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Discussion on the Key Role and Practice of Operating Room Nurses in Infection Control

Meng Wu

Operating Room, Jingzhou Central Hospital, Jingzhou 434020, Hubei, China

Abstract: This paper focuses on the key role and practical paths of operating room nurses in infection control, and studies the difficult problems in the prevention and control of surgical site infections. Analyze the infection risk links in the operating room and the core responsibilities of nurses, reveal the multiple role mechanisms of nurses in infection control, design practical strategies from dimensions such as process optimization, skill improvement, and monitoring feedback, and construct an infection control system involving all staff. Research shows that operating room nurses can effectively reduce the risk of infection, improve medical quality, provide core guarantees for patient safety, and promote the transformation of operating room infection control towards refined management through practical actions such as standardized operation execution, real-time risk monitoring, and team collaboration supervision.

Keywords: Operating room nurse; Infection control; Surgical safety; Nursing practice; Risk prevention and control

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1. Introduction

As a high-risk medical facility, the quality of infection control in the operating room is directly related to the postoperative recovery and life safety of patients. Surgical site infection can prolong the hospital stay, may cause serious complications, and increase the medical burden. Operating room nurses, as direct participants throughout the surgical process, play a key role in infection control. The standardization of operation and awareness of risk prevention and control directly affect the incidence of infection. This paper deeply explores the mechanism and practical strategies of nurses in infection control. It is of great significance for improving the prevention and control system, enhancing the team's prevention and control capabilities, and ensuring patient safety, providing practical support for the quality management of operating rooms.

2. The current situation of infection control in operating rooms and the role positioning of nurses

2.1. The current situation and risk links of infection control

At present, infection control in operating rooms is confronted with multiple risks and challenges. Incomplete sterilization of preoperative instruments, lack of intraoperative environmental monitoring, and improper disposal of postoperative waste can all lead to infections. Insufficient compliance of hand hygiene among surgical personnel and non-standard implementation of aseptic operations are common risk points. Inadequate skin preparation for patients and overly long operation times can also increase the probability of infection. The current prevention and control system has the problem of emphasizing process formulation over implementation supervision. Some nurses have insufficient understanding of the risks of new infections, and their emergency response capabilities need to be improved. Moreover, infection control mostly relies on personal experience and lacks a standardized and all-staff prevention and control mechanism, making it difficult to meet the infection prevention and control needs of complex surgical scenarios.

2.2. The infection control role of operating room nurses

Operating room nurses play multiple roles as executors, supervisors, and coordinators in infection prevention and control [1]. At the implementation level, core prevention and control measures such as aseptic technical operations and instrument sterilization management must be effectively implemented without the slightest oversight. During the supervision process, it is necessary to always pay attention to whether the operations of surgical personnel are compliant and whether there are any changes in environmental risks. Any violations found should be corrected immediately. The coordination work should take into account the prevention and control arrangements for each link before, during, and after the operation, so that the infection control requirements of multiple departments can be precisely connected. The training on infection prevention and control knowledge is also undertaken by nurses, who systematically impart operation norms to newly recruited staff, allowing the prevention and control concept to permeate every detail of the entire surgical process and become the core force supporting the efficient operation of the infection control system.

3. The key role mechanism of operating room nurses in infection control

3.1. The guaranteeing role of the implementation of operation norms

Operating room nurses have built the first line of defense for infection prevention and control with strict operating norms. Before the operation, conduct precise checks on the sterilization effect of the instruments and the integrity of the packaging to ensure that every sterile item meets the usage standards. During the operation, skin disinfection and towel laying should be carried out in a standardized manner to keep the boundaries of the sterile area clear. At the same time, attention should be paid to whether the sterile clothing worn by the surgical personnel is standardized and whether hand hygiene is implemented properly. After the operation, contaminated dressings and instruments should be properly treated, and disinfection, sterilization or harmless disposal should be carried out according to their categories. Every operation was carried out strictly in accordance with the prevention and control guidelines, using standardized actions to reduce human errors and keep the risk of infection at the lowest level, laying a solid foundation for the safety of the surgery.

3.2. The real-time monitoring role of risk links

Operating room nurses rely on their professional sensitivity to conduct real-time monitoring of infection risk links. Before the operation, assess the patient's underlying diseases, nutritional status, and other infection susceptibility factors, and formulate personalized prevention and control plans based on this. During the operation, closely monitor the changes in temperature, humidity, and air cleanliness of the surgical environment, adjust the parameters of the purification system in a timely manner, and at the same time pay attention to the placement and usage status of items on the sterile instrument table to avoid cross-contamination. After the operation, monitor any abnormal manifestations such as bleeding, redness, and swelling of the dressing at the surgical site and report them to the doctor immediately for handling. Full-process risk monitoring can identify potential infection risks at an early stage, buy precious time for the implementation of intervention measures, and effectively reduce the possibility of infection.

3.3. The coordinating and supervisory role of team behavior

As core members of the surgical team, operating room nurses bear the responsibility of coordinating and supervising the infection control behavior of the entire team. Before the operation, an infection risk assessment meeting was organized to clearly define the prevention and control responsibilities of each member [2]. During the operation, when non-standard actions such as crossing the sterile area or not replacing damaged gloves in time were found among the surgical personnel, timely corrections were made through gesture reminders and soft prompts. After the operation, the team was organized to jointly review and carefully analyze the weak links in the prevention and control work of the day. Nurses coordinate the prevention and control work of different professionals with effective communication skills, ensuring that surgeons, anesthesiologists, technicians, and other types of personnel strictly follow the unified prevention and control standards, and thus unite the overall strength of the prevention and control work.

3.4. The leading and disseminating role of prevention and control culture

Operating room nurses shoulder the responsibility of leading and disseminating in the construction of infection control culture. In their daily work, they always practice the prevention and control concept of "patient safety first", gradually making standardized operation a professional instinct. During the process of team collaboration, actively share experiences in infection prevention and control, such as the specific application methods of new disinfection technologies, thereby promoting the overall awareness of prevention and control within the team. For intern nurses and trainees, a "one-on-one" teaching model is adopted. Through demonstration operations, key points of prevention and control are conveyed, and implicit practical experience is transformed into clear operational norms. The active participation of nurses can create a cultural atmosphere where "everyone attaches importance to prevention and control and everything implements norms", making infection control the common direction of the entire team's efforts [3].

4. Practical strategies for infection control among operating room nurses

4.1. Optimization of preoperative infection prevention and control preparations

During the preoperative preparation stage, it is necessary to strengthen the prevention and control of all elements of infection. Nurses should check the sterilization monitoring reports of surgical instruments in advance and

confirm the sterilization qualification through dual verification of physical and chemical monitoring. Specialized inspections are carried out on precision instruments to prevent infection risks caused by instrument issues. One day before the operation, patients are guided to complete skin cleaning and skin preparation. Non-invasive shaving methods are adopted to reduce the risk of skin damage. Appropriate antibacterial soap solutions are selected based on the surgical site to ensure the effectiveness of skin preparation. The purification system in the operating room is activated 30 minutes before the operation. Simultaneously monitor the number of air dust particles