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Original Research

Application of a Physician–Nurse Collaborative Whole-Course Management Model in Patients With Endometrial Cancer and Atypical Endometrial Hyperplasia Undergoing Fertility-Preserving Treatment

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Abstract

Background: The incidence of endometrial cancer (EC) has been rising annually, and many young patients wish to preserve their reproductive potential. This study aims to evaluate the impact of a whole-course management model on treatment adherence and efficacy among patients with early-stage EC and atypical endometrial hyperplasia (AEH) seeking fertility preservation. **Methods**: This retrospective cohort study involved 162 patients diagnosed with EC or AEH who underwent fertility-preserving treatment at Peking University People's Hospital between July 2010 and December 2023. Patients were divided into two groups: the control group (n = 80; diagnosed from July 2010 to June 2019) received conventional disease management, while the experimental group (n = 82; diagnosed from November 2022 to December 2023) received a physician–nurse collaborative whole-course management model. In the experimental group, each patient was assigned a dedicated nurse responsible for monitoring treatment, ensuring protocol adherence, and promptly reporting any abnormalities or disease progression to physicians. Data from both groups were collected over a one-year follow-up period. **Results**: No statistically significant differences in baseline characteristics, including residence, income, occupation, education, and treatment regimens, were observed between the two groups ($p > 0.05$). The experimental group exhibited significantly higher follow-up rates at 3 months (91.5% vs. 93.8%, $p = 0.578$), 6 months (64.6% vs. 46.3%, $p = 0.019$), and 1 year (64.6% vs. 30.0%, $p < 0.001$), as well as greater patient satisfaction (68.3% "very satisfied" vs. 17.5% "very satisfied", $p < 0.001$). The median time to complete remission was shorter in the experimental group (6.2 months vs. 10.4 months, $p = 0.007$), and no disease progression was observed. **Conclusions**: The physician–nurse collaborative whole-course management model is effective for patients with EC and AEH undergoing fertility preservation. It significantly enhances treatment adherence, patient satisfaction, and clinical outcomes.

Keywords: whole-course management; endometrial cancer; fertility preservation; physician–nurse collaboration

1. Introduction

The incidence of endometrial cancer (EC) has been gradually increasing. EC ranks as the second most common gynaecological cancer worldwide [1–3]. The incidence of EC among women under 40 years of age ranges from 3% to 14%. Patients with atypical endometrial hyperplasia (AEH) present with a precancerous condition with potential progression to EC [4]. Fertility-sparing treatments show no significant difference in efficacy among patients with the two conditions [5]. In 2020, there were 420,000 new cases of EC globally, with 80,000 new cases in China. Approximately 75% of patients are diagnosed at an early stage. Young EC patients often express strong desires for fertility, drawing significant attention from oncologists and reproductive specialists. With China's aging population increasing annually [6], fertility issues transcend individual concerns, forming a critical foundation for family stability and national development.

The expert consensus on fertility preservation in patients with EC recommends that patients undergo an endometrial biopsy every 3 months to assess treatment efficacy on the basis of pathological results, adjust treatment plans, and detect recurrence early [7]. Concurrently, the 2023 Chinese Multidisciplinary Expert Consensus on Fertility Preservation in EC emphasizes rigorous follow-up for high-risk patients undergoing fertility preservation [8]. Given that a certain risk of recurrence persists even after a complete response (CR) is achieved, favorable treatment outcomes are intrinsically linked to patient management models [9]. However, no study has explored which model is most suitable for managing fertility-sparing patients with EC and atypical hyperplasia, resulting in a lack of clinical practice and data support. Physician–nurse collaboration refers to a series of patient-centered activities in which doctors and nurses share patient information, jointly participate in decision-making, and coordinate to provide comprehensive treatment and nursing services [10]. On this basis, the research team implemented a physician–nurse collaboration + full-disease-course management model. This study aims to evaluate the impact of this management approach on treatment adherence and efficacy among patients with

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early-stage EC and atypical hyperplasia undergoing fertility preservation while improving management quality and exploring an optimal management model.

