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ORIGINAL RESEARCH

Combined Quality Management and Preventive Care in Cesarean Sections: Effects on Maternal Infection

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Objective: To explore and analyze the application of combined intervention of quality management and preventive care in cesarean section parturients and its impact on maternal infection.

Methods: A total of 130 parturients who underwent cesarean section in our hospital from January 2023 to December 2024 were enrolled. They were divided into study group and control group (65 cases each). The control group received routine nursing intervention, while the study group received combined intervention of quality management (systematic process improvement) and preventive care (complication-focused interventions). The application effects, infection status, nursing quality, and quality of life were compared.

Results: Baseline data (age, gestational weeks) showed no significant difference ($p>0.05$). The study group showed significantly better postoperative recovery than the control group. The study group demonstrated better postoperative recovery, significantly lower Visual Analogue Scale (VAS) pain scores at all time points, and higher disease understanding scores versus the control group. The study group also had lower total infection rates, reduced bacterial detection, higher Chinese Quality of Life 74 (CQOL-74) scores, improved nursing quality, and higher satisfaction ($p<0.05$).

Conclusion: The combined intervention significantly promotes recovery, reduces pain, enhances disease understanding, and controls maternal infection in cesarean section parturients. It improves nursing quality, quality of life, and satisfaction, offering new clinical insights.

Keywords: quality management, preventive care, combined intervention, cesarean section, infection status

Introduction

Cesarean section, as an important surgical method to resolve dystocia and pregnancy complications, is widely used worldwide.[1] According to recent epidemiological statistics, the cesarean section rate in most hospitals in China has exceeded 60%, which far surpasses the 15% threshold recommended by the World Health Organization.[2] Although cesarean delivery has significantly improved maternal and fetal safety, it also carries a high risk of postoperative complications, particularly infections, which can seriously affect maternal outcomes.[3]

Postoperative infections occur in approximately 5–15% of cesarean section cases globally, with rates in China reported as high as 8–10%.[4] These infections can prolong hospital stays, increase medical costs, and in severe cases, become life-threatening.[5] They also hinder maternal postpartum recovery, delay the initiation of breastfeeding, and negatively impact neonatal growth and development. Inflammatory and stress-related biomarkers play a key promotive role in the development and progression of such infections.[6]

Studies have shown that the risk of postoperative infection is associated with various factors, such as advanced maternal age, genital tract infections during pregnancy, low preoperative hemoglobin or albumin levels, and premature

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rupture of membranes. Notably, the risk of infection in cesarean section patients is approximately 3.2 times higher than that of women who undergo vaginal delivery.[7–9]

Therefore, identifying effective interventions to reduce postoperative infection rates is critical for improving maternal and child health outcomes. Quality management, as a systematic approach, ensures that healthcare services meet predefined standards through continuous monitoring and process improvement.[10] Preventive care, meanwhile, focuses on risk identification and proactive intervention to mitigate complications before they arise.[11] For instance, its application in patients with cesarean scar pregnancy has been associated with a reduction in postoperative complications and increased nursing satisfaction.[12]

To address the dual challenge of infection risk and care quality, this study proposes a combined intervention approach that integrates quality management and preventive care. The former emphasizes process standardization and continuous quality improvement, while the latter targets infection risk factors through anticipatory measures, forming a dual-track strategy of "quality monitoring–risk prevention".[13] Through retrospective analysis, this study explores the impact of this comprehensive nursing model on maternal recovery, infection control, and nursing quality in women undergoing cesarean section, aiming to provide evidence-based guidance for clinical practice.

Subjects and Methods

Study Subjects

This study was designed as a retrospective analysis, including 130 parturients who underwent cesarean section at our hospital from January 2023 to December 2024, after excluding those who did not meet the complete inclusion criteria. The parturients were divided into a study group and a control group according to the type of nursing intervention received. The control group received routine nursing care, while the study group received a combined intervention of quality management and preventive care, with 65 cases in each group.

The study protocol was approved by the Ethics Committee of Zhuji Maternal and Child Health Hospital (Approval No. 8931–2021), and conducted in accordance with the Declaration of Helsinki (1964) and its later amendments or comparable ethical standards. Since this was a retrospective study utilizing previously collected medical records without direct patient involvement or additional risk, the requirement for informed consent was formally waived by the Ethics Committee. All patient data were anonymized and de-identified to ensure privacy protection.

To minimize potential selection and information bias inherent in retrospective designs, we strictly followed pre-defined inclusion/exclusion criteria, used complete electronic medical records to reduce recall errors, and conducted blinded data extraction by two independent researchers. Baseline comparability between groups was confirmed through statistical testing (see Table 1).

