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Application of Robocare Nursing Mode in Whole-Process Nursing of Domestic Robot-Assisted Radical Prostatectomy

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Abstract

Objective: To investigate the application effects of the Robocare nursing model in the whole-process care of domestic robot-assisted radical prostatectomy. **Methods:** A total of 60 patients undergoing domestic robot-assisted radical prostatectomy were selected from the Operating Room of a Grade III-A hospital in Jingzhou City between September 2024 and September 2025. The patients were randomly divided into a control group (30 cases) and an experimental group (30 cases) using a random number table method. The control group received conventional nursing care, while the experimental group received the Robocare nursing model. Postoperative recovery time, postoperative complication incidence, and nursing satisfaction were compared between the two groups. **Results:** The experimental group showed shorter initial anal ventilation time, postoperative ambulation time, first bowel movement time, drainage tube removal time, and hospitalization duration compared to the control group ($P < 0.05$). The total postoperative complication rate in the experimental group was lower than that in the control group ($P < 0.05$), and patients in the experimental group exhibited higher overall satisfaction upon discharge ($P < 0.05$). **Conclusion:** The Robocare nursing model can effectively shorten postoperative recovery time, reduce postoperative complication incidence, and improve nursing satisfaction when applied to the whole-process care of domestic robot-assisted radical prostatectomy.

Keywords

Robocare Nursing Mode, Robot, Radical Prostatectomy, Whole-Process Nursing

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1. Introduction

Prostate cancer is a malignant tumor of the male genitourinary system, primarily characterized by symptoms such as dysuria, urinary frequency, urgency, and rectal pain [1]. For these patients, robot-assisted radical prostatectomy serves as a crucial clinical treatment. The robotic surgical system, with its advantages of minimal invasiveness, flexible precision instruments, shorter postoperative recovery time, and high safety, has been widely adopted in urological surgeries [2]-[4]. However, this surgical approach presents new challenges for nursing care models. To ensure surgical efficiency, clinical practice currently incorporates corresponding nursing interventions to support the procedure. Yet traditional operating room nursing still falls short of meeting clinical demands. The Robocare nursing model, as an innovative approach, employs robot-assisted precision care to implement comprehensive perioperative nursing interventions centered on time management, thereby ensuring surgical quality and improving patient outcomes [5]-[7]. The TuMi robot, a new type of robotic platform developed by China Shanghai MicroPort Robotics Homo sapiens Company, aims to offer a more affordable, compact, and feature-rich alternative to the Da Vinci system. This study aims to evaluate the application of the Robocare nursing model in the full-process nursing care of domestically produced Tumai robot-assisted laparoscopic radical prostatectomy. The results are reported below.

2. Data and Methods

2.1. General Information

A total of 60 patients undergoing domestic robot-assisted radical prostatectomy were selected from the Operating Room of a Grade III-A hospital in Jingzhou City between September 2024 and September 2025. The random number table method was used to generate random numbers based on the admission sequence of the study subjects. According to the corresponding generated random numbers, patients numbered 1 - 30 were assigned to the control group, while patients numbered 31 - 60 were assigned to the experimental group. The control group received standard nursing care, while the experimental group underwent Robocare nursing care. Comparison of general patient data showed no statistically significant differences ($P > 0.05$), as shown in **Table 1**. Inclusion criteria: 1) Pathological histology confirmed diagnosis of prostate cancer; 2) Met surgical indications and were receiving their first TUMAI robot-assisted laparoscopic radical prostatectomy at this hospital; 3) Age ≥ 18 years; 4) Informed consent from both patients and their families. Exclusion criteria: 1) Coexisting coagulation disorders; 2) Complications, including heart, liver, or kidney dysfunction; 3) Cognitive impairment or mental abnormalities; 4) Midoperative switching to manual surgery or open surgery. The research has been approved by our hospital's ethics committee.

Table 1. General information of the two groups.

Project	Control group (n = 30)	Test group (n = 30)	t/χ^2/Fisher value	*P* value
Age (Years)	69.93 ± 5.85	70.13 ± 6.67	−0.123[a]	0.902
BMI (kg/m^2)	24.65 ± 3.47	23.94 ± 2.98	0.854[a]	0.397
TNM by Stages			5.705[b]	0.107
T1	0 (0.0%)	3 (10%)		
T2	22 (73.33%)	23 (76.67%)		
T3	7 (23.33%)	2 (6.67%)		
T4	1 (3.33%)	2 (6.67%)		
Degree of Education			2.59[c]	0.459
Primary School	7 (23.33%)	8 (26.67%)		
Junior Middle School	13 (43.33%)	8 (26.67%)		
Secondary Vocational/High School	6 (20%)	6 (20%)		
College and Above	4 (13.33%)	8 (26.67%)		

Note: a: t-value; b: Fisher value; c: χ^2 value.

