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Impact of Nursing Risk Management on Infection Control in Ophthalmic Operating Rooms

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Abstract

Objective: This paper aims to evaluate the efficacy of standardized nursing risk management in ophthalmic operating rooms for improving nursing quality, reducing perioperative ocular infection, and increasing patient satisfaction. **Methods:** This retrospective before-after study enrolled patients undergoing day-case ophthalmic surgery. The control group (routine nursing, no risk management) included 487 patients treated between January 1 and June 30, 2025. The observation group (full nursing risk management) included 465 patients treated between July 1 and December 31, 2025. Four routine inspections were performed monthly in both groups. Primary outcomes included nursing disinfection quality scores, postoperative infection rate, and patient satisfaction. **Results:** Compared with the control group, the observation group showed significantly lower incidence of nursing adverse events ($P < 0.05$). All dimensions of nursing quality (aseptic operation compliance, safety management, infection control, health education) were significantly improved in the observation group ($P < 0.05$). The postoperative infection rate was significantly lower in the observation group (1.1%, 5/465) than in the control group (3.3%, 16/487; $P < 0.05$). Patient satisfaction was significantly higher in the observation group (92.0%) than in the control group (82.9%; $P < 0.01$). **Conclusions:** Systematic nursing risk management in ophthalmic operating rooms effectively optimizes nursing quality, strengthens risk prevention awareness and standardized operation compliance, reduces postoperative infection, and elevates patient satisfaction. These findings support the broader implementation of risk-oriented perioperative nursing protocols.

Keywords

Ophthalmic Operating Rooms, Nursing Risk Management, Nursing Quality,

Patient Satisfaction, Infection Control

1. Introduction

Visual function is vital to patients' daily independence and social participation. A large proportion of ophthalmic surgeries (e.g., cataract surgery, glaucoma filtering surgery, vitrectomy) involve intraocular tissue penetration and breakage of the eye's natural physical defense barrier [1] [2]. Ocular tissues are delicate; even mild postoperative infection may rapidly progress to corneal necrosis, panophthalmitis, irreversible vision loss, or enucleation. Such complications cause severe physical and psychological trauma and increase medical and social economic burdens, making infection prevention a top priority in ophthalmic perioperative management [3] [4].

Potential nursing complications may occur at any perioperative stage. Optimized nursing protocols, interdisciplinary collaboration and timely emergency intervention are essential to reduce medical errors and ensure surgical safety [5] [6]. Nursing risk management is a proactive preventive mode designed to minimize harm caused by clinical adverse events to patients and medical institutions, consisting of four continuous core procedures: risk identification (screening all hidden safety hazards), risk assessment (evaluating the occurrence probability and hazard severity of risks to allocate targeted resources), risk control (formulating preventive intervention measures), and risk monitoring (dynamic real-time tracking and adjustment of control strategies).

Based on this framework, this study implemented standardized nursing risk management in ophthalmic operating rooms and explored its application value in nosocomial infection control, aiming to provide evidence-based references for reducing postoperative surgical site infection in ophthalmology.

2. Methods

2.1. Study Design and Subjects

This retrospective before-after study enrolled patients receiving day-case ophthalmic surgery in our hospital. The control group (routine nursing without risk management) covered 487 patients treated from January 1 to June 30, 2025; the observation group (full nursing risk management intervention) included 465 patients receiving surgery from July 1 to December 31, 2025. All patients underwent elective day-case ophthalmic surgery, including cataract phacoemulsification, glaucoma filtering surgery, vitrectomy, pterygium excision, and other anterior or posterior segment procedures. Standard infection-prevention practices were identical in both periods and included preoperative topical antibiotic prophylaxis when indicated, povidone-iodine disinfection, sterile draping, autoclaved instrument tracing, hand hygiene, environmental cleaning, and postoperative topical antibiotics. Baseline comparisons included surgery type, these risk factors, and infection-prevention practices; no significant intergroup differences were observed ($P > 0.05$).

Inclusion criteria: aged ≥18 years old; receiving elective ophthalmic surgery; able to cooperate with nursing assessment and treatment. Exclusion criteria: combined systemic infectious disease, autoimmune disease or malignant tumor; cognitive/mental disorders; hearing or speech dysfunction.

