

Development and testing of nursing intervention model to promote prevention of dehydration in elderly cardiac surgery patients

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Abstract

The purpose of this study was to develop and test a nursing intervention model for promoting the prevention of dehydration in elderly patients who have undergone cardiac surgeries.

The study was conducted using a case study method with due ethical considerations by obtaining approval from the institutional review boards at the centers participating in the study. A nursing intervention model was developed based on the literature and researchers' nursing intervention for elderly patients who underwent cardiac surgery. The goal of intervention was that these patients can understand the necessity of preventing dehydration, take actions to prevent it, and be aware of any abnormalities such as dehydration and heart failure. The timing of intervention was prior to hospital discharge and at the first visit to an outpatient department. The intervention focused on the abilities of these patients to: 1) understand the necessity of preventing dehydration, 2) drink more than 1,000 ml of water per day, and 3) identify any abnormalities related to the symptoms of dehydration and cardiac failure. The nursing intervention model was tested by applying it to one male patient in his 70s who underwent coronary artery bypass grafting; this patient achieved the goal of intervention, suggesting the usefulness of the nursing intervention model.

Key words : cardiac surgery, elderly patients, nursing intervention model, prevention of dehydration

1 Introduction

Ischemic heart disease due to arteriosclerosis is commonly observed among elderly patients undergoing cardiac surgery. In recent years, it has been reported that valvular heart disease tends to be rheumatic less frequently, while the incidence of age-related aortostenosis and mitral insufficiency is increasing^{1,2)}. Although the use of coronary artery bypass graft surgery, which had constantly increased until drug-eluting stents effective for the prevention of coronary artery restenosis became available, was shown to be decreasing in a questionnaire survey conducted by the Japanese Association for Thoracic Surgery³⁾, overall, it is still increasing every year. One of the reasons for this may be an increasing number of elderly patients and those with severe diseases, in whom surgery was previously not applicable³⁾.

When the blood plasma volume in the extracellular fluid decreases, the intracellular fluid usually flows in to replenish the loss of blood plasma; however, in the elderly, such a loss is not sufficiently replenished due to a lower intracellular volume, and, consequently, dehydration frequently occurs⁴⁾. Further, it has been demonstrated that a decreased cardiac reserve due to age-related myocardial cell death, a lower circulating blood volume, and a decline in the autonomic nervous system function, as well as a higher incidence of myocardial infarction and hypertensive heart disease, are responsible for the frequent occurrence of heart failure in elderly patients⁵⁾.

Following cardiac surgery, it is important to motivate patients to make efforts to prevent the disease recurring, in addition to providing them with appropriate treatment. So currently therapeutic diets and exercise are taught, and pharmacotherapy is performed as discharge advice for patients^{6,7)}. Up to the present, studies focusing on the self-management of postoperative medication as a lifetime issue, using an assessment sheet⁸⁾, discharge advice for patients who underwent cardiac surgery⁹⁾, and nurses' recognition regarding such advice¹⁰⁾ have been conducted. Regarding elderly patients, the use of a balance sheet promoting fluid consumption has been examined¹¹⁾; however, to the author's knowledge, there have been no studies examining nursing intervention models to promote the prevention of dehydration in elderly patients who underwent cardiac surgery.

Considering the importance of providing support to patients undergoing cardiac surgery, whose number is likely to continuously increase, in terms of the prevention of recurrences, it is necessary to develop a nursing intervention model promoting the prevention of dehydration in elderly patients, and verify its validity.

2. Objective

This study aimed to develop a nursing intervention model promoting the prevention of dehydration in elderly patients who underwent cardiac surgery ("nursing intervention model"), and verify its validity.

3. Methods

3.1 Development of a nursing invention model

A nursing intervention model (Table 1) was developed based on the literature and researchers' nursing intervention for elderly patients who underwent cardiac surgery.

3.2 Application of the nursing invention model

3.2.1 Subject

This study involved a subject who underwent cardiac surgery and met the following conditions:

- > Age of 65-80
- > No postoperative complications
- > No symptoms of heart failure or fluid restriction
- > Ability to manage himself without cognitive problems
- > Consent for participation in the study

3.2.2 Data collection

The researchers applied the developed nursing intervention model, and recorded the subject's response, statements, facial expressions, and behavior.

