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Indwelling urinary catheterization in acute-phase neurosurgery patients and results of engagements towards establishing support for urinary independence, with sleep evaluations

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KEY WORDS

neurosurgical patients, acute care, continence aids, sleep disorder, indwelling urinary catheters

Introduction

As Japan enters an era of the "super" aging society, aged persons account for the majority of patients even at acute hospitals. There is thus a demand for nurses to be engaged, from the early treatment stages, in helping elderly patients to maintain and expand daily life functions, including activity of daily living (ADL). Nurses and a nursing researchers have been working closely together in developing programs for supporting removal of indwelling urinary catheterization and establishment of early-period urinary independence[1]. The program in 2013 focused on elderly patients with heart failure[2], while in 2014 program targeted orthopedic disease patients undergoing hip replacement surgery[3]. For neurosurgical patients, however, early removal of indwelling urinary catheters involves numerous lower urinary tract symptoms (LUTS), including urinary retention, pollakiuria, nocturia, etc., and is also often accompanied by sleep disorders and other problems. All this makes independent urinary behavior difficult.

Sleep disorders was frequently complicated in the cerebrovascular disease patients[4]. Reversed sleep-waking rhythm which involves drowsiness in the daytime and waking at night is frequently encountered in the early stages of stroke[5].

LUTS occur in approximately 40%-70% of a stroke, with high frequency of urinary retention and incontinence in acute phases; these are reportedly related to severe obstructive sleep apnea[6]. Related Guidelines[7] state: "Inasmuch as the high frequency of LUTS in cerebral infarction can obstruct rehabilitation, sufficient evaluation is recommended (Grad B) via observation of urination patterns, residual urine measurements, and urodynamic tests." Nevertheless, currently there is ambiguity regarding concrete support methods for urinary independence, and effective intervention has not been achieved.

We thus felt the necessity of clarifying early-period urinary independence support that considers the specific LUTS and sleep disorders of neurosurgical patients, and of ascertaining the effectiveness of said support.

Study purpose

The purpose of this study was, for neurosurgery patients in an acute hospital who require indwelling urinary catheterization management, to investigate the efficacy of engagements to support early-period urinary independence and of related sleep evaluations.

Methods

1. Study design and survey period

This study was an intervention study with a survey period from July 1 to September 30, 2015.

2. Study subjects

Subjects were neurosurgical patients who, in tandem with their treatment, require indwelling urinary catheterization management, hospitalized in the surgical ward (orthopedic surgery and neurosurgery department, 44 beds) of a general hospital (344 beds) that provides acute-care services and that serves as the central hospital in “City A” (population: approximately 100,000 people).

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3. Details of the intervention

The intervention program involved nurses ensuring safe and effective catheter removal, and supporting independent urination behavior from an early stage, including during rehabilitation, based on assessment of LUT function in elderly patients during catheterization management.

Fundamentally, when nurses performed catheterization management on elderly patients, they performed an "initial assessment of urination behaviour" (1) based on physical function, medical history, medication being taken currently, and LUTS prior to catheterization management as a rule. This was done at the time of admission and discharge from the ward, or when the patient had recovered to the point that they were able to leave the bed. They then assessed the potential for catheter removal, and the risk of LUTS and sleep disorders occurring after catheter removal. Thereafter, a nursing plan aimed towards establishing independent urination based on early assessment was devised (2). According to the course of treatment, nurses then defined when "the catheter could be safely and effectively removed" (3) and removed the catheter. After removal, as a rule, nurses performed a "monitoring using a voiding diary and devices to measure bladder capacity and residual urine volume" (4) for 3 days, in tandem with sleep evaluations. Measurement of bladder capacity and residual urine volume was performed using a portable ultrasonic bladder capacity measurement device, the urine USH-052® , and nurses measured the bladder capacity and residual urine volume during urination or in the event that it was difficult for patients to report the urge to urinate to nurses, then every two hours. This was done to understand the urination pattern. Urination care was selected to support each aspect of LUT function, based on the assessment of LUT function. Primarily, each aspect of the urination pattern was measured in elderly patients who had incontinence, and a period of urination induction was established, after which urination was induced before incontinence could occur. Meanwhile, in elderly patients noted to have impaired urinary outflow, urination was induced when the urine volume exceeded 400 ml, and intermittently induced three times a day if the bladder capacity and residual urine volume were 200 ml or more in order to prevent bladder overdistension, which has a negative impact on LUT function.

