



The Effects of Telenursing Aiming to Prevent Postsurgical Complications and Improve Quality of Life among Patients with Prostate Cancer

Daisuke Sato^{1*}, Fumiko Sato², Naoko Sato² and Yoko Arinaga³

¹Department of Nursing, Faculty of Health Sciences, Komatsu University, Ishikawa 923-8511, Japan

²Department of Oncology Nursing, Health Science, Tohoku University Graduate School of Medicine, Miyagi 980-8575, Japan

³Ai International Medical Research Institute, Nagasaki, Japan

Abstract

Background: Over 90% of patients undergoing prostate cancer surgery report symptoms of urinary incontinence and sexual dysfunction. Complications after surgery reduce the self-esteem of prostate cancer patients and impair their social function.

Objective: Therefore, we conducted a randomized controlled study to examine whether 3 months of telenursing could reduce complications in prostate cancer patients.

Interventions/Methods: The participants were randomly assigned to either an intervention group or a control group. Using a tablet computer, the participants were asked to provide information on various items, including urinary frequency, number of incontinence pads used, and presence of sexual desire and erections. Both the participants and researchers monitored automatically-graphed time-dependent changes in symptoms, and the researchers could propose concrete measures to reduce patients' complications. The control group received ordinary care. The intervention period for both groups was 3 months. If there was a problem reported after discharge from hospital, the intervention was stopped and the hospital was contacted. The primary endpoint was an improved score on the expanded prostate cancer index composite and improved urinary incontinence based on a positive stress test. The secondary endpoint was an evaluation of self-care responses to the Functional Assessment of Cancer Therapy-General (FACT-G) instrument.

Results: The results showed that urinary function, urinary bother, and sexual bother improved in the intervention group.

Conclusions: Furthermore, significant improvements were seen in physical, emotional, and functional well-being improved on the FACT-G.

Implications for Practice: These findings suggest that telenursing can reduce postoperative complications and sense of burden in patients with prostate cancer.

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Introduction

The National Cancer Act, which came into effect in April 2007, seeks to create an environment that provides cancer patients with appropriate information on cancer care and medical services. At the end of 2011, there were 96.1 million Japanese (79.1% of Japan's population) Internet users. Over 60% of Japanese people aged 65-69 years, and over 40% of those aged 70-79 years use the Internet [1,2], implying that even elderly cancer patients can easily obtain information on cancer care through the Internet. In telenursing in Europe and the United States, the use of the Internet in the provision of nursing services has been increasing in popularity since the 1990s [3]. Telenursing was conducted for cancer patients who chemotherapy in the 2000s [4]. In the case of Japan, outpatients who visit hospitals on remote islands [5] and patients with chronic obstructive pulmonary disease (COPD) who receive home oxygen therapy for the prevention of acute exacerbation of COPD [6] have utilized telenursing support; however, there have been no reports on the use of telenursing by cancer patients. The performance of information and communication technology (ICT) such as personal computers, cell phones, and other communication equipment has dramatically improved, and the use of such devices no longer requires extensive technical knowledge. In addition, further developments are expected in telenursing for supporting home care, as the age of cancer survivors is rapidly increasing.

In Japan, the incidence of prostate ca is rising due to the growing elderly population and the widespread use of the prostate-specific antigen (PSA) test. Over 90% of patients undergoing prostate cancer

surgery, which is an orthodox treatment option for prostate cancer, report symptoms of urinary incontinence and sexual dysfunction [7,8], and about 10-20% of these patients do not show improvement in these symptoms at 1 year after surgery [9]. Complications after surgery impair physical function in such patients, leading to a lower quality of life (QOL) and sense of overall well-being [10-12]. To reduce these complications, such patients are therefore required to continue performing pelvic floor muscle exercises and reduce their alcohol consumption.

