The influence of peripheral intravenous catheterization on the sleep quality of patients

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Introduction:

- ◆ Peripheral intravenous catheter (PIV) placement is the most common medical treatment method for inpatients. (Carr P, 2017)
- ◆ PIV placement is an invasive method and uncomfortable experience for patients.
- ◆ Catheterization may affect sleep, because patients having a catheter will be worried about the catheter and wake up. (Kobayashi K, 2017)
- ◆ However, there have been no studies examining the relationship between PIV placement and sleep quality.

Method:

- Design: Observational study
- Study setting: Ophthalmic ward of the University of Tokyo Hospital
- Participants: Inpatients who have a planned surgery on the following day.
 - ‘Catheterization group’ — patients who were administered a PIV with heparin lock (100 U/ml) in preparation for a surgery.
 - ‘Non-catheterization group’ — patients who were not catheterized.
- Exclusion criteria: Patients under 20 years old
- Sleep parameters:
 - 1) ‘Nemuri SCAN’ (PARAMOUNT BED CO., LTD. Tokyo, Japan)
 - 2) Subjective sleep quality questionnaires,
 - The Oguri-Shirakawa-Azumi sleep inventory, MA version (OSA-MA)
 - Other questions (original)
 - How was your sleep last night?
 - Did you change positions as usual?
 - How many times did you leave your bed last night?
 - Were you able to find a comfortable sleeping position?
 - Did you wake up due to worry about catheter during the night? →If so, what was the reason? (pain, anxiety, itchy, and so on)

(Catheterization group only)

This study was approved by the Research Ethics Committee of the Graduate School of Medicine at the University of Tokyo (No.11670).

Table 1.
Characteristics of the catheterization group and non-catheterization group

	Catheterization (n=53)	Non-catheterization (n=55)	p-value
Age [years]	72.2 ± 11.1	70.9 ± 13.1	0.575
Sex [male]	27 (50.9)	30 (54.5)	0.428
Body Mass Index [kg/m ²]	22.8 ± 3.2	23.2 ± 4.6	0.547
Experience of surgery	43 (81.1)	42 (76.4)	0.356
Taking sleep aid	7 (13.2)	3 (6.0)	0.184
PSQI-J ¹⁾	5.8 (3.1)	5.8 (3.2)	0.941

N = 108, Mean ± SD or n (%)

1) PSQI-J [0-21]: the Pittsburgh Sleep Quality Index, Japanese Version: The measure consists of 19 individual items, creating 7 components that produce one global score. High score is judged as sleeping disorder. The cut-off point is 5.5.

Table 2.
Peripheral intravenous catheterization and sleep parameters by Nemuri SCAN

	Catheterization (n=53)	Non-catheterization (n=55)	p-value
Total sleep time (min)	473.4 (72.4)	468.1 (62.1)	0.688
Time in bed (min)	558.6 (49.9)	546.9 (54.5)	0.248
Sleep latency (min)	14.3 (9.0)	13.8 (10.3)	0.766
Sleep efficiency (%)	84.6 (9.7)	85.6 (7.9)	0.542
Waking after sleep onset (min)	67.1 (46.9)	62.8(42.8)	0.623
Out-of-bed (times)	2.5 (1.8)	2.1 (2.0)	0.266
Activity score ¹⁾ [count/min]	42.9 (18.4)	40.0 (18.0)	0.422

N = 108, Mean ± SD or n (%)

1) Activity score: the intensity and frequency of large body movements (excluding smaller movement, such as breathing and heartbeat)

Table 3. Peripheral intravenous catheterization and subjective sleep quality

	Catheterization (n=53)	Non-catheterization (n=55)	p-value
Sleepiness on rising (4 items)	47.7 (10.0)	49.1 (8.9)	0.426
Initiation and maintenance of sleep (5 items)	40.0 (10.5)	39.1 (11.7)	0.666
Frequent dreaming (2 items)	51.0 (10.3)	49.9 (11.9)	0.622
Feeling refreshed (3 items)	48.4 (9.1)	47.7 (9.4)	0.698
Sleep length (2 items)	47.4 (12.1)	48.0 (10.5)	0.764

N = 108, Mean ± SD or n (%)

Discussion & Conclusion:

This study found that PIV placement influenced the subjective sleep quality of patients who experienced pain associated with movement, due to stimulus from the catheter, even though it was not related to sleep parameters by body vibrometer. Continued development of the catheter and catheter fixation method are required for reducing pain and improving sleep quality.

