

ORIGINAL ARTICLE

Quantitative and qualitative investigation of the stress experiences of intensive care unit patients mechanically ventilated for more than 12 hr

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Funding information

Japan Society for the Promotion of Science,
Grant/Award Number: 23593264; Japan
Society for the Promotion of Science, Tokyo,
Japan (KAKENHI Grant in Aid for Scientific
Research (C))

Abstract

Aim: The aim was to qualitatively and quantitatively clarify the stress experiences of patients who were mechanically ventilated in an intensive care unit (ICU) for more than 12 hr.

Methods: The participants were adult patients without cognitive impairment who were mechanically ventilated in a general ICU for more than 12 hr. The Japanese version of the ICU Stressful Experiences Questionnaire (ICU-SEQJ) survey was performed before subjects were discharged from the ICU to collect narratives about how they felt and what they thought during their ICU stay. The results were analyzed in a collective and complementary way by dividing ICU-SEQJ scores into quartiles and comparing the first (low stress experience group) and third quartiles (high stress experience group).

Results: A total of 96 subjects were enrolled in the study, with 25 scoring in the high stress experience group and 24 in the low stress experience group. The high stress experience group had significantly longer duration of intubation, higher amounts of analgesics and sedative drugs, higher C-reactive protein, lower level of deepest sedation and greater absence of medical history than the low stress experience group. Analysis of the subjects' narratives revealed "Unbearable holistic discomfort", "Pain of being unable to control myself as before" in the high stress experience group and "Responding by giving meaning" in the low stress experience group.

Conclusions: Nurses must recognize that long intubation hours and invasive procedures are subjective stress experiences that may cause patients to suffer holistic discomfort and lose their sense of control.

KEYWORDS

intensive care unit, mechanical ventilation, mixed method, patient experiences, patient stress

1 | INTRODUCTION

Intensive care unit (ICU) patients who are mechanically ventilated often experience discomfort, and more than 80% of patients who remember their ICU experience complain of

being unable to talk because of tubes, thirstiness, feeling tense and being unable to control things (Rotondi et al., 2002). A survey conducted in Japan also revealed that 80% of such patients experienced thirstiness and nearly 70% felt that restricted movement, difficulty in conversation and pain

caused by tubes induced a certain level of stress (Takashima et al., 2017). The stress and pain caused by endotracheal tubes, being unable to talk and restricted movement can be extremely strong. Moreover, it has been pointed out that one in four ICU patients suffer from depression and anxiety not only during their stay in the ICU, but also after discharge (Burry et al., 2015; Davydow, Gifford, Desai, Bienvenu, & Needham, 2009), which can lead to long-term aggravation of cognitive and motor functions (Iwashyna, Ely, Smith, & Langa, 2010; Pandharipande et al., 2013; Weinert & Meller, 2006). Furthermore, it has been reported that the quality of life (QOL) of patients 5 years after discharge from the ICU is significantly lower than that of the general population (Cuthbertson, Roughton, Jenkinson, MacLennan, & Vale, 2010). Moreover, post-traumatic stress disorder (PTSD) develops in 25–44% of patients within 6 months of discharge from the ICU, further reducing their QOL. Although the risk factors for PTSD have not been clarified, fearful experience in the ICU, benzodiazepine dosage, lack of memory of the ICU stay and delusional memories have been pointed out as possible factors (Jackson et al., 2014; Parker et al., 2015).

The 2010 Conference of the Society of Critical Care Medicine identified motor dysfunctions, cognitive dysfunctions and mental disorders that occur during or after a stay in the ICU or after discharge from hospital as disorders to be widely recognized as post-intensive care syndrome (PICS) (Needham et al., 2012). The risk factors of PICS include immobility during stay in the ICU, the number of days of mechanical ventilation, deep sedation, delirium and hypoglycemia (Harvey & Davidson, 2016). Health workers need to provide care considering the long-term prognosis until social rehabilitation, recognizing not only the disease that caused ICU admission and any invasive treatments, but also that the immobility and mental stress caused by ICU admission can be an invasion. Early rehabilitation (Kayambu, Boots, & Paratz, 2013; Morris et al., 2016) to prevent PICS and the use of an ICU diary have been effective in reducing depression and anxiety among ICU patients after discharge (Jones et al., 2010), and a number of studies are being conducted in this field. Therefore, nursing interventions to reduce stressful experiences during ICU stays and maintaining and improving QOL after discharge need to be considered as part of treatment and care performed in ICUs. A number of studies have been performed to survey stress experiences in ICU patients. However, the individual experiences of each ICU patient are different (Olsen, Nester, & Hansen, 2017). To clarify the details of actual situations and the factors associated with stressful experiences, both the experiences of ICU patients and the results of objective evaluations should be analyzed, which could allow more personalized interventions. This could contribute to improvements

in the QOL of patients after they are discharged from the ICU. Therefore, in this study, we aimed to clarify, both qualitatively and quantitatively, the stress experiences of ICU patients who were mechanically ventilated for more than 12 hr through collective analysis and discussion of patients' narratives about their levels of comfort during their stay in the ICU.

