

Circadian Modulation of Electrocardiographic Alternans in Kidney Failure Patients on Dialysis

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Circadian rhythm can modulate trends of electrocardiogram (ECG) indexes (periodicity: 24h), as ECG alternans (ECGA). ECGA, defined as an ABAB fluctuation of ECG waves, is affected by ions passage across cardiocyte membrane. Dialysis treatment involves ion rebalancing and, to our knowledge, circadian rhythm effect on kidney failure patients' ECGA during and after the dialysis treatment hasn't been investigated yet. This work aims to verify if circadian rhythm modulation on ECGA in kidney failure patients exists and to study the effect of dialysis treatment.

ECGA was analyzed on 51 long-term (48h on average) 12-lead ECG from kidney failure patients, while and after undergoing dialysis treatment (which lasted, on average, 4h). Acquisitions included dialysis (the start time of which could be early morning, late morning, or early afternoon), following night, and following day and night. Measures of P-wave alternans (PWA; μV), QRS-complex alternans (QRSa; μV) and T-wave alternans (TWA; μV) were obtained using the enhanced adaptive matched filter method.

Results indicate that, in dialysis-free days, ECGA trend was modulated with a periodicity of 24h in all leads. PWA/QRSa/TWA trends reached their minimum values (lead average, 7/9/15 μV) during the night and their maximum values (lead average, 12/16/21 μV ; $P < 0.05$) during the day. Dialysis interrupted the circadian periodicity of ECGA, causing a decrement of PWA/QRSa/TWA maximum values (lead average, 9/12/17 μV) during the day. Generally, ECGA values increased from dialysis to 24h after; maximal increments were +61%, +27%, and +53% for PWA, QRSa and TWA, respectively; mean increments were +30%, +20% and +21%.

In conclusion, in our kidney failure population, ECGA was affected by circadian modulation and the dialysis treatment interrupted its periodicity, causing a decrement in all forms (PWA/QRSa/TWA) of ECGA.