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## Effects of postoperative delirium of patients on family members and their response

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**Abstract** The present study aims to clarify how family members are affected by and cope with postoperative delirium in patients. Subjects were 25 family members of patients who exhibited delirium following a surgical procedure. Family members were evaluated by salivary amylase, self-rated health, Profile of Mood States (POMS) and the empathic coping scale at three points in time: pre-surgery, during the postoperative delirium episode and post-delirium. The NEECHAM Confusion Scale (Japanese version) was used to assess delirium in the patients. Salivary amylase levels of family members were significantly higher during the delirium than pre-surgery and post-delirium. Furthermore, family members experienced Tension-Anxiety and Anger-Hostility as a result of the patients' postoperative delirium. Family members were not able to use empathic coping to deal with the patient exhibiting postoperative delirium. These results suggest the need for nurses to make an effort to understand the situation being experienced by family members of patients who exhibited postoperative delirium and offer them support to enable them to deal with the patient using empathy.

*Key word* : postoperative delirium of patient, family members, effect, coping

### Introduction

Delirium is a psychological symptom that develops rapidly and temporarily and is characterized by disordered cognitive functioning, reduced awareness, reduced attentiveness, increased or reduced psychomotor activity and disordered sleep wake cycles<sup>1)</sup>. Delirium is a common complication following surgical procedures, occurring with a high rate of 21.4-45.6%<sup>2-4)</sup>, and postoperative delirium often occurs during the first three days after the procedure<sup>2, 5, 6)</sup>.

Lipowski<sup>1)</sup> classified occurrences of delirium into three factors: precipitating organic factors, facilitating factors and predisposing factors. Previous studies have confirmed that postoperative delirium is caused by a complex entanglement of many different factors<sup>3, 5, 7-9)</sup>. The postoperative delirium influence the secondary disability<sup>10)</sup> and life prognosis to a patient<sup>11)</sup>. In addition, delirium does not only affect the patient exhibiting symptoms, but also affects fulfillment of services in the ward and management of the hospital<sup>12)</sup>. These findings indicate the strong necessity to prevent postoperative delirium.

In terms of preventive care for delirium, successful initiatives are being developed that aim towards multimodal intervention for preventing delirium<sup>13)</sup> and assessment tools<sup>14-18)</sup>. Moreover, programs are also being

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developed that enable family members to actively confront the delirium of the patient<sup>19)</sup>, and there is a need for intervention in not only patients, but also their family for delirium prevention.

It has been reported that, among patients who exhibit delirium, the longer they stay in the ICU, the more broadly they remember dreams they saw there, and the dreams were frightening<sup>20)</sup>. Furthermore, nurses providing care to terminal stage patients with delirium see the pain the patient is experiencing and the divergence from a peaceful death for which family members had been hoping, and see the delirium as a painful experience<sup>21)</sup>.

According to a report by William et al.<sup>22)</sup> on family members of patients who exhibited delirium, many patients with advanced cancer could remember their experience being delirious and the number of times the patient and their family members remembered the patient experiencing symptoms of delirium nearly always matched. Family members are more attuned to the actions of patients than medical staff and sense it as distressful. This may result in moderate to severe distress in not only the patients exhibiting delirium, but also their family members. The level of distress experienced by family members is reportedly higher than the patient and nurses<sup>23)</sup>. Family members also express concern over how to help the patient, the patient's imminent death and their own well-being, indicating the need for emotional support for the family<sup>24)</sup>.

Delirium symptoms expressed by patients are thus painful for their family members and expose them to a stressful situation. Although most studies on family members of patients exhibiting delirium investigate family of terminal stage patients or bereaved family and are often qualitative, using multiple objective indicator has not been systematically studied. Moreover, most of these studies are retrospective. Almost no longitudinal studies have been conducted that examine the same family during the brief period from pre-surgery to hospital discharge. Almost no studies look at family members of patients who exhibited acute, and in particular postoperative, delirium. Moreover, while it has been clearly determined that family members

experience distress when they encounter the patient exhibiting delirium, the physical and emotional effects and cope have not been adequately clarified. In addition, it is unclear how they cope with patients exhibiting symptoms of delirium.