2.2. Methodology

2.2.1. Control Group

The control group received standard interventions, including preoperative visits, intraoperative management, and postoperative care. 1) Preoperative Visit: One day before surgery, circulating nurses conducted a preoperative assessment to inform patients about surgical precautions. 2) Intraoperative Management: Patients were administered general anesthesia with continuous vital sign monitoring. The operating room temperature was maintained at 21˚C - 25˚C to ensure patient comfort. 3) After surgery, patients were transferred to the anesthesia recovery room. If no adverse reactions occur within 2 hours, they can be moved to the general ward, with circulating nurses completing handover documentation.

2.2.2. Test Group

The comprehensive care under the Robocare nursing model is implemented alongside conventional interventions, with a dedicated Robocare nursing team comprising the Department of Anesthesiology Director, Operating Room Head Nurse, Urology Head Nurse, and three surgical nurses. 1) Preoperative Education: On admission day, team members conduct initial consultations with patients and their families to collect medical data and provide preoperative education. One day prior to surgery, the team distributes informational brochures and presents PowerPoint presentations detailing treatment approaches, robotic-assisted surgical advantages, preoperative precautions, potential postoperative complications, and

recovery protocols. 2) Intraoperative Management: During surgery, continuous monitoring of vital signs (heart rate, blood pressure, respiration) ensures prompt identification and management of abnormalities. Body temperature is carefully regulated using air blankets and infusion warming devices. The team assists surgeons in optimizing robot positioning and instrument angles to maintain optimal working conditions, while maintaining close communication with surgical team members to ensure the precise delivery of instruments and medications for successful procedure completion. 3) Postoperative Care: On the first postoperative day, monitor the patient's vital signs, address any abnormalities, and observe drainage tube patency and fluid output. Administer scheduled bilateral lower limb pneumatic compression therapy to prevent postoperative deep vein thrombosis (DVT). Guide patients through rehabilitation exercises such as pelvic floor muscle training. Before initiating training, ensure complete bladder emptying with no residual urine. Perform anal contractions followed by normal breathing, then rhythmically lift pelvic muscles to maximum contraction for 2 seconds, followed by relaxation. Complete 3 repetitions per set, performing 10 - 20 sets daily. Gradually increase to 4 sets daily. Brief patients on precautions for the next three days. Conduct discharge education one day before hospital discharge. Remind patients to schedule suture removal at 9 days post-operation. Conduct telephone follow-ups two weeks after discharge to assess bleeding and pain management, reporting findings to physicians. Schedule a follow-up examination one month post-discharge to evaluate disease-related indicators. Notify patients for a third follow-up visit three months after discharge.

2.3. Observing Indicators

1) Postoperative Recovery Evaluation: The study documented and compared the first rectal gas passage time, postoperative ambulation duration, initial bowel movement timing, drainage tube removal schedule, and total hospitalization periods between the two groups. 2) Postoperative Complications: These included nausea/vomiting, deep vein thrombosis in the lower extremities, pulmonary infections, and anastomotic leakage. 3) Nursing Satisfaction Assessment: Newcastle Satisfaction with Nursing Scale (NSNS) [8] was employed to evaluate nursing satisfaction levels, categorized as: Excellent (76 - 95 points), Good (65 - 75 points), Fair (57 - 64 points), Poor (41 - 56 points), and Very Poor (19 - 40 points).

2.4. Statistical Analysis

All data were statistically analyzed using SPSS 26.0. Categorical data were presented as frequency (percentage) [n(%)], while ordinal data (line) were analyzed using the chi-square test, Fisher's exact probability test, or the rank sum test. Normally distributed quantitative data were expressed as mean ± standard deviation, with inter-group comparisons conducted using independent samples t-tests. Differences were considered statistically significant when $P < 0.05$.

3. Results

3.1. Comparison of Postoperative Recovery between the Two Groups

The time of anal ventilation, time of getting out of bed after surgery, time of defecation, time of drainage tube removal, and hospitalization time of the first trial group were shorter than those of the control group, and the difference was statistically significant ($P < 0.05$), as shown in Table 2.

Table 2. Comparison of postoperative recovery between the two groups ($\overline{x} \pm s$).

