 patients scheduled for cardiac surgery were reviewed retrospectively. Cerebral NIRS monitor was applied routinely to measure perioperative cerebral oxygenation in cardiac surgical patients. We used multiscale entropy (MSE) analysis to evaluate the complexity of cerebral oximetry values. Baseline and mean values of intraoperative cerebral oxygenation were also recorded. Independent t test, ROC analysis, and logistic regression were applied to exam the correlation to major organ morbidity and mortality.

Results

Among major organ morbidity and mortality, the complexity of cerebral saturation was only correlated with adverse neurological outcomes. The patients with postoperative neurological complications had significant higher cerebral oximetry complexity ($p < 0.001$), lower perioperative mean oximetry value ($p = 0.04$), but had no difference in baseline cerebral saturation ($p = 0.08$). Besides, cerebral oximetry complexity was an independent predictor of adverse neurological outcomes ($p < 0.001$).

Conclusion

Complexity of peri-operative cerebral saturation can be applied to predict the clinical neurological outcomes better than baseline or average intraoperative cerebral oximetry values can in cardiac surgical patients.

Table 1. Factors predicting neurological outcomes: multivariate logistic regression analysis

Variables	Coefficient	Std. Error	<i>p</i>
Cerebral oximetry complexity	0.58142	0.22512	0.0098*
Baseline cerebral oximetry value	-0.09206	0.06599	0.1630
Average cerebral oximetry value	-0.06348	0.07534	0.3994

* $p < 0.05$

Figure01a-f. Independent t test of brain oximetry complexity on major organ morbidity and mortality. * $p < 0.05$