2. Materials and Methods

2.1 Study Design and Participants

We enrolled patients with EC and endometrial atypical hyperplasia who underwent fertility-sparing treatment at the Department of Gynecology, Peking University People's Hospital, between July 2010 and December 2023 for this retrospective cohort study. Eligible participants were aged 18 to 40 years, provided informed consent, had a pathologically confirmed diagnosis of stage G1 or G2 EC or endometrial atypical hyperplasia, demonstrated tumor confinement to the endometrium via imaging studies, and expressed a strong desire to preserve fertility. Patients with a pathological diagnosis of stage G3 EC or concomitant malignant tumors were excluded. Efforts to minimize missing data included long-term surveillance and the use of additional follow-up channels, such as contact with family members and review of internal health records. Multivariate multiple imputation with chained equations was used to account for missing values for the enrolled parameters.

2.2 Sample Size Calculation

As this was a retrospective study, a post hoc power analysis was conducted on the final sample of 162 patients (82 in the experimental group and 80 in the control group) to determine the detectability of the primary endpoint (patient follow-up rate). The analysis, using a two-sided alpha of 0.05 and the observed rates (90% vs. 73%), demonstrated that the study had 80% power to detect the observed difference.

2.3 Classification Methods and Intervention

The control group included 80 patients who were diagnosed between July 2010 and June 2019. The control group received traditional management: the assigned nurse provided routine discharge instructions, including postdischarge precautions. An attending gynecologist was responsible for the patients' diagnosis and treatment during hospitalization and informed the patients of the follow-up appointment time. The patients were followed up regularly at the outpatient clinic and received treatment according to medical instructions.

The study group included 82 patients who were diagnosed between November 2022 and December 2023. The observation group was subjected to a comprehensive disease management model. The specific details are as follows: ① The medical-nursing collaboration team consisted of the patient's attending physician, resident physician, chief resident, nursing team leader, and nurses. Workflows were established with clearly defined responsibilities. ② Upon enrollment, electronic medical records, including patient name, age, diagnosis, medical history, reproductive needs, and treatment progression (treatment plan, pathology results, and treatment outcomes), were created. ③ A WeChat group was established for timely communication among medical staff and patients. ④ Closed-loop treatment protocols were implemented. Nurses assumed responsibility for one-on-one comprehensive patient management, ensuring adherence to treatment schedules. Specific process: Within 2 weeks of outpatient diagnosis, nurses verified medication adherence and test completion. Upon hospital admission authorization, nurses coordinated with the chief resident to facilitate timely admission and ensure prompt hysteroscopy. After receiving the hysteroscopy pathology report, patients were reminded to schedule an outpatient follow-up. ⑤ If side effects occurred during treatment, nurses contacted the attending physician of the specialty team for management. Vigilance against disease recurrence or progression was maintained through this type of management. ⑥ Focused follow-up management was implemented for patients with specific molecular subtypes or recurrent disease. Any changes in conditions during treatment were promptly addressed by the medical team, with multidisciplinary team (MDT) consultation initiated when necessary. ⑦ Online consultation services were offered to provide patient support. ⑧ Quarterly telephone follow-ups were conducted to monitor patient health status. ⑨ The nursing team leader compiled patient data monthly, reporting to the team's chief physician and attending physicians on the following: total patient numbers, patients with specific molecular subtypes, and treatment progress and outcomes for targeted therapy and chemotherapy patients. Medical and nursing staff jointly analyzed these reports to identify patients who need continued monitoring the following month and to establish key treatment priorities.

2.4 Observation Indicators

The follow-up rate (defined as loss to follow-up when phone numbers are invalid, calls go unanswered, or patients refuse to respond to follow-up inquiries), satisfaction rate, complete remission rate, and time to complete remission for both patient groups during their one-year treatment at the hospital were recorded.

Observation indicators: (1) The primary outcome was the follow-up rate. If patients receive regular treatment, they should have at least four follow-up visits per year. The follow-up rate is calculated by dividing the actual number of follow-up visits by the expected number of four visits: number of follow-up visits within 1 year/4 $\times$ 100%. Patients underwent follow-up visits at 3 months, 6 months, and 1 year post-treatment. Data were extracted from the hospital's outpatient platform. (2) Patient satisfaction with the comprehensive healthcare management model. Both groups were surveyed on satisfaction one year after enrollment, with the following response options: very satisfied, fairly satisfied, satisfied, fairly dissatisfied, and very dis-