Group	Number of cases	First anal ventilation time (h)	Time to get out of bed after surgery (h)	Time to first defecation (h)	Time of drainage tube removal (d)	Length of stay (d)
Control group	30	43.57 ± 3.29	25.05 ± 3.20	48.99 ± 3.52	8.07 ± 0.79	10.03 ± 0.71
Test team	30	27.51 ± 2.38	9.35 ± 0.86	33.91 ± 3.01	4.84 ± 0.47	7.04 ± 0.46
t value		21.637	25.964	17.843	19.128	19.297
P value		0.000	0.000	0.000	0.000	0.000

3.2. Comparison of Postoperative Complication Rates between the Two Groups

The total incidence of postoperative complications in the control group was 36.67%, while that in the experimental group was 13.33%, indicating a significantly lower incidence of postoperative complications in the experimental group compared to the control group, and the difference was statistically significant ($P < 0.05$), as shown in Table 3.

Table 3. Comparison of postoperative complications between the two groups [n(%)].

Group	Number of cases	N and V	Deep vein thrombosis in the lower extremities	Pulmonary infection	Vaginal fistula	Infection of the incisional wound	Postoperative hemorrhage	Overall incidence
Control group	30	3 (13.33)	1 (3.33)	2 (6.67)	1 (3.33)	2 (6.67)	2 (6.67)	11 (36.67)
Test team	30	1 (3.33)	0 (0)	1 (3.33)	0 (0)	1 (3.33)	1 (3.33)	4 (13.33)
χ^2 value								5.963
P value								0.015

3.3. Comparison of Nursing Satisfaction between the Two Groups at Discharge

The rank test of grade data showed that, compared with the control group, the total satisfaction of patients in the experimental group was higher at discharge, and the difference was statistically significant ($P < 0.05$), as shown in Table 4.

Table 4. Comparison of nursing satisfaction between the two groups at discharge [n(%)].

Group	Number of cases	Very satisfied	Satisfied	Generally satisfied	Discontent	Very dissatisfied	Overall satisfaction
Control group	30	10 (33.33)	8 (26.67)	4 (13.33)	5 (16.67)	3 (10)	22 (73.33)
Test team	30	16 (53.33)	10 (33.33)	2 (6.67)	1 (3.33)	1 (3.33)	28 (93.33)
Z/χ^2 value				−2.147			4.320
P value				0.032			0.038

4. Discussion

Prostate cancer, a highly prevalent malignant tumor in males, has shown an increasing trend in recent years [9]. Robotic-assisted radical prostatectomy has become a crucial surgical approach due to its advantages of minimal invasiveness and faster recovery [10]. However, this surgical method imposes higher demands on perioperative care. The Robocare comprehensive nursing model, a novel intervention specifically designed for robotic-assisted radical prostatectomy, provides step-by-step, meticulous care through advanced holistic nursing concepts. This approach helps patients recover faster and reduces complication rates [11] [12].

The study results demonstrate that the experimental group showed significantly better outcomes than the control group in multiple aspects: first-time anal ventilation time, postoperative ambulation time, first bowel movement time, drainage tube removal time, and hospitalization duration ($P < 0.05$). This indicates that the Robocare nursing model effectively promotes postoperative functional recovery. The reasons for this may include preoperative consultations with patients and families to provide knowledge education, enhancing patients' awareness through distributing brochures and PPT presentations, thereby improving cooperation and accelerating recovery [13] [14]. The experimental group also exhibited a markedly lower postoperative complication rate than the control group ($P < 0.05$), suggesting that Robocare nursing enhances surgical safety. This may be attributed to the nursing team's close monitoring of robot operations during surgery, assisting doctors in adjusting instrument angles, implementing warm-up measures, administering bilateral lower limb pneumatic therapy postoperatively, and early functional exercises—all contributing to successful procedures and improved recovery [15] [16]. Additionally, preoperative multi-format education increased patient engagement, while professional intraoperative coordination enhanced safety, ultimately boosting satisfaction levels [6].

In conclusion, the Robocare nursing model applied in the comprehensive care of domestically developed robot-assisted radical prostatectomy (RAP) can effectively shorten postoperative recovery time, reduce complication rates, promote physical rehabilitation and early recovery, while improving patient satisfaction. However, this study has certain limitations: the relatively small sample size and single-center design, as well as the absence of long-term follow-up analysis. Further validation of these conclusions requires large-scale, multi-center studies with extended follow-up periods to ensure reliability.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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