However, some patients are discharged from hospital soon after receiving general discharge instructions from medical staff, so the problem of support taking each patient's background and specific needs into consideration has become a critical issue. In addition, in Japan, where over 90% of nurses are female, it is difficult to assess complications related to a prostate cancer patient's sense of well-being after surgery. Many patients do not seek support from nurses because they feel hesitant to tell nurses about postoperative conditions such as sexual dysfunction [13,14]. In Western countries, there

Corresponding Author: Daisuke Sato, Department of Nursing, Faculty of Health Sciences, Komatsu University, Komatsu, Ishikawa 923-0971, Japan; E-mail: daisuke.sato@komatsu-u.ac.jp

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have been a number of practical reports about nursing support for sexual dysfunction after surgery [15], in-person counseling between a patient and a partner [16], and periodic telephone counseling for urinary incontinence. However, none of these studies has provided significant evidence that such treatment is beneficial. Therefore, we need to develop a system that allows patients to consult with nurses at any time using ICT. The advantages of telenursing using ICT could include the immediate identification of home care patients' symptoms, and the ability to make patients feel more relaxed in regard to sensitive matters. By monitoring patients' symptoms objectively, this system could also help nurses prepare for potential problems and consider appropriate symptom management at an early stage.

We conducted a randomized controlled study to address the question of whether a telenursing system using ICT is effective for improving postoperative complications and quality of life in patients with prostate cancer.

Conceptual Framework

The theoretical framework of the study was provided to the Tele-Nurse Practice Model (TNPM) [17]. The TNPM is a theoretical framework nurses can use to define and guide the complex process of care in a telephone encounter. Tele-nursing provide comprehensive care and information on self-management to patients, and provide resources for health promotion and changes in health behavior in cooperation with other professionals. In the study, nurses use ICT to grasp the state of side effects after surgery of cancer patients. Nurses can grasp side effects symptoms accompanied prostate cancer patients in real time and provide nursing support at an early stage. At the same time, Tele-nursing using ICT can easily share patient information with a doctor, and can prepare an environment where patients can receive treatment early.

Methods

Study Design

A randomized controlled study was conducted to examine whether telenursing could help prevent the acute exacerbation of postoperative adverse symptoms in patients with prostate cancer. This study was approved by the ethics committees of the research department at Tohoku University Graduate School of Medicine (No. 2013-1-615) and Miyagi Cancer Center (No. 26-4).

Participants

The study participants were prostate cancer outpatients who visited the Urology Department at Miyagi Cancer Center, underwent radical prostatectomy without receiving neo-adjuvant therapy, had urinary and sexual dysfunction after surgery, and met the following eligibility criteria: 1) informed of their cancer diagnosis, 2) under 70 years of age, 3) had a Gleason score lower than 10 and were classified into a low, intermediate, or high risk group according to the D'Amico classification, and 4) agreed to participate in the study. The exclusion criteria are as follows: 1) 70 years of age or over, 2) had a Gleason score of 10 or higher and were classified into a very high risk group according to the D'Amico classification, 3) had distant metastasis, and 4) had a mental disorder. Gleason score is a pathological classification that represents the malignancy of prostate cancer. A Gleason score of 6 or less is a low-risk cancer of malignancy, 7 is a cancer of medium risk, and 8 to 10 are cancer of high risk. D'Amico classification comprehensively evaluates Gleason score, PSA, TNM classification, and determines the malignancy of prostate cancer.

Postoperative complications are expected to improve without intervention in about 80% of prostate cancer patients within 1 year after surgery [9]. Therefore, the required sample size was estimated by assuming that complications would improve in 90% of the participants at a significance level of 0.05, 80% power, and a 10% non-inferiority margin. The required sample size was 32 for the intervention and control groups. About 10% of the participants were expected to discontinue participation in this study; therefore, the sample size was increased to 36 for both groups.

We asked the doctors in charge at Hospital to distribute a study manual to prostate cancer patients hospitalized for surgery, and explained the study in detail to these patients. Those who agreed to participate were asked to submit consent forms. Those agreeing to participate were then randomly assigned to one of two groups—an experimental group and a control group—using a table of random numbers.