In a previous study, family members of cancer patients exhibiting delirium had expressed emotional distress due to changing the patient<sup>24)</sup>. Therefore, we examined the definition of family to focus on "emotion of family members". Friedman<sup>25)</sup> defines a family as "two or more persons who are joined together by bonds of sharing and emotional closeness and who identify themselves as being part of the family". Wright et al.<sup>26)</sup> emphasizes the emotional connection, defining a family as "a group of individuals bound by strong emotional ties, a sense of belonging, and fervor for involvement in the lives of one another". According to these definitions, a family shares emotional aspects and identifies themselves as being part of the family. For this study, we defined a family as "persons who interact and communicate within the family according to their social roles, have an emotional bond with the patient, and identify themselves as being part of the family".

With the advance of medical care technologies, there is a growing tendency to aggressively perform highly invasive medical procedures on older people in Japanese medical practice. As a result, more and more older people are exhibiting postoperative delirium. Although postoperative delirium is short-lived, it appears abruptly and is a sudden occurrence that is unexpected by family members who had been hoping for the patient's steady recovery following the surgical procedure. In such a condition, it is therefore likely that postoperative delirium exhibited by the patient has a large effect on their family members. Therefore, clarification of how family members are affected by postoperative delirium in patients and how they deal with the patient may help enhance support for family members of patients exhibiting postoperative delirium.

## Conceptual Framework

Lazarus and Folkman<sup>27)</sup> define stress as a special type

of relationship between individuals and their environment that is appraised by each individual or is subjectively appraised. They claim that judging whether or not a relationship between an individual and his/her environment is stressful depends on cognitive appraisal. Lazarus and Folkman<sup>27)</sup> separate stress perception into two types of appraisal. They state that primary appraisal is when the person facing a stressor evaluates that there is harm or danger and that coping efforts are needed and they experience negative emotions such as depression and anger. They also note that stress and emotions are mutually dependent. Secondary appraisal is the selection of options for coping with stressors, for example evaluating what can be done and whether or not that option is acceptable. Coping is defined as perception of the stressor and behavioral efforts to alleviate emotional responses arising from that appraisal.

In the present study, we created a conceptual framework of the situation in which family members of patients exhibiting postoperative delirium are placed based on Lazarus' stress coping model (Fig. 1). To family members, the patient's postoperative delirium is a stressor, and acknowledging it triggers physical and emotional responses. Those family members are then thought to carry out some type of coping behavior towards the patient exhibiting delirium. Physical and emotional effects were measured with salivary amylase, the POMS profile of mood states scale and self-rated health.

For this study, we defined a family as "persons who interact and communicate within the family according to their social roles, have an emotional bond with the patient, and identify themselves as being part of the family". This means that even when the patient is in a state of delirium, family members emotionally tied to

each other are likely to remain close to the patient, and offer them care to respond to the patient's condition. We focused on empathy that can be approached from the view of sharing another's emotions or understanding others. O'Brien and Delongis<sup>28)</sup> hypothesized that empathy would arise in stressful situations, as assuming the role of maintaining relations in a stressful interpersonal relationship may be considered a form of empathic coping. Based on the O'Brien and Delongis concept, Kato et al.<sup>29)</sup> developed an empathic coping scale and revealed a significant relationship between empathic coping and psychological stress. This scale can assess thoughts and actions based on empathy in stressful situations. The results of previous studies allowed us to predict that family members would experience a stressful situation when exposed to the patient's delirium. We therefore used the empathic coping scale to examine whether or not family members were using empathic coping to deal with the patient in the present study.

## Aim

The present study aims to clarify how family members are affected by and cope with postoperative delirium in patients.

## Method

### Research period

Data on family members of patients who exhibited postoperative delirium was collected from the surgical department and orthopedics department of two core community hospitals during the period from August 2010 to June 2012.