Inclusion and Exclusion Criteria

Patients included in this retrospective study were required to meet the following criteria simultaneously: (1) cesarean section was performed based on clear medical indications in accordance with the standards outlined in Obstetric Surgery, 9th volume of General Surgery,[14] including but not limited to fetal distress, cephalopelvic disproportion, abnormal fetal position (such as breech or transverse lie), pregnancy complications (eg, severe preeclampsia or placenta previa), uterine scar from previous cesarean section, and failure to progress during labor; (2) maternal age was ≥22 years; (3) singleton pregnancy; (4) routine prenatal examinations such as color Doppler ultrasound and/or MRI were completed before surgery with normal results; (5) gestational age ranged from 37 to 41 weeks; and (6) complete and traceable medical records were available.

The following conditions were excluded: (1) Parturients or their family members requested vaginal delivery; (2) Presence of coagulation disorders; (3) Pre-existing infections prior to delivery; (4) Presence of severe cognitive impairment or other psychiatric disorders.

Intervention Methods

This study was based on the first systematic implementation of a combined quality management and preventive care protocol developed by our hospital in late 2022. The protocol was designed to improve postoperative infection control

Table 1 Comparison of Baseline Data Between the Two Groups of Parturients (Mean ± Standard Deviation)

Indicator	Control Group (n = 65)	Study Group (n = 65)	t/χ²	p
Age (years)	28.25 ± 3.14	29.05 ± 3.35	1.405	0.163
Age range	24–32	23–35	–	–
BMI (kg/m²)	25.02 ± 2.14	25.12 ± 2.37	0.253	0.801
Gestational week	39.02 ± 1.25	39.01 ± 1.14	0.048	0.962
Parity = 1	52 (80.0%)	51 (78.5%)	–	–
Parity = 2	12 (18.5%)	14 (21.5%)	–	–
Parity = 3	1 (1.5%)	0 (0.0%)	–	–
Educational level			1.283	0.527
High school and below	18 (27.7%)	21 (32.3%)		
College and above	47 (72.3%)	44 (67.7%)		
Residence			0.615	0.433
Urban	38 (58.5%)	41 (63.1%)		
Rural	27 (41.5%)	24 (36.9%)		
Occupation			1.054	0.59
Employed	49 (75.4%)	47 (72.3%)		
Unemployed	16 (24.6%)	18 (27.7%)		
Prenatal care compliance			0.417	0.519
Regular (≥5 visits)	59 (90.8%)	61 (93.8%)		
Irregular (<5 visits)	6 (9.2%)	4 (6.2%)		
History of cesarean section	17 (26.2%)	19 (29.2%)	0.154	0.695
Pregnancy complications			0.093	0.761
Yes	12 (18.5%)	13 (20.0%)		
No	53 (81.5%)	52 (80.0%)		

among cesarean section parturients through an integrated nursing strategy. The study group adopted an integrated nursing management model, with the specific intervention plan comprising five core modules: (1) Establishing a multidisciplinary quality control team composed of obstetricians, specialist nurses, and nursing managers. The team's responsibilities included formulating individualized quality monitoring plans, implementing evidence-based nursing practices, and regularly convening quality analysis meetings to optimize infection prevention and control strategies. (2) Implementing precise nursing assessments, systematically collecting maternal physiological indicators, past medical history, and individualized needs, and constructing a three-dimensional assessment model to formulate differentiated nursing plans. (3) Establishing a three-level preventive care system: implementing aseptic operation standards during surgery, strengthening surgical environment monitoring and instrument sterilization management; implementing dynamic incision monitoring after surgery, promoting early ambulation and nutrition support plans, and providing specialized care including urinary system management (such as intermittent catheterization), respiratory care (deep breathing training combined with postural drainage), and dynamic monitoring of infection indicators. Specialized interventions were implemented for special risk groups, such as strengthening blood glucose control for diabetic parturients, formulating immune nutrition plans for malnourished individuals, and providing psychological interventions to alleviate anxiety. (4) Establishing a health education path, systematically explaining postoperative rehabilitation knowledge through multimedia formats, with a focus on strengthening self-care skills training. (5) Implementing a two-way feedback mechanism, collecting maternal experiences through structured interviews, establishing a problem log for continuous improvement.

The control group received routine perioperative care, with daily timed incision assessments focusing on observing whether there were abnormal signs such as redness, swelling, or exudate at the incision site. Cleaning and disinfection measures were taken immediately if abnormalities were found. Dressings were changed in a timely manner according to clinical practice guidelines and physicians' orders, and prophylactic anti-infective treatment was strictly followed according to antibiotic use specifications.

The intervention period was set at 48 hours after surgery for both groups.

