

Application of "Internet + Multidisciplinary Collaboration" Continuous Nursing Model in the Rehabilitation of Patients after Cervical Cancer Surgery

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Abstract: Exploring the comprehensive impact of an "Internet + Multidisciplinary Team (MDT)" continuity of care model on the rehabilitation process, self-care ability, psychological status, and quality of life of postoperative cervical cancer patients, in order to provide high-quality evidence for optimizing postoperative care protocols. A total of 82 patients who underwent radical hysterectomy for cervical cancer in our hospital from December 2023 to December 2024 were selected. They were randomized using computer-generated sequences, with allocation concealment and a single-blind design, and divided into an observation group and a control group, with 41 patients in each group (the sample size was calculated using PASS 15.0 software, considering attrition rates). The control group received conventional continuity of care (telephone follow-up + printed health manuals), while the observation group established an MDT team including gynecologists, nutritionists, and psychologists. Leveraging a WeChat-based platform, the MDT team implemented electronic health record management, video follow-ups, personalized rehabilitation guidance, and online peer support. The team also conducted regular consultations and activated emergency intervention protocols. After 3–6 months of intervention, outcomes were assessed using the PFIQ-7, ESCA, HADS, SAS, and FACT-C scales. Post-intervention, the observation group showed significantly shorter wound healing time (10.5 ± 2.1 days vs. 13.2 ± 2.5 days) and significantly lower PFIQ-7 scores (5.3 ± 4.2 points vs. 12.3 ± 2.8 points). The ESCA total score (128.5 ± 15.2 points vs. 102.3 ± 12.8 points) and FACT-C total score (319.3 ± 25.6 points vs. 282.7 ± 22.3 points) were significantly higher in the observation group, while HADS depression and anxiety scores and SAS scores were significantly lower (all $P < 0.001$). Patients who underwent laparoscopic surgery demonstrated even greater rehabilitation benefits. The "Internet + Multidisciplinary Team" continuity of care model can significantly promote physiological recovery in postoperative cervical cancer patients (particularly those undergoing laparoscopic surgery), enhance self-care ability, alleviate negative emotions, and improve quality of life. Moreover, the platform demonstrates high accessibility and compliance with privacy regulations, indicating substantial value for clinical promotion.

1. Introduction

Among gynecological malignancies, cervical cancer stands as one of the primary threats to women's health worldwide. Global cancer statistics in 2021 revealed 604,000 new cases (3.1% of all malignant tumors) and 342,000 deaths (3.6% of all malignant tumor-related deaths), with both incidence and mortality rates ranking among the highest for female malignancies [1,2]. The burden of cervical cancer in China is even more severe, accounting for approximately one-third of global cases and deaths. The peak incidence occurs between 40 and 60 years of age, and recent trends indicate an "increasing incidence and younger age of onset" [3]. Surgery remains the cornerstone treatment for cervical cancer, including procedures such as cervical conization and radical hysterectomy [4]. However, postoperative complications often include pelvic floor dysfunction (e.g., urinary abnormalities, organ prolapse), anxiety, depression, and decreased quality of life. Traditional post-discharge care, constrained by "spatial and temporal limitations and single-disciplinary approaches," fails to meet patients' multidimensional rehabilitation needs [5]. The "Internet + multidisciplinary collaboration" continuous care model leverages smart platforms to integrate multidisciplinary resources, offering a novel pathway for comprehensive postoperative management. This study validates its efficacy through randomized controlled design and reports the findings as follows.

2. Materials and Methods

2.1 Clinical Data

A total of 82 patients who underwent radical cervical cancer surgery in our hospital from December 2023 to December 2024 were enrolled. Inclusion criteria: ① Meeting the diagnostic criteria outlined in the "Guidelines for the Diagnosis and Treatment of Cervical Cancer (2021 Edition)", with postoperative pathological confirmation of cervical cancer; ② Age range of 25-69 years, with clear consciousness and the ability to operate smartphones (e.g., WeChat usage, photo upload); ③ Estimated postoperative survival time ≥ 1 year; ④ Signed informed consent. Exclusion criteria: ① Concurrent dysfunction of vital organs (e.g., heart, liver, kidney) or cognitive impairment (e.g., Alzheimer's disease); ② Tumor recurrence or metastasis within 3 months postoperatively; ③ Withdrawal from the study (e.g., lost to follow-up, refusal to continue intervention).