Intervention Programs

The telenursing support system aiming to prevent postsurgical complications and improve quality of life among patients with prostate cancer is shown in Figure 1. First, the participants received explanations from the doctor and nurse about pelvic floor muscle exercise methods, including the number of repetitions, the recommended amounts of drinking water, and the effects of sildenafil citrate. The participants then received a brief outline of telenursing from a researcher, as well as a tablet computer. Using the tablet computer, the participants were then asked to log into a patient website and enter information regarding postoperative symptoms and complications, including urinary frequency, the severity of urinary incontinence, the number of incontinence pads used, stool frequency, the presence of sexual desire, the presence of erections, hours of sleep, and presence of a sound sleep. Questions regarding anxiety about home care were then sent by email to a researcher, and the entered data were kept in cloud storage. Their symptoms were automatically graphed as progress notes that could be monitored by both participants and researchers. The data transmitted from the researchers were also kept in cloud storage and automatically transmitted to the participants, who were expected to review their home care by monitoring their own graphed data.

Researchers could then learn how the participants understood pelvic floor muscle exercise methods after surgery, as well as the number of repetitions, the amount of drinking water consumed, and the effects of sildenafil citrate. They could then log into the patient website to check the participant's postoperative complications and home care situation, such as daily activities, including job and household activities, and the amount of drinking water consumed. An achievable goal was set based on the acquired data, and consultation and educational support was implemented (5). The period of intervention was set at 3 months. Participants were then asked to answer closed-ended questions that appeared on an Internet terminal at a specific time once a day and transmit their responses to a server using a tablet computer. This task was expected to take about 10 minutes. Trigger points were set for each question item beforehand. Researchers continued monitoring transmitted data, offering necessary information on concrete self-care activities if a trigger point became active. In this way, educational guidance was conducted on the ICT screen to advise each patient in terms of his/her activities of daily living. Researchers also sent emails to participants every 2 weeks asking whether they were troubled by complications and other problems in daily activities. The intervention and control groups underwent outpatient examinations at the first

and third postoperative months. The target participants then received an evaluation of their postoperative complications from the attending physician in accordance with their symptoms and therapeutic drug prescriptions. During all 3 months of the intervention period, we set up an environment in which we could contact the hospital if there were any concerns about patients in either group.

Content of Evaluation

The primary endpoint was an improved score on the expanded prostate cancer index composite (EPIC) and improved urinary incontinence based on a positive stress test. EPIC measures the severity of complications and sense of burden in prostate cancer patients. It is composed of 50 items and four subscales (urinary, bowel, sexual, hormonal). The reliability and validity of the Japanese version of EPIC [18]. A self-administered questionnaire survey was conducted at 1 and 3 months after surgery. A stress test was conducted by asking patients to cough when they felt bladder fullness and by checking the level of urinary incontinence. According to the method proposed by the International Continence Society, a participant puts on an absorbent pad and drinks 500 ml of water before performing the following activities: stand from sitting (10 times), cough vigorously

(10 times), and wash hands in running water for 1 minute. Changes in weight are recorded, with an increase of 2 g classified as positive. In the present study, all participants had urinary incontinence; therefore, the weight of pads was not measured. Instead, a bladder ultrasound device (Bladder Scan BVI 6100 Japan) was used to evaluate the level of urinary incontinence by twice measuring the amount of urine left in the bladder: before and after the stress test (at 1 and 3 months after surgery).

For secondary endpoint, QOL was evaluated using the Functional Assessment of Cancer Therapy-General (FACT-G) [19]. The FACT-G is a self-administered questionnaire survey that measures health-related QOL. It is composed of 27 items and four subscales: physical well-being (PWB), social/family well-being (SWB), emotional well-being (EWB), and functional well-being (FWB). Its reliability and validity has been confirmed. The FACT-G was conducted before and at 1 and 3 months after surgery, and the evaluation of self-care activities for the management of complications was conducted at 1 and 3 months after surgery. Participants were asked about their concrete coping behaviors and readjustments in daily living. In addition, the participants of the intervention group were asked about the convenience of telenursing and ICT.

