

## CARTA AL COMITÉ DE REDACCIÓN

### MODIFICATION OF CARDIAC AUTONOMIC REGULATION IN NEPHROLOGY RESIDENTS DURING NIGHT SHIFT

#### *MODIFICACIÓN DE LA REGULACIÓN AUTONÓMICA CARDIACA EN RESIDENTES DE NEFROLOGÍA DURANTE LA NOCHE DE GUARDIA*

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#### **To the Editor:**

There is a clear association between the change of work shift and cardiovascular diseases. Hypertension, hypertrophy of the left ventricle, atherosclerosis and myocardial infarction in night shift workers are more frequent and tend to be more severe than in workers on the day shift, through several mechanisms including the autonomic modulation of the cardiovascular system.<sup>(1)</sup> Little is known about the response of the autonomous system during the night shift in Nephrology residents. The work environment of the nephrology residents who work in the night shift involves stressful situations, sleep deprivation and desynchronization of the circadian rhythm. Night shifts and circadian misalignment are considered a risk factor for developing cardiovascular diseases in physicians.<sup>(2-3)</sup> However, the factors that affect the balance of the autonomic nervous system during the night shift, including physical activity, sleep deprivation and work stress, remain unknown.

We measured the modification of the

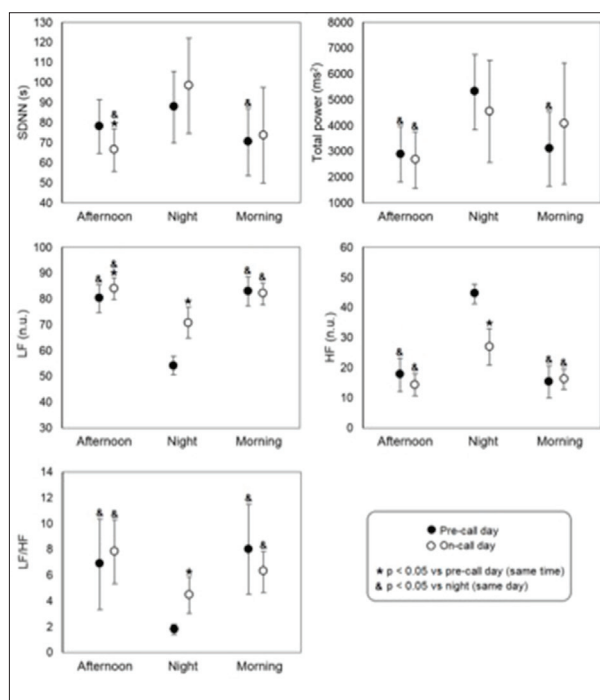
autonomic modulation of the heart rate during and after the day and night work shift through the analysis of heart rate variability (HRV).<sup>(4)</sup> Our aim was to identify the changes in cardiac autonomic regulation related to the day shift (pre-call day) and the night shift morning (on-call day). HRV indexes were compared in the afternoon of pre-call day, night and morning of the on-call day.

The study design was observational case-crossover. Nine residents physicians from the Department of Nephrology were included (8 men and 1 woman, 30.3 ± 0.68 years old, body mass index 24.7 ± 2.7 Kg/m<sup>2</sup>. None of the participants smoked cigarettes or took any medication). The study protocol was approved by the Research and Bioethics Committee of our institution (protocol number 18-1064). Ambulatory 24-hour ECG (Holter) recordings were obtained for each participant on a regular workday (with an 8:00 am check-in time and 4:00 pm check-out time) and on an on-call day where the residents must remain in the hospital overnight (entry

time at 8:00 am and departure time at 4:00 pm on the day after the night shift). During the night-shift, the residents have a designated area where they could sleep. The Holter recording initiated at 3:00 p.m. on the pre-call day and ended at 3:00 p.m. on the on-call day. For each day, HRV indexes were evaluated three times: during the afternoon (5:00 pm to 11:00 pm), the night (0:00 to 6:00 am) and the morning (7:00 a.m. to 1:00 p.m.). The recording was processed in 5-minute segments to obtain the standard deviation of all RR intervals (SDNN), low frequency power (LF, from 0.04 to 0.15 Hz), high frequency power (HF, from 0.15 to 0.4 Hz) and the LF/HF ratio.<sup>(4)</sup> The number of steps was measured with a pedometer. Participants were given a logbook for coffee consumption.

During the on-call day, the participants reported fewer sleep hours ( $6.03 \pm 0.82$  hours) compared to the pre-call day ( $2.22 \pm 1.19$  hours),  $p < 0.001$ . There were no differences with respect to the type of working day in coffee consumption and physical activity (number of steps). Compared with the pre-call day, in the on-call day it was observed lower SDNN in the afternoon, higher LF in the afternoon and night, lower HF in the night and higher LF / HF in the night (Figure 1). This suggests a decrease in HRV (SDNN) due to a probable increase in sympathetic activity in the afternoon of the on-call day (LF), while in the night of the on-call day there is an increase in sympathetic activity (LF), decrease in parasympathetic (HF) and therefore a clear sympathetic predominance in the sympathovagal balance (LF/HF). SDNN was higher at night compared to the evening (only on-call day) and compared with the morning (only on the pre-call day). The total power was higher at night compared to the evening (on both days) and in the morning it decreased only on the pre-call day. On both days, during the-night there was a decrease in LF and LF/HF and an increase in HF, which indicates a lower sympathovagal balance during the night, compared the afternoon or the morning, on both days.

**Figure 1.** Heart rate variability parameters during afternoon, night and morning compared by the day before the night duty (pre-call) day and the night duty day (on-call). Circles correspond to mean value and error bars indicate 1 standard deviation. The results are reported as mean  $\pm$  standard deviation and compared between the groups by ANOVA for repeated samples with post-hoc comparisons corrected by the Bonferroni method. n.u. = normalized units.<sup>(4)</sup>



During the night shift, residents of Nephrology are exposed to situations of stress, fatigue and sleep deprivation. The present study shows a clear sympathetic dominance associated with the night shift that could be explained by lack of sleep, but not by physical activity or coffee intake. Specifically, the increase in the value in LF, concomitant with a decrease in the value of HF during the night shift compared to the pre-call night, indicates that the sympathetic activity predominates during the night shift. In contrast, during the pre-call, there was an evident dominance of parasympathetic activity during the night. The loss of this phenomenon can be corroborated by increasing LF/HF ratio during the night shift compared to the pre-call night. The decrease in

SDNN during the afternoon of the on-call day with respect to the pre-call day suggests that there is a decrease in HRV secondary to an enhanced sympathetic activity. Similarly, a greater spectral power is found in LF in the pre-call afternoon with respect to the on-call afternoon. The fact that this sympathetic hyperactivity occurs before the night-shift, suggests that the factor that unbalances the autonomic nervous system is a phenomenon of anticipation at the beginning of the night shift. Possibly, Nephrology residents have associated psychological stressors during the night shift and develop the expectation of facing an overwhelming situation.

From the current results, it can be inferred that sleep deprivation is an important factor in the autonomic imbalance during the care of Nephrology residents, as it has been seen in other scenarios.<sup>(5-6)</sup> The decrease in HRV is a risk factor for developing cardiovascular diseases.<sup>(1-2)</sup> Residents of nephrology are exposed to this risk factor repeatedly during all their residence, and this probably impacts on their quality of life.

In conclusion, during the on-call day, HRV is lower compared to the pre-call day, in addition to the effect of the workload and the night shift. Another factor associated with this autonomous imbalance is the sleep deprivation experienced by residents during the night shift. This effect is reflected in the increase in sympathetic activity associated with work during the night on duty.

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