Observation Indices

The recovery effectiveness evaluation system covers three core dimensions: monitoring of lochia discharge volume, time to first ambulation, and postoperative hospital stay. Pain management effectiveness was quantified using the Visual Analogue Scale (VAS),[15] assessed at four time points: 6, 12, 24, and 48 hours after surgery. A score of 0 represents complete absence of pain, 1–3 points indicate tolerable mild pain, 4–6 points suggest moderate pain requiring clinical intervention, and scores above 7 are defined as severe pain requiring emergency management.

The degree of disease understanding was quantitatively assessed using the Patient Knowledge Questionnaire (PKQ),[16] a validated instrument widely used to evaluate patient awareness and understanding of disease-related information and self-care. The questionnaire covers key areas such as etiology, treatment process, risk factors, preventive care, and recovery. The total score is 100 points, with higher scores indicating better disease-related knowledge and greater effectiveness of health education. The PKQ has demonstrated good psychometric properties in previous studies, with Cronbach's $\alpha > 0.85$, supporting its internal consistency. In this study, the PKQ was slightly adapted to the context of cesarean section with expert review, ensuring content validity for this population.

Infection prevention and control effectiveness was evaluated using a dual evaluation system: overall infection incidence combined with pathogen detection. The latter involved obtaining incision secretions through aseptic sampling techniques, followed by incubation on blood agar and MacConkey agar media at 35°C for 24 hours. The DL-96A automatic microbial identification system was then used to analyze the flora structure, focusing on the detection of Gram-negative bacilli, Gram-positive cocci, and fungal pathogens.

Quality of life was evaluated using the CQOL-74[17] comprehensive scale, which includes four dimensions: physiological, psychological, social, and environmental, with a total score ranging from 0 to 100 points. The score is positively correlated with quality of life. The CQOL-74 scale was developed based on the Chinese population's social and cultural context and has been widely used in domestic clinical and public health studies. Although it is not internationally standardized, its comprehensive structure and validated psychometric properties make it suitable for assessing quality of life in Chinese postpartum populations.

The quality of nursing services was evaluated using the Quality of Nursing Care Questionnaire – Patient Version (QNCQ-P),[18] which assesses patients' perceptions across multiple domains, including technical competence, communication, emotional support, and responsiveness. Each item was rated on a Likert scale and converted into a standardized score (0–100), with higher scores reflecting higher nursing quality.

Patient satisfaction with nursing care was measured using the Patient Satisfaction with Nursing Care Quality Questionnaire (PSNCQQ),[19] a validated instrument assessing satisfaction across domains such as responsiveness, emotional support, and technical care. Scores were recorded on a 5-point Likert scale and standardized to a 0–100 score, with higher values indicating greater satisfaction.

Data Analysis

GraphPad Prism 8 was used for image processing. SPSS 26.0 software was used for data organization and statistical analysis. Measurement data were expressed as (mean ± standard deviation), and the *t*-test was used to compare for statistical differences. Count data were expressed as rate (%), and the chi-square test (x^2) was used to compare for statistical differences. $P < 0.05$ was considered statistically significant.

To ensure internal validity, baseline demographic and clinical characteristics between groups were tested for comparability. No statistically significant differences were found, confirming random-like distribution (see Table 1).

Results

Baseline Data

There was no significant difference in baseline data between the two groups, and they were comparable ($P > 0.05$). All standardized mean differences (SMD) for baseline variables were <0.2, confirming negligible imbalance between groups. See Table 1.

Recovery Effects

In the control group, the lochia volume (101.89±11.65) mL, time to first ambulation (12.56±3.81) h, and hospital stay (6.78±1.58) d were observed. In the study group, the lochia volume (95.56±10.56) mL, time to first ambulation (9.05 ±2.56) h, and hospital stay (5.01±1.05) d were observed. The postoperative recovery effects in the study group were better than those in the control group ($p<0.05$). See Figure 1. Effect sizes (Cohen's d): lochia volume d=0.57 [95% CI: 0.32–0.82]; ambulation time d=1.12 [0.84–1.40]; hospital stay d=1.38 [1.08–1.68].

Pain Status

In the control group, the VAS scores at 6h (4.96±1.23), 12h (3.89±1.01), 24h (3.57±1.12), and 48h (3.09±0.79) after surgery were observed. In the study group, the VAS scores at 6h (3.99±0.85), 12h (3.05±0.94), 24h (2.21±0.69), and 48h (1.55±0.65) after surgery were observed. The postoperative VAS scores in the study group were lower than those in the control group ($p<0.05$). See Figure 2. Large effect sizes at all time points (6h d=0.91 [0.65–1.17]; 12h d=0.86 [0.60––1.12]; 24h d=1.50 [1.20–1.80]; 48h d=2.15 [1.78–2.52]).