2 | METHODS

2.1 | Research design

We employed a mixed study design in which quantitative data based on scales and qualitative data to elucidate patients' experiences were collected simultaneously, to clarify the stress experiences of ICU patients; the quantitative data were explained complementarily by the qualitative data. "Stress experience" was defined as a response in which a patient feels physical and psychological burdens from a stressor.

2.2 | Participants and data collection

The participants employed for this study were patients who were mechanically ventilated for more than 12 hr in the general ICU of University Hospital A from January 2013 to March 2014. A duration of 12 hr of mechanical ventilation was considered appropriate since the median number of intubation hours of ICU patients at University Hospital A in the preceding year was 13.8 hr. Patients who had delirium or cognitive impairment, a history of re-admission to the ICU and of re-intubation, were unable to communicate, and did not have memory of their stay in the ICU at all at the time of the interview were excluded. In the case that trained nurses judged it necessary to screen for delirium, the Confusion Assessment Method for the ICU (CAM-ICU) was used, and such patients were excluded from the study.

To quantitatively evaluate stress experiences in the ICU, we used the ICU Stressful Experiences Questionnaire (ICU-SEQ) after receiving permission from the author, Dr. A.J. Rotondi. The ICU-SEQ was translated into Japanese and then reverse-translated for use in this study. Since this scale includes question items about memory and is able to deal with the problem of missing memory, it was considered appropriate for this study. However, since this scale was developed in the United States in 2002, the researchers examined the validity of the survey items for present conditions in Japan through a pretest. As a result, the following items were added: "Aspiration was hard", "I was hungry" and "I wanted to go to the restroom but I couldn't". Therefore, a total of 34 items comprised the Japanese version of the ICU-SEQ (ICU-SEQJ). These items were added because

the pretest patients complained of pain with aspiration and to assess stress related to excretion and meals since hospital meals start with breakfast on post-operative Day 1 in the case of heart surgery, for which many study subjects were expected to be included. Each question item was rated on a five-point Likert scale from “I had no stress at all” (1 point) to “I experienced extreme stress” (5 points) with “I don’t remember” scoring 0 points. Higher total scores indicate stronger stress experience and scores range from 34 to 170 points. Cronbach’s α coefficient of the 34 items was 0.90 and the reliability of the scale was confirmed (Takashima et al., 2017).

For qualitative data, a semi-structured interview was performed by asking the participants, “How did you feel and what did you think during your stay in the ICU” after the ICU-SEQJ was completed. The interviewers were enrolled in or had completed a master’s degree in nursing and were ICU nurses experienced in qualitative investigations who had received interview training.

Data for the following participant characteristics were collected from the patients’ medical records: age, sex, employment status, marital status, admission status (planned or emergent), disease name, medical history, reason for admission (surgical form, status), hours of mechanical ventilation, vital signs, In-Out balance, treatment (drugs such as analgesics, sedatives or pressor agents), presence of complications, deepest level of sedation and mean sedation value on the Richmond Agitation-Sedation Scale (RASS), strongest pain value and mean pain value on the Numeric Rating Scale (NRS), recovery status, caloric intake status, blood examination data (hematocrit, Hb, white blood cells, K, Na, C-reactive protein (CRP), albumin), height, weight, smoking history, number of days of ICU stay and number of days of hospitalization.

From the time when discharge from the ICU was determined to actual discharge, the researchers and nursing managers confirmed that the patient was able to sit squarely or stand after tube removal, had stable circular breathing and mental status, and that the survey would not be an excessive burden on the patient. Each patient was interviewed in a semi-private room on the ICU ward for 5 to 20 min.

2.3 | Quantitative data analysis

In order to clarify the characteristics of patients with high and low total stress scores, descriptive statistics for quantitative data and stress experience items were compared by dividing the total ICU-SEQJ score into first and third quartile categories. A Student’s *t*-test was performed to confirm the normality of the data and the level of significance was set at 5%. The statistical analysis software SPSS for Windows ver.23 (IBM, Armonk, NY, USA) was used for all data analyses.

2.4 | Qualitative data analysis

The qualitative data analysis process consisted of the following steps. First, the recorded interviews were transcribed and read to get an overall understanding. Then, the transcribed text was divided into meaningful units. The meaningful units were extracted and encoded. Based on their similarities and differences, the initial codes were then classified into subcategories and categories. Maximum variation sampling, member checking, peer questioning and cross-examination were used to ensure the trustworthiness, dependability, and credibility of the data, respectively. In order to analyze the characteristics of patients with particularly high and low stress experiences based on the qualitative data, the total ICU-SEQJ scores of the first and third quartile groups were compared and analyzed. The third quartile and the first quartile were assumed to represent the high stress experience group and low stress experience group, respectively.