3.3 Design

This is a case study.

3.4 Ethical considerations

The study was conducted with the approval of the Research Ethics Committee of the study facility. The subject was introduced by his doctor, whose cooperation was obtained, and provided with a written and oral explanation of the study objectives and methods, completely voluntary participation and withdrawal at any time, and privacy protection to obtain his consent.

4. Results

4.1 Development of a nursing intervention model

The nursing intervention model consisted of components, such as <goals of intervention>, <timing of intervention>, <focuses of intervention>, <methods of intervention>, and <details of intervention approaches>, as shown in Table 1.

4.1.1 Goals of intervention

The goal of intervention was that these patients can understand the necessity of preventing dehydration, take actions to prevent it, and be aware of any abnormalities such as dehydration and heart failure.

Dehydration in elderly patients is mainly caused by an

Table1. Nursing intervention model to promote prevention of dehydration in elderly cardiac surgery patients

Goals of intervention	Elderly cardiac surgery patients can understand the necessity of preventing dehydration, take actions to prevent it, and be aware of any abnormalities such as dehydration and heart failure	
Timing of intervention	Prior to hospital discharge (The first intervention approach)	At the first visit to an outpatient department (The second intervention approach)
Focuses of intervention	1) Understanding the necessity of preventing dehydration 2) Consuming 1,000 ml/day of fluids 3) Detecting signs of dehydration and heart failure	
Methods of intervention	1) Developing the patient’s understanding of the necessity of preventing dehydration 2) Discussing with him the appropriate method for him to consume 1,000 ml/day of fluids 3) Enhancing his knowledge of the method to detect signs of dehydration and heart failure	
Details of intervention approaches	<ul style="list-style-type: none"> ◆ Explanation using a brochure <ul style="list-style-type: none"> • the definition, causes, and symptoms of dehydration • effects of dehydration on the disease • daily fluid requirements • methods to consume 1,000 ml/day of fluids • the definition and symptoms of heart failure • the necessity and methods of measurement of body weight • methods to identify edema • self-measuring the radial puls ◆ Explanation given regarding to how to use self-check sheet <ul style="list-style-type: none"> • method to record amount of daily fluid consumption • methods to record the body weight and pulse, as well as the presence or absence of edema, dehydrated skin, and subjective symptoms 	<ul style="list-style-type: none"> ◆ Reflect the progress with the patient by using the self-check sheet <ul style="list-style-type: none"> • Checking the appropriate amount of daily fluid consumption • Checking the method of measuring daily fluid consumption • Any abnormal findings of the body weight and pulse, as well as the presence or absence of edema, dry skin, and subjective symptoms • Confirming the methods used by the patient to conduct the self-check has been appropriate or not • If abnormality is found, reporting to the doctor

impaired thirst mechanism due to a decline in the central nervous system function and self-restriction of fluid consumption to avoid frequent urination and incontinence⁴⁾. When dehydration occurs, the blood becomes more concentrated, and, consequently, the risk of thrombosis and coronary artery reocclusion increases¹²⁾. Therefore, the prevention of dehydration is important for elderly patients, and nursing approaches promoting it are necessary.

Otomo¹³⁾ reported that patients who underwent cardiac surgery tended to practice discharge advice regarding the prevention of dehydration without fully understanding its necessity or did not practice it due to a lack of such an understanding after discharge. Based on this finding, it may be necessary to develop patients' understanding of the necessity of preventing dehydration first in order to promote it.

Following cardiac surgery, fluid consumption management is needed in a large number of patients, depending on their cardiac function. Under such circumstances, it may also be necessary to detect signs of dehydration or heart failure due to excessive fluid consumption, while promoting fluid consumption to prevent dehydration in elderly patients.

4.1.2 Timing of intervention

The timing of intervention was determined two times. The timing of the first time was decided to be prior to discharge where the patients' postoperative condition would be stable. The second time was decided to be their first outpatient appointment in order to confirm their progress after discharge.

