Relationship between REM sleep and testosterone secretion in older men

P. Penev(1), K. Spiegel(1,2), M. L’Hermite-Balériaux(2), R. Schneider(1), E. Van Cauter(1)

(1) Section of Endocrinology, Department of Medicine, University of Chicago, Chicago, IL, USA.
(2) Laboratoire de Physiologie and Centre d’Etudes des Rythmes Biologiques, Université Libre de Bruxelles, Brussels, Belgium.

Sleep is a major regulator of endocrine function. A consistent relationship has been evidenced between age-related changes in sleep and in growth hormone and cortisol secretion. The aim of the present study was to investigate whether the age-related androgen decline in healthy men – characterized by considerable inter-individual variability, the causes of which are poorly understood - is related to concomitant sleep alterations.

Seven healthy young men (20-28 y.o; BMI 23.1 ± 0.6 kg/m², mean ± SE) and 7 older men (51-69 y.o; BMI 25.2 ± 0.8 kg/m²) were included in the study. All subjects were investigated in a sleep unit during 48 hours of bed rest including two sleep periods between 23:00 h and 07:00 h. Sleep was recorded polygraphically during the second night in the young, and during both nights in the older subjects. All records were scored in 30-second epochs according to standard clinical criteria. Blood samples were obtained through an indwelling catheter at 30-min intervals during the last 24 hours of the study and plasma total testosterone levels were measured in each sample by radioimmunoassay. A robust locally weighted regression procedure was used to generate best-fit curves for the quantitative description of testosterone profiles.

Testosterone levels in both age groups exhibited clear 24-h rhythms with highest levels in the morning. Compared to the young, older subjects had significantly lower mean (9.0 ± 0.7 ng/ml vs 12.2 ± 0.8 ng/ml; p = 0.011), peak (10.9 ± 0.7 vs 14.1 ± 1.0 ng/ml; p = 0.025) and trough (7.3 ± 0.7 vs 10.2 ± 0.8 ng/ml; p = 0.018) values of the 24-h testosterone profile. Older subjects had significantly shorter total sleep times (343 ± 22 vs 406 ± 9 min; p = 0.03), with decrements in stage 2 and REM sleep, and increased wake time during the night. The amount of REM sleep in all subjects was linked to higher peak testosterone values (r = 0.56; p = 0.046), and tended to correlate with testosterone levels during the sleep period (r = 0.54; p = 0.059). In the older group, there was a strong positive correlation (r = 0.85; p = 0.015) between the amplitude of the 24-h testosterone rhythm and the amount of REM sleep. These results illustrate the importance of the interrelation between sleep and testosterone levels and suggest that in males, the amount of REM sleep could modulate testosterone secretion. The reduction of REM sleep in older subjects could contribute to the age-related androgen decline in men.