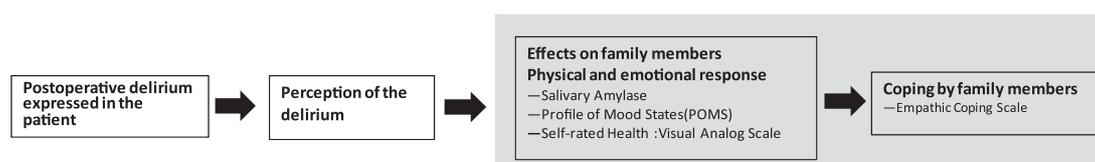


Fig 1. Conceptual Framework

### Sample and Setting

When selecting patients who exhibited postoperative delirium, we set eligibility criteria based on the risk factor of the postoperative delirium which Lipowski<sup>1)</sup> has presented and previous studies about the risk factor of the postoperative delirium<sup>3, 7, 9)</sup> (Table 1). We decided that the eligibility criteria 1 and 2 are required and one from among 3 to 8 is required. To select subjects to participate in the study, a request was made to the nursing supervisor of the ward who introduced us to the patient's family members. A total of 117 family members of patients undergoing a surgical procedure fulfilled the eligibility criteria. Of those, 113 consented to participate in the study. Thirty of the respective patients exhibited delirium. Analysis was carried out on 25 family members after excluding 5 cases where, for example, family members did not encounter the delirium or the condition of the patient worsened. The reason for excluding 5 subjects is shown in Figure 2. Criteria for family members were that they must be at least 20 years old, they must not have severe dementia or a psychiatric disorder, they must be able to communicate and they must have encountered the patient's

delirium. Family members of patients who were calmed by medical management were also excluded. Preventive nursing care for postoperative delirium was not provided for any patients or their family members prior to surgery at the institutions where data were collected. However, when explaining the medical procedure, doctors explained the possibility of delirium arising as a postoperative complication to patients they deemed at risk of exhibiting delirium.

Table 1. Eligibility criteria of patients scheduled for a surgical procedure

<ol style="list-style-type: none"> <li>1 . Age is 60 years or over</li> <li>2 . General anesthesia</li> <li>3 . Disordered visual/auditory functioning</li> <li>4 . Past history of delirium</li> <li>5 . Alcohol use or sleeping pills</li> <li>6 . Past history of cerebrovascular disease</li> <li>7 . Mild reduction in cognition functioning</li> <li>8 . Tendency towards depression</li> </ol> <p style="text-align: center;">1 and 2 are required and one from among 3 to 8 is required.</p>
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### Date Collection Procedure (Fig. 2)

The present study was conducted over a period of

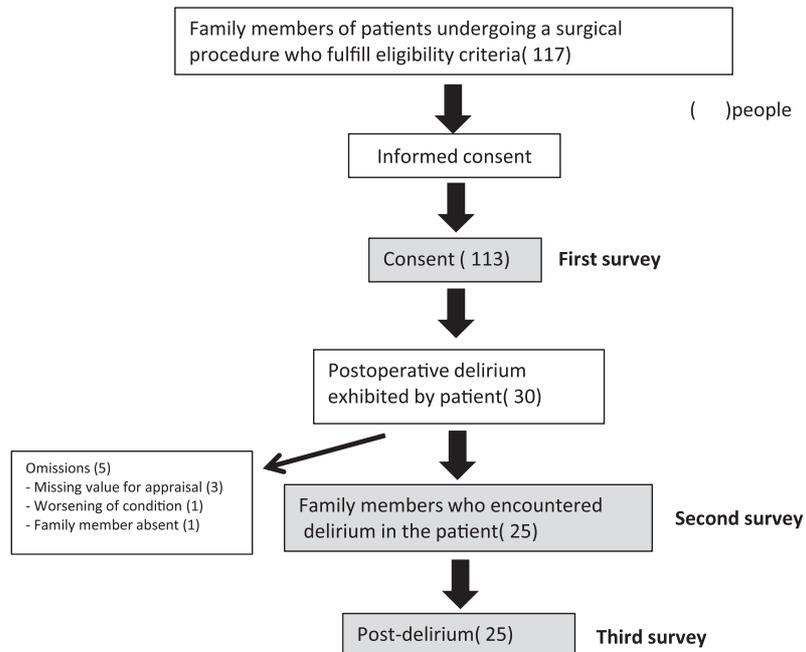


Fig 2. Procedure for data collection

time. The research plan was set based on a shortened hospital stay or shortened period from admittance to surgery. "Pre-surgery" refers to the period from admittance to the hospital to the actual surgery and "postoperative delirium episode" refers to the period from onset to offset of postoperative delirium. "Post-delirium" refers to the period from offset of the postoperative delirium until release from the hospital.