Through conference during regular nursing, nurses conducted "nursing interventions aimed towards establishing independent urination and assessed them" (5) that corresponded to LUT function that changed during the clinical course.

4. Survey procedures

1) Basic information: Study researchers collected information from electronic clinical records (hospital medical records, nursing records) of subjects post-intervention. Basic attributes were age, sex, medical history, medicine prescribed during hospitalization, urology consultation, site of residence before hospitalization, walking ability, urination method.

2) Functioning ability and health evaluation: During intervention and at discharge, physical and/or occupational therapists measured ADL (functional independence measure, FIM) and cognition (Mini-Mental State Examination, MMSE), and nurses measured vitality (Vitality Index).

3) Sleep evaluations: In principle, for a one (1) week period using sleep SCAN® (Paramount Bed Co., Ltd.). It is expected that a nonwear device for scoring sleep/wake and in-bed/out-of-bed, enables convenient long-term sleep-related evaluation in various fields, including hospital settings[7]. In tandem with monitoring using a voiding diary and devices to measure bladder capacity and residual urine volume.

5. Analysis method

Descriptive statistics were used for overview of subjects, urination condition, sleep evaluation, and functioning ability and health evaluation. Case studies were used to investigate the efficacy of engagements for urinary independence and of sleep evaluations. We examined all cases and presented on the basis of one example on the results.

6. Ethical considerations

This study was conducted with the approval of the Medical Ethics Committee of Komatsu Municipal Hospital. When conducting the surveys, both the subject and his or her family caregiver were provided with both written and oral explanations of the purpose of the study and the ethical considerations, and their signed, written consent to participate in this study was obtained. The following were the ethical considerations: From the perspective of protecting private information, we encoded physical measurement and achieved linkable anonymity through the use of a conversion table. The data and conversion

chart were stored in a secure, locked cabinet.

Results

1. Overview of subjects (Table 1)

Consent for study participation was obtained from 12 subjects hospitalized during the survey period. Age was 77.8±15.5 (42-98) years. Diagnosis were subarachnoid hemorrhage (5 persons), brain contusion (3 persons), cerebral hemorrhage (3 persons), cerebral infarction (1 person). Prior to hospitalization, most resided in their own homes, with walking for motility, and use of toilet for urination.

2. Urination status (Table 2)

Days with indwelling urinary catheterization were 15.8

Table 1. Characteristics of participants N=12

ID	Variable			Life background			
	Age	Gender	Diagnosis	Residence	Assistance certification	Method of transfer	Method of urination[1)]
A	74	M	Cerebral contusion	Home	Not adapt	Walking	Toilet
B	86	F	Subarachnoid hemorrhage	Home	Not adapt	Walking	Toilet
C	42	F	Subarachnoid hemorrhage	Home	Not adapt	Walking	Toilet
D	74	M	Subarachnoid hemorrhage	Home	Not adapt	Walking	Toilet
E	75	F	Subarachnoid hemorrhage	Home	Not adapt	Walking	Toilet
F	85	M	Cerebral infarction	Home	Not adapt	Walking	Toilet
G	88	F	Cerebral contusion	Home	Not adapt	Walking	Toilet
H	98	F	Cerebral contusion	Care house	Adapt	Cane	Toilet Diapers
I	91	F	Subarachnoid hemorrhage	Home	Adapt	Walking	Toilet
J	75	F	Cerebral hemorrhage	Home	Not adapt	Walking	Toilet
K	88	F	Cerebral hemorrhage	Home	Adapt	Walking	Toilet Portable
L	58	M	Cerebral hemorrhage	Home	Not adapt	Walking	Toilet

