Heart Rate Variability as an indicator of nociceptive pain in disorders of consciousness?

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1. Background

Heart rate variability (HRV) has been proposed as an indicator of nociceptive pain processing\textsuperscript{1} although its reliability as pain indicator remains under debate. The objective was to study the interest of an HRV complexity analysis\textsuperscript{2} method as an indicator of nociceptive pain processing in severely brain-injured patients with disorders of consciousness

2. Methods

Twenty-two patients (11 in minimally conscious state [MCS], 11 in a vegetative state/unresponsive wakefulness syndrome [VS/UWS]) and 14 healthy subjects [HS] were included in this study. We administered a non-noxious and a noxious stimulation while recording the electrocardiographic response was recorded before, during, and following non-noxious and noxious stimulation. The short-term Complexity Index (CIs) was calculated. Mann-Whitney and Wilcoxon’s test were used to investigate differences in CIs according to the level of consciousness (i.e., HS vs patients and VS/ UWS vs MCS) and the three conditions (i.e., baseline, non-noxious, noxious). The correlation between the three conditions and the Coma Recovery Scale-Revised\textsuperscript{3} were investigated by Spearman’s correlations.

We observed higher CIs values in HS as compared with patients during baseline and following the noxious stimulation. We also found higher CIs values in MCS vs VS/UWS patients following the noxious condition and lower values in the noxious vs non-noxious condition solely for the VS/UWS group. A correlation was found between CIs in noxious condition and Coma Recovery Scale-Revised scores.

3. Results

Electrocardiographic activity was recorded in three different conditions:
- Baseline: spontaneous activity during 5 minutes.
- Non-noxious stimulation: five rapid taps on the top of the patient’s right and left shoulder
- Noxious stimulation : pressure on the nail bed of the middle finger of the right and left hand using a Newton-meter

Non-noxious and noxious stimuli were administered for 5 seconds, they were separated by 10 seconds and followed by 5 minutes rest.

CIs values for Healthy, MCS and VS/UWS  groups in baseline (white) non-noxious (light gray) and noxious (dark gray) condition. (p=.007 (*); p=.001 (**))

Scatterplot of the Coma Recovery Scale-Revised (CRS-R) scores and CIs values in noxious condition for VS/UWS (dark grey dots) and MCS (light gray dots) patients.

4. Conclusion

Our data suggest a less complex autonomic response to noxious stimuli in VS/UWS patients\textsuperscript{4}. Such analysis may help to better understand sympatheticvagal response to potentially painful environmental stimulation in brain-injured patients.

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