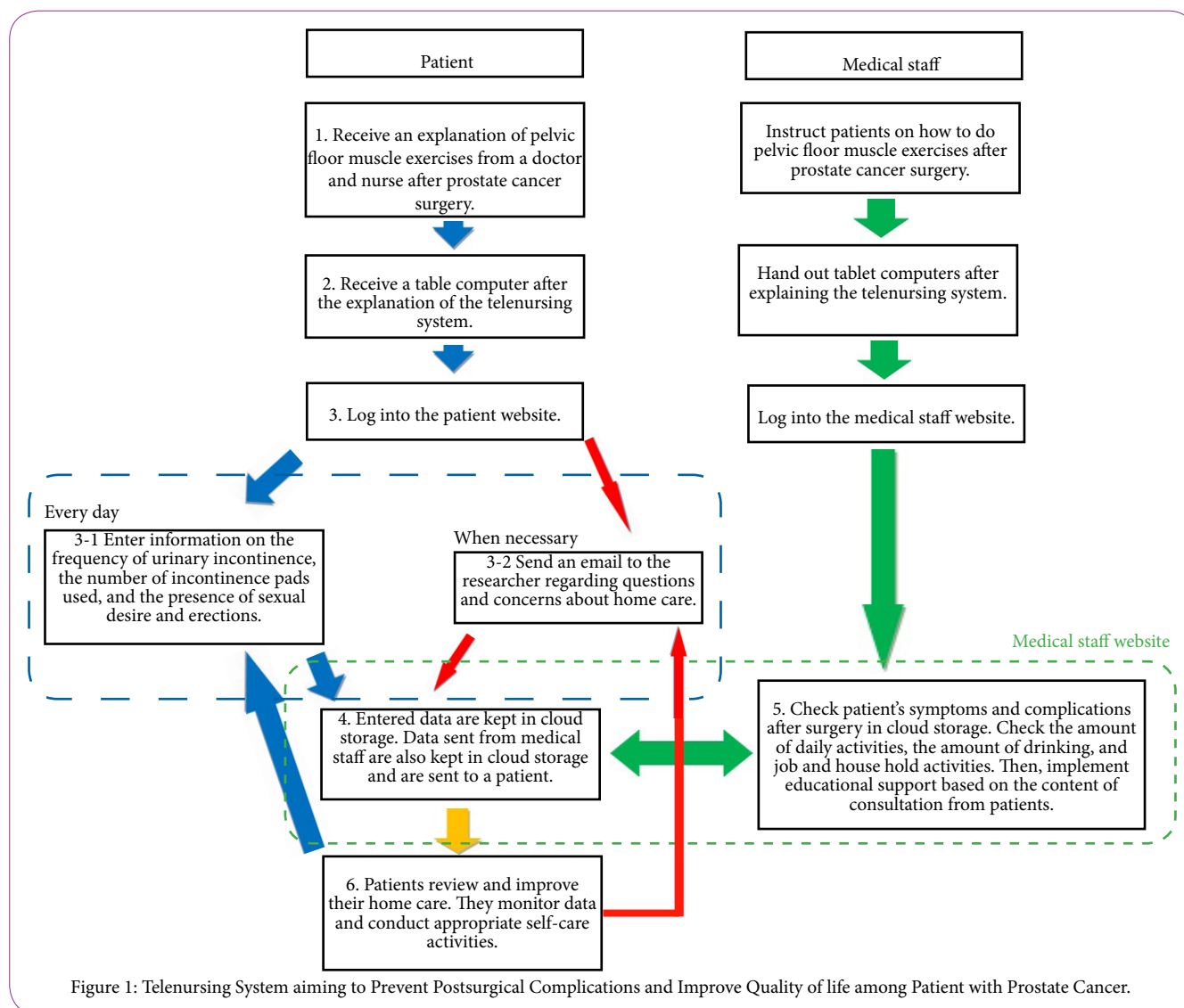


Figure 1: Telenursing System aiming to Prevent Postsurgical Complications and Improve Quality of life among Patient with Prostate Cancer.

Information on the participants' ages, content of treatment, PSA test results, Gleason scores, prescription drugs, and Neurovascular bundle (NVB) preservation was collected from their medical records.

