Application Analysis of Doctor-Nurse Cooperation Follow-up Model Based on the Internet Platform in Continuation Care of Patients after Uro-oncology Surgery

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Abstract: *Objective:* To explore the application effect of a doctor-nurse cooperation follow-up model based on an Internet platform in the continuation of care for patients after uro-oncology surgery. *Methods:* A convenient sampling method was used to select patients with urinary system tumors who underwent surgery in the Department of Urology in Grade III A general hospital in Shanghai from May to August 2022. Patients who underwent surgery from May to June 2022 were assigned to the control group, and those who underwent surgery from July to August 2022 were assigned to the experimental group. The control group received routine post-discharge nursing health education and telephone follow-up. On the basis of routine discharge guidance, the experimental group implemented the intervention method based on the Internet platform in continuation care. The levels of self-management efficacy, satisfaction, and incidence of unplanned readmission were compared one month after discharge between the two groups. *Results:* One month after discharge, the self-management efficacy of the experimental group (90.15 ± 7.92) was significantly higher than that of the control group (79.10 ± 7.84), and the patient satisfaction score (97.83 ± 2.32) was significantly higher than that of the control group (90.23 ± 2.58), with statistical significance (*P* < 0.05). Additionally, the incidence of unplanned readmissions within one month after discharge in the experimental group (1.59%) was slightly lower than that in the control group (4.84%). *Conclusion:* The doctor-nurse cooperation follow-up model based on the Internet platform in continuation care can significantly improve the self-management efficiency of patients after discharge and enhance patient satisfaction, providing a new approach for discharge follow-up of urological tumor patients after surgery.

Keywords: Urologic neoplasms; Internet platform; Doctor-nurse cooperation; Continuation care

1. Introduction

Urologic neoplasms mainly include bladder cancer, renal cancer, and prostate cancer. According to data from the National Cancer Society, the incidence of urologic neoplasms is increasing year by year [1-3]. Surgical

treatment is the preferred option for early urologic neoplasms [4]. With the improvement of modern medical and surgical techniques and the promotion of the concept of rapid rehabilitation, the postoperative hospitalization time for patients with urinary system tumors has gradually shortened [5-7]. Most patients need to carry drainage tubes when discharged, necessitating professional nursing intervention and rehabilitation guidance to improve their self-management efficiency and ability, thereby ensuring patient safety.

In the past, the continuous care of patients with urinary tumors after surgery was usually carried out via a telephone follow-up model, primarily completed by nurses. This mode had several issues, such as low doctor participation, simple follow-up content, and low efficiency. In recent years, the National Health Commission has issued several policies advocating for and promoting the cooperation between the "Internet plus" model and the medical field [8,9]. "Internet plus medical health" has become a popular research direction. The "Internet plus" continuous care model has been actively applied to different patients, achieving satisfactory results [10-12]. However, there are currently few reports on the application of the "Internet plus" continuous nursing model for patients with urinary tumors after surgery. This study was conducted to evaluate the effect of a doctor-nurse cooperation follow-up model based on an Internet platform in the continuation of care for patients after uro-oncology surgery.

2. Materials and methods

2.1. General information

A convenient sampling method was used to select 130 patients who underwent surgical treatment in the urological tumor ward of our hospital from May 2022 to August 2022 and met the inclusion and exclusion criteria. Patients who underwent surgery from May to June 2022 were assigned to the control group, and those who underwent surgery from July to August 2022 were assigned to the experimental group. Inclusion criteria: (1) pathological results indicating malignant tumors of the urinary system (bladder tumor, kidney tumor, and prostate tumor); (2) age ≥ 18 years old; (3) clear mind and certain reading and understanding ability; (4) proficiency in using smartphones and WeChat software. Exclusion criteria: (1) terminal stage of malignant tumor (expected survival time is not more than 6 months); (2) combined with heart, liver, kidney, or other serious uncontrollable diseases. During the follow-up, 5 patients were lost to follow-up, 2 patients in the experimental group (did not follow up online as required), and 3 patients in the control group (follow-up phone calls were not answered). Finally, a total of 125 subjects were included, with 63 in the experimental group and 62 in the control group, as shown in **Figure 1**. All patients and their families voluntarily participated and signed informed consent forms. This study adhered to the ethical standards outlined in the 1964 Declaration of Helsinki.