1) Portable: Portable toilet

Table 2. Urination condition of participants after remova urinary catheter N=12

ID	Urinary catheter		Monitoring using a voiding diary and devices to measure residual urine volume							Interprofessional Collaboration	
	Indwelling days	Issues after removal[1)]	Monitoring period (day)	Method of urination	Day&night time frequency[2)]	Nighttime frequency[3)]	Voided volume (ml)	Residual urine volume (ml)	Daily urine volume (ml)	Urology consultation	Rehabilitation
A	9	LUTS	22	Intermittent catheterization	6	2	198.5± 93.5	234.4 ± 128.7	1735.9 ± 351.7	○	○
B	11	LUTS UTI	25	Intermittent catheterization	5	2	185.5± 96.9	230.4 ± 136.4	1352.1 ± 293.4	○	○
C	19	Not at all	3	Toilet	5	2	336.7± 137.2	16.7 ± 13.0	1538.0 ± 554.4	×	○
D	18	LUTS UTI	13	Intermittent catheterization	7	2	171.5± 75.5	233.5 ± 140.0	1488.8 ± 242.3	○	○
E	19	Not at all	4	Toilet	8	2	188.6± 53.1	28.7 ± 18.6	1323.5 ± 514.1	○	○
F	13	LUTS UTI	25	Intermittent catheterization	4	2	175.0± 131.6	227.3 ± 134.4	1477.6 ± 393.2	○	○
G	14	LUTS Reinsertion	26	Intermittent catheterization	4	2	223.4± 78.0	257.6 ± 104.8	1397.0 ± 581.7	○	○
H	8	LUTS Reinsertion	10	Intermittent catheterization	5	2	315.5± 108.3	197.1 ± 118.0	1222.5 ± 239.4	○	○
I	8	LUTS	6	Intermittent catheterization	6	2	380.9± 263.4	172.3 ± 101.8	2197.5 ± 292.6	×	○
J	4	Not at all	11	Diapers	7	2	308.9± 197.3	40.1 ± 66.2	2162.5 ± 95.5	×	○
K	63	LUTS	14	Intermittent catheterization	4	2	281.9± 215.0	281.3 ± 97.4	1317.9 ± 249.0	○	○
L	4	Not at all	4	Toilet	11	4	213.9± 160.4	26.3 ± 31.5	2184.7 ± 971.1	×	○
	15.8±15.8				8.6±6.8	2.2±0.6	248.4± 72.5	162.1 ± 102.8	1616.5 ± 364.7		

1) LUTS: lower urinary tract syndrome, UTI: urinary tract infection 2) Day time: 06:00-20:59 3) Night time: 21:00-05:59

±15.8 days, issues after removal catheters were LUTS (8 of 12 persons, 66.7%), reinsertion (2 of 12 persons, 16.7%), urinary tract infection (UTI) (3 of 12 persons, 25%). Urination methods during monitoring were intermittent catheterization (including diapers) (8 of 12 persons, 66.7%), toilet (3 of 12 persons, 25%), diapers (1 of 12 person, 8.3%). Day and night time frequency was 8.6±6.8 times/day, nighttime (9 p.m. to 5 a.m.) 2.2±0.6 times. One-time mean voided (urine) volume was 248.4±72.5 ml, one-time mean residual urine volume was 162.1±102.8 ml, daily mean urine volume was 1616.5±364.7 ml. Subjects examined in the urology consultation were 8 persons. Rehabilitation was performed for all subjects.

3. Sleep evaluation after removal indwelling urinary catheters (Table 3)

Excluding 1 person for whom there was missing data, 11 persons were analyzed. Sleep time was 5.1±2.2 hours at night (9 p.m. to 5 a.m.), 10.8±5.8 hours daily, with in-bed times of 21.0 ± 1.9 hours.