2.5 | Ethical considerations

This study was approved by the ethics review board of the study facility (reference no: 24-016 6782). The participants were informed both orally and in written documents that they would not suffer disadvantages in medical treatment and nursing even if they declined to join the study, that all data and information were protected and that they could freely choose to discontinue their participation in the study at any prior time. Informed consent to participate was obtained from all participants. The interviewers were ICU nurses who received training on conducting personal interviewing from the researchers. Nurses responsible for the care of the concerned patient did not interview that patient. During the interviews, the interviewers observed the expressions and responses of the participants so as to confirm that the interview was not a mental or physical burden. In the case that the interview was deemed to be a burden on the participants, the interview was halted.

3 | RESULTS

3.1 | Summary of the participants

Informed consent to participate in the study was obtained from 96 participants, consisting of 74 men and 22 women with an average age \pm standard deviation (SD) of 69.4 ± 11.5 years. Sixty-four participants (66.7%) indicated post-cardiovascular surgery management as a reason for ICU admission, which accounted for the highest percentage. Other reasons included burn injury and infectious diseases. Seventy-one participants (74.0%) were planned admissions and 25 (26%) were emergency admissions (Table 1). The average duration of intubation was 54.7 ± 60.0 hr, ranging

TABLE 1 Characteristics of mechanically ventilated patients using the Japanese version of the Intensive Care Unit (ICU) Stressful Experiences Questionnaire (n = 96)

Characteristics		All		
		n	mean \pm SD	p value
Sex	Men	74	86.8 \pm 24.7	
	Women	22	90.3 \pm 24.7	.551
Marital status	Married	64	89.0 \pm 27.1	
	Other	32	82.7 \pm 27.1	.334
Employment status	Employed	46	92.8 \pm 24.8	
	Unemployed	50	82.5 \pm 23.8	.034
Smoking status	Smoker	41	85.8 \pm 24.9	
	Non-smoker	55	88.7 \pm 23.4	.565
ICU admission	Emergent	25	93.9 \pm 27.9	
	Not emergent	71	85.4 \pm 22.2	.031
Medical history	Present	74	84.8 \pm 22.7	
	Absent	22	96.3 \pm 26.7	.048
Treatment at admission	Cardiovascular surgery	64	85.4 \pm 21.4	
	Digestive surgery	18	82.9 \pm 30.2	
	Other	14	98.2 \pm 23.3	.185

SD, standard deviation.

from 12.7 to 303.4 hr, and the average ICU stay was 6.8 \pm 5.9 days. As for recovery status, 53 participants (55.2%) took a passive sitting position on the day after ICU admission, 39 (40.6%) took a standing position during their ICU stay and 61 (63.5%) started food ingestion.

3.2 | ICU-SEQJ

The total mean score \pm SD of the ICU-SEQJ was 87.57 \pm 23.9 points, and the mean score was 2.6 \pm 0.57 points (three points was considered moderate). Seventy-six (84.4%) participants answered “I clearly remember” for at least one item, 28 (29.2%) answered “I don’t remember” for at least one item, and 10 (10.4%) answered “I don’t remember” for seven items related to mechanical ventilation.

Table 2 shows a comparison of the overall results and results for the first and third quartiles based on the mean item scores, excluding responses of “I don’t remember”. The mean score \pm SD of all stress experience items in the high stress experience group (3.35 \pm 0.71) was significantly higher than that of the low stress experience group (1.87 \pm 0.44), except for “I had difficulty breathing because of the endotracheal tube” and “Aspiration was hard”. “I was thirsty” scored 3.13 points in the low stress experience group and all other items scored below three points. Five participants in the low stress experience group and two participants

in the high stress experience group answered “I don’t remember” for items about mechanical ventilation. For all participants, the item mean values were below three points (meaning that the participants felt a certain level of stress), and in the high stress experience group, eight out of 25 participants (32%) suffered moderate or extreme nightmares. Among the items newly added to the ICU-SEQJ, “Aspiration was hard” was the seventh most stressful experience among all the items, but it was not as stressful as “I felt hungry” and “I wanted go to the rest-room but I couldn’t”.

3.3 | Comparison of related factors between groups (Table 3)

The high stress experience group scored significantly higher in having no previous medical history ($p = .002$), had longer intubation ($p = .005$), a shallower level of deepest sedation ($p = .035$), higher total narcotic drug consumption ($p = .000$) and higher CRP value just before tube removal ($p = .000$) than the low stress experience group. For the high stress group, the strongest pain based on the NRS was higher (3.2 vs. 2.1) and the emergency admission rate was higher (48% vs. 25%) than for the low stress group, but these differences were not significant.

3.4 | Comparison of participant experiences between groups

For experiences of ICU patients who were mechanically ventilated for more than 12 hr, certain characteristics were seen in the high stress experience and low stress experience groups (Table 4).