Salivary amylase, self-rated health, POMS and the empathic coping scale were measured in 113 family members who provided consent to participate in the study prior to the surgical procedure (first survey). Salivary amylase, self-rated health, POMS and the empathic coping scale were measured in 25 family members of patients who exhibited postoperative delirium, excluding 5 of the original 30 patients who were omitted from the study (second survey). Salivary amylase, self-rated health, POMS and the empathic coping scale were measured in family members after the patient's symptoms of delirium ceased and before they were released from the hospital (third survey).

## Instrumentation

### Delirium Assessment

Delirium was assessed during the period starting before the surgery until the 5th day after surgery using the Japanese version of the NEECHAM Confusion Scale (J-NCS). The NEECHAM Confusion Scale was developed by Neelon et al.<sup>15)</sup> and translated into Japanese by Watanuki et al.<sup>17)</sup>. It is comprised of three subscales: cognitive information processing, behavior and physiological control. Each subscale is then further composed of multiple items and the severity of delirium is evaluated by looking at the total score. The severity of delirium is thus determined by the total score. Nurses can evaluate these points that can be observed during usual provision of care, leaving no burden on the patient. The severity is severe to moderate confusion (0-19 points), mild to early development of confusion (20-24 points), not confused but at high risk of confusion (25-26 points) or not confused or normal function (27-30 points). In the present study, patients with a score of

24 or less were deemed to have delirium.

Regarding reliability and validity of the J-NCS, it has been confirmed to be equivalent to the original English version and indication for clinical judgment has been confirmed to be equivalent to the English version<sup>17)</sup>. To increase the reliability of the score when using the J-NCS, evaluators received special training<sup>17)</sup>. Researchers participated in the clinical nurses' training session during which they explained how to use the scale and set a fixed training period. In addition, if necessary, a researcher joined the clinical nurse to evaluate delirium in the patient from their symptoms.

### Salivary Amylase

Amylase is only secreted from the pancreas and salivary glands. Salivary amylase has been shown to be controlled by norepinephrine. It becomes more active during unpleasant stimulation and less active during pleasant stimulation, making it useful for determining whether stimulation is pleasant or unpleasant. Salivary amylase is thus used as a biomarker to indicate stress levels and many studies have been reported on its application in many fields<sup>30-33)</sup>. Measurement requires placing a special chip under the tongue for 30 seconds and placing it in a dedicated machine (Nitro, Osaka, Japan)<sup>34)</sup>. This inspection method is quick and easy. Measured values are evaluated as no stress for 0-30 KU/L, mild stress for 31-45 KU/L, moderate stress for 46-60 KU/L or severe stress for 61 KU/L or higher. As the subjects in the present study were family members present before and after a patient's surgical procedure and the postoperative condition of the patient was unpredictable, we felt it necessary to consider the burden to the family members. We therefore chose minimally-invasive salivary amylase measurement that can be done quickly and easily instead of questionnaire assessing stress. However, salivary amylase is also affected by circadian variation and meals<sup>34)</sup>. We therefore took measurements during the daytime and confirmed before taking measurements that at least one hour had passed since the subject's last meal. Furthermore, as volume of salivary secretions affects measurements, we also checked whether subjects had an illness or were on any medications that affect salivary secre-

tion and if they felt dryness of the mouth. If they had low salivary secretions, we requested them to massage their salivary glands and try checking their salivary secretion volume. Measurements were carried out without others present and were performed after the subject had finished completing all questionnaires as much as possible after visiting the patient.

#### Profile of Mood States (POMS) : POMS-SFJ

POMS is a scale that is widely used to evaluate transient and variable moods and emotions. POMS has 6 scales that are Tension-Anxiety (A-T), Depression-Dejection (D), Anger-Hostility (A), Vigor (V), Fatigue (F) and Confusion (C). Total Mood Disturbance (TMD) score is the sum of the 5 scales excluding Vigor minus the score for Vigor and expresses a negative mood. Each item is rated on a 5-point scale from 0 (absence) to 4 (extremely) to create an overall score. In the present study, we used the POMS Short Form Japanese version (POMS-SFJ) made up of 30 items that was created by Yokoyama et al.<sup>35)</sup>. The POMS-SFJ has high integrity with the original version.

#### Self-rated Health : Visual Analog Scale

The Visual Analog Scale is a self-rated scale often used to evaluate pain<sup>36)</sup>. It has been used in various investigations in addition to pain, such as evaluating the feel of face masks<sup>37)</sup> and subjective fatigue in family members caring for bedridden elderly persons<sup>38)</sup>. In the present study, we used this scale to assess the health status of the family members over time. It can be measured easily, with subjects marking their current subjective state on a 10 cm horizontal line. The line extends from 0, which is the lowest point for self-rated health to 10, the highest point. The actual distance to the point marked is measured and that length is used for evaluation.