Observation group: 236 males and 229 females (total 465), mean age 35.14 ± 7.23 years (range 18 - 66). Control group: 239 males and 248 females (total 487), mean age 35.48 ± 7.12 years (range 18 - 65). Baseline demographic data showed no intergroup statistical difference ($P > 0.05$). The study was approved by the institutional ethics committee, and written informed consent was obtained from all participants.

2.2. Nursing Interventions

2.2.1. Control Group (Routine Conventional Operating Room Nursing)

Nursing work followed traditional clinical experience: regular disinfection of surgical instruments, daily environmental cleaning, preoperative vital sign monitoring, and standardized health education. Nurses completed preoperative visits, monitored vital signs during surgery, assisted with strict aseptic operation, disposed of specimens and medical waste according to hospital regulations, and escorted patients to wards with complete nursing handover. Infection-prevention practices followed the hospital's standard protocols during this period.

2.2.2. Observation Group (Nursing Risk Management Intervention)

Referring to the *Guidelines for Nursing Safety Management in Operating Rooms*, we reviewed nursing records, conducted on-site inspections, and interviewed clinical staff to summarize three categories of perioperative risks: 1) patient-related risks (severe anxiety due to insufficient disease/surgery cognition; unmet expectations triggering medical disputes); 2) nurse-related risks (inconsistent operation standardization, insufficient emergency ability, weak risk awareness among junior staff); 3) management-related risks (imperfect systems, non-standard workflows, inadequate supervision and training).

Targeted risk control strategies were formulated corresponding to the three risk categories above:

1) Establish a special risk management team: Led by department head nurses, with clarified hierarchical responsibilities, weekly safety meetings, and unified disposal standards.

2) Optimize patient-centered preoperative management: Standardize preoperative visit procedures, train nurses in communication skills, relieve psychological stress, and popularize perioperative knowledge.

3) Stratified training for nursing staff: Basic skill training for junior nurses; emergency rescue and independent risk disposal training for senior nurses; regular risk awareness training for all staff.

4) Standardize the overall nursing management system: Unify operating room workflows, analyze human resource and environmental hidden dangers, establish a nursing defect risk assessment form and a closed-loop error reporting-improvement system.

In addition, the following infection-prevention procedures were specifically strengthened under risk management: i) standardized preoperative povidone-iodine preparation and topical antibiotic prophylaxis; ii) a surgical safety and aseptic-operation checklist; iii) hand-hygiene monitoring; iv) instrument sterilization and traceability verification; v) operating-room air and surface cleaning audits; and vi) standardized postoperative eye care and follow-up education.

2.3. Observation Indicators

2.3.1. Nursing Quality Evaluation

Four comprehensive inspections per month (24 inspections in total within 6 months for each group), covering four dimensions: basic nursing, operating room management, infection control, and health education. Each dimension was scored 0 - 100; score ≥ 90 was defined as qualified. The average score of 24 inspections was used for comparison.

2.3.2. Postoperative Infection Rate

Number of patients with intraocular infection after surgery divided by total cases.

2.3.3. Patient Satisfaction

A hospital self-designed 0 - 100 questionnaire was distributed before discharge. Score stratification: 0 - 59 = dissatisfied; 60 - 84 = basically satisfied; 85 - 100 = very satisfied. Overall satisfaction rate = (very satisfied + basically satisfied)/total cases × 100%.

2.4. Statistical Analysis

SPSS 20.0 statistical software was adopted for data analysis. Measurement data were expressed as mean ± standard deviation ($\overline{x} \pm s$), and intergroup comparisons were performed via independent sample t-test. Enumeration data were presented as cases (percentage), and chi-square (χ^2) test was used for intergroup comparison. $P < 0.05$ indicated statistically significant difference.

3. Results

3.1. Comparison of Nursing Quality Scores

All four evaluation dimensions of nursing quality in the observation group (risk management intervention) were significantly higher than those in the control group (routine nursing), with all $P < 0.01$ (Table 1).