In the experimental group, there were 19 females and 44 males, aged 21–75 years, with an average age of 65.28 ± 12.53 years, including 22 cases of bladder tumor, 22 cases of kidney tumor, and 19 cases of prostate tumor. In the control group, there were 21 females and 41 males, aged 19–73 years, with an average age of 66.58 ± 13.22 years, including 22 cases of bladder tumors, 19 cases of kidney tumors, and 21 cases of prostate tumors. There were no significant differences between the two groups in gender, age, education level, course of disease, tumor stage, whether discharged with a tube, and whether complicated by other chronic diseases ($P > 0.05$), as shown in **Table 1**.
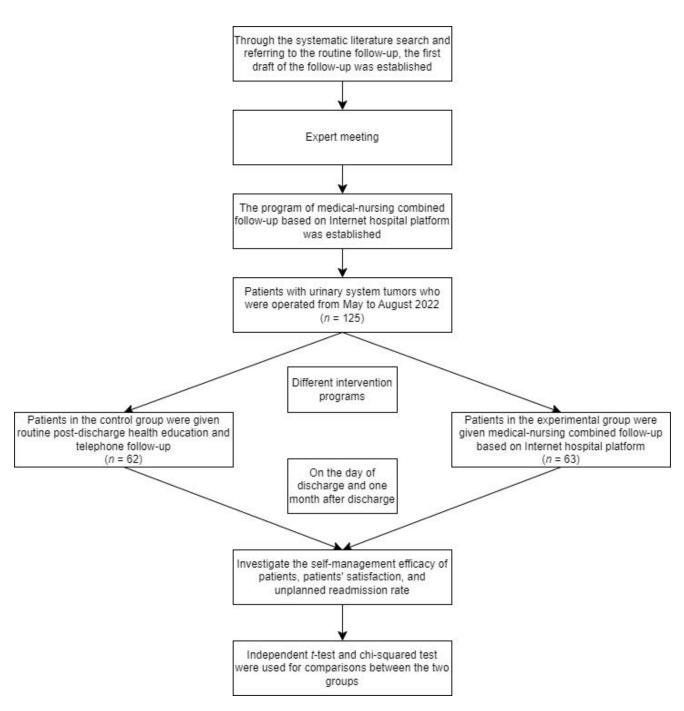
Figure 1. Flowchart of this study

Table 1. Comparison of general patient data between the two groups

Items	Control group ($n = 62$)	Experimental group ($n = 63$)	t / χ^2	P
Age	66.58 ± 13.22	65.28 ± 12.53	0.564	0.287
Gender			0.198	0.656
Female	21 (33.9%)	19 (30.1%)		
Male	41 (66.1%)	44 (69.9%)		
Diagnosis			0.312	0.856
Badder tumor	22 (35.5%)	22 (34.9%)		
Renal tumor	19 (30.6%)	22 (34.9%)		

Table 1 (Continued)

Items	Control group (*n* = 62)	Experimental group (*n* = 63)	t/χ^2	*P*
Prostate tumor	21 (33.9%)	19 (30.2%)		
Educational level			0.748	0.688
Primary school education or below	12 (19.4%)	15 (23.8%)		
Junior high school or high school diploma	42 (67.7%)	38 (60.3%)		
College degree or above	8 (12.9%)	10 (15.9%)		
Course of disease			1.332	0.514
1 month	6 (9.7%)	9 (14.3%)		
1–3 months	23 (37.1%)	18 (28.6%)		
> 3 months	33 (53.2%)	36 (57.1%)		
Neoplasm staging			1.046	0.593
Early stage	29 (46.8%)	33 (52.4%)		
Middle stage	27 (43.5%)	22 (34.9%)		
Late stage	6 (9.7%)	8 (12.7%)		
Combined with other chronic diseases			1.119	0.290
Yes	19 (30.6%)	25 (39.7%)		
No	43 (69.4%)	38 (60.3%)		
Discharge with tube			0.642	0.423
Yes	34 (54.8%)	39 (61.9%)		
No	28 (45.2%)	24 (38.1%)		