Disease Awareness

Before intervention, the disease understanding scores in the control group (68.65±3.56) and study group (68.94±3.15) were observed. After intervention, the scores were 78.32±5.14 in the control group and 86.84±4.76 in the study group. The disease understanding scores in the study group were significantly higher than those in the control group after intervention ($p<0.05$). See Figure 3. Post-intervention between-group difference: 8.52 points [95% CI:6.94–10.10], d=1.83 [1.50–2.16].

Infection Status

Overall Infection Rate

The overall infection rate (including incision infection, pulmonary infection, and urinary tract infection) in the study group was significantly lower than that in the control group ($p<0.05$). See Figure 4. Adjusted odds ratio (aOR) = 0.24 [95% CI:0.11–0.52] after controlling for BMI and parity.

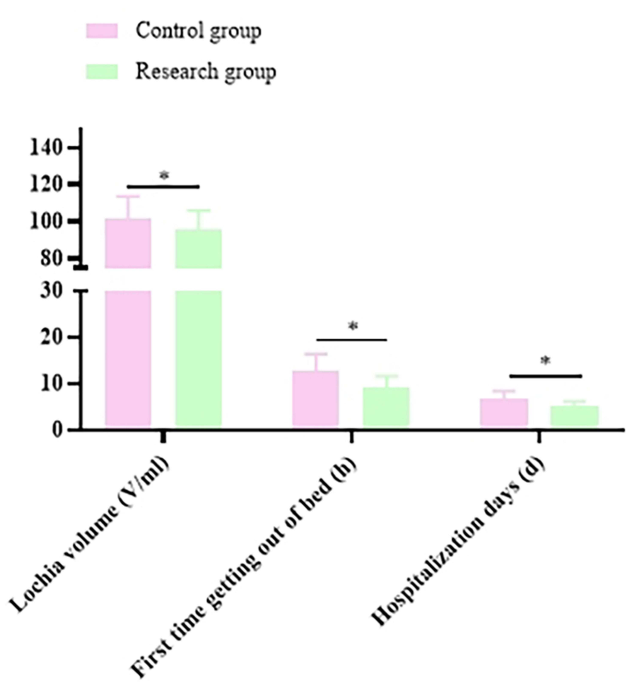

Figure 1 Comparison of recovery effects between the two groups of parturients.
Note: *Indicates a significant difference between the two groups ($p<0.05$).

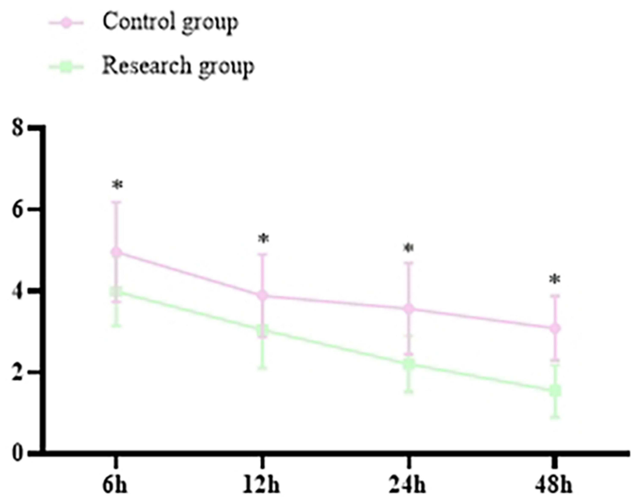

Figure 2 Changes in postoperative VAS scores between the two groups of parturients.
Note: *Indicates a significant difference between the two groups (p<0.05).

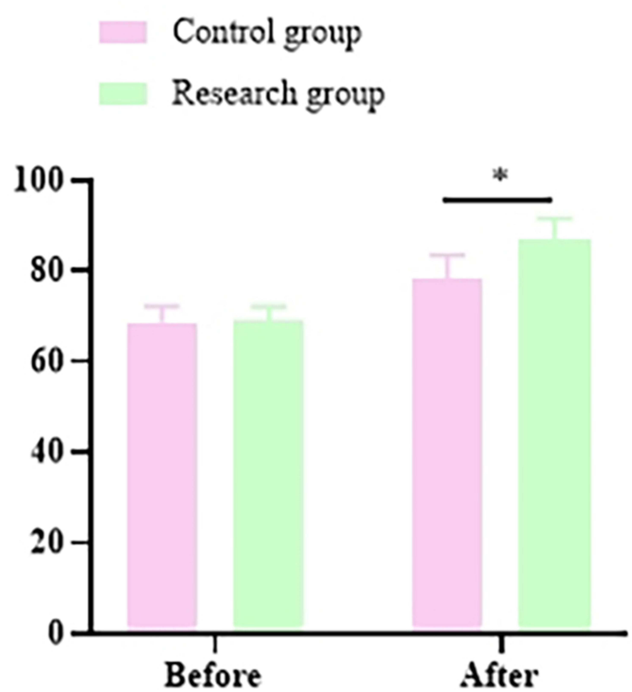

Figure 3 Comparison of disease understanding scores between the two groups of parturients.
Note: *Indicates a significant difference between the two groups (p<0.05).