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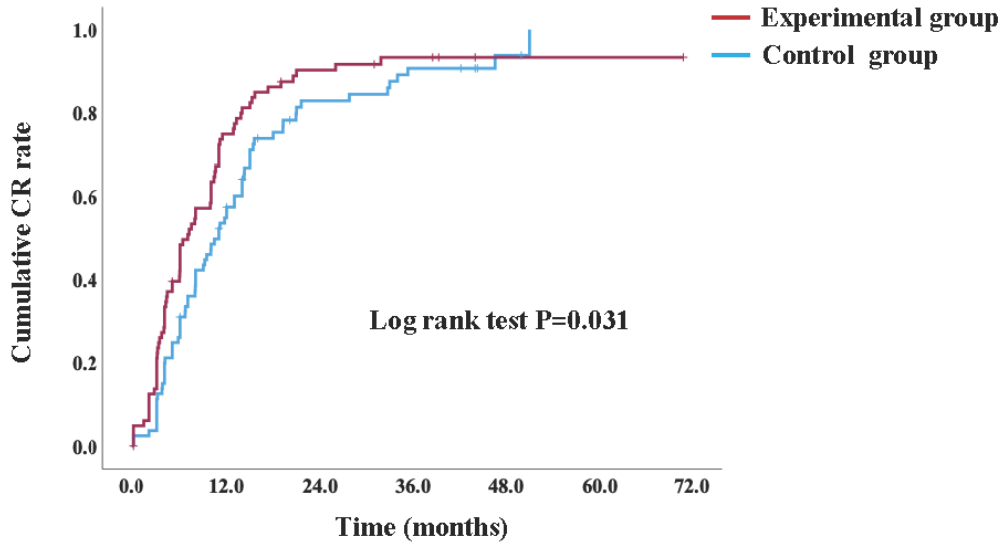

Fig. 1. Kaplan–Meier curves of the cumulative CR rate for patients in the experimental group (n = 82) and control group (n = 80). CR, complete response.

satisfied. Surveys were distributed and collected via Questionnaire Star (Changsha, Hunan, China).

Secondary Endpoints: (1) CR Rate. It is the proportion of patients who achieved a CR among all patients. At the end of each treatment cycle, hysteroscopic endometrial biopsy and histopathological examination were performed to evaluate treatment efficacy on the basis of pathological findings. CR: Pathological examination revealed no AEH or endometrioid carcinoma lesions. Partial response (PR): Histopathological evidence revealed reduced disease severity and/or decreased lesion size compared with baseline results. Stable disease (SD): Histopathological findings were consistent with pretreatment status, showing no significant change. Progressive disease (PD): Histopathological evidence revealed increased disease severity and/or expanded invasion compared with baseline results. Recurrence: Pathological data confirmed AEH or recurrence following treatment-induced CR [8]. (2) Time to complete remission. It is the duration from the patient's initial presentation for treatment to the first occurrence of complete remission.

2.5 Statistical Methods

Data were analyzed using SPSS 20.0 statistical software (IBM Corporation, Armonk, NY, USA). Continuous variables meeting normal distribution requirements are expressed as the mean $\pm$ standard deviation ($\bar{x} \pm s$). Paired t tests were used for within-group comparisons before and after intervention, whereas independent t tests were employed for between-group comparisons. Categorical variables are presented as frequencies or percentages (%). Between-group comparisons were performed using the chi-square (χ^2) test. $p < 0.05$ was considered to indicate statistical significance.

3. Results

(1) This study included 162 patients (2 patients in the control group were considered lost to follow-up because of unanswered phone calls), with 82 in the EC group and 80 in the AEH group. There were no statistically significant differences between the two groups in terms of education level, place of residence, or annual income ($p >$ 0.05), as shown in Table 1. The control group was subjected to a historical review approach, whereas the experimental group was subjected to a collaborative process management model involving medical and nursing staff. However, the data indicate that despite the timespan between the groups, medication regimens were not significantly different between the two groups ($p = 0.447$).

(2) Comparison of follow-up rates between the two groups: The follow-up rates at 6 months were higher in the experimental group than in the control group. The 1-year follow-up rate in the experimental group was significantly greater than that in the control group. The difference is statistically significant ($p < 0.05$). See Table 2.

(3) A comparison of patient satisfaction between the two groups revealed that the satisfaction level in the experimental group was significantly greater than that in the control group (n = 58, $p = 0.001$). See Table 3.