2.2. Nursing methods

2.2.1. Control group

The control group received routine post-discharge nursing health education and follow-up guidance. The contents included:

(1) The responsible nurse provided health education to patients and their families before discharge according to their individual conditions, including disease-related knowledge, dietary guidance, medication guidance, activity, and rest guidance;

(2) Informed the patient of the date and place of suture removal or extubation, and reminded the patient to follow the doctor's advice for regular postoperative review;

(3) Conducted a telephone follow-up 3–7 days after discharge, including asking about the patient's current physical condition, wound, catheter, diet, activity, and bowel and urine status.

2.2.2. Observation group

On the basis of routine discharge guidance, the experimental group implemented the intervention method based on the Internet platform in continuation care.

2.2.2.1. Establishment of the "Internet medical joint follow-up" group

The team members included 1 head nurse, 3 doctors (1 each for kidney, prostate, and bladder cancer), 1 specialist ostomy nurse, 5 clinical nurses, and 1 information nurse. The head nurse was responsible for

coordinating and managing the liaison work, the doctors handled further evaluation and follow-up of patients with referral needs, the specialist ostomy nurse managed complications of ostomy patients, the clinical nurses were responsible for follow-up promotion and data collection throughout the process, and the information nurse managed the follow-up platform maintenance and communication. Before the formal follow-up work, the team members were trained on the work content and the use of the follow-up platform. Team members coordinated their work and performed their respective duties.

2.2.2.2. Establishment of an Internet medical joint follow-up platform

Based on the WeChat public account of a Grade III A general hospital in Shanghai, a joint follow-up platform for medical care was set up. The platform includes two login ports: a medical login port and a patient login port. The patient login interface has modules such as online return visits, appointment registration, report inquiry, personal center, and online payment, to meet patients' online treatment and follow-up needs. The medical staff interface includes patient management, online consultation, report inquiry, health education, personal center, and other modules. The platform supports real-time chat functionality and two-way picture and video transmission between patients and medical staff. Before discharge, the responsible nurse instructed patients or their families to register personal accounts on this platform, bind patient information, and inform them of the procedures for using the follow-up platform. The first online follow-up of patients after discharge was conducted within 7 days.

2.2.2.3. Establishing the contents of the doctor-nurse cooperation follow-up model

Through a systematic literature search, combined with and referring to the current routine follow-up of patients with three major tumors of the urinary system, the research group formulated the first draft of the joint follow-up of medical care for urinary tumors based on the Internet platform and discussed it at an expert group meeting. This expert meeting included 24 medical and nursing experts in urology-related specialist fields, including 10 clinical medical experts and 14 nursing experts. The degree of expert authority was 0.895, the Kendall coordination coefficient was 0.502, and the significance test of the Kendall coordination coefficient was $P < 0.05$, indicating that the conclusion was credible. Through the expert meeting, the follow-up contents were revised as follows:

(1) According to the follow-up content of the patient's urine color, "ask the patient about the color of the urine" was revised to "guide the patient to take photos for evaluation";

(2) For patients after total cystectomy, the follow-up evaluation included assessing whether patients had low back pain.

The research group members summarized and integrated the expert opinions and determined the final follow-up content. The specific follow-up contents are shown in **Table 2**. The doctor-nurse cooperation follow-up system remains open to patients, ensuring that patients can contact medical personnel at any time when they encounter disease-related problems. In addition, medical staff will push disease-related information and video education to patients according to the current stage of the disease.