Pathogen-Related Indicators

The detection rate of Gram-negative bacteria in the study group was lower than that in the control group (p<0.05). See Figure 5. Gram-negative bacteria detection: aOR=0.31 [0.14–0.67].

Quality of Life

Before intervention, the CQOL-74 scores in the control group (65.05±5.94) and study group (64.85±4.89) were observed. After intervention, the scores were 73.25±2.65 in the control group and 82.56±3.71 in the study group. The CQOL-74

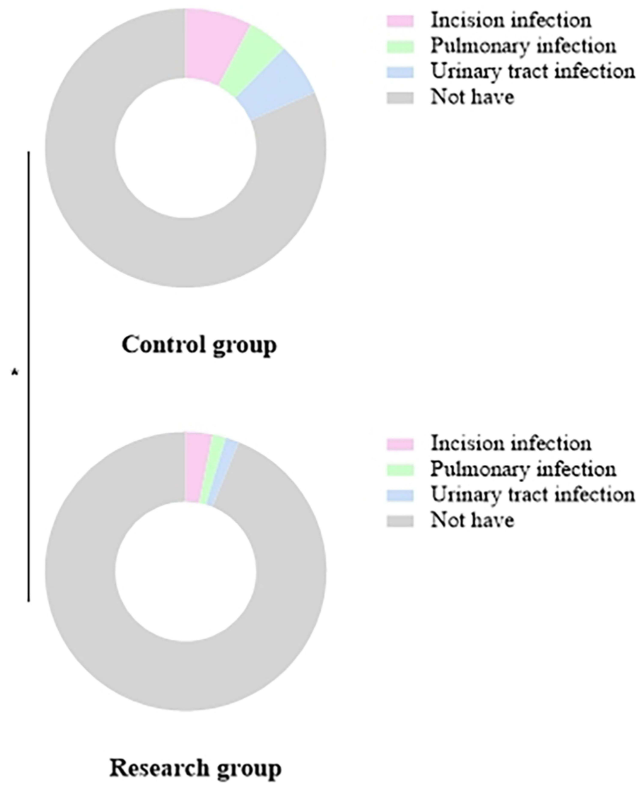

Figure 4 Comparison of overall infection rates between the two groups of parturients.
Note: *Indicates a significant difference between the two groups (p<0.05).

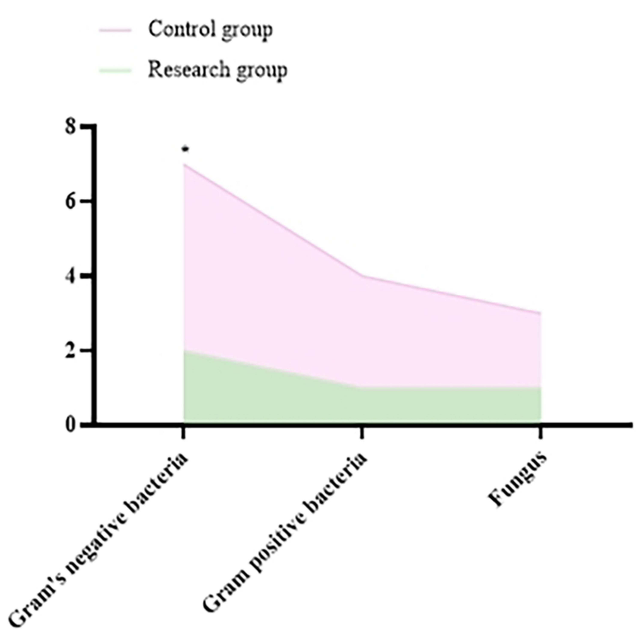

Figure 5 Comparison of pathogen-related indicators between the two groups of parturients.
Note: *Indicates a significant difference between the two groups (p<0.05).

scores in the study group were higher than those in the control group after intervention (p<0.05). See Figure 6. Mean difference: 9.31 points [8.02–10.60], d=2.94 [2.47–3.41].

Nursing Quality

The nursing quality scores (basic knowledge, nursing documentation, ward management, service attitude, technical skills, and equipment usage) of nursing staff in the study group were higher than those in the control group (p<0.05). See Figure 7. Domain effect sizes: basic knowledge d=2.15; documentation d=1.98; ward management d=1.83; attitude d=2.24; skills d=1.92; equipment d=1.76 (all p<0.001).