As for sleep SCAN® evaluation, information was shared in conferences between nurses and attending physicians; three (3) persons (A, C, J) were prescribed sleep medication, and two (2) persons (A, J) were reevaluated.

4. Functioning ability and health evaluation (Table 4)

Improvements at time of hospital discharged compared with start of intervention were as follows: ADL, from 21 ±11.3 points to 48±37.6 points; vitality, from 2±2.4 points to 6±2.8 points; cognition, from 14±8.8 points to 21±7.2 points.

Multiple persons used a wheelchair at time of discharge. Urinary independence was achieved for 10 of 12 persons (83.3%), who were either discharged to their own home or transferred to rehabilitation wards.

Mean hospitalization days were 41±17.6 days.

5. One case of effects due to early-period urinary independence support program (person "A")

"A" was an age 74 male. He collapsed at approximately 2:30 a.m. in his home entranceway, and was transported to hospital by ambulance. Admitted to hospital with brain contusion, acute subdural hematoma, and traumatic subarachnoid hemorrhage. Urinary catheter was inserted on hospitalization day in the high care unit (HCU), and removed after hospital-ward transfer (9 days insertion).

"A" suffered from urinary retention after catheter removal, and was examined in the urology department. Due to oral medicine and drainage catheter, incontinence volume surpassed residual urine volume and drainage volume, and urinary independence was established. Further, nurses added observations of disturbance of consciousness (Japan Coma Scale (JCS) 10-100 and JCS 2-10; JCS 10-100 at hospitalization and JCS 2-10 at ward transfer), nocturnal awakenings, daytime somnolence,

Table 3. Sleep condition of participants N=11

ID	Monitoring period (day)	Night (21:00–05:59)		Day and Night		Sleeping pills
		Sleep (h)	Awaking (h)	Sleep (h)	Awaking (h)	
A	11	0.3 ± 0.3	8.7 ± 0.3	2.7 ± 0.9	18.4 ± 0.9	○[1]
	9	4.3 ± 0.9	4.7 ± 0.9	5.5 ± 0.9	19.0 ± 1.4	
B	13	7.4 ± 0.7	1.6 ± 0.7	14.7 ± 2.4	21.3 ± 1.9	×
C	4	6.7 ± 0.2	2.3 ± 0.2	9.3 ± 0.2	21.2 ± 0.8	○[2]
D	13	4.5 ± 0.9	4.5 ± 0.9	9.6 ± 1.6	18.5 ± 1.0	×
F	7	6.7 ± 1.5	2.3 ± 1.5	18.6 ± 1.8	23.5 ± 0.7	×
G	8	8.1 ± 0.7	0.9 ± 0.7	21.3 ± 1.9	23.3 ± 0.9	×
H	8	7.0 ± 1.8	2.0 ± 1.8	16.8 ± 4.7	23.5 ± 0.5	×
I	6	5.8 ± 1.2	3.2 ± 1.2	10.2 ± 2.0	20.7 ± 1.8	×
J	6	2.7 ± 1.5	6.3 ± 1.5	4.3 ± 1.5	20.7 ± 1.2	○[1]
	17	2.9 ± 1.7	6.1 ± 1.7	4.4 ± 2.0	18.8 ± 1.8	
K	14	4.4 ± 1.7	4.6 ± 1.7	11.7 ± 2.8	23.1 ± 1.0	×
L	6	5.2 ± 0.7	3.8 ± 0.7	11.6 ± 0.8	21.5 ± 1.3	×
		5.1 ± 2.2	3.9 ± 2.2	10.8 ± 5.8	21.0 ± 1.9	

1) A physician prescribed sleep medication, which led to improvement of day–night reversal. They were reevaluation.
2) Taking sleeping pills from hospitalization

spontaneity declines, etc., and shared sleep-evaluation information in conferences with attending physicians. A physician prescribed sleep medication, which led to an increase in nighttime sleep time and improvement of day-night reversal. (Figure 1 2 3)

Discussion

In this study, for neurosurgery patients in an acute hospital who required indwelling urinary catheterization management, engagements were performed toward urinary independence, and clarification was made of the effectiveness of said engagements as well as of (related) sleep evaluations.