3.5 | High stress experience group

The high stress experience group experienced “Anxiety and fear for myself being threatened” as indicated by “I felt that I was going to die” and “It was like a hell that I have never experienced”, and “Unbearable holistic discomfort” including “Unbearable physical painful” such as “Pain all around my body” and “Respiratory discomfort that suggests death”. Moreover, they experienced “Hardship of being unable to express myself” as indicated by “I felt difficulty in talking because of the tube set in my throat”, “I was unable to call a nurse because my hands were tied” and “It was difficult to converse in writing because my hands were shaking”, and “Pain of being unable to control myself as before” because of “Pain of being restricted from freedom” and “Anxiety for different behaviors in different everyday life” related to excretion and walking. Further, they made comments such as

TABLE 2 Ranking of stress experiences of patients who remembered their stay in the intensive care unit

Ranking	Experience	All	Q3	Q1	Q1 vs. Q3
					<i>p</i> value
1	It was stressful being thirsty	3.67	4.20	3.13	.000
2	It was stressful not being able to talk	3.51	4.48	2.15	.002
3	I felt discomfort caused by the endotracheal tube	3.51	4.42	2.17	.003
4	It was stressful not being able to move freely because of the tube and infusion	3.39	4.32	2.67	.000
5	It was stressful having difficulty talking	3.38	4.40	2.46	.000
6	The endotracheal tube was uncomfortable	3.33	4.36	1.84	.006
7	Aspiration was hard	3.31	4.08	2.55	.062
8	I found the pain stressful	3.10	3.56	2.50	.010
9	I felt tense	3.03	3.76	2.08	.000
10	It was stressful not being able to control myself	3.01	3.64	2.38	.023
11	I felt scared	2.90	3.80	1.54	.000
12	It was stressful having difficulty swallowing	2.82	3.96	1.83	.000
13	It was stressful not being able to sleep	2.69	3.52	2.00	.001
14	It was stressful not being able to fall asleep	2.65	3.56	2.08	.000
15	I felt severe pain caused by the endotracheal tube	2.64	3.58	1.95	.002
16	It was stressful not being able to inhale sufficiently from the endotracheal tube	2.58	3.17	1.94	.047
17	It was stressful waking up in the middle of the night	2.53	3.44	1.5	.70000
18	I was depressed and felt down	2.46	3.48	1.50	.000
19	I could not stop thinking about death	2.45	3.16	1.71	.000
20	I felt anxious when there were no staff nearby	2.41	3.20	2.13	.001
21	I felt anxious about tracheal intubation	2.33	3.38	1.32	.042
22	I found the noise stressful	2.31	2.76	1.92	.000
23	I was unable to sleep because of the endotracheal tube	2.26	3.36	1.48	.001
24	I wanted to go to the restroom but I couldn't	2.21	2.52	1.75	.029
25	I had difficulty breathing because of the endotracheal tube	2.19	3.00	1.55	.207
26	I felt as though something bad was going to happen	2.15	2.76	1.61	.004
27	I was hungry	2.10	2.44	1.96	.000
28	I felt lonely	2.09	2.96	1.38	.010
29	I was in a state of panic	2.08	3.00	1.48	.000
30	I felt lonely not being able to see my spouse, relatives, friends	2.05	2.72	1.50	.001
31	I found the treatment in the ICU stressful	1.98	2.68	1.57	.000
32	It was difficult to breathe after the endotracheal tube was removed	1.95	2.13	1.43	.036
33	I had headaches	1.67	1.96	1.33	.000
34	I had nightmares	1.55	2.04	1.29	.000
	Average	2.60	3.35	1.87	.000
	SD	0.566	0.706	0.444	

n: All = 96, Q1 = 24, Q3 = 25; Scores: Likert 5 ("I experienced extreme stress") to 1 ("I had no stress at all").

t-test

SD, standard deviation.

"I became confused with the relationship between my brain and heart", "I felt strange and like there was a gap between my body and mind", and indicated "Hardship of

feeling strangeness of a gap between the body and mind", "I lost my memory first so I was very confused and scared", "Feelings of guilt because of acting

TABLE 3 Comparison of intensive care unit admission status between patients in the first and third quartiles

Item	Quartile	n	Mean value	SD	p value
Age (year)	Q ₁	24	72.2	9.2	.088 ^a
	Q ₃	25	66.4	13.9	
Intubation duration (min)	Q ₁	24	41.7	53.9	.005 ^a
	Q ₃	25	92.9	67.1	
Deepest sedation: RASS	Q ₁	24	−3.8	1.3	.035 ^a
	Q ₃	25	−2.9	1.5	
Total sedative dose (kg/m ² mg)	Q ₁	24	134.0	121.3	.000 ^a
	Q ₃	25	512.8	424.6	
Total fentanyl dose (kg/m ² mg)	Q ₁	24	49.5	82.2	.000 ^a
	Q ₃	25	320.7	309.6	
Total consumption of catecholamine (mg)	Q ₁	24	440.0	882.3	.975 ^a
	Q ₃	25	433.0	660.3	
Strongest pain (NRS)	Q ₁	24	2.1	2.7	.139 ^a
	Q ₃	25	3.2	2.3	
CRP at admission (mg/dL)	Q ₁	24	1.4	2.0	.362 ^a
	Q ₃	25	5.8	7.0	
CRP just before extubation (mg/dL)	Q ₁	24	6.1	3.5	.000 ^a
	Q ₃	25	12.7	6.9	
CRP in the morning of the day of extubation (mg/dL)	Q ₁	24	9.8	6.1	.386 ^a
	Q ₃	25	8.5	4.3	
Number of days of ICU stay (days)	Q ₁	24	7.2	6.8	.300 ^a
	Q ₃	25	9.1	8.0	
Number of days of hospitalization (days)	Q ₁	24	51.9	38.5	.605 ^a
	Q ₃	25	60.5	72.4	
			Yes	No	
Presence of medical history (n)	Q ₁	24	22	2	.003 ^b
	Q ₃	25	14	11	
Emergency admission status (n)	Q ₁	24	6	18	.084 ^b
	Q ₃	25	12	13	
Presence of employment (n)	Q ₁	24	8	16	.095 ^b
	Q ₃	25	13	12	