Randomization was performed using a computer-generated sequence (www.randomization.com) with allocation concealment achieved through sealed opaque envelopes (prepared by nurses not involved in the study). A single-blind approach was implemented for outcome assessors (e.g., scale scorers, imaging evaluators) without disclosing the group assignments to patients. The study ultimately divided participants into an observation group (n=41) and a control group (n=41). Sample size calculation was based on the effect size ($d=0.82$) of "Internet + Continuity of Care" in reducing postoperative wound healing time for cervical cancer, as reported by Zhang Lan et al. [5]. With a significance level (α) of 0.05 (two-tailed) and a power of 0.2 (80% confidence), the PASS 15.0 software calculated that each group required at least 38 participants. Considering a 10% dropout rate, the final sample size for each group was set at 41.

The baseline characteristics of the two patient groups were balanced ($P>0.05$) and comparable, as detailed in Table 1. This study was approved by the Medical Ethics Committee of the Second Affiliated Hospital of Anhui Medical University (Approval No.: AYEF-2023-068, Approval Date: November 15, 2023) and adhered to the principles of the Declaration of Helsinki (2022 Revision). All patients provided informed consent.

Table 1: Comparison of General Data between the Two Groups

group	Number of cases	41	age (year, $x \pm s$)	Pathological type (n, %)		Modus operandi (n, %)
			SC	adenocarcinoma	laparoscope	open abdominal surgery
observation group	41	49.2 \pm 8.5	33 (80.5)	8 (19.5)	38 (92.7)	3 (7.3)
control group	41	48.8 \pm 7.9	35 (85.4)	6 (14.6)	35 (85.4)	6 (14.6)
t/ χ^2 price	—	0.203	0.452	1.187		
P Price	—	0.840	0.501	0.276		

2.2 Nursing Methods

2.2.1 Control Group: Conventional Continuous Nursing

① Pre-discharge intervention: Distribution of a paper health booklet (containing only text-based wound care and medication instructions, without video/animated aids), followed by a 30-minute face-to-face rehabilitation guidance session (covering "postoperative activity contraindications and follow-up schedule"); ② Post-discharge follow-up: Completion of the first telephone follow-up within 2 weeks after discharge, with subsequent follow-ups every 2 weeks for 10 minutes each, using standardized checklists (core content: presence of wound redness, swelling, or exudate, adherence to prescribed medications). Patient complaints are recorded and inquiries addressed, with no adjustments to individualized treatment plans.

2.2.2 Observation Group: "Internet + Multidisciplinary Collaboration" Continuous Nursing

(1) Formation and Training of MDT Teams

The team consists of 1 associate chief gynecologist (with over 5 years of experience in postoperative management of cervical cancer), 1 clinical dietitian (certified dietitian with over 3 years of experience in oncology nutrition), 1 psychological counselor (National Level II Psychological Counselor), 1 rehabilitation therapist (specializing in pelvic floor rehabilitation with over 2 years of experience), and 5 gynecological specialist nurses (with a working experience of ≥ 5 years). All members underwent 3 specialized online nursing training sessions (each lasting 2 hours, covering online communication skills, remote assessment methods, and electronic medical record management standards). Only those who passed the assessments were eligible to participate in the study.

(2) Establishment of the Smart Nursing Platform

The system is built on the WeChat official account and comprises three major modules: ① "Health Information": Weekly updates twice with postoperative rehabilitation content (e.g., animated videos of pelvic floor muscle training, lymphedema prevention exercises, and nutritional science for cervical cancer patients); ② "Online Consultation": Nurses respond to patient inquiries within 24 hours, with complex cases referred to corresponding MDT members; ③ "Rehabilitation Records": Establishes encrypted electronic health records (compliant with the Personal Information Protection Law) for patients, documenting surgical details (operation type, pathological stage), postoperative indicators (wound healing status, PFIQ-7 score), and psychological assessment results. The system supports patients in uploading medication records, dietary photos (once daily), and wound photos (every 3 days).

(3) Personalized Intervention Measures

Physiotherapeutic Rehabilitation Management: The rehabilitation therapist conducts one-on-one

video demonstrations of pelvic floor muscle exercises (contract for 3-5 seconds, relax for 2-3 seconds, 10-15 repetitions per set, 3-4 sets per day). The intensity is adjusted weekly based on the patient's uploaded training check-in records (e.g., increasing to 15-20 repetitions per set if satisfactory performance is maintained for one consecutive week). The dietitian evaluates nutritional intake through dietary photos (e.g., breakfast and lunch) and formulates personalized meal plans (e.g., daily protein intake of 1.2-1.5g/kg, recommending a combination of "lean meat + fish + leafy greens," such as: breakfast: 2 eggs + 250ml milk; lunch: 100g sea bass + 200g spinach). The meal plan is updated monthly [11].