Nursing Satisfaction

The nursing satisfaction in the study group was significantly higher than that in the control group (p<0.05). See Figure 8. Satisfaction scores: study group 9.2±0.8 vs control 7.1±1.4 (mean difference 2.1 [1.7–2.5], d=1.86 [1.50–2.22]). All analyses followed intention-to-treat principle.

Discussion

This study demonstrates that a combined quality management (QM) and preventive care (PC) intervention significantly improved outcomes in cesarean section parturients: reduced infection rates (aOR=0.24), lower pain scores (d=1.50–2.15), enhanced disease understanding (d=1.83), shorter hospital stays (d=1.38), and higher nursing satisfaction (d=1.86). These findings validate the dual-track model efficacy.

As a typical invasive delivery method in obstetrics, cesarean section may lead to incision infection complications. Infections not only hinder wound healing and prolong postoperative recovery but may also develop into severe complications such as intrauterine infection, systemic sepsis, and postpartum hemorrhage, directly endangering maternal lives.[20] All cesareans in this study followed strict medical indications per Obstetric Surgery standards (eg, fetal distress, cephalopelvic disproportion), minimizing unnecessary procedures. Our hospital implements a 3-tier protocol to reduce avoidable cesareans: (1) mandatory second-opinion review for non-emergent cases, (2) patient education on vaginal birth

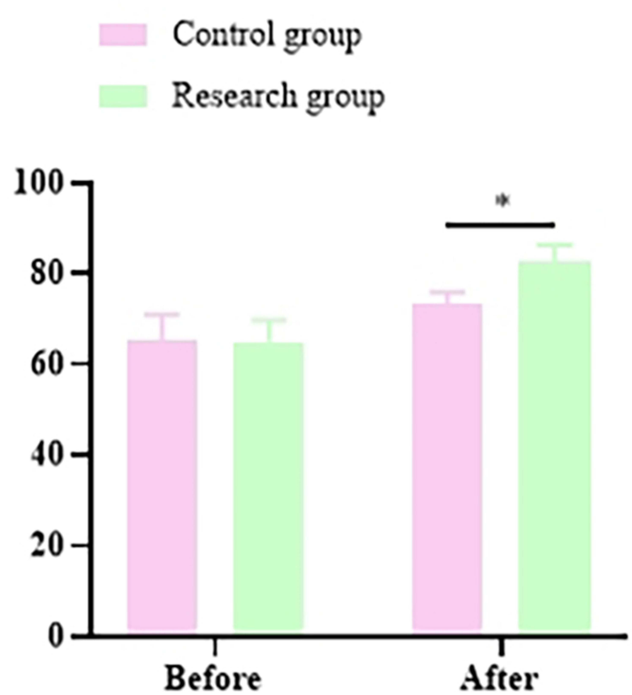

Figure 6 Comparison of CQOL-74 scores between the two groups of parturients.
Note: *Indicates a significant difference between the two groups (p<0.05).