Note: Sedatives are fentanyl and propofol and dexmedetomidine hydrochloride.

CRP, C-reactive protein; NRS, Numeric Rating Scale; RASS, Richmond Agitation–Sedation Scale.

^aChi-squared test.

^bt test.

violently and hitting somebody” and “Pain accompanied with gap in perception, feeling and memory”. Such pain and hardship were narrated as “Relief and peace from the care of nurses” such as “A nurse encouraged me and held my hand” and “Feeling of being supported by staff members” such as “Feeling that I overcame the situation because I was supported by staff members”, which revealed that they experienced “Conversion of pain to a sense of relief” such as “Sense of relief at the time of tube removal” and “Conversion of a hard experience to pleasure”.

3.6 | Low stress experience group

For the low stress experience group, “Physical pain” such as “Hardship of physical pain”, “Pain of aspiration” and “Hardship of being unable to swallow”, and “Psychological pain” such as “I have been tense” and “Unstable feeling that my heart cannot match my body” were mentioned, which revealed that the patients experienced “Conversion of pain to a sense of relief”. Some common characteristics in the low stress experience group were “Accepting the reality because

TABLE 4 Narratives of intensive care unit (ICU) patients in the third and first quartiles

	Code	Subcategory	Category
Q ₃	Confusion/perplexity	Anxiety and fear for myself being threatened	Unbearable holistic discomfort
High stress experience group	Fear of life being threatened		
	Anxiety for uncertain future		
	Feeling of being unable to express experience in words		
	Pain all around my body	Unbearable physical pain	
	Pain of the intubation tube		
	Respiratory discomfort that suggests death		
	Unbearable pain of palpitations		
	Hardship of being unable to talk	Hardship of being unable to express myself	Pain of being unable to control myself as before
	Hardship of restriction by mitten	Pain of being restricted from freedom	
	Anxiety of excretion in bed	Anxiety over different behaviors than in everyday life	
	Difficulty in posture adjustment		
	Hardship of being unable to walk		
	Hardship of feeling a gap between the body and mind	Gap in perception and feeling	Pain accompanied with gap in perception, feeling and memory
	Fear of scattered memories		
	Feeling of guilt like acting violently		
	Stress of unfamiliar place, sounds and light	Stress of unfamiliar environment	Environmental stress of ICU
	Renewed awareness of the value of health	Awareness of the value of health	Renewed awareness of the value of health
	Sense of security because of the presence of nurses	Relief and peace because of the care of nurses	Feeling of being supported by staff members
	Sense of relief being with familiar people		
	Feeling of overcoming and being encouraged with my hands held	Feeling of overcoming and being supported	
	Feeling that I overcame the situation and was supported by staff members		
	Sense of relief with extubation	Conversion of pain to relief	Conversion of pain to sense of relief
	Conversion of a hard experience to pleasure		
	Sense of security in being in the ICU	Sense of security for ICU	Sense of security in being in the ICU
	Gratitude for the kindness of nurses	Gratitude for staff members	Positive emotions toward team and staff members
	Gratitude for the staff members and team		
	Consideration of the hardship of the staff members working at the ICU	Consideration of staff members	
	Satisfaction with treatment		
	Hope for recovery	Hope for recovery	Hope for the future
	Hope for enjoying hobbies		

TABLE 4 (Continued)

	Code	Subcategory	Category
Q ₁	Hardship of being unable to move	Uncontrollable discomfort	Uncontrollable discomfort
Low stress experience group	Hardship of physical pain	Physical pain	Physical pain
	Pain of aspiration		
	Hardship of being unable to drink		
	Experience of surprise and strangeness	Anxiety/tension	Psychological pain
	Retention of tension		
	Mysterious feeling of being unable to tell what is what	Strange feeling that is not realistic	Strange feeling
	Stress of having constant visitors	Stress of human environment	Environmental stress of ICU
	Anxiety over unknown sounds	Stress of physical environment	
	Happiness at the time of extubation		Conversion of pain to sense of relief
	Happiness with the feeling of recovery	Conversion to relief because of the pain	
	Make effort for what can be expected	Responding by providing insight	Responding by giving meaning
	Persuading myself to entrust everything to the nurse	Persuading myself to entrust	
	Persuading myself that it is necessary for me	Understanding by giving meaning	
	Feeling more comfort than expected	Comfort compared with prediction	
	Satisfaction with involvement	Satisfaction with involvement	Positive emotion toward team and staff members
	Sense of security because of staff members' support	Sense of security because of staff members' support	
	Hope for recovery	Hope for recovery	Hope for the future
	Hope for becoming able to enjoy hobbies		

Distinctive categories are shown in bold.

it is necessary for my body” and “Responding by giving meaning” as indicated by “Understanding by giving meaning”, “Persuading myself to entrust” and “Responding by providing insight”.