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Aims:

To examine the relationship between PIV placement and sleep quality, such as sleep parameters and subjective sleep quality.

'Nemuri SCAN' (a sheet-shaped body vibrometer)

This device has a highly sensitive pressure sensor and detects motion through the mattress, identifies whether the sleeper is in or out of bed, and calculates an activity score every minute for scoring sleep/wake.

This score reflects the intensity and frequency of large body movements and excludes smaller movements due to breathing and heartbeat.

Scoring of sleep/wake states was done using the Cole-Kripke algorithm (Cole et al., 1992). The device can calculate TST: total sleep time, SE: sleep efficiency, SL: sleep latency, WASO: wake after sleep onset, and Awakenings.

<http://www.paramount.co.jp/learn/reductionworkburden/nemuriscan>

28.6 cm long, 77 cm wide, 2.5 cm thick

The Oguri-Shirakawa-Azumi sleep inventory, MA version (OSA-MA)

The OSA-MA edition was a short form, targeting middle-aged and elderly people, it was scored using 5 factors with 16 items and 4 scales.

Five factors : 1) sleepiness on rising (4 items)
2) initiation and maintenance of sleep (5 items)
3) frequent dreaming (2 items)
4) feeling refreshed (3 items)
5) sleep length (2 items)

Scores are standardized to evaluate sleep quality and high scores are judged as good sleep quality. (Oguri M et al., 1985)

Results:

- The number of participants in the ‘catheterization group’ and ‘non-catheterization group’ were 53 and 55, respectively. (**Table 1**)
- There were no significant differences in sleep parameters or subjective sleep quality between the two groups. (**Table 2,3**)
- However, 19 of the 52 participants (36.5%) in the ‘catheterization group’ awoke during the night, worried about their inserted catheter.
- **The most widely given reason was ‘pain associated with movement’ (63.2%).**
- Additional analysis (**Table 4, 5**): For the participants who experienced pain associated with movement, Fragmentation Index was higher and three of the five subjective sleep quality factors measured by OSA-MA were lower than those of the other participants.

Table 4. The relationship between experience of pain associated with movement and sleep parameters by Nemuri SCAN among catheterization group

	Yes (n=12)	No (n=40)	p-value
Total sleep time (min)	479.9 (68.4)	471.1 (75.2)	0.716
Time in bed (min)	562.7 (48.9)	557.1 (51.3)	0.739
Sleep latency (min)	16.5 (8.7)	13.6 (9.2)	0.343
Sleep efficiency (%)	85.0 (7.5)	84.4 (10.4)	0.858
Waking after sleep onset (min)	65.3 (33.5)	67.9 (51.0)	0.866
Out-of-bed (times)	2.9 (2.0)	2.4 (1.7)	0.382
Activity score [count/min]	39.5 (9.1)	43.6 (20.5)	0.514
Fragmentation index (%)*	45.1 (7.4)	35.7 (10.0)	0.004

N = 53: catheterization group, Missing data = 1

*Fragmentation Index : the percentage of phases of 1 min immobility vs. the whole periods of immobility

Table 5. The relationship between experience of pain associated with movement and subjective sleep quality among catheterization group

	Yes (n=12)	No (n=40)	p-value
Sleepiness on rising (4 items)	44.5 (9.8)	48.5 (10.1)	0.232
Initiation and maintenance of sleep (5 items)	32.8 (12.0)	42.0 (9.3)	0.007
Frequent dreaming (2 items)	47.6 (13.5)	51.8 (9.2)	0.226
Feeling refreshed (3 items)	42.1 (8.7)	50.2 (8.6)	0.007
Sleep length (2 items)	40.8 (10.6)	49.1 (12.0)	0.036

N = 53: catheterization group, Missing data = 1