Different Effect Of Early Neurocognitive Rehabilitation On Autonomic Nervous System In Critically Ill Patients With And Without Delirium

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INTRODUCTION

Recently, high incidence of autonomic nervous system (ANS) dysfunction in patients admitted in Intensive Care Units (ICUs) has been observed. ANS dysfunction suggests a sympathovagal imbalance due to brain dysfunction leading to central cholinergic deficit. Heart rate variability (HRV) analysis has been successfully used as measure of ANS' integrity. HRV has been related to prefrontal cortex; hence, prefrontal activation could help to strengthen the ANS integrity via vagus nerve stimulation. We are interested in improving the ANS dysfunction through neural circuits' activation. Thus, we propose a therapy that could reinforce ANS via vagus nerve stimulation through the prefrontal activation by means of cognitive rehabilitation techniques.

OBJECTIVE

We explored the effect of an early neurocognitive intervention over the integrity of the ANS, measured by HRV. Associations between HRV changes and mechanical ventilation and delirium were explored in a subsequent analysis.

METHODS

17 critically ill patients received a 20-minute Early Neurocognitive Rehabilitation in Intensive Care (ENRIC) session in their own bed in ICU. HRV was derived from the recorded ECG signal during pre-session, session and post-session. Power in each specific frequency bands related to sympathetic (Low Frequency, PLF) and parasympathetic activity (High Frequency, PHF) was computed. PLF was computed within the classic band, while PHF was computed within a band centered at respiratory rate. Changes in HRV parameters from pre-session to post-session were analyzed using Wilcoxon signed-rank test. Mann-Whitney U-test was used to analyze differences in PLF and PHF changes between mechanically ventilated and non-ventilated patients, and patients with and without delirium.

RESULTS

Clinical data of sample are summarized in table 1. Comparing with baseline, 9 patients (53%) showed a decreased PLF in post-session, while 8 (47%) presented a higher PLF ($p=0.759$). In 12 patients (71%), PHF increased after the session ($p=0.836$). Significant differences were found between patients with and without delirium in PHF changes ($-7.92\times10^{-5}\pm8.98\times10^{-5}$ vs $6.62\times10^{-4}\pm2.44\times10^{-3}$, $p=0.044$). No differences were found between mechanically ventilated patients and non-ventilated in PLF and PHF changes ($p=0.615$ and $p=0.315$, respectively).

CONCLUSIONS

An increase of parasympathetic activity was observed in most patients after the ENRIC session. However, patients suffering delirium showed a decrease in PHF compared with delirium-free patients. Mechanical ventilation did not modify the effect of ENRIC. Clinical characteristics of the critically ill patients should be further studied to elucidate which patients could be the best candidates for early neurocognitive interventions.

Table 1. Descriptives

Age (M, SD)		64,31	10,47
Gender (N, %)	Male	12	70,59
	Female	5	29,41
Diagnosis (N, %)			
	Intestinal perforation	3	17,65
	Peritonitis	3	17,65
	Septic shock	2	11,76
	Politrauma	2	11,76
	Pneumonia	2	11,76
	Hemorrhagic shock	1	5,88
	Toxic intake	1	5,88
	Pancreatitis	1	5,88
	Esophageal perforation	1	5,88
	Acute respiratory failure	1	5,88
APACHE-II (M, SD)		24,31	9,53
SOFA (M, SD)		9,5	4,53
RASS (M, SD)		1,13	2,26
Duration of intubation, days (M, SD)		18,69	31,27
Duration of sedation, days (M, SD)		7,69	8,55
Length of ICU stay, days (M, SD)		24,94	30,17
Septic Shock (N, %)		9	52,94
Cardiac arrest (N, %)		1	5,88

APACHE-II: Acute Physiology and Chronic Health Evaluation II, SOFA: Sequential Organ Failure Assessment, RASS: Richmond Agitation-Sedation Scale, M Mean, SD: Standard Deviation.

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