4.1.3 The focuses of intervention

Considering the necessity of enhancing the knowledge of the prevention of dehydration and concretely showing the required amount of fluid consumption based on the literature¹²⁾, the focuses of intervention were determined as follows: 1) understanding the necessity of preventing dehydration; 2) consuming 1,000 ml/day of fluids; and 3) detecting signs of dehydration and heart failure.

Hattori¹⁴⁾ defined the self-monitoring in patients with cardiac failure as monitoring and grasping their heart conditions to detect signs of deterioration in cardiac failure in an early stage and appropriately maintain their physical conditions and treatment.

Based on this finding, the focuses of intervention was designed to promote the elderly patients to be able to

consume fluids as well as self-checking the early signs of dehydration and heart failure

4.1.4 Methods of intervention

The methods of intervention were as follows: 1) developing the patient's understanding of the necessity of preventing dehydration; 2) discussing with him the appropriate method for him to consume 1,000 ml/day of fluids; and 3) enhancing his knowledge of the method to detect signs of dehydration and heart failure.

Fukada¹⁵⁾ pointed out that patients expect nurses to provide them with discharge advice, while fully understanding them, working with them to resolve their problems, and leading them to continuous self-management after discharge.

Based on this finding, the intervention approaches included discussing with the patient the appropriate method for him to continuously manage himself after discharge.

4.1.5 Details of intervention approaches

The details of intervention approaches were as follows:

Based on the first focus, the patient was provided with brochures developed by the researchers regarding the definition, causes, and symptoms of dehydration (Material 1), and its effects on his disease (Material 2) during the first intervention approach.

Based on the second focus, daily fluid requirements (Material 4) and methods to consume 1,000 ml/day of fluids (Material 5) were shown to the patient, using the brochures. Further, a method to record his daily fluid consumption, using a self-check sheet (Material 8), was suggested to him. During the second intervention approach, his daily fluid consumption recorded on the self-check sheet was examined.

Based on the third focus, the definition and symptoms of heart failure (Material 3), the necessity and methods of measurement of body weight (Material 6), and methods to identify edema (Material 6) and take the pulse (Material 7) were shown to the patient, using the brochures, while methods to record the body weight and pulse, as well as the presence or absence of edema, dehydrated skin, and subjective symptoms, were explained to him, using the self-check sheet (Material 8).

During the second intervention approach, the patient's records were examined using the self-check sheet to confirm whether he had appropriately monitored himself to detect signs of abnormalities. His ability to inform doctors of any of such signs was also examined.

4.2 Verification of the nursing intervention model

The nursing intervention model was applied to the following subject and verified, as follows:

4.2.1 Subject overview

A single-living 70-year male patient without an occupation, who underwent single-graft off-pump coronary artery bypass surgery, was studied, considering his eldest son as a key person. The patient's current medical history included percutaneous transluminal coronary angioplasty for acute myocardial infarction, showing a favorable postoperative course without complications.

4.2.2 Focus 1: Understanding the necessity of preventing dehydration

During the first intervention approach, the definition, causes, and symptoms of dehydration were explained using the brochure (Material 1). The patient initially stated a lack of interest in the brochure, "Such an explanation is unnecessary for me. I didn't have any symptom even before surgery, and only a single graft was enough". His statements suggested that he was not considering dehydration as his own issue. However, as the effects of dehydration (Material 2) were explained, he mentioned the course of his disease, such as cardiac catheterization and cardiac surgery, and stated, "I will read it carefully". Such a positive change in his attitude toward understanding the necessity of preventing dehydration appeared to be brought about through the explanation of the relationship between dehydration and cardiac disease.

During the second intervention approach, the patient's use of the self-check sheet (Material 8), on which he had recorded his daily fluid consumption, was examined with him. Reflecting on his record, he stated, "No dehydration has occurred ever since I returned home, but maybe I should have drunk a little more".

4.2.3 Focus 2: Consuming 1,000 ml/day of fluids

During the first intervention approach, the daily fluid requirements were shown using the brochure (Material 4). The patient showed interest in the brochure, and confirmed the required amount, stating, "I see, 1,000 ml a day". Subsequently, when the effects of dehydration on cardiac disease were explained based on its definition, causes, and symptoms, he began to appear to recognize dehydration as his own issue, stating, "So, I have to drink a lot of fluids, haven't I?"