In this study, 10 of 12 persons (83.3%) successfully had their urinary catheter removed and regained urinary independence.

Favorable results were thus achieved, as shown in comparison with the percentages stated in two indices, (1) the care protocol of 76.5% regained urinary independence for cerebrovascular disease patients with indwelling urinary catheters seven (7) days or longer[9], and (2) the autonomous urinary function early-term evaluation of 72.7% for elderly urinary retention patients[10]. In addition, sleep evaluations were made in regards to LUTS

Table 4. Changes in daily life function evaluation of participants

ID	Daily life function evaluation						Life background			
	FIM[1]		Vitality Index		MMSE		Method of transfer	Method of urination[4]	Destination	Length of hospital stay
	Start[2]	End[3]	Start[2]	End[3]	Start[2]	End[3]				
A	18	27	0	6	13	21	Wheelchair	Toilet, Diapers	Rehabilitation ward	38
B	26	72	3	9	15	23	Walker	Toilet, Portable	Rehabilitation ward	37
C	52	124	6	10	30	29	Walking	Toilet	Home	37
D	18	30	0	5	0	16	Wheelchair	Toilet	Rehabilitation ward	31
E	18	110	6	10	—	28	Walking	Toilet	Rehabilitation ward	45
F	18	20	2	4	—	—	Wheelchair	Diapers	Rehabilitation ward	49
G	18	18	4	1	—	—	Wheelchair	Urinary catheter	Hospital	67
H	20	42	0	7	11	22	Wheelchair	Urinary catheter	Hospital	44
I	2	18	0	5	16	—	Wheelchair	Diapers	Hospital	17
J	18	21	0	5	—	—	Wheelchair	Toilet, Diapers	Rehabilitation ward	30
K	18	22	0	3	—	8	Wheelchair	Diapers	Rehabilitation ward	76
L	22	72	0	8	14	—	Walking	Toilet	Rehabilitation ward	17
	21±11.3	48±37.6	2±2.4	6±2.8	14±8.8	21±7.2				41±17.6

1)FIM: Functional Independence Measure 2) Start: At the time of intervention 3) End: At the time of discharge
4) Portable: Portable toilet −: Unknown

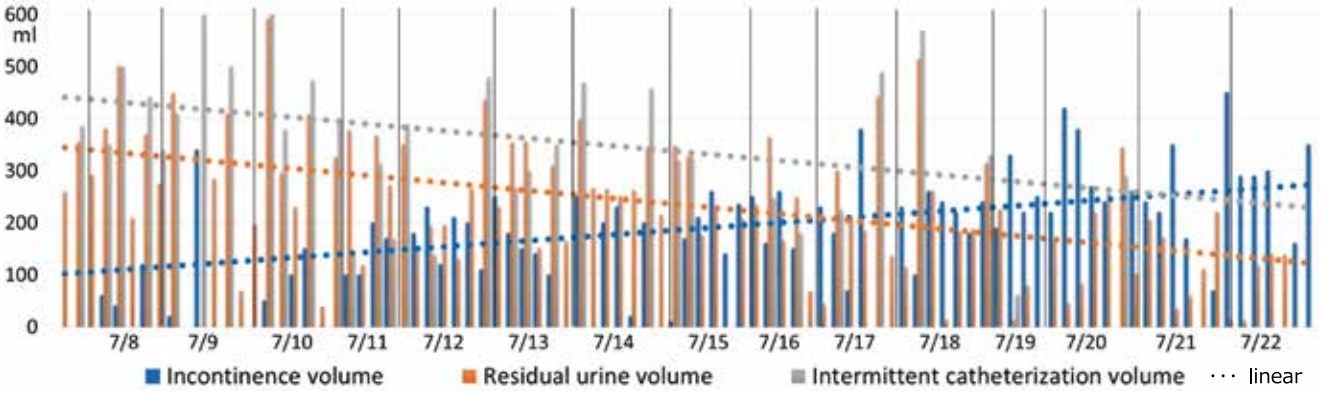

Figure1 Monitoring using a voiding and devices to measure bladder capacity and residual urine volume