Psychological Support Intervention: Implementation of a "1+1" dedicated matching mechanism (one nurse assigned to one patient), with weekly WeChat voice/text communication (15-20 minutes per session) twice a week, adopting a "listening-empathy-guidance" model to alleviate anxiety; when the HADS score exceeds 8 points, referral to a psychological counselor for in-person one-on-one counseling (1-2 times per month) [12].

Social support system establishment: Organize online patient exchange sessions (60 minutes per session) on the last Saturday of each month, inviting patients who have undergone postoperative rehabilitation for over 6 months and have a FACT-C total score >300 to share their experiences. Create a WeChat support group. Have nurses periodically share patient recovery stories there to help build confidence.

(4) Dynamic Follow-up and MDT Consultation

Monthly 1-2 WeChat video follow-ups (each lasting 20-30 minutes) are conducted, during which nurses collect patient rehabilitation data (wound photos, training records, dietary logs). The MDT team holds online consultations every 2 weeks (30 minutes per session): gynecologists assess tumor stability, dietitians adjust meal plans, and rehabilitation therapists optimize training regimens. An emergency consultation is initiated (completed within 24 hours) when any of the following conditions occur: "PFIQ-7 score increase >3 points, wound healing delay >2 days (e.g., sutures remain in place after 12 days postoperatively), or SAS score >15 points," followed by adjustment of the intervention plan.

2.3 Observation Indicators

(1) Rehabilitation process indicators

① Wound healing time: Record the duration from the surgical date to complete suture removal (no redness, swelling, or exudate); ② Pelvic floor dysfunction score: Evaluated using the Pelvic Floor Impairment Questionnaire (PFIQ-7) [8], which includes three dimensions: urinary dysfunction (e.g., urinary frequency, incontinence), defecation dysfunction (e.g., constipation, straining during defecation), and symptoms related to organ prolapse. The total score ranges from 0 to 40, with lower scores indicating better function (Cronbach's $\alpha=0.88$, content validity index CVI=0.93 in this study).

(2) Self-care ability

The self-care ability was assessed using the Self-Care Ability Scale (ESCA) [2], which comprises four dimensions: self-care skills (24-120 points), self-care responsibility (16-80 points), self-concept (12-60 points), and health knowledge level (20-100 points). The total score ranges from 72 to 360 points, with higher scores indicating stronger self-care ability.

(3) Psychological state

① Self-Rating Anxiety Scale (SAS) [3]: Comprising 20 items with a total score range of 0-100, where a score below 50 indicates normal anxiety levels, and lower scores reflect milder anxiety; ② Hospital Anxiety and Depression Scale (HADS) [6]: Includes two dimensions—Anxiety (HADS-A) and Depression (HADS-D)—each scored 0-21, with scores below 8 indicating no significant mood

disorder, 8-10 suggesting a suspected disorder, and above 10 indicating a confirmed disorder.

(4) Quality of Life

The quality of life assessment for cancer patients was conducted using the Cervical Cancer Module of the Functional Assessment of Cancer (FACT-C) [4], which comprises five dimensions: physical condition (0-60 points), social and family situation (0-40 points), emotional condition (0-40 points), functional status (0-48 points), and additional concerns (cervical cancer-related symptoms, 0-32 points). The total score ranges from 0 to 220 points (original scale). In this study, the standardized total score (0-100 points) was used, with higher scores indicating better quality of life.

2.4 Statistical Methods

Data were analyzed using SPSS 23.0 software, and graphs were plotted with GraphPad Prism 9.0. Measurement data were expressed as mean \pm standard deviation ($\bar{x} \pm s$), with intergroup comparisons performed using independent samples t-test and subgroup analyses using stratified t-test. Categorical data were presented as case numbers (percentage, n,%), with intergroup comparisons using χ^2 test. Effect sizes were expressed as Cohen's d ($d > 0.8$ for large effect, $0.5 < d \leq 0.8$ for moderate effect, $d \leq 0.5$ for small effect). All statistical tests were two-tailed, with $P < 0.05$ indicating statistically significant differences. The primary outcome measures (wound healing time and 6-month FACT-C total score) were reported with 95% confidence intervals (95% CI).

3. Results

3.1 Comparison of Rehabilitation Progress Indicators between the Two Groups

After intervention, the observation group showed significantly shorter wound healing time and significantly lower PFIQ-7 scores compared to the control group, with statistically significant differences (all $P < 0.001$, large effect). (See Table 2 for details.)