Statistical Analysis

The Mann-Whitney U test or Fisher's exact test was used to compare individual attributes between the intervention and control groups. Descriptive statistics for EPIC were calculated. The Wilcoxon test was used to examine time-dependent changes in EPIC and FACT-G. The volume of urine in the bladder before the test was rated as 100%, and the percentage after the test was measured. The Mann-Whitney U test was used for statistical analysis ($p < .05$). All statistical analyses were performed using SPSS Ver. 21.

Ethical Considerations

The purpose and methods of study were explained to participants both verbally and in written form. The acquired data were managed safely and appropriately by collecting, storing, and discarding the information according in a company server with the privacy mark certification.

Results

Outline of the Participants

An outline of the study participants before surgery is shown in Table 1. We asked 75 patients who met all inclusion criteria to participate in the study, 63 of whom agreed and were randomly assigned to either an intervention group (30 patients) or a control group (33 patients). None of the participants dropped out of the study. No statistically significant differences in any variables were observed between the two groups.

There was no statistically significant difference in comparison between the results of EPIC and FACT-G before surgery between the two groups.

Comparison between the Two Groups at 3 Months after Surgery

Table 2 shows a comparison between the two groups at 3 months after surgery in EPIC, stress test, and FACT-G results. The EPIC scores for urinary function ($p = .01$), urinary bother ($p = .02$), and urinary incontinence ($p = .02$) were significantly higher in the intervention group, indicating recovery. The results of the stress test showed

Table 1: Overview of The Study Participants.

Item	Intervention (n=30)		Control (n=33)		p-value
	n (%)	Mean \pm SD	n (%)	Mean \pm SD	
Age		62.7 \pm 4.1		64.3 \pm 3.4	.26
50s	9 (30.0)		7 (21.2)		.10
60s	21 (70.0)		26 (78.8)		
Occupation	12 (40.0)		14 (42.4)		.60
Educational background					
Junior high school	5 (16.6)		7 (21.2)		.56
High school	18 (60.0)		20 (60.6)		
University	6 (20.0)		5 (15.1)		
Other	1 (3.4)		1 (3.1)		
Family structure					
Single	4 (13.3)		2 (6.0)		.80
Couple	17 (56.6)		18 (54.5)		
Couple and children	4 (13.3)		10 (30.3)		
Three generation	5 (16.8)		3 (9.2)		
Anamnesis	19 (63.3)		20 (52.2)		.19
PSA (pre-surgery)		6.48 \pm 1.03		6.63 \pm 1.98	.48
Gleason score (pre-surgery)		6.88 \pm 0.6		6.65 \pm 0.65	.29
Less than 7	7 (23.3)		10 (30.3)		.42
7	15 (60.0)		20 (66.6)		
More than 7	5 (16.7)		3 (3.1)		
NVB					
Both resection	20 (66.6)		21 (56.5)		.57
One resection	10 (33.4)		12 (43.5)		
PDE5 inhibitors	3 (10.0)		3 (9.0)		.48
Anticholinergic drug	6 (20.0)		9 (27.2)		.46

Age, preoperative PSA, and Gleason score were compared using the Mann-Whitney U test. Other variables were compared using Fisher's exact test.

Abbreviation: PSA: prostate specific antigen; NVB: neurovascularbundle; PDE5 inhibitors: phosphodiesterase type 5 inhibitors

that the urine volume in the bladder was higher in the intervention group, indicating an improvement in urinary incontinence. On the FACT-G, total ($p = .03$), PWB ($p = .04$), and FWB scores ($p = .01$) were significantly higher in the intervention group, indicating an improvement in QOL.

Narrative of the intervention group on the effect of telenursing

Some participants in the intervention group reported experiencing “a heightened desire to continue to practice pelvic floor muscle exercises” because they received periodic messages that asked them “about symptoms and the content of home care”, and they “could consult readily” and “get advice immediately” when they “faced some trouble in activities of daily living.” These responses showed that participants recognized that they could continue to do pelvic floor muscle exercises using the information acquired from telenursing. The effect of telenursing extracted the sense of security by motivation of behavior change and connection with nurse.