3.7 | Both groups

“Environmental stress of ICU” as indicated by “I felt stress when somebody called on me when I wanted to be left alone”, “Unknown noise got on my nerves” and “The light was dazzling”. Meanwhile, responses such as “I felt relieved because all the necessary equipment and staff members were there” and “The care was more generous than I imagined” were observed as “Sense of security in the ICU” in both groups. Moreover, “Positive emotions toward the team and staff members” as indicated by “I relied on knowledgeable staff members”, “I felt relieved with the rapidity of the support”, “I have realized that health is really important” and “Renewed awareness of the value of health” were observed, while “I want to enjoy my life doing what I like”, “I want to recover and become able to walk through rehabilitation as

soon as possible” and “Hope for the future” were also mentioned.

4 | DISCUSSION

The present study showed that ICU admission patients experience pain as holistic physical, mental, and spiritual pain and as an inability to perform self-control of one's activities. However, they also experience a feeling of liberation from pain, being supported, and dealing with the experience by attaching meaning to it as an effective means of reducing the stress. This was shown by comparing the high stress group and the low stress group rather than by analyzing the ICU-SEQ or the unpleasant and pleasant memories. ICU admission was a causal factor of stress in prior studies, but in the present study it was not significantly related.

For the high stress experience group of ICU patients in this investigation, strong stress was observed for difficulty in conversation in conjunction with endotracheal intubation, discomfort caused by the endotracheal tube and thirstiness.

This is because intubation hours were long and their deepest level of sedation was only moderate, and the authors presume the patients were able to respond to nurses' calls. Since CRP just before tube removal was high in the high stress experience group, we believe acute stress reaction caused by physical invasion was experienced as patient stress among this group. Samuelson et al. (2007) investigated the stress experiences of 250 ICU patients using the ICU-SEQ and reported that subjects had suffered endotracheal intubation, being unable to talk and pain, and the causal factors of stress increasing with light sedation and with length of intubation time were similar to our findings in the present study; however, differences with the present study include the absence of a relationship between time spent in the ICU and the occurrence of nightmares in contrast to the indication of its presence in prior studies. The absence of a relationship between number of days in the ICU and the strength of stress despite the pain of intubation indicates that the admission environment itself was not a causal factor and the qualitative data suggest that there was no stress-inducing care while in the ICU as shown in the report by Samuelson (2011). The absence of that relationship may have been influenced by a feeling of having overcome the stress due to a feeling of being supported by staff. The low rate of nightmare occurrence is characteristic of the present study. The rate tended to be larger in the high stress group but overall the average rate was minimal. Samuelson et al. (2006) reported that nightmares were related to deep sedation and midazolam, but this relationship may have been precluded in the present study by the sedative and analgesic use of fentanyl, propofol and dexmedetomidine.

In our study, narcotic drug consumption was significantly larger in the high stress experience group although pain was not significantly higher, which suggests that the required treatment was administered presumably as pharmacotherapy. However, the contents of the participants' narratives indicated that they experienced holistic pain that threatened them and made them think that their death was coming due to physical pain; therefore, it is supposed that pain control by drugs alone is insufficient for patients with long endotracheal intubation hours. The mean NRS value was 3.2 even in the high stress experience group, and pain control was appropriately accomplished. However, the Critical Care Pain Observation Tool and the Behavioral Pain Scale for patients who cannot self-report their answers were not used in the present study. A systematic assessment of pain is effective for pain control (Georgiou, Hadjibalassi, Lambrinou, Andreou, & Papathanassoglou, 2015). Since qualitatively severe pain was expressed in the systematic assessment unlike in the objective indices, it is necessary to use scales even in cases where self-reporting is not possible and to perform comprehensive assessment that does not only rely on

scales, such as observation of patients' expressions, respiratory status and physical conditions.