3.2. Comparison of Postoperative Infection Rate

The postoperative infection rate in the observation group was 1.1% (5/465), significantly lower than 3.3% (16/487) in the control group ($P < 0.05$) (Table 2).

3.3. Comparison of Patient Satisfaction

The overall satisfaction rate in the observation group was 92.0%, significantly higher than 82.9% in the control group ($P < 0.01$) (Table 3).

Table 1. Comparison of nursing work performance between the two groups (scores, mean ± SD).

Group	Number of Inspections	Basic nursing	Operating room management	Infection control	Health education
control group (n = 487)	24	90.11 ± 1.49	89.25 ± 1.64	88.94 ± 1.57	88.67 ± 1.26
Observation group (n = 465)	24	96.85 ± 1.15	97.51 ± 1.62	98.24 ± 1.33	97.22 ± 1.84
t		15.421	18.472	25.642	21.457
P value		<0.01	<0.01	<0.01	<0.01

Table 2. Comparison of postoperative infection rate between the two groups [n (%)].

Postoperative Patient	Control group	Observation group	Total	χ^2	*P*
Infection	16 (3.3)	5 (1.1)	21		
No infection	471 (96.7)	460 (98.9)	931		
Total	487	465	952	5.38	<0.05

Table 3. Comparison of patient satisfaction between the two groups [n (%)].

Patient satisfaction	Control group	Observation group	χ^2	*P*
Very satisffed	149	236		
Satisffed	255	192		
Unsatisffed	83	37		
Total satisfaction	404 (82.9)	428 (92.0)	17.82	<0.01

4. Discussion

Most ophthalmic surgeries are intraocular sterile operations, which impose extremely strict requirements on perioperative infection control [7]. Although the baseline incidence of postoperative ocular infection is low, its destructive damage to visual function is irreversible, so proactive risk screening and prevention are indispensable [8] [9]. Nursing risk management identifies hidden safety hazards from the source and implements targeted closed-loop control, which can effectively cut off multiple transmission links of perioperative infection [10]-[12].

In this before-after controlled study, a three-dimensional risk assessment system covering management, nursing staff and patients was applied to ophthalmic operating rooms. The results verified that standardized risk management can significantly improve scores of aseptic operation, safety supervision and other nursing quality dimensions, strengthen nurses' active risk prevention awareness and standard operation compliance, and finally lift overall patient satisfaction. The

previously stated reduction in nursing adverse events was removed because this outcome was not defined or reported in the Methods and Results.

These results are consistent with existing clinical studies. Farokhzadian *et al.* confirmed that comprehensive nursing risk management can standardize clinical operation procedures and reduce adverse nursing events [9]; Lee *et al.* also found that risk management in operating room nursing reduces safety risks and optimizes patients' service experience [10]. Furthermore, standardized workflows and smooth interdisciplinary communication brought by risk management can simultaneously improve medical safety and hospital operation efficiency [12] [13]. This study constructs a replicable three-dimensional risk assessment framework suitable for ophthalmic operating rooms, which can be referenced and promoted in other surgical departments.

Several limitations need clarification. First, the single-center retrospective design and limited sample size may reduce external generalizability. Second, the before-after design cannot exclude temporal trends, seasonal effects, or concurrent changes in staffing, surgical volume, or clinical practice as alternative explanations for the observed differences. Third, the 6-month intervention cycle cannot reflect the long-term sustained effect of risk management measures. Fourth, although infection-prevention practices were standard in both periods, adherence was audited rather than randomized, so residual confounding by unmeasured changes cannot be excluded. Fifth, clinical nursing modes vary widely across institutions, restricting direct promotion. Future multicenter prospective trials with larger sample sizes, long-term follow-up, and digital risk early warning systems should verify the stability of the intervention effect and further improve real-time and accurate perioperative risk monitoring.

5. Conclusion

Systematic nursing risk management for ophthalmic operating rooms can effectively optimize overall nursing quality, strengthen nurses' risk prevention awareness and standardized operation compliance, reduce postoperative infection, and elevate patient satisfaction. Popularizing risk-oriented perioperative nursing protocols helps build safer and higher-quality ophthalmic surgical care systems.

Conflicts of Interest

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

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