Discussion

A comparison between intervention and control groups at 3 months after surgery showed improvements in urinary function, urinary bother, and sexual bother. The EPIC scores of the intervention group and the control group did not differ much from those of the previous study [20]. Starting pelvic floor muscle exercises before surgery and continuing such exercises after surgery has been reported to accelerate

the recovery of urinary function [21,22]. The urinary function of patients was considered to have improved because both doctors and nurses told the patients how to do pelvic floor muscle exercises before prostate cancer surgery. However, it is difficult for many patients receiving home care to continue performing these exercises for a long time in addition to other duties for family, community, and work [7]. It is therefore necessary to have a favorable environment for continuing to practice pelvic floor muscle exercises, which prevent the exacerbation of urinary dysfunction and urinary bother. The telenursing system is an environment where not only general nursing information is provided, but also individual education is carried out and both the nurse and patient can be evaluated. This environment can continue providing actions for improving postoperative complications over the long term.

Participants in the intervention group entered data regarding their urinary incontinence, sexual function, and implementation of pelvic floor muscle exercises every day using a tablet computer. This information could be shared with nurses, who used it to assess patient conditions and conduct educational support. Patients whose urinary function was good were asked to adjust the use of sanitary napkins and incontinence pads in accordance with the change in their conditions. Those who did not see improvements in their urinary function were asked to reevaluate how they performed pelvic floor muscle exercises and to set new achievable goals. Next, both patients and nurses evaluated urinary function every week. Nurses

Table 2: Comparison between Groups at 3 Months after Surgery.

		Comparison at 3 months after surgery		p-value
		Intervention (n=30)	Control (n=33)	
		Median (IQR)		
EPIC	Summary score			
	Urinary	84.7 (73.7-97.8)	75.7 (63.8-97.2)	.01
	Bowel	100.0 (92.3-97.5)	100.0 (94.6-98.5)	.31
	Sexual	28.9 (19.2-32.7)	26.9 (19.2-34.6)	.13
	Hormonal	93.2 (79.1-94.6)	94.8 (79.5-98.4)	.25
	Subscale			
	Urinary function	76.8 (53.2-95)	71.8 (50.2-93)	.01
	Urinary bother	85.7 (75-92.7)	78.5 (71.4-94.4)	.02
	Urinary incontinence	66.7 (39.5-87.5)	53.7 (22.8-70.8)	.02
	Urinary irritative/Obstructive	96.4 (78.5-92.1)	94.8 (82.1-93.1)	.21
	Bowel function	100.0 (96.4-97.8)	100.0 (82.9-98.9)	.57
	Bowel bother	100.0 (96.4-97.8)	100.0 (96.4-94.5)	.61
	Sexual function	2.8 (0-12)	5.5 (0-16.7)	.09
	Hormonal function	85.0 (60-98.4)	85.0 (55-97.1)	.45
	Hormonal bother	100.0 (87.5-98.7)	100.0 (91.7-98.4)	.25
(1) Stress test		93.87 (4.83)	81.07 (9.41)	.01
FACT-G	Summary score	96.0 (48-85)	66.0 (45-85)	.03
	subscale			
	Physical well-being	19.0 (9-26)	18.0 (10-22)	.04
	Social/family well-being	21.0 (10-26)	19.0 (9-25)	.08
	Emotional well-being	17.0 (10-25)	15.0 (9-24)	.02
	Functional well-being	18.0 (9-22)	15.0 (9-23)	.01

(1) Bladder urine volume (%) after the stress test (bladder urine volume before the stress test as 100%) and average SD.

proposed an achievable goal based on the patients' daily activities, the number of arousals during sleep at night, the amount of drinking after sleep onset, and the repetitions of pelvic floor muscle exercises. Some patients failed to see improvements in urinary function even after they had done pelvic floor muscle exercises for a long time. An anticholinergic agent, beta-receptor stimulant, and alpha-receptor stimulant were prescribed for patients whose urinary dysfunction was serious. One patient in the intervention group requested that he wanted to take an anticholinergic drug at an early stage; therefore, a nurse reported the patient's condition to the doctor in charge through telenursing. In this case, telenursing contributed to early treatment.