(4) Comparison of the time to complete remission between the two groups revealed that, compared with the control group, the experimental group achieved complete remission earlier (6.2 vs. 10.4 months, $p = 0.007$). Additionally, Kaplan–Meier curves revealed that the experimental group had a significantly shorter time to CR (Fig. 1). With respect to treatment outcomes, among the 80 patients in the control group, 2 patients developed metastatic cancer, and 2 patients experienced uncontrolled disease progression, leading to hysterectomy (see Table 4). Further

Table 1. Comparison of baseline characteristics between the two patient groups.

Variable	Experimental group (n = 82)	Control group (n = 80)	χ^2/t	p
Diagnosis			1.206[a]	0.272
EC	45 (54.9)	37 (46.3)		
AEH	37 (45.1)	43 (53.8)		
Age (years)	33.2 (±5.0)	33.24 (±4.6)	0.057[b]	0.955
BMI (kg/m^2)	27.48 (± 4.92)	26.64 (±5.7)	1.009	0.315
Education [n (%)]			2.933[a]	0.569
Primary Education	1 (1.2)	0 (0.0)		
Lower Secondary Education	4 (4.9)	5 (6.3)		
High school diploma	18 (22.0)	14 (17.5)		
Some college/associate	49 (59.8)	55 (68.8)		
Graduate/professional	10 (12.2)	6 (7.5)		
Occupation [n (%)]			8.385[a]	0.078
Unemployed	9 (11.0)	7 (8.8)		
Staff	53 (64.6)	59 (73.8)		
Student	2 (2.4)	2 (2.5)		
Civil servant	8 (9.8)	11 (13.8)		
Freelancer	11 (12.2)	1 (1.3)		
Annual income [n (%)]			9.204[a]	0.056
<1440 USD	16 (19.5)	6 (7.5)		
1440 USD–14,390 USD	51 (62.2)	48 (60.0)		
>14,390 USD	15 (18.3)	26 (32.5)		
Residence [n (%)]			1.653[a]	0.647
First-tier cities	44 (53.7)	43 (53.8)		
Second-tier cities	12 (14.6)	17 (21.3)		
Third-tier cities	19 (23.2)	15 (18.8)		
Nonurban	7 (8.5)	5 (6.3)		
Regular menstruation	42 (51.9%)	53 (64.6%)	2.738	0.098
PCOS	18 (22.2%)	25 (30.5%)	1.433	0.231
DM	9 (11.1%)	5 (6.1%)	1.305	0.253
Hyperlipidemia	20 (24.7%)	22 (26.8%)	0.097	0.755
HBP	6 (7.4%)	7 (8.5%)	0.071	0.790
Treatment Plan [n (%)]			8.893[a]	0.447
MPA	37 (45.7)	42 (52.5)		
MPA + Diabetes treatment	9 (11.1)	7 (8.8)		
MPA + Diabetes treatment + Lipid-lowering therapy	1 (1.2)	1 (1.3)		
MPA + Diabetes treatment + Lipid-lowering therapy + Letrozole Tablets	2 (2.5)	0 (0.0)		
MPA + Diabetes treatment + Lipid-lowering therapy + Hypertension treatment	4 (4.9)	0 (0.0)		
GnRHa	3 (3.7)	7 (8.8)		
MET	16 (19.8)	15 (18.8)		
MET + Diabetes treatment	2 (2.5)	2 (2.5)		
GnRHa + IUD	5 (6.2)	3 (3.8)		
MPA + IUD	2 (2.5)	3 (3.8)		

[a]: Chi-square test; [b]: t test.

EC, endometrial cancer; AEH, atypical endometrial hyperplasia; BMI, body mass index; PCOS, polycystic ovary syndrome; DM, diabetes mellitus; HBP, high blood pressure; MPA, medroxyprogesterone acetate; MET, metformin; IUD, intrauterine device; GnRHa, gonadotropin-releasing hormone agonist.

multivariate Cox analysis revealed that after adjusting for body mass index (BMI), age, and comorbidities, the experimental group remained an independent protective factor for achieving faster remission ($p = 0.011$). No other risk factors significantly affected the time to complete remission (Table 5).

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Table 2. Comparison of regular follow-up rates at 3 months, 6 months, and one year between the two patient groups.