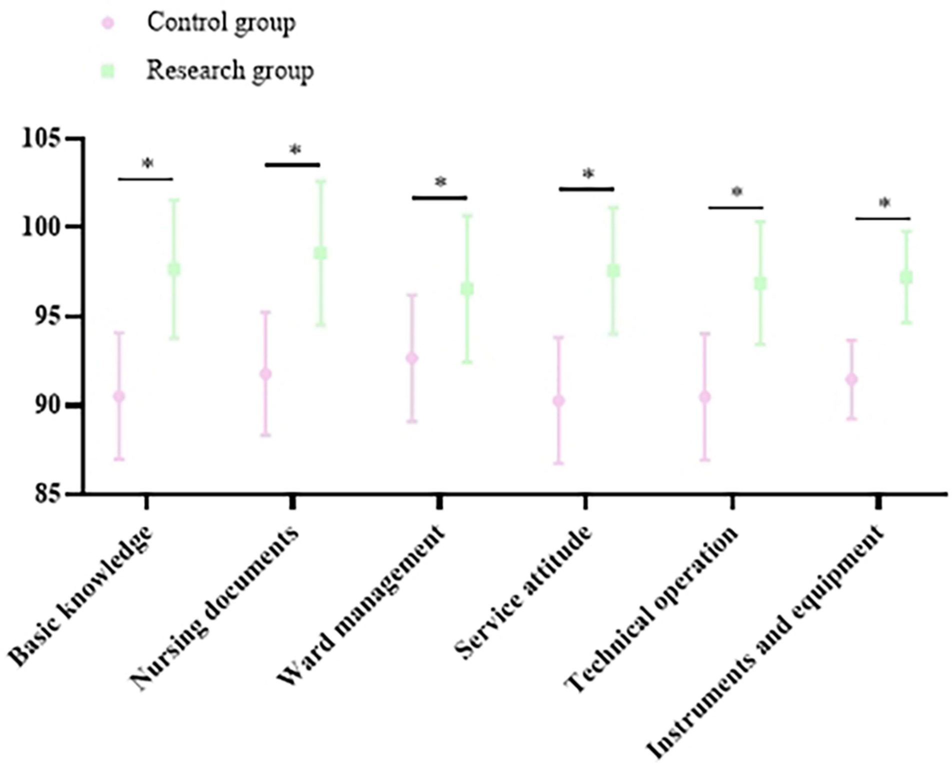

Figure 7 Comparison of nursing quality between the two groups of nursing staff.
Note: *Indicates a significant difference between the two groups (p<0.05).

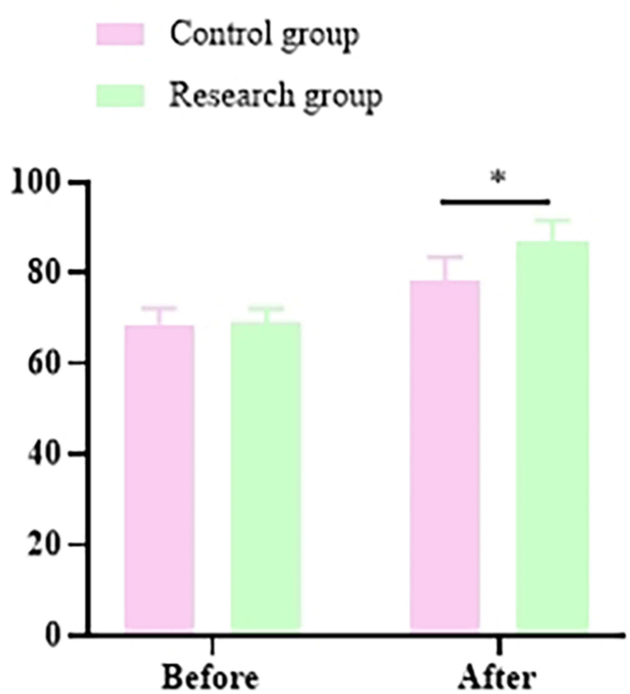

Figure 8 Comparison of nursing satisfaction between the two groups of parturients.
Note: *Indicates a significant difference between the two groups (p<0.05).

after cesarean (VBAC), and (3) real-time audit of cesarean decisions by the obstetrics quality committee. In recent years, with the continuous increase in cesarean section rates, postoperative infections have shown a significant upward trend, making effective prevention and control of surgical incision infections an urgent issue in obstetric research.[21,22]

This study constructed an innovative nursing model for the prevention and control of postoperative infections in cesarean section by integrating the core elements of quality management and preventive care. It was found that the combined intervention of quality management and preventive care has a good application effect in cesarean section parturients, promoting recovery, reducing pain, improving maternal understanding of the disease, effectively controlling maternal infections, and improving nursing quality, quality of life, and nursing satisfaction.

Quality management is a management model that focuses on the effectiveness of patient care services and involves collaborative participation of medical staff and patients, with the ultimate goal of achieving dual success in patient physical and mental recovery and satisfaction improvement.[23] The primary step in optimizing nursing service effectiveness is to strengthen the professional quality and operational skills of the nursing team. Especially in special fields such as obstetric care, enhancing the specialized capabilities of nursing staff can directly translate into improved service quality.[24] Internationally, similar integrated approaches show comparable efficacy: A US study combining surgical safety checklists (QM) and preoperative decolonization (PC) reduced post-cesarean infections by 34% (RR=0.66, p=0.02).[25] Our pain management results align with German research where structured perioperative care reduced VAS scores by 2.1 points (vs 1.9 in our study).[20] Given the particularity of the maternal group, the potential risks in the nursing process are significant. It is necessary to establish a comprehensive obstetric nursing standard system, clarify work standards and responsibility boundaries for each position, and ensure operational compliance through institutional constraints. Establish a dynamic supervision mechanism, adopt a combination of regular and random inspections to timely identify and correct deviations in the nursing process, and coordinate with performance appraisal and salary incentive systems to link work quality with economic benefits, effectively motivating the nursing team's work. The professional attitude of nursing staff directly affects the quality of service. It is necessary to guide them to transform their service concepts, from passive execution to active service, deeply understand the individualized needs of patients and their families, and practice the patient-centered service tenet.[26–28] Given the high sensitivity of maternal and child health, it is necessary to strengthen the awareness of nursing risk management, standardize the nursing documentation process, ensure the timeliness, objectivity, and completeness of medical documents, implement a bedside handover system for high-risk parturients, increase the frequency of communication between doctors and patients, and build a multi-dimensional risk prevention and control network. The combined intervention of quality management and preventive care is essentially an organic integration of "systematic quality improvement" and "proactive risk prevention and control." This dual-track mechanism has produced significant synergistic effects in the nursing of cesarean section parturients, achieving standardization and continuous improvement of nursing processes. Based on the analysis of the results of this study, this improvement is not accidental but is based on data-driven scientific management. For example, a tertiary hospital reduced the number of infusion-related call bell uses from 367 to 159 times through the "Excellent Nursing Circle" activity, achieving a target compliance rate of 100.97%. The key lies in ① the precision of problem analysis, using Pareto analysis to identify main causes and fishbone diagrams to trace root causes, ensuring that improvement measures directly address pain points. ② a collaborative model with full participation, cross-level division of labor (such as the head nurse serving as the team leader and team members including nurses of different seniority) ensures execution and promotes experience inheritance. ③ the scientific foundation of evidence-based nursing, integrating international guidelines (such as the Canadian RNAO Best Practice Guidelines) into clinical practice to optimize operations such as intravenous catheter management and reduce the risk of drug extravasation.[29–31]