Table 2: Comparison of Rehabilitation Progress Indicators between the Two Groups ($\bar{x} \pm s$, 95% CI)

group	Number of cases	Wound healing time (sky)	95%CI	PFIQ-7score (component)	95%CI	t-price	P-price	Cohen's d
observation group	41	10.5 \pm 2.1	9.8~11.2	5.3 \pm 4.2	3.9~6.7	4.348	<0.001	0.89
control group	41	13.2 \pm 2.5	12.4~14.0	12.3 \pm 2.8	11.3~13.3	6.544	<0.001	1.42

Subgroup analysis revealed that in laparoscopic surgery patients, the observation group showed a more significant reduction in wound healing time (9.8 ± 1.8 days, 95% CI: 9.2–10.4 days) compared to the control group (12.5 ± 2.2 days, 95% CI: 11.8–13.2 days) ($t=4.612$, $P < 0.001$, Cohen's d=1.05). In open surgery patients, the observation group's wound healing time (13.2 ± 2.5 days, 95% CI: 11.9–14.5 days) remained shorter than that of the control group (15.8 ± 2.7 days, 95% CI: 14.3–17.3 days), but the difference was of smaller effect size ($t=2.897$, $P=0.006$, Cohen's d=0.62).

3.2 Comparison of Self-Care Ability and Psychological Status between the Two Groups

After intervention, the scores of all dimensions and the total score on the ESCA scale in the observation group were significantly higher than those in the control group, while the scores on HADS-A, HADS-D, and SAS were significantly lower than those in the control group. All differences were statistically significant (all $P < 0.001$, large effect). (See Table 3 for details.)

Table 3: Comparison of Self-care Ability and Psychological Status between the Two Groups ($x \pm s$, 95% CI)

metric	group	Number of cases	grade	95%CI	t-price	P-price	Cohen's d
ESCA total score (points)	observation group	41	128.5 ± 15.2	124.1~132.9	7.842	<0.001	1.23
	control group	41	102.3 ± 12.8	98.5~106.1		≤ 0.001	
HADS-A (subscale)	observation group	41	3.8 ± 1.2	3.5~4.1	4.987	≤ 0.001	1.08
	control group	41	5.9 ± 1.8	5.4~6.4		≤ 0.001	
HADS-D (subscale)	observation group	41	4.2 ± 1.5	3.8~4.6	5.321	≤ 0.001	1.15
	control group	41	6.8 ± 2.1	6.2~7.4		≤ 0.001	
SAS(component)	observation group	41	8.5 ± 2.3	7.9~9.1	5.178	≤ 0.001	1.12
	control group	41	12.3 ± 3.0	11.4~13.2		≤ 0.001	

3.3 Comparison of Quality of Life between the Two Groups

After intervention, the observation group showed significantly higher scores in all dimensions of the FACT-C scale and the standardized total score compared to the control group, with the most significant improvements observed in the emotional status and social-family dimensions (all $P < 0.001$, large effect). (See Table 4 for details.)

Table 4: Comparison of FACT-C Scale Scores between the Two Groups ($x \pm s$, 95% CI, Standardized Scores)

Physiological status	observation group	41	68.5 ± 6.2	$66.6 \sim 70.4$	5.234	<0.001	1.14
Social and family circumstances	control group	41	60.2 ± 5.8	58.4~62.0		<0.001	
	observation group	41	72.3 ± 7.1	70.1~74.5	4.471	<0.001	0.97
Emotional state	control group	41	64.5 ± 6.8	62.3~66.7		<0.001	control group
	observation group	41	70.4 ± 6.5	68.2~72.6	4.823	<0.001	1.05
Function status	control group	41	62.3 ± 5.9	60.3~64.3		<0.001	
	observation group	41	75.6 ± 8.0	73.1~78.1	4.168	<0.001	0.91
Additional attention	control group	41	67.4 ± 7.5	65.0~69.8		<0.001	
	observation group	41	32.5 ± 4.1	31.2~33.8	4.321	<0.001	0.94
Standardized total score	control group	41	28.3 ± 3.8	27.1~29.5		<0.001	
	observation group	41	319.3 ± 25.6	311.5~327.1	6.845	<0.001	1.50
	control group	41	282.7 ± 22.3	275.8~289.6		<0.001	

4. Discussion

4.1 Promoting Mechanism of "Internet + MDT" Model on Postoperative Rehabilitation of Cervical Cancer

Postoperative recovery from cervical cancer requires multidimensional collaborative

interventions encompassing physiological, psychological, and nutritional aspects. Traditional nursing care, characterized by "single-discipline specialization and intermittent follow-up," fails to meet these demands [9]. The "Internet + MDT" model established in this study enhances nursing efficacy through two core advantages:

First, systematic integration of multidisciplinary resources: Gynecologists oversee the safety of tumor rehabilitation, dietitians provide precise nutritional support through "dietary photo assessment" (e.g., daily protein intake of 1.2-1.5 g/kg promotes wound healing [10]), rehabilitation therapists deliver personalized pelvic floor exercises to improve neuromuscular coordination (the observation group showed a 41.2% reduction in PFIQ-7 scores), and nurses coordinate the entire process to avoid fragmented interventions. This "division of labor and collaboration" model better aligns with the complex postoperative needs of patients compared to traditional nursing care.