Term	Experimental group (n = 82)	Control group (n = 80)	χ^2	p
Three-month follow-up rate [n (%)]	75 (91.5)	75 (93.8)	0.309	0.578
Six-month follow-up rate [n (%)]	53 (64.6)	37 (46.3)	5.543	0.019
One-year follow-up rate [n (%)]	53 (64.6)	24 (30.0)	19.467	<0.001

Table 3. Comparison of patient satisfaction between two groups.

Term	Experimental group (n = 82)	Control group (n = 80)	p
Satisfaction [n (%)]			<0.001
Extremely dissatisfied	0 (0.0)	1 (1.3)	
Less satisfied	0 (0.0)	0 (0.0)	
Satisfied	6 (7.3)	47 (5.8)	
Fairly satisfied	20 (24.4)	18 (22.5)	
Very satisfied	56 (68.3)	14 (17.5)	

Table 4. Comparison of treatment outcomes between the two patient groups.

Term	Experimental group (n = 82)	Control group (n = 80)	Z	p
Treatment outcome grouping [n (%)]			-	0.057
CR	58 (70.7)	45 (56.3)		
PR	20 (24.4)	29 (36.3)		
Disease Persists	4 (4.9)	2 (2.5)		
Disease progression	0 (0.0)	4 (5.0)		
Time to CR (months)	6.2 (3.2, 11.8)	10.4 (5.4, 15.5)	–2.690[c]	0.007

CR, complete response; PR, partial response. [c]: Mann-Whitney U test.

4. Discussion

4.1 Advantages and Characteristics of the Integrated Management Model for Physician–Nurse Collaboration

This study revealed that a comprehensive management model involving healthcare team collaboration can increase patient follow-up rates. Previous literature has extensively reported on fertility-sparing treatment options and adverse reactions in patients with early-stage EC and AEH who are receiving fertility-preserving treatment [4,11–14]. However, few studies have detailed individualized management strategies for these patients. Patient-centered, holistic, and comprehensive management should be established for breast cancer patients, and chronic disease management should be advocated for. A commonality between the two diseases is that both breast cancer and early-stage EC/atypical hyperplasia patients have malignant tumors with relatively favorable prognoses. On the basis of the results of this study, it is recommended that both EC and AEH patients who retain fertility undergo comprehensive management. Beyond regular disease follow-up, enhanced patient management, including attention to comorbidities and symptoms such as weight gain and vaginal bleeding caused by high-dose progestin use, is essential.

An integrated management model involving collaborative care between medical staff and patients can significantly increase patient satisfaction. With the nation's economic development, Chinese patients now hold higher expectations for the healthcare industry. This study effectively integrates medical professionalism with humanistic care. Through this model, medical staff gain patient trust during treatment. Following consistent long-term care, patients develop a new relationship with the medical team during treatment—a partnership among medical staff, patients, and caregivers working together to overcome illness.

This study revealed that the use of this model can enhance treatment efficacy. Patients in the experimental group showed no disease progression within one year, with a higher complete remission rate than that in the control group. The control group lacked dedicated personnel and fixed follow-up schedules, leading to patients' neglect of their conditions and failure to detect changes promptly, resulting in disease progression in four individuals. Unlike those in the control group, patients in the trial group could immediately contact physicians and assigned nurses via internet portals or WeChat upon experiencing adverse reactions. They also participated fully in MDT discussions during disease decision-making, providing informed consent and exercising decision-making authority over their treatment. This enhanced patient understanding of their conditions while enabling healthcare providers to detect and address issues early through comprehensive management, achieving integrated prevention and treatment. Collaborative, comprehensive management also fostered patient compliance, establishing consistent habits and routines throughout treatment. Extensive data indicated that the recurrence rate of EC is high even after CR, necessitat-

Table 5. Multivariate Cox analysis of factors associated with treatment time to remission.