#### Empathic Coping Scale

O'Brien and DeLongis<sup>28)</sup> hypothesized that empathy would arise in stressful situations, as assuming the role of maintaining relations in a stressful interpersonal relationship may be considered a form of empathic coping. Based on this concept, Kato et al.<sup>29)</sup> developed an empathic coping scale and revealed a significant relationship between empathic coping and psychological

stress. It is composed of two subscales: one on cognitive and emotional coping (6 items) and one on behavioral coping (4 items). Each item is ranked on a 4-point scale from 0-3, with higher scores corresponding to high frequency of coping. Reliability and validity have been demonstrated. In the present study, this scale was used to measure the degree to which family members were empathic when interacting with the patient, when they encountered them during an episode of delirium. We received approval from the researchers who developed the scale to use it in this study.

#### Data Analysis

All data is expressed as a mean $\pm$ SD. We tested normality of salivary amylase, self-rated health, the 6 POMS subscales and the 2 subscales of the empathic coping scale between the three time points measured (pre-surgery, postoperative delirium episode, post-delirium) and compared them using the Friedman test. We then performed multiple comparison tests on only the items with a significant difference. The level of significance was 5%. The data was statistically analyzed with SPSS 17.0 J statistical software.

#### Ethical considerations

This study was approved by the ethics committee of Kyushu University Institutional Review Board for Clinical Research and the ethics committee of the hospitals taking part in the study. Family members were explained the purpose and methods of the study, that participation was voluntary, and that their privacy and personal information would be protected. They were also explained that patient treatment, nursing care and treatment of family members would be unaffected should they refuse to participate. We received approval from the patient or their family member as a legal representative to view the patient's medical records in order to collect data. All ethical considerations were explained orally and in writing and subjects signed consent forms before participating in the study.

## Results

#### Attributes of the study participants

The mean age of family members was 62.1 $\pm$ 14.6 (34-

90) years. Fourteen were female and eleven were male. Regarding familial relationship, most were the patient's son (7 subjects) or daughter (5 subject). Of those who were spouses, 6 were the patient's wife and 3 were the patient's husband. Of the remaining subjects, 3 were the patient's daughter-in-law and 1 was the patient's younger brother. Fifteen of the family members were employed. Five family members had previously encountered the patient exhibiting delirium. Nineteen had some type of illness and were under treatment, mostly for high blood pressure or hypercholesteremia. Most of them visited the patient daily (Table 2).

Of the 117 patients surveyed, 30 exhibited delirium, a rate of 26.5%. Five of the 30 subjects were excluded from analysis because of an insufficient delirium assessment, worsening of the patient's condition, or lack of visits from family members. Excluding those 5 subjects who were omitted for various reasons, most patients exhibited delirium on the day after the surgery, followed by two days after surgery. The delirium lasted  $2.4 \pm 1.2$  (1-5) days. The lowest J-NCS score was  $15.5 \pm 4.7$  (6-24) points, and many cases of delir-

Table 2. Characteristics of family members of patients who exhibited postoperative delirium

Variable	N=25
<b>Age</b>	
Mean (year) $\pm$ SD	62.1 $\pm$ 14.6
Range	34 ~ 90
<b>Sex (%)</b>	
Male	11 (44)
Female	14 (56)
<b>Relationship (%)</b>	
Spouse	9 < wife 6, husband 3 > (36)
Son/daughter	12 < son 7, daughter 5 > (48)
Daughter-in-law	3 (12)
Sibling	1 (4)
<b>Job (%)</b>	
Yes	15 (60)
No	10 (40)
<b>Delirium experience (%)</b>	
Yes	5 (20)
No	20 (80)
<b>Treatment for Illness (%)</b>	
Yes	19 (76)
No	6 (24)
<b>Frequene of visitation (%)</b>	
Every day	19 (76)
Occasionally	4 (16)
Irregulaly	2 (8)

ium were confirmed to be moderate to severe (Table 3).