Table 2. Contents of the doctor-nurse cooperation follow-up model

Items	Details	Online doctor's consultation is needed
Temperature	Whether there is a fever after discharge	Contact the doctor online if the temperature is more than 38.5°C
The color of urine	Ask the patient if the urine color is normal, can use photographs to determine the color of the urine	The urine is bright red or presents blood clots
Whether discharge with tube	(1) Guide the patient to fix the catheter properly, keep the drainage unobstructed, and observe the color. Ask if there is any obstruction of the catheter, and guide patients to do perineum care, to prevent infection. Inform the patient of the time to remove the catheter and the online appointment time for extubation (2) If the negative pressure ball has not been removed, guide the patient to maintain it in the negative pressure, maintain its patency, and fix it properly. Ask the patient about the color of the drainage fluid (photographs can be sent) and the total amount of negative pressure balls per day. Inform the patient of the indication that the negative pressure balls can be removed, and guide the patient to make an appointment online to remove the negative pressure balls	The urine is bright red or presents blood clots The catheter is blocked The catheter slipped out The color of the drainage fluid of the negative pressure ball is bright red or more than 300 mL/d or increased continuously The negative pressure ball is leaking The negative pressure ball is blocked The negative pressure ball slipped out
Wound healing and dressing condition	Assess wound healing, bleeding, and exudation of the dressing Inform the patient of the time of removal of stitches and the method of online appointment	The wound has severe pain, severe bleeding, seepage, and so on
Diet	Assess the patient's daily food intake and inform the patient to pay attention to the intake of high-quality protein	Patients develop nausea and vomiting resulting in significantly reduced eating or loss of appetite
Defecation	Assess whether the patient has normal stool	Constipation or diarrhea or stop defecating
Activities and exercises	Assess the patient's daily activity, advise the patient to do appropriate aerobic exercise, and take care to avoid movements that increase internal abdominal pressure	
Pelvic floor exercises	Guide patients with prostate cancer after catheter removal to perform pelvic floor muscle exercise, videos and education materials can be sent to patients through the Internet platform to guide the precautions for pelvic floor muscle exercise	
The stoma of the urinary system	Evaluate the color of the stoma (with pictures), the occurrence of complications such as stoma bleeding and necrosis, and whether the patient has learned to change the stoma bag Combined with video information to educate patients about stomatology nursing knowledge Evaluate whether the catheter in the stoma is unobstructed, and instruct the patient to pay attention to protection when replacing the stoma bag to avoid catheter withdrawal Inform the patient of the catheter replacement time	If complications arise, the enterostomal therapist should intervene promptly
Lumbago pain	To evaluate patients with low back pain after total cystectomy	The patient presented with significant lumbago
Other situations	Ask the patient if there is any other discomfort	If necessary, contact the doctor online

2.3. Observational index

2.3.1. Self-management efficacy

The Chinese version of the Strategies Used By People to Promote Health (SUPPH) scale was used to assess the self-management efficacy levels of patients at the time of discharge and one month after discharge. The scale was originally developed by Professor Lev *et al*. [13] of the University of Lagos in the United States in 1996 to measure and evaluate the self-efficacy of patients with chronic diseases in self-management activities. In 2011, Huijuan Qian [14] conducted a Chinese and cultural adaptation of this scale and confirmed that it has good

reliability and validity [15], making it suitable for evaluating the self-management efficacy of cancer patients in China. The Chinese version of SUPPH consists of 28 items, covering three dimensions: positive attitude, self-stress reduction, and self-decision making. The total Cronbach's α coefficient of the questionnaire was 0.978, and the Cronbach's α coefficients for the three dimensions were 0.971, 0.821, and 0.949, respectively, indicating good reliability and validity [16]. The pre-experimental results of this study showed a Cronbach's α coefficient of 0.943 for this questionnaire.

2.3.2. Patient satisfaction

A satisfaction scale designed by the investigator was used to evaluate patient satisfaction levels. The evaluation included four aspects: form and content of nursing service, attitude and communication, technology and ability, and health education. Each item was rated on a 5-point Likert scale: very dissatisfied, dissatisfied, average, satisfied, and very satisfied, corresponding to scores from 1 to 5. The higher the score out of 100, the higher the patient's satisfaction with the medical staff. The pre-experimental results of this study showed a Cronbach's α coefficient of 0.832 for this survey tool.

