Changes of blood pressure and heart rate variability precede a grand mal seizure in a pregnant woman

Renaldo Faber1*, Holger Stepan1, Mathias Baumert2, Andreas Voss2 and Thomas Walther3

1 Department of Obstetrics and Gynecology, University of Leipzig, Germany
2 Faculty of Medical Engineering, University of Applied Sciences, Jena, Germany
3 Department of Pharmacology, Erasmus Medical Center, The Netherlands

Abstract

In order to evaluate blood pressure- and heart rate variability as a potent diagnostic tool for different hypertensive pregnancy disorders we started a clinical trial recording these variables in early pregnancies predisposed for preeclampsia. During routine measurements one of the patients experienced a grand mal epileptic seizure. Since the parameters of both heart rate and blood pressure variability were sequentially altered immediately before the seizure, this case report provides an interesting insight into autonomic cardiovascular control in a developing convulsive fit and the pathophysiological generation of a grand mal seizure in pregnancy.

Keywords: Blood pressure variability; eclampsia; grand mal seizure; heart rate variability; pregnancy.

Case report

Heart rate variability and blood-pressure variability (HRV/BPV) have been shown to be relevant predictors for the mortality of patients with cardiovascular disorders [1, 6]. Also patients with epilepsy show significant changes in HRV and BPV caused by anticonvulsive drugs or by epilepsy [3, 4]. Our group could show that normal pregnant women exhibit significant alterations in autonomic cardiovascular control in comparison to non-pregnant women [5].

In an ongoing longitudinal study we investigated pregnancies with and without risk factors for preeclampsia (e.g. pathological uterine perfusion) in order to evaluate whether HRV and BPV differ between various hypertensive disorders in pregnancy [3]. Furthermore, the predictive value of selected variability parameters relevant to preeclampsia was assessed. Pregnant women were monitored for 30 minutes every four weeks, beginning at 20 weeks, using a PORTAPRES non-invasive blood pressure monitor with a sampling frequency of 200 Hz [5].

A 21-year old gravida 1 para 0 suffered from epilepsy due to a fronto-temporal arterio-venous malformation and was treated with carbamazepine and valproate. Variability parameters at the first measurement at 20 weeks were normal (data not shown) and the woman experienced no epileptic seizure during pregnancy. In the 24th week of gestation, during the second monitoring session, the patient developed a grand mal seizure. The generalized tonic-clonic convulsions appeared clinically to be a typical epileptic fit but this could not be confirmed by concomitant EEG. Blood pressure and heart rate were recorded over 12 minutes until the onset of unconsciousness. As described by Voss et al. [5], the data was analyzed comparatively to a 12-minute reference curve recorded from the woman at 20 weeks. Since important abnormalities were obvious (Figure 1, Panel A), we divided the values into 4-minute-intervals in order to detect the beginning of possible changes before the seizure.

Both BPV and HRV showed an important increase in the very low frequency band (VLF) at the beginning of monitoring (12 minutes prior to seizure). At this time the low frequency (LF) domain was upregulated with delay, but the high frequency bands remained unchanged. The delayed LF abnormalities are first manifest in the BPV followed by an increase in LF of HRV (Figure 1, Panel B). Since VLF bands mainly reflect sympathetic activity, this part of the autonomic control seems to be important for the evolution of epileptic seizures.

The analysis shows for the first time the behavior of HRV and BPV immediately before a grand mal seizure in a pregnant woman. However, we cannot exclude the possibility that the observed convulsions represent only the end of a complex seizure generated from the fronto-temporal focus. Recently, reduced HRV and BPV have been reported in non-pregnant patients with epilepsy in the interictal period [4]. However, our patient showed no differences to normal pregnant women during the first measurement. This is in contrast to the documented finding that epilepsy per se, as well as anticonvulsive drugs, has an impact on HRV and BPV [3, 4].

Our case report shows that simple blood pressure and heart rate monitoring with high resolution may allow prediction of a generalized convulsive seizure. Since our
Figure 1 (A) Systolic blood pressure (SBP) and beat-to-beat intervals (BBI) of a pregnant woman 4 weeks (control) and 12 minutes before epileptic seizure. (B) Comparison of blood pressure and heart rate variability (BPV and HRV) between measurements beginning 12 minutes before grand mal seizure (GMS) and 4 weeks before the seizure (con). Frequencies are divided into very low (VLF), low (LF), and high (HF) frequency. 1 = 1–4 minutes, 2 = 5–8 minutes, 3 = 9–12 minutes interval before seizure.
group has shown that different types of hypertensive pregnancy disorders including preeclampsia are characterized by distinct HRV and BPV alterations [2], it is of great interest to discover how these parameters might change before the onset of an eclamptic fit. We are aware that this method is not clinically applicable for the prediction of a seizure in pregnancy. However, the measured alterations in the autonomic cardiovascular control, particularly in the VLF of HRV and BRV, provide an interesting insight into the pathophysiological generation and development of a grand mal seizure in pregnancy.

References