Salivary amylase was measured in 24 subjects, excluding those who were extremely high levels at the all time of the patient's delirium. Table 4 shows salivary amylase and self-rated health at the 3 time points measured. Salivary amylase levels were  $85.5 \pm 76.0$  KU/L at pre-surgery,  $141.4 \pm 97.4$  KU/L during the delirium and  $95.0 \pm 66.0$  KU/L post-delirium. A significant difference was seen between the 3 time points ( $p=0.03$ ).

Table 3. Characteristics of patients who exhibited delirium

Variable	N=25
<b>Age</b>	
Mean (year) $\pm$ SD	82.0 $\pm$ 6.2
Range	68 ~ 88
<b>Sex (%)</b>	
Male	18 (72)
Female	7 (28)
<b>Day of onset of delirium (%)</b>	
Day of surgery	3 (12)
1 day after surgery	13 (52)
2 days after surgery	8 (32)
3 days after surgery	1 (4)
<b>Length of delirium occurrence</b>	
Mean $\pm$ SD	2.4 $\pm$ 1.2
Range	1 ~ 5
<b>J-NCS score</b>	
Mean $\pm$ SD	15.5 $\pm$ 4.7
Range	6 ~ 24
<b>Severity of delirium (%)</b>	
Moderate to severe	20 (80)
Mild	5 (20)
<b>Illness (%)</b>	
Digestive disorder	18 (72)
Orthopedic disorder	3 (12)
Respiratory disease	2 (8)
Vascular disease	2 (8)
<b>ADL before surgery (%)</b>	
Independent	21 (84)
Nursing care needed	4 (26)
<b>Type of Delirium (%)</b>	
Hyperactive	19 (76)
Underactive	0 (0)
Mixed	6 (24)
<b>Delirium symptoms (%)</b>	
Unintelligible locution	19 (76)
Getting out of bed	13 (52)
Touching tubes	13 (52)
Hyperactivity	12 (48)
Talkativeness	11 (44)
Firm expression	8 (32)
Agitation	8 (32)
Hallucination	8 (32)
Dazedness	6 (24)
Vacant expression	5 (20)
Visual fixation on one point	4 (16)

According to multiple comparison tests, salivary amylase levels during the delirium were significantly higher than pre-surgery and post-delirium levels ( $p=0.012$ ,  $p=0.003$ , respectively). Self-rated health was  $60.8 \pm 25.7$  mm at pre-surgery,  $56.8 \pm 20.0$  mm during the delirium and  $60.0 \pm 28.0$  mm post-delirium. No significant difference was seen between the 3 time points ( $p=0.08$ ).

Among POMS subscales, significant differences were observed for Tension-Anxiety ( $p=0.019$ ) and Anger-Hostility ( $p=0.025$ ). According to multiple comparison tests, Tension-Anxiety scores were significantly higher during the delirium than post-delirium ( $p=0.002$ ) and significantly higher at pre-surgery than during post-

delirium ( $P=0.000$ ). Anger-Hostility scores were higher during the delirium than post-delirium. Although no significant differences were observed in TMD score between the 3 time points, scores at pre-surgery and during the delirium were higher than post-delirium (Table 5).

Regarding the empathic coping scale, cognitive and emotional coping scores were  $12.7 \pm 5.6$  at pre-surgery,  $12.0 \pm 4.0$  during the delirium and  $12.0 \pm 3.9$  post-delirium. Behavioral coping scores were  $7.9 \pm 3.1$  at pre-surgery,  $8.5 \pm 2.4$  during the delirium and  $7.9 \pm 2.6$  post-delirium. No significant difference was seen between the 3 time points for either coping style ( $p=0.311$ ,  $p=0.108$ , respectively; Table 6).

Table 4. Salivary amylase and self-rated health at each test period

	Measurement time			P-value
	Pre-surgery	Postoperative delirium episode	Post-delirium	
Salivary Amylase (KU/L) N=24	$85.5 \pm 76.0$	$141.4 \pm 97.4$	$95.0 \pm 66.0$	0.03 <sup>a)</sup>
		*	*	
Self-rated Health (mm) N=25	$60.8 \pm 25.7$	$56.8 \pm 20.0$	$60.0 \pm 28.0$	0.08 <sup>a)</sup>

Friedman's two-way analysis of variance by ranks a)

Wilcoxon signed-rank test (Bonferroni correction) \* $p < 0.017$

Table 5. POMS score at each test period (N=25)

