

## THE EXAMINATION OF NOCTURNAL URINATION AND SYMPATHETIC NERVE ACTIVITY IN THE ELDERLY PEOPLE BY USING 24HR UROFLOWMETER, SLEEP EEG MEASUREMENT AND URINE CATHECHOLAMINE.

### Hypothesis / aims of study

In the previous study we conducted, using sleep EEG measurements, it was found that ① in the elderly, nocturnal awakening time became longer, ② decreased urine stream was an independent influence factor on the quality of sleep. However, the causes have not been clarified. First, we thought the reason was as follows: it took a long time to urinate due to the decreased urine stream; thus, sympathetic nerve activity has been activated. They felt difficulty to re-enter sleep and nocturnal awakening time became longer. Second, we thought the reason was as follows: that dysuria and sleep disorders might have been caused by the stimulated sympathetic nerve activity during the nocturnal period. We are going to prove these hypotheses based on sleep EEG measurement, portable uroflowmeter and diurnal variation measurement of sympathetic nerve activity (urinary catecholamine secretion amount measurement).

### Study design, materials and methods

Our subjects were people who were 60 years of age or older and met the condition with ECOG PS 0-1 and less than 50mL residual urine, woke up one or more times for urination during the nocturnal period but didn't feel it troublesome. Exclusion criteria were as follows: urinary tract infections, urinary tract stones, urinary tract malignancy, neurogenic bladder, severe diabetes, severe heart diseases and severe liver disease. We assessed lower urinary tract symptoms using International Prostate Symptom Score (IPSS) and QOL Score. Strength of urine stream was measured using a portable uroflow meter (co-developed with Micronics Co., Ltd.). We measured 24 hour urination conditions; measured daytime strength of urine stream and nocturnal strength of urine stream respectively. When nighttime/daytime (N/D) ratio becomes lower, nocturnal strength of urine stream was assumed to be insufficient. We assessed the quality of sleep subjectively, using nocturia specific QOL questionnaire sheet (N-QOL questionnaire sheet). We also assessed the quality of sleep objectively; we measured sleep EEG, using simplified electroencephalograph (EEG sensor ZA®, Proassist Co., Ltd.). Head electrodes were attached to only two sites. As data were transferred wirelessly from a transmitter to a receiver, it neither restricted the subject's sleep position, nor interfered urination operation. EEG data were analyzed using a dedicated analysis software, SleepSign® (Kissei Comtec Co., Ltd.). We performed diurnal variation measurement of sympathetic nerve activity by measuring urinary catecholamine (CA) secretion which correlated with sympathetic activity. Urine was accumulated during the night (22:00 to 6:00) and daytime (6:00 to 22:00) respectively. Then, urinary CA was measured. When nocturnal urinary CA/ daytime urinary CA ratio was greater, it was assumed that nocturnal sympathetic was more active.

### Results

In the 28 cases, we were able to measure all the items (average years of age:  $71.1 \pm 8.84$ ). IPSS total score was  $10.32 \pm 7.17$ , QOL was  $4.06 \pm 1.39$  and NQOL total score was  $76.3 \pm 11.28$ . Urinary noradrenaline (NA) showed no correlations with NQOL total score during the whole day, daytime and night time. N/D ratio of urinary NA showed a correlation with NQOL total score (Fig. 1,  $p = 0.045$ ). In addition, urinary dopamine (DA) showed no correlations with NQOL total score during the whole day, daytime and night time, either. However, N/D ratio of urinary DA showed a correlation with NQOL total score (Fig. 2,  $p = 0.015$ ). N/D ratio of strength of urine stream in 24-hour urine flow rate measurements showed no correlations with N/D ratio of urinary CA. Furthermore, the length of the deep sleep showed no correlations with N/D ratio of urinary CA.

### Interpretation of results

Normal healthy people have little diurnal variation of plasma CA value during the rest. However, urinary CA exhibits bilateral character: high value during the daytime and low value during the nighttime. When N/D ratio of urinary CA was higher, it is thought that nocturnal sympathetic nerve becomes more active. We had a hypothesis in which nighttime decreased strength of urine stream and extended nocturnal awakening time were caused by stimulated nocturnal sympathetic nerve activity. However, in this study, the correlation between N/D ratio of urinary CA and strength of urine stream or prolonged nocturnal awakening time was not observed. However, as nighttime/ daytime ratio of urinary CA became higher, NQOL total score became lower. Therefore, we thought that even if a person was not troubled by nocturnal urination, due to activated nocturnal sympathetic nerve, the quality of sleep was likely to be degraded.

### Concluding message

In the case of people who have nocturnal frequent urination but do not feel it troublesome, our study shows a correlation between the quality of sleep and activated nocturnal sympathetic nerve. We will further investigate sympathetic nerve activity in the nocturia patients who have trouble with nocturnal urination, and tend to elucidate nocturia.

### Disclosures

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