2.3.3. Rate of unplanned readmissions

The unplanned readmissions within one month for both groups were collected, including the incidence and specific conditions of unplanned emergency visits and hospitalizations.

2.4. Statistical analysis

Data were processed using SPSS Statistics version 22.0. Measurement data conforming to a normal distribution are expressed as means ± standard deviation (SD), while count data are expressed as frequency and percentage. An independent sample *t*-test was used for measurement data conforming to a normal distribution, and a rank sum test was used for data not conforming to a normal distribution. Chi-squared or Fisher's exact probability test was performed for categorical data, such as the unplanned extubation rate. A *P*-value of < 0.05 was considered statistically significant.

2.5. Quality control

To ensure the validity and authenticity of the data, all data in this study were checked and entered by two individuals, and invalid questionnaires were excluded. Additionally, all researchers received standardized training on how to use the "Internet Follow-up Platform," ensuring they were familiar with the operational methods and procedures.

3. Results

3.1. Comparison of self-management efficacy between two groups

The results of this study showed that there was no statistical significance in the scores of self-management efficacy between the two groups before intervention (*P* > 0.05). One month after discharge, the scores of all dimensions and total scores of self-management efficacy of patients in the experimental group were significantly higher than those of the control group (*P* < 0.05; **Table 3**).

Table 3. Comparison of self-management efficacy between two groups (mean ± SD)

Items	Control group (*n* = 62)	Experimental group (*n* = 63)	*t*	*P*
The dimensions of a positive attitude	41.97 ± 4.22	45.79 ± 4.14	5.112	0.000
The dimensions of self-decision	7.37 ± 1.72	9.29 ± 1.69	6.314	0.000
The dimensions of self-decompression	29.76 ± 4.26	35.06 ± 4.87	6.483	0.000
Total score	79.10 ± 7.84	90.15 ± 7.92	8.068	0.000

3.2. Comparison of patient satisfaction between two groups

Table 4 shows the satisfaction score of the experimental group (97.83 ± 2.32) was significantly higher than that of the control group (90.23 ± 2.58; *P* < 0.05).

Table 4. Comparison of patient satisfaction between two groups (mean ± SD)

Items	Control group (*n* = 62)	Experimental group (*n* = 63)	*t*	*P*
Content and form of nursing service	21.16 ± 1.33	24.18 ± 1.13	8.911	0.000
Attitude and communication	21.47 ± 1.38	23.25 ± 1.53	6.815	0.000
Technology and capability	21.25 ± 1.27	23.14 ± 1.23	8.435	0.000
Health education	22.46 ± 1.02	24.12 ± 0.94	9.440	0.000
Total score	92.23 ± 2.58	97.83 ± 2.32	12.773	0.000

3.3. Comparison of the rate of unplanned readmissions between two groups

The results of this study showed that there were 3 cases of unplanned readmissions in the control group and 1 case of unplanned readmissions in the experimental group within 1 month after discharge. The rate of unplanned readmissions in the experimental group (1.59%) was lower than that in the control group (4.84%), but the difference was not statistically significant (*P* > 0.05).

4. Discussion

In recent years, advancements in medical technology, changes in public health awareness, and the widespread implementation of cancer screening have significantly increased the early detection rates of malignant urinary system tumors, providing more opportunities for early treatment and surgery for patients. Additionally, the development and application of neoadjuvant chemotherapy and immunotherapy drugs [17] have improved the survival rate and survival time for patients with urinary tumors, leading to a steady decline in mortality rates [18,19]. The comprehensive treatment model centered around surgery has greatly enhanced the quality of life and life expectancy for these patients, though they often face challenges in post-operative self-care, increasing the demand for high-quality follow-up care.