	Measurement time			P-value
	Pre-surgery	Postoperative delirium episode	Post-delirium	
Mood States			*	
Tension-Anxiety	$8.1 \pm 5.0$	$7.0 \pm 4.5$	$5.2 \pm 3.4$	0.019 <sup>a)</sup>
		**		
Depression	$3.7 \pm 4.4$	$4.5 \pm 4.2$	$3.4 \pm 3.0$	0.855 <sup>a)</sup>
Anger-Hostility	$2.4 \pm 2.4$	$3.9 \pm 2.5$	$3.4 \pm 2.9$	0.025 <sup>a)</sup>
Vigor	$4.1 \pm 3.9$	$5.0 \pm 4.0$	$6.1 \pm 3.8$	0.059 <sup>a)</sup>
Fatigue	$5.6 \pm 4.9$	$6.0 \pm 4.5$	$5.3 \pm 4.2$	0.562 <sup>a)</sup>
Confusion	$5.8 \pm 4.1$	$5.8 \pm 2.4$	$5.7 \pm 3.2$	0.573 <sup>a)</sup>
TMD	$20.7 \pm 18.3$	$20.7 \pm 13.5$	$16.9 \pm 14.8$	0.106 <sup>a)</sup>

Friedman's two-way analysis of variance by ranks a)

Wilcoxon signed-rank test (Bonferroni correction) \* $p < 0.017$ , \*\* $p < 0.001$

TMD: Total Mood Disturbance

## Discussion

### Effects of postoperative delirium in patients on their family members

Salivary amylase levels of family members were significantly higher during the patients' postoperative delirium episode than pre-surgery and post-delirium. Salivary amylase levels increase as a transient stress response and decrease after the stress disappears. Salivary amylase is used as a biomarker to indicate stress levels, demonstrating that the postoperative delirium exhibited by the patient was unpleasant for their family members.

Previous interview studies have shown retrospectively that delirium in patients was distressful for family members<sup>22-24</sup>. In the present study, we used objective indices to examine the effects of acute postoperative delirium in patients on their family members and the coping behavior of those family members using a longitudinal and multilateral approach. According to the results, family members of patients who exhibited postoperative delirium experienced stress, similar to the results of previous studies that used a different approach or scale for assessment. This confirms that delirium exhibited by patients is stressful for their family members, even for patients in a variety of situations.

In the present study, it was confirmed from an increase in salivary amylase level that postoperative delirium in patients was stressful for their family members, but there were no significant differences in self-rated health. Incidentally, 76% of family members were affected by a chronic disease such as high blood pressure or hypercholesterolemia and continue to receive treatment. Furthermore, as the age of patients

undergoing surgery increases, more and more family members are themselves among the aged. As episodes of delirium are very short, responses of health view may not appear right away during the onset. It is thus necessary to carefully monitor the effects of the postoperative delirium in the patient on the health of their family members.

We compared scores in the POMS subscales at three different points in time to examine the emotional effects. In the Tension-Anxiety subscale, scores were higher before the surgery and during the delirium than after the delirium disappeared. Nakamura et al.<sup>39</sup> investigated the feelings of family members of older cancer patients undergoing surgery and demonstrated that family members were extremely anxious about the patient's condition. In addition, family members of patients undergoing surgery are coping with various challenges in the brief period between diagnosis of the disease and treatment<sup>40</sup>, which may have cause high Tension-Anxiety scores prior to the surgical procedure. In the present study, Tension-Anxiety scores continued to be high following the surgery as the patient exhibited delirium. This suggests that, similar to previous reports that, while family members are aware that a medical system that covers all possible measures is in place for the period after surgery, they still feel a strong sense of danger for the patient's life<sup>41</sup>, the stressful situation for family members continues from before the surgery to after the surgery. In such a psychological situation, postoperative delirium exhibited by the patient can cause additional stress, which may have resulted in the higher Tension-Anxiety scores.

Anger-Hostility scores were higher during the delirium than post-delirium. Lazarus<sup>42</sup> states that stress and emotions are mutually dependent. If anger becomes

Table 6. Empathic coping scale score at each test period (N=25)

	Measurement time			P-value
	Pre-surgery	Postoperative delirium episode	Post-delirium	
Cognitive and emotional coping	12.7±5.6	12.0±4.0	12.0±3.9	0.311
Behavioral coping	7.9±3.1	8.5±2.4	7.9±2.6	0.108

Fiedman's two-way analysis of variance by ranks

an unpleasant emotion, it may cause damage and be threatening, or it may arise from a challenging situation. The Anger-Hostility POMS subscale included such items as “am bothered and feeling troubled” and “in a bad mood”, and the delirium exhibited by the patient may be considered unpleasant by family members. It is also possible that family members feel anger at themselves for not being able to help the patient in front of them who is exhibiting delirium.