Restriction from freedom because of difficulty in conversation and physical restriction due to endotracheal intubation and inconvenience in behaviors in everyday life such as excretion or posture adjustment were experienced as uncontrollable pain. Samuelson (2011) investigated unpleasant memories of ICU patients and reported that most patients complained about environmental factors such as suppression and obstacles caused by the intubation tube and other devices. Nurses should understand that procedures required for treatment and safety management during ICU admission often cause pain to patients. Patak, Gawlinski, Fung, Doering, and Berg (2004) reported that 62% of patients who were mechanically ventilated felt strong frustration about communication, which agrees well with our finding that being unable to talk caused extremely strong stress in the high stress experience group. Yes/no answers, lip reading and limb movements have been frequently used as communication methods in ICUs in the United States (Happ et al., 2011). Stovsky, Rudy, and Dragonette (1988) reported that patients who were accustomed to using communication boards before surgery were satisfied with that method after surgery. It is necessary to establish a way of grasping a patient's level of pain when they have difficulty in conversation due to endotracheal intubation, uncontrollable pain and thirstiness. In the case of elective operations, it would be effective to explain to the patient before surgery that they will have difficulty talking due to endotracheal intubation after the surgery, and to discuss their preferred methods of communication beforehand. Happ et al. (2015) developed a training program, "The Study of Patient-Nurse Effectiveness with Assisted Communication Strategies", that describes concrete methods and knowledge intended for mechanically ventilated patients. It has been reported that intervention using this program improved satisfaction among nurses, but among patients, pain, bed sores, suppression rate and the number of days of ICU stay were not reduced. Establishing measures that lead to improvements in the quality of patient care through improved communication between nurses and patients under stress is required.

Pain in the high stress experience group was experienced as holistic discomfort, in which anxiety and fear threatened the patients themselves and overlapped with physical pain. Above all, uncertain fear, anxiety and confusion were expressed. Missing memory during intubation was seen in 10% of the high stress experience group, and "Pain accompanied with gap in perception, feeling and memory" such as strange feelings and a gap between the body and mind was mentioned in both the high and low stress experience groups. Delusional memories and missing memories during an ICU stay are factors of PTSD after discharge (Jones,

Griffiths, Humphris, & Skirrow, 2001). A survey on the memory of nine patients that recalled their ICU stay 3 months after discharge revealed that patients remembered various experiences, such as being under mechanical ventilation, during their hospital stay and after discharge. Moreover, it has been reported that patients frequently have inaccurate memories during their stay in the ICU and many suffer PTSD even 12 months after discharge (Lof, Berggren, & Ahlstrom, 2006). Furthermore, another survey on the memories of mechanically ventilated patients performed 5 days after discharge from the ICU investigated facts, feelings, emotions and delusional memories such as nightmares and hallucinations using an ICU memory tool, and reported that 34% of the participants suffered delusional memories (Samuelson et al., 2006) while other surveys reported that 21.1% of patients had delusional memories in interviews performed 2–3 days after discharge (Rundshagen, Schnabel, Wegner, & am Esch, 2002). In this study, interviews were performed before the participants were discharged from the ICU, and therefore, realistic narratives of their experiences were likely obtained from most of them. In this study, patients with delirium were excluded from participating. It has been reported (Svenningsen et al., 2014) that a significantly high rate of delusional memory in patients with delirium was found in interviews 1 week after discharge from the ICU. It will therefore be necessary to investigate how experiencing stress while in the ICU is related to delirium. Ringdal, Plos and Bergdom (2008) reported that surrealistic memories during ICU admission are balanced by positive experiences. Since the patients in this study had many positive experiences, we believe it is meaningful to listen to their narratives about memories that remain even after they are discharged from the ICU. Since the ICU environment itself can be a stressor, it is necessary to consider that the presence of nurses, including any treatment and care given, which are part of the human environment, may cause a strong emotional response among patients and lead to surrealistic memories. Furthermore, it is necessary to recognize motor dysfunction, cognitive dysfunction and mind disorders that may develop after discharge from the ICU as PICS, and to investigate the actual situations of patients, including their experiences during and after ICU admission.

This study revealed that patients in the low stress experience group responded to their situations by providing insight, recognizing that hospitalization in the ICU was necessary or entrusting everything to nurses and doctors in some cases. As a related factor, it is possible that the number of patients with a medical history and living with a disease might have influenced the results. The feeling of control is lost when stressors cannot be controlled. ICU patients experience fear and tension that they may not be able to deal with due to various stressors, and they can encounter difficulty in

expressing their needs. It is necessary to confirm how patients recognize their situation, if they feel their situation is possible to deal with and how they respond to their situation. In order to achieve this, clear information must be given to patients before ICU admission to reinforce the recognition of reality during ICU stay and to establish appropriate communication so that the needs of the patient can be determined. In recent years, the ABCDEFGH bundle has been proposed for PICS prevention (Davidson, Harvey, Bemis-Dougherty, Smith, & Hopkins, 2013). This bundle includes adjustment of care and communication and exercise therapy at an early stage and family intervention. In addition, we believe support that enables patients to participate in their own treatment and deal with their situation independently is also an important element. It has been reported that for patients with a long-term ICU stay and whose memories were broken or distorted, an ICU diary in which nurses record events and take photographs reduced depression and anxiety among the patients after discharge from the ICU and improved their QOL (Backman, Orwelius, Sjoberg, Fredrikson, & Walther, 2010; Knowles & Tarrier, 2009).