Since the 1980s, nursing scholars, particularly in the United States, have been integrating information technology into the nursing field. Currently, using Internet information technology for health consultation and medical services is common in Western developed countries. In recent years, the National Health Commission has also incorporated "Internet plus" into the development strategy for nursing and health services, placing greater emphasis on developing "Internet plus medical services." In this study, the doctor-nurse cooperation follow-up model overcomes the time and space limitations of traditional extended nursing [20], delivering

specialized management and rehabilitation exercise knowledge to patients after discharge through online interaction. Compared with traditional follow-up methods, this approach saves time and effort, allows patients to repeatedly view relevant health education, and offers significant advantages. Therefore, Internet-based joint medical follow-up is not only an innovation in the nursing service model but also an expansion of medical service forms, enriching the content of continued care for discharged patients with urinary tumors.

Self-management efficacy is an individual's belief in their ability to complete a specific task and achieve the desired outcome [21]. The results of this study showed that, compared to traditional telephone follow-up, the Internet-based joint follow-up model significantly improved the self-management efficacy of patients one month after discharge, consistent with other studies [22-24]. Possible reasons include: (1) The timeliness of telephone follow-up may be limited. In practice, some patients may find phone communication inconvenient, or there may be communication barriers, preventing medical staff from fully understanding the patients' physical and mental states. The Internet platform, as a new communication tool, facilitates the exchange of texts, pictures, and voice messages, addressing the interaction and information limitations of traditional follow-up models. (2) The Internet-based joint medical follow-up platform prioritizes patient-centered care, providing continuous support to discharged patients. Patients can access professional nursing guidance at any time by leaving messages or asking questions online. (3) The Internet-based joint medical follow-up model allows for the online processing of medical referrals. For issues that cannot be resolved online, nursing staff can refer patients to the online doctor consultation interface, offering sufficient clinical medical support and ensuring patient safety. This greatly boosts patients' self-management confidence and enhances their ability to cope with their condition.

Continuous care extends inpatient care by providing uninterrupted medical services to discharged patients, enabling nursing staff to monitor recovery and address issues in patient behavior and care processes post-discharge. This study found that patient satisfaction in the experimental group increased significantly, indicating that the doctor-nurse cooperation follow-up model based on the Internet platform in continuation care was highly appreciated by patients, consistent with other studies [25,26]. The Internet-based online follow-up facilitates patient contact with medical staff from home, especially beneficial for out-of-town patients, significantly reducing the time and cost associated with traveling to Shanghai for medical treatment. It should be noted that Internet-based online follow-up is a network-dependent medical service, which may be challenging for elderly patients. Therefore, it is recommended to establish a team combining full-time and part-time staff with a community service management team to provide focused care and guidance to elderly patients who require online follow-up, helping them adapt to and accept the online follow-up model.

Unplanned readmission refers to a patient's unexpected return to the hospital for the same or a related condition after a previous discharge [27]. The rate of unplanned readmission is an important indicator of hospital treatment and nursing quality. This study showed that the Internet-based joint follow-up model significantly reduced the rate of unplanned readmission within one month of discharge. Potential reasons include the influence of factors such as patient age, comorbidities, tumor stage, and length of stay on unplanned readmission [28]. Additionally, the study's small sample size of 125 patients and short follow-up period are limitations that may have contributed to the statistical significance of the findings. Future studies should increase the sample size and extend the follow-up period to verify whether the doctor-nurse cooperation follow-up model based on the Internet platform can improve the unplanned readmission rate in patients.

5. Conclusion

The medical-nursing combined follow-up program based on the Internet hospital platform can significantly improve patients' self-management efficiency after discharge and increase patient satisfaction. It also enriches

the forms of continuous care for discharged patients and provides a new approach for discharge follow-up after urological tumor surgery. Due to objective limitations, this study included a smaller number of subjects, and the follow-up period was only one month. Future studies should expand the sample size and extend the follow-up period to verify the effects of the medical-nursing combined follow-up program based on the Internet hospital platform.

Authors contribution

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