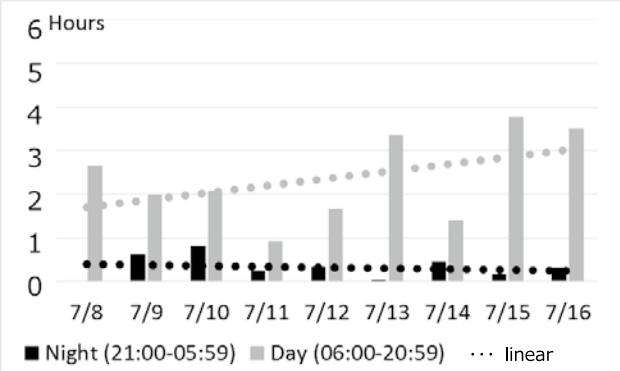

Figure2 Sleep evaluation during the monitoring

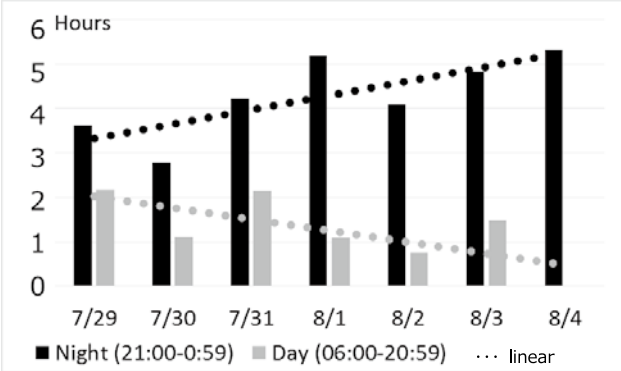

Figure3 Sleep evaluation after interprofessional conferences

characteristic of acute-phase neurosurgical patients: there was objective ascertainment of sleep disorders (day-night reversal, etc.), and all related information was shared with attending physicians during interprofessional conferences. In addition to this nursing intervention, there were also linkages with the urology and rehabilitation departments. This widespread linkage of efforts among different professionals is also thought to have influenced the (beneficial) results of this study.

Urinary independence for cerebrovascular disease patients usually requires approximately two (2) months[6], and easy use of indwelling catheters are factors preventing patient discharge to their own home. These facts make early urinary catheter removal desirable[4]. The 10 persons in this study for whom urinary independence was established were either discharged to their own homes or transferred to rehabilitation wards. Having nurses engaged in urinary independence support from an early stage of treatment is thought to have contributed to long-term maintenance and expansion of daily-life functions through the acute, recovery, and maintenance phases.

Study results this time suggest that future investigation will be required regarding effects of early intervention on acute-phase neurosurgical patients, as well as on other related issues including sleep evaluation, interprofessional conferences, etc.

Conclusion

The following items were clarified as results of engagements to support urinary independence for neurosurgery patients in an acute hospital who require indwelling urinary catheterization management.

1. Engagements directed towards urinary independence resulted in improvements in daily life functioning ability and health evaluation, as well as in release to own home or transfer to rehabilitation wards.

2. Sleep evaluations enabled objective ascertainment of characteristic sleep disorders (day-night reversal, etc.) of acute-phase neurosurgery patients, and sharing of information in conferences, with the suggestion that sleep evaluations may have contributed to sleep-disorder improvements.

In these ways, our study results suggested the efficacy of engagements by nurses in acute hospitals toward urinary independence of patients and of sleep evaluations.

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急性期の脳神経外科疾患患者に対する尿道カテーテル留置からの離脱および自排尿確立にむけた取り組みと睡眠評価による効果

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