	Multivariate analysis	
	OR (95% CI)	*p*
BMI	1.010 (0.979, 1.042)	0.525
Age	0.975 (0.939, 1.011)	0.174
Pathology		
AEH	1.116 (0.788, 1.581)	0.535
EC	1	
Regular menstruation		
Yes	0.848 (0.601, 1.198)	0.350
No	1	
PCOS		
Yes	0.878 (0.593, 1.300)	0.515
No	1	
DM		
Yes	1.048 (0.585, 1.877)	0.875
No	1	
Hyperlipidemia		
Yes	0.826 (0.562, 1.216)	0.333
No		
HBP		
Yes	0.614 (0.325, 1.159)	0.133
No	1	
Experimental group		
Yes	1.569 (1.109, 2.220)	0.011
No	1	

ing long-term follow-up [15,16] and comprehensive management. Key reasons include the following: comprehensive management effectively promotes and cultivates good follow-up habits and patient compliance, reducing recurrence caused by treatment interruption. A published study [17] emphasized the critical importance of regular screening for high-risk gynecologic cancer patients, including patients with AEH, to detect early abnormalities. Some CR patients may neglect follow-up because of the perceived absence of symptoms, work demands, or academic pressures. Such practices require prompt correction to avoid missing opportunities for timely detection of disease progression and intervention. Patients may experience treatment-related adverse reactions, including vaginal bleeding, perimenopausal symptoms, and weight gain [16]. Establishing comprehensive care through coordinated physician–nurse collaboration enables swift professional guidance to mitigate adverse effects and disease progression. Additionally, patients with specific molecular subtypes face increased recurrence risks and warrant particular attention [18,19].

4.2 Limitations

This study employed a historical control design with a significant time span between the control and experimental groups (2010–2019 vs. 2022–2023), potentially introducing time-related confounding factors such as increased patient health awareness and optimized hospital management processes, including the widespread adoption of online clinics. However, the study minimized the impact of temporal bias through the following measures: Baseline data balance: No differences existed between groups in key variables such as age, residence, income, and treatment protocols. Treatment protocol consistency: Despite the 13-year time span, medication regimens were not significantly different between the groups. Reasonableness of follow-up rate comparison: The increased follow-up rate in the experimental group was primarily attributed to the comprehensive management model, including WeChat group reminders and nurse accountability systems.

Nevertheless, future studies may further validate the robustness of these findings by adopting a contemporary randomized controlled design to overcome the limitations of historical controls, enhancing sensitivity analyses for confounding factors, and integrating long-term follow-up data to assess the management model's impact on long-term outcomes such as fertility rates and recurrence rates.

This study evaluated the effectiveness of process management for healthcare collaboration among patients with endometrioid carcinoma grade 1 (ECG1) and AEH. The results demonstrated that this model significantly improved patient follow-up rates and patient satisfaction. In addition, multivariate Cox regression analysis confirmed the independent protective effect of the process-based management approach in this patient population. Although regular follow-ups are not independent determinants of treatment efficacy, consistent monitoring and comprehensive management substantially enhance treatment outcomes. This approach represents a crucial strategy for managing patients with EC and AEH and warrants broader implementation. Research has indicated that patients experience anxiety and depression because of their condition, with severe cases of psychological issues such as depression [15]. The physician–nurse collaboration model can effectively improve patient adherence [15] and alleviate anxiety and depression. Women of childbearing age face multifaceted challenges, including academic demands, career pressures, family responsibilities, and their own medical conditions. They require support from family, healthcare providers, and the broader community. How to assess and intervene with such patients warrants careful consideration. Additionally, comprehensive management demands significant amounts of human and time resources. Selecting appropriate electronic information systems as supportive tools is another area that deserves attention.

5. Conclusions

An integrated management model involving medical and nursing collaboration is applicable for managing patients with EC and atypical hyperplasia who wish to pre-

serve fertility. It significantly enhances treatment adherence and patient satisfaction while contributing to improved treatment outcomes.

Availability of Data and Materials

Data and materials availability statement all data generated in this study are included in the article, and supplemental material or supporting data can be obtained upon request.

Author Contributions

YL: conceptualization, funding acquisition, data curation, writing-original draft, visualization. XT: data curation, formal analysis, writing-review & editing. JW: resources, project administration. XL: conceptualization, methodology, formal analysis, writing-review & editing, supervision. YW: conceptualization, methodology, writing-review & editing, visualization, supervision. All authors reviewed the manuscript, contributed to its revision, and approved the final version for submission. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethics Approval and Consent to Participate

All the subjects provided informed consent before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethical Review Committee of the Peking University People's Hospital (Approval No.: 2023PHB267-001).

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Conflict of Interest

The authors declare no conflict of interest.

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