Prior to the study, we had predicted that family members encountering postoperative delirium in a patient would become agitated by the appearance of an unexpected condition in the patient and would become confused. However, there were no differences in the POMS confusion subscale between the 3 time points measured. This suggests that the postoperative delirium did not go so far as to cause confusion in the family members, perhaps because it was occurring in a hospital environment and they felt reassured by the presence of doctors and nurses should postoperative delirium occur, or they had received adequate warning prior to the surgery. However, family members encountering postoperative delirium in a patient are placed in a stressful situation that causes negative emotions. Nurses must therefore make an effort to understand the psychological conditions of family members and provide them with support to help relieve them from the stressful situation as much as possible.

#### **How family members cope with postoperative delirium in patients**

The results of previous studies allowed us to predict that family members would experience a stressful situation when exposed to the patient’s delirium in the present study. However, we posited that even when the patient is in a state of delirium, family members emotionally tied to each other would be likely to remain close to the patient, and offer them care to respond to the patient’s condition. The theory of empathic coping hypothesizes that empathy towards others would arise in stressful situations. Using an empathic coping scale developed based on this concept, we examined whether or not family members were using empathic coping to deal with the patient. But, in the present investigation,

no significant differences were seen in this scale when comparing the different time points. This indicates that family members were unable to use empathic coping when dealing with patients exhibiting postoperative delirium.

In the institutions where data for the present study collected, delirium was discussed as a complication of the medical procedure prior to the surgery with the patient and their family members in cases where the patient was expected to exhibit delirium. Moreover, the nurses did not intervene somehow for the patient or their family members. Even if family members receive a general explanation about the possibility of delirium from the doctor during the explanation of the medical procedure, there is much less concern given to the delirium compared to the surgery itself, and it may be difficult for them to imagine what an episode of delirium would actually be like. When seeing the patient in an actual episode of delirium, family members may be at a loss as to how to react, and may feel tension or anxiety. The family members may therefore have been confused as to how to respond to the patient exhibiting postoperative delirium and were unable to carry out good communication. To critically-ill patients, the presence of family members has been shown to provide them with comfort, support, encouragement and hope<sup>43)</sup>. It is therefore preferable for family members to use empathy when coping with patients during an episode of postoperative delirium. It is necessary for nurses to explain prospects for the course of the delirium exhibited by the patient and basic coping methods such as accepting and not denying what the patient is feeling, thereby putting the family members at ease. If they do so, they can consider how to deal with the patient together with the family member and follow through with that plan. Hupcey<sup>44)</sup> discussed the need for a good relationship between nurses and family members when dealing with patients in a critical condition of intensive care unit including the postoperative patient as well as the need for family members to participate in the provision of care to the patient. Nurses must discuss postoperative delirium with the family members prior to the surgery based on the patient’s individual situ-

ation. They must make preparations to enable prevention of delirium and to enable family members to feel reassured to cope with the patient during an episode of delirium. Such efforts could not only help reduce the amount of distress in family members, but also raise the level of satisfaction in family members who participate in care treatment.

### Study limitations and future work

In the present study, it was difficult to procure subjects as the study required family members to actually be present during a postoperative delirium episode exhibited by the patient. Although we selected patients at high risk for exhibiting delirium in order to increase the number of subjects, predicting delirium proved difficult. Furthermore, subjects had to be family members who could provide data at three different time points during a brief period of time, making it difficult to increase the number of subjects. Future studies must be conducted using a larger sample size. Doing so will make it possible to also examine individual family support.

### Conclusion

We investigated the effects and cope of postoperative delirium in patients on their family members. Salivary amylase levels were high during the delirium, indicating that it was a stressful situation for family members. As emotional impact on family members, the POMS profile of mood states indicated that postoperative delirium in patients gave rise to Tension-Anxiety and Anger-Hostility in their family members. Moreover, family members were not able to use empathic coping to deal with patients' delirium.

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