Second, the spatiotemporal breakthrough of the smart platform: The WeChat official account eliminates the need for additional apps, reducing the usage threshold for patients (particularly middle-aged and elderly patients); dynamic tracking of electronic health records (such as wound photos and training records) enables MDT teams to adjust treatment plans in real time, avoiding deviations in "empirical guidance." In this study, the observation group experienced a 2.7-day reduction in traction duration (Cohen's $d=0.89$), confirming the accelerated effect of "online real-time intervention" on the rehabilitation process, which outperformed the results of "pure WeChat follow-up" in Zhan Tingting's study [7] (a 1.8-day reduction in wound healing time).

4.2 The Value of the Model in Improving Self-Care Ability and Psychological State

Self-care competence is a core influencing factor in long-term rehabilitation after cervical cancer surgery [2]. In this study, the observation group showed a 25.6% increase in the ESCA total score (Cohen's $d=1.23$), with the key mechanisms being: ① "visual guidance" (e.g., pelvic floor muscle training animations) reduced the difficulty of rehabilitation procedures and enhanced self-care skills; ② "medication/dietary record uploading" established behavioral supervision and strengthened self-care responsibility; ③ "online health information push" (twice weekly) continuously supplemented health knowledge and improved health cognition—consistent with Yuan Changrong et al.'s [2] theory that "self-care competence requires a three-dimensional reinforcement of knowledge, skills, and attitudes."

On the psychological level, the incidence of anxiety in postoperative cervical cancer patients reached as high as 62.3% [13]. This model alleviates negative emotions through "triple support": ① The "1+1" dedicated matching provides a private communication channel, enabling patients to more readily express concerns about "body image changes and tumor recurrence"; ② Visual feedback from video follow-ups (e.g., observing patients' facial expressions) enhances psychological assessment accuracy (avoiding information gaps in telephone follow-ups); ③ Peer support from patient exchange meetings reduces stigma (the emotional status dimension score in the observation group improved by 13.0%). This "individualized + group-based" psychological intervention resulted in a greater reduction in SAS scores compared to the "pure telephone psychological counseling" in Li Jing et al.'s study [6] (3.8 vs. 2.1 points).

4.3 Research Advantages and Limitations

The advantages of this study are as follows: ① The use of a rigorous randomized controlled trial (RCT) design (computerized randomization, concealed assignment, single-blind) reduced selection bias and assessment bias; ② The clarification of the multidisciplinary team (MDT) consultation process and intervention threshold improved the reproducibility of the protocol; ③ Supplementary subgroup analysis revealed that patients undergoing laparoscopic surgery were more likely to

benefit from this model (possibly due to better postoperative recovery, resulting in more significant intervention effects).

Limitations require objective recognition: ① Single-center study (only the Second Affiliated Hospital of Anhui Medical University) with a small sample size (82 cases), and the results need multicenter validation when extrapolated to other regions (especially primary care hospitals); ② Follow-up duration of only 3-6 months, without evaluating the intervention's impact on "long-term pelvic floor function stability and tumor recurrence rate" beyond 1 year; ③ Exclusion of advanced cervical cancer patients (e.g., FIGO stage II B or higher), and the applicability of the model in severe cases requires further exploration; ④ Lack of "intervention cost-benefit ratio" data, making it difficult to assess its health economics value. Future research should focus on "multicenter RCTs, long-term follow-ups, and cost analysis" to strengthen the evidence chain.

5. Conclusion

The "Internet + Multidisciplinary Collaboration" continuous care model integrates multidisciplinary resources from gynecology, nutrition, psychology, and rehabilitation, leveraging the WeChat smart platform to achieve a closed-loop management system of "dynamic assessment-personalized intervention-comprehensive follow-up." This model significantly reduces wound healing time in post-cervical cancer surgery patients, improves pelvic floor dysfunction, enhances self-care capabilities and quality of life, and alleviates anxiety and depressive symptoms. It is characterized by "simple operation, high accessibility, and privacy compliance." Particularly for laparoscopic surgery patients, the model demonstrates more pronounced rehabilitation promotion effects, providing a replicable innovative paradigm for continuous care after cervical cancer surgery. It is worthy of clinical promotion and application in gynecology departments of secondary and higher-level hospitals.

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