When he was asked about his fluid consumption before surgery, while discussing with the researchers the appropriate method to consume the required amount of fluid, he answered, "I did not use to drink so much. I used to drink just a glass not larger than 200 ml with food".

To consume the required amount of fluid, the researchers suggested to the patient consuming fluids at fixed hours of the day or whenever he was inclined to do so (Material 5); he chose the former method, stating, "OK, I will drink at meals". When he used the self-check sheet (Material 8) to record and confirm daily fluid consumption, he expressed

his anxiety about his recording, stating, "I am not sure if I can remember how much I have drunk"; therefore, the effective use of the self-check sheet was discussed with him, and he was advised to record the number of glasses of fluid consumed. As a result, he stated, "I will be able to record it at least immediately after drinking", showing a positive attitude toward the use of the self-check sheet to check his fluid consumption.

During the second intervention approach, his record on the self-check sheet was examined to confirm whether he had actually consumed the required amount of fluid. The record showed that he had consumed more than 1,000 ml of fluids at fixed hours of the day, as he chose. Regarding his fluid consumption, he stated, "I drank glasses of water or tea with food. I also tried to drink between meals, but maybe I should have drunk a little more fluids". Further, regarding the use of the self-check sheet, he stated, "I have recorded how many glasses I consumed".

After examining the record, the patient was encouraged to continue consuming 1,000 ml of fluids a day, and provided with an explanation of its importance for the prevention of reinfarction.

4.2.4 Focus 3: Detecting signs of dehydration and heart failure

During the first intervention approach, the definition of heart failure was explained using the brochure (Material 3). The patient initially appeared to consider the explanation as irrelevant to him, stating, "I have no such symptoms".

However, when measurement of the body weight was explained as a method to detect abnormalities (Material 6), he stated, "I always measure my body weight after taking a bath. I did it even before surgery, and I will continue to do it after discharge", showing a positive attitude toward continuously measuring his body weight. Further, he appeared to recognize the necessity of measuring it at a fixed hour of the day.

Subsequently, when he was provided with an explanation of the self-evaluation of dehydrated skin and edema (Material 6), he took off his socks and stated, "Look, there is no swelling of my feet anymore". On the other hand, he appeared to consider the self-evaluation of edema, shown in the brochure, as difficult, stating, "I don't know how to do it"; therefore, he was advised to solely confirm the presence or absence of edema. Regarding dehydrated skin, he appeared to be anxious about his cutaneous condition after discharge, stating, "My skin will become drier when I return home"; therefore, he was provided with an explanation of dehydrated skin as a sign of dehydration, and advised to solely record its presence or absence.

When the method to take the pulse (Material 7) was

explained, he showed a positive attitude and stated, "Let me see, where is my artery?", while attempting to take his pulse by touching his radial artery.

The actions to be taken when some abnormality was detected (Material 7) were also explained. He stated, "I have never gained more than 2 kg", showing an interest in these actions.

Regarding the use of the self-check sheet (Material 8), he stated, "No problem", showing a positive attitude toward its use for the detection of signs of dehydration and heart failure.

During the second intervention approach, the changes in his body weight and pulse, as well as the presence or absence of edema, dehydrated skin, and subjective symptoms recorded on the self-check sheet were examined to confirm whether he had appropriately monitored himself to detect abnormalities.

Regarding measurement of the body weight, he stated, "I measured my weight first every morning", and, in fact, the record showed that he had performed the measurement at the same hour of the day, and appropriately recorded the results on the self-check sheet.

Regarding pulse measurement, he stated, "I took my pulse around 8 o'clock in the morning, and found it normal". The record showed that he had performed pulse measurement at the same hour of the day, and appropriately recorded the results on the self-check sheet.

Similarly, regarding edema, dehydrated skin, and subjective symptoms, he stated, "None of these occurred"; in fact, he had filled in the self-check sheet with the word "absence".

The absence of signs of dehydration and heart failure was also confirmed by checking the record on the self-check sheet. The patient had also informed his doctor of their absence.

After examining the record, the patient was encouraged to continue monitoring himself to detect signs of dehydration and heart failure.

These results demonstrate that the goals of intervention were achieved through the two approaches.