Positive contents such as conversion to relief triggered by hardship, positive emotions toward the team and staff members, a sense of security from being in the ICU and hope for the future were included in the narratives of both the high and low stress experience groups that were not clarified by their ICU-SEQJ scores. A survey conducted by Samuelson (2011) revealed that 100% of mechanically ventilated ICU patients had unpleasant memories and 59% had pleasant memories, and the contents included physical distress, emotional peace and care service. Although the participants were not asked specifically about pleasant memories in our survey, a number of positive experience comments were obtained in the interviews. Participants with particularly strong stress experiences felt a sense of relief triggered by unbearable hardship, and this, along with the support of staff members, helped them overcome the situation. Kolcaba (2003) defined “comfort” as an experience of a person who is strengthened by the need for relaxation, relief and transgression being satisfied in physical, psycho-spiritual, environmental and social contexts. The patients experienced holistic pain with mechanical ventilation, which is a strong physical invasion, and further experienced pain relief, transcending the hardship. This indicates that their pain was relieved by the support of nurses, which soothed the patients, and the patients dealt with such hardship themselves and transcended the situation in some cases. Nurses need to satisfy patients’ needs for pain and anxiety relief and to consider care that supports the patients in overcoming their situation independently and in recovery so that they can live their lives as before ICU admission as much as possible. On the other hand, when there are no such supports,

patients experience only holistic pain. Although our quantitative analysis revealed that the impacts of the ICU environment were not strong stress experiences, they were found to be stressful experiences in the qualitative analysis. Nurses need to pay attention to color, noise, light and the atmosphere of the ICU, keeping in mind that patients are constantly interacting with the ICU environment. Recommending elderly patients use aids such as glasses or hearing aids or making time for them to relax with their families are also examples of environment adjustments that can be made. Nurses, who comprise the human environment, should provide patients with comfort and peace so that they can overcome endotracheal intubation and the various discomforts caused by the ICU environment. In addition to relieving pain and stress experience during an ICU stay, we presume that patients' negative stress experiences may be reduced by nurses' understanding of patients' positive experiences, which may help them overcome their situation. This may lead to improvement in patients' QOL not only during their stay in the ICU but also after they are discharged, and may help support them to reach a level of self-realization where they face their hope for the future (Jackson et al., 2014). Patients experience relief and peace from the presence and attitudes of nurses; therefore, it is important for nurses to be conscious of their behavior and attitudes in the presence of patients.

4.1 | Limitations and future direction

The results of this study were obtained in interviews conducted from the time point when discharge from the ICU was determined to the time when the patient was discharged. Since the patients likely felt like they were recovering and relief knowing they were being discharged, and because the interviews were performed by ICU staff members, the patients might have expressed more gratitude toward staff members than they otherwise might have. Moreover, because the interviews were performed after completion of the questions in ICU-SEQJ, the scores were generally known and this may have been a source of bias. However, the interviewers were not nurses who were responsible for the participants' care, and the authors attempted to minimize the above bias by offering interview training to the nurses. Moreover, it has not been clarified if patients were influenced by the presence of their families during their ICU stay. In the future, it is necessary to follow up on patients' abilities to deal with stress experiences during their ICU stay and their cognitive function and QOL after they are discharged from the ICU so as to explore comfortable care that supports patient recovery.

5 | CONCLUSION

The stress experiences of 96 ICU patients who were mechanically ventilated for more than 12 hr were investigated qualitatively and quantitatively by using the ICU-SEQJ and a semi-structured interviewing method. The following points were clarified.

The items with high mean values in the high stress experience group were related to being unable to talk, pain caused by the intubation tube, difficulties in talking and restricted movement. Comparison between the low stress experience group (first quartile of ICU-SEQJ scores) and high stress experience group (third quartile of ICU-SEQJ scores) revealed that the patients in the high stress experience group had longer intubation hours, shallower levels of deepest sedation and larger consumption of narcotic drugs. Comparison of narratives between the high and low stress experience groups revealed that patients in the high stress experience group suffered "Unbearable holistic discomfort" and "Pain of being unable to control myself as before" and were characterized by "Feeling of being supported by staff members" while those in the low stress experience group were characterized by "Responding by giving meaning".

Nurses should recognize that patients with long intubation hours who experience strongly invasive procedures can suffer holistic pain that cannot be reduced by pain killers alone, and losing their sense of control may be a subjective stress experience for them. Since such experiences differ depending on the medical history and treatment of each patient, nurses must consider and assess the individual needs of each patient and perform intervention that promotes the reduction of stressful experiences.

ACKNOWLEDGMENTS

The authors sincerely thank all the study participants and the ICU nurses and doctors for their cooperation in this study. This study was supported by the Japan Society for the Promotion of Science, Tokyo, Japan (KAKENHI Grant in Aid for Scientific Research (C)).

DISCLOSURE

There are no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

N.T. was in charge of the study plan, data collection, and overall manuscript writing. K.S. contributed to data collection and data analysis. Y.Y. contributed data analysis and contributed to revising this manuscript. Both authors read and approved the final manuscript.

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How to cite this article: Takashima N, Yosihno Y, Sakaki K. Quantitative and qualitative investigation of the stress experiences of intensive care unit patients mechanically ventilated for more than 12 hr. *Jpn J Nurs Sci*. 2019;16:468–480. <https://doi.org/10.1111/jjns.12253>