In summary, in this study, the combined intervention reduced the total infection rate, improved the CQOL-74 score, enhanced the basic knowledge score of nursing staff, and strengthened the self-care ability of parturients. It can be considered that the quality management combined with preventive care model is comprehensive and targeted. Quality management places patient needs at the core, focuses on optimizing service effectiveness, and builds a closed-loop system for the entire nursing service process through refined management to effectively avoid service breakpoints that may exist in traditional nursing models. The concept of preventive care emphasizes comprehensive and proactive identification and intervention of risk factors in patients, significantly reducing the risk of complications such as infections through systematic interventions covering the entire preoperative, intraoperative, and postoperative periods. The two have an inherent logical synergistic effect: quality control provides theoretical support and implementation frameworks for preventive care, decomposes key links in the nursing process, establishes standardized operating procedures, and promotes continuous improvement in nursing effectiveness. Preventive care, through the establishment of an early warning system, can proactively identify potential risks and take targeted prevention and control measures. This risk prevention and control mechanism not only reduces the incidence of adverse events such as postoperative infections but also optimizes the operational effectiveness of the quality control system through practice feedback.[32,33] The two form a virtuous cycle of "theory-practice-optimization", reducing medical risks while promoting the iterative upgrading of medical staff's professional quality and service capabilities.[34–36]

Despite the significant effects of the dual-track intervention revealed in this study, it is still necessary to objectively examine its limitations to guide improvements in subsequent research. Firstly, the sample size of this study was 130 cases, which, although meeting the minimum requirements for retrospective studies, may weaken statistical power. Additionally, the single-center design may introduce regional bias, potentially affecting the generalizability of the results. The VAS pain score relies on subjective reports from patients and may be influenced by emotional states. Future research can adopt physiological-psychological joint assessments (such as skin conductance monitoring combined with pain diaries) to improve data objectivity. Furthermore, the implementation of preventive care is affected by individual nurse experience, which may impact infection prevention effectiveness. Standardized operation videos and real-time monitoring systems can enhance intervention consistency. However, the core value of the combined intervention model of quality management and preventive care lies in the closed-loop management of "prevention-monitoring-improvement", which has broad application prospects in the future. The National Health Commission's "Action Plan for Further Improving Nursing Services (2023–2025)" emphasizes "strengthening the foundation and improving quality", which is highly aligned with the concept of this study. Future multicenter studies should evaluate this model's adaptability across healthcare settings (eg, rural clinics vs urban hospitals).

Conclusion

In conclusion, the combined intervention of quality management and preventive care demonstrates significant clinical utility for enhancing care quality and safety in cesarean section parturients. Its efficacy arises from: preventive care ensuring standardized and continuously optimized nursing processes, while PC proactively blocks infection risks through systematic risk mitigation. This synergistic dual-track mechanism significantly reduces infection rates (aOR=0.24) and improves maternal outcomes.

While preventive care principles are established in surgical care, our model innovatively integrates them with evidence-based PC through: (1) multidisciplinary dynamic monitoring teams, (2) individualized three-level prevention protocols, and (3) closed-loop feedback systems—an approach underexplored in obstetric nursing.

Despite promising results, limitations exist: The single-center design and modest sample size (n=130) may limit generalizability, potentially inflating effect sizes (eg, d=2.15 for pain reduction). Future multicenter trials with larger cohorts are warranted to validate scalability.

Future research should explore this model's adaptability across diverse medical settings and enhance interventions through technological integration (eg, AI risk prediction, VR nursing training), advancing nursing quality improvement.

Disclosure

The authors report no conflicts of interest in this work.

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