5. Discussion

The nursing intervention model was verified, and its validity was examined, as follows:

5.1 Verification of the nursing intervention model

The nursing intervention model was verified by examining the focuses and timing of intervention.

5.1.1 Focus 1: Understanding the necessity of preventing dehydration

Although the patient did not express positive statements regarding the necessity of preventing dehydration, the intervention approaches led him to consider dehydration as his own issue. Funayama¹⁶⁾ reported that postoperative

therapy provided to patients who underwent coronary artery bypass surgery during a certain period of time after surgery contributes to their prospect of complete recovery, which serves as mental support during therapy. Based on this finding, concretely explaining to the patient the effect of dehydration on his disease, rather than providing him with a general explanation of dehydration, may have changed his viewpoint on this issue.

Further, Yokomizo¹⁷⁾ reported that brochures patients can repeatedly read are useful. In fact, providing brochures is an effective approach for elderly patients whose daily life, visual, and auditory functions have declined. In this study, its effect appeared to be particularly marked after the patient's discharge.

5.1.2 Focus 2: Consuming 1,000 ml/day of fluids

In order to discuss with the patient the appropriate method to consume 1,000 ml/day, it was effective to concretely show him the required amount of daily fluid consumption while confirming his consumption before admission.

The method chosen after discussion may have facilitated his consumption of more than 1,000 ml of fluids a day, resulting in the prevention of dehydration.

In addition, an enhanced understanding of the necessity of preventing dehydration may have led him to understand the importance of sufficiently consuming fluids, and resulted in his actual consumption of more than 1,000 ml of fluids a day.

5.1.3 Focus 3: Detecting signs of dehydration and heart failure

It was effective to concretely show the patient the method to detect signs of dehydration and heart failure in order to promote his understanding of the importance of monitoring them; this also suggests that such a method may be useful for elderly patients who have undergone cardiac surgery. Further, the use of brochures may have facilitated the patient's review of the method after discharge. Also, recording the results of measurement and evaluation on the self-check sheet, in addition to considering signs of dehydration and heart failure as his own issue, may lead him to continuous self-monitoring.

5.1.4 The timing of intervention

In this study, continuous intervention was facilitated by setting its timing at before discharge and the first outpatient consultation.

Due to the recent shortening of the hospital stay, it is difficult to sufficiently provide patients with discharge advice and confirm their understanding of this. Under these circumstances, a nursing intervention approach provided on the first outpatient consultation may serve as an opportunity to confirm patients' self-management based on discharge advice after discharge. Continuous intervention approaches

may also enhance their motivation to continuously monitor their health conditions.

5.2 The validity of the nursing intervention model

These results suggest that the nursing intervention model may be valid for developing an understanding of the necessity of preventing dehydration, enhancing knowledge of the method to detect signs of dehydration and heart failure, and promoting the prevention of dehydration by discussing together an appropriate method to consume more than 1,000 ml/day of fluids in elderly patients who have undergone cardiac surgery.

6. Conclusion

The results of intervention approaches provided based on the nursing intervention model suggest its validity for goal achievement.

As this study involved a single patient, it is necessary to verify the model with a greater number of subjects in order to generalize the results.

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Material 1

Prevention of dehydration in patients who have undergone coronary artery bypass grafting

Dehydration means?

The condition in which the volume of body fluid (total volume of water in the body) has decreased.


Body fluid contains water and electrolytes (for example sodium and potassium): the electrolytes represent water-soluble and conductive mineral ions. Dehydration also refers to a lack of these electrolytes (especially sodium ions) and water.

The cause of the dehydration?

Insufficient water intake or loss of water as a result of a large volume of insensible perspiration (sweating) due to diarrhea, vomiting, or fever.

Symptoms of dehydration ?


This results in dry mouth, skin dryness, continuous mild fever, reduction in urine volume, poor appetite, fatigue, and loss of body weight.



Material 2

If you suffer dehydration,...

The cells in the body become dysfunctional. This condition, if untreated, can be life-threatening. Additionally, the blood is concentrated and this makes the body vulnerable to a blood clot (thrombus). The heart must pump the concentrated blood with a more powerful force. This is a heavier burden on the heart. Consequently, the heart requires a larger volume of blood. The coronary arteries that have become smaller due to arteriosclerosis cannot receive enough blood. Therefore, the same condition as angina pectoris will occur.