Telenursing help patients improve his/her disease condition by sharing goals with a nurse²³ and enhancing feelings of self-efficacy [12]. Urinary incontinence tends to be serious soon after surgery; therefore, many prostate cancer patients fluctuate between hope and despair over their ever-changing physical condition. Nursing intervention in this study became a trigger to evaluate patients' efforts to achieve their goals and to review their management. The primary endpoint, stress test and EPIC results, contributed to improvements in urinary function in the intervention group. Patients could better understand their own level of urinary incontinence by seeing their own bladder echo. Setting a specific target value and carrying out support indispensable for improving symptoms enhanced their self-efficacy and motivation to manage their own symptoms.

All participants were asked to make their own decision regarding NVB preservation or resection after receiving an explanation of the risk of declining sexual function. NVB preservation is associated with the recovery of sexual function after surgery, but also a risk of prostate cancer recurrence [22,23]. NVB resection can also lead to a decline in sexual function, so medical staff must monitor this in patients and provide support at an early stage after surgery if necessary. The problem of sexual function is content with shame. Therefore, it is difficult to consult nurse while looking at the face of nurse. Telenursing is useful because patients can talk indirectly to nurses about their own sexual function, as well as their feelings about it. It is important to confirm whether we want patients to take medication for sexual dysfunction and want opportunities to talk about sexual activity after surgery. Although avoidance attitude in regard to sexual bother can be an appropriate coping mechanism for recovering mental health [26-28], it is not a direct method to solve the problem. In cooperation with the doctor in charge, telenursing was helpful for checking patients' views on sex and preventing his/her sexual bother from worsening. A standard consultation with urologist and nurse 3 months after treatment to discuss sexual and relational issues is considered as most preferable [29]. Patients felt relief because they could get necessary information in a timely fashion from a distant place. This sense of security helped enhance the patients' abilities to manage their own symptoms. In diabetes and other cancer patients, the ability to manage symptoms by distant nursing was improved [30]. Telenursing was shown to be effective for symptom management of patients with chronic diseases including cancer. In the cultural background of Japan, there is a culture that is abhorrent to tell others about information on sexuality. It is meaningful for patients and nurses that patients with prostate cancer in Japan can communicate information on sexuality without looking at the face of medical personnel by telenursing.

QOL was evaluated using the FACT-G. The scores of FACT-G in the intervention group and the control group were not significantly different from those of the previous study [31]. The relationship between prostate cancer patients' complications after surgery and

QOL showed that their physical well-being improved as they found relief from their symptoms. Educational support aiming for the improvement of complications after surgery and the sense of security brought about by communication with nurses through telenursing was thought to contribute to the improvement of emotional and functional well-being at 3 months after surgery.

The Prospects of Telenursing by ICT

The 5-year survival rate for cancer has reached over 60%. Increasingly more cancer patients continue to work after surgery (Ministry of Health, Labour and Welfare 2014). This shorter duration of hospital stay is accompanied by an increase in the number of patients who receive medical treatment at home. It is therefore necessary to construct a system of medical care that helps cancer patients manage their own lives through both work and treatment by enabling nurses to assess the conditions of their dysfunction and rehabilitation, even if they are in a distant place. Telenursing by ICT makes it possible for nurses to support cancer patients after surgery by assisting their home care and managing their complications, such as the side effects of anticancer drugs and radiation therapy. It can also help consolidate the support system for cancer patients, including end-of-life care, reduce healthcare costs, and streamline home-visit nursing. In future studies, the application of telenursing should be examined from a variety of perspectives.

Limitation of this Study

This study was a verification of intervention effect in a short period of 3 months. The reason for setting the intervention period is generally considered to be a period during which the effect of remote nursing is easy to verify because the period up to 3 months after surgery is heavy symptom of postoperative complications and affects patient's QOL. It was. However, recovery of postoperative complications of prostate cancer is a mid- to long-term problem generally requiring about six months to a year, so mid- to long-term verification is necessary in the future.

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Conflict of Interest

The authors have no conflict of interest to declare.

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