Material 3

What is heart failure?

The heart functions as a pump delivering blood throughout the body. Heart failure refers to the condition in which the pumping function declines and, as a result, the heart cannot pump enough blood throughout the body.

What are the symptoms of heart failure?


Tired quickly, weakness, palpitation, difficulty in breathing, reduction in urine volume, weight gain or swelling, and fast pulse.



Material 4

How much water should we drink?

< Volume of water in human body >

	IN	Diet	1000ml
		Water produced in the body	300ml
		Water drunk	1200ml
	OUT	Blood	5%
		Water between the cells	15%
		Water inside the cells	40% with aging → 30%

Urine and stools 1600ml Incoming and outgoing water
Breath and sweat 900ml **2500ml/day**

We can obtain approximately 1,000 ml of water from the diet (assuming 3 meals per day, 1 soup and 3 dishes: 1,400 kcal) but should also obtain water from other sources.

Drink 1,000 ml of water as a target.

Material 5


Let's consider how to drink!

~Drinking at predetermined times~
 An example is to drink a 150~200ml cup of water on rising, at breakfast, 10 a.m., lunch, 15 p.m., dinner, and after bathing.

~Drinking when possible~
 An example is to drink a 500~or 1,000ml teapot/pot of water completely in the day.

What should we drink?

Water or tea is recommended.



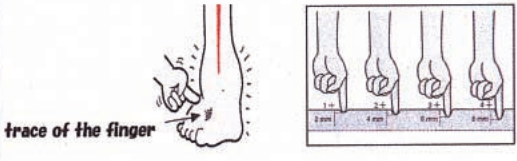
Material 6

How can we find abnormalities?

~Let's measure body weight~
 Gain and loss of body weight may provide a clue to detect the symptoms of heart failure and dehydration, respectively. Measure body weight at a specific time during the day.

~Let's check the condition of skin or edema (swelling)~

Check for tension and dryness of the skin. Also, after pressing the instep or shin with a finger, check for a trace of the finger.




trace of the finger

Material 7


~Let's take the pulse~

Take the pulse for one minute with the index and middle fingers applied to the thumb side of the wrist.

Check for a disturbed, fast, or slow pulse. In addition, if you have any subjective symptoms such as palpitation, chest tightness, and difficulty breathing, check for pulse abnormality.



If you experience rapid weight gain (caution is needed if more than 2 Kg per week) and have edema (swelling) or any symptoms of failure, consult a physician.



Material 8

Let's practice self-check

	bodyweight (OKg)	pulse rate	volume of water drunk (Oml)	the presence or absence of swelling	the presence or absence of skin dryness	the presence or absence of subjective symptoms
Before hospital discharge						
date						
date						
date						
date						
date						
date						
date						
date						
date						
date						
date						
date						
date						
date						
date						
date						
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* Please submit the results at the next visit.

心臓手術を受けた高齢患者の脱水症予防を促すための 看護介入モデルの作成と検証

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抄録

本研究の目的は、心臓手術を受けた高齢患者の脱水症予防を促すための看護介入モデルを作成し、検証することである。

研究方法は、事例研究とし、倫理的配慮は、研究協力施設の倫理委員会の承認を得て実施した。看護介入モデルは、文献および研究者の心臓手術を受けた高齢患者の看護実践に基づいて作成した。介入の目標は、心臓手術を受けた高齢患者が脱水症予防の必要性を理解し、脱水症予防や脱水症、心不全の異常の発見行動ができるとした。介入の時期は退院前を第1回目、初回外来受診時を第2回目とし、介入の焦点は①脱水症予防の必要性を理解することができる②1000ml/日以上飲水することができる③脱水症、心不全症状の異常の発見ができるとした。看護介入モデルの検証は、作成した看護介入モデルに沿って、冠状動脈バイパス術を受けた70歳代の男性1名に適応し、介入の目標を達成することができたことから、看護介入モデルの有用性が示唆された。

キーワード：心臓手術，高齢患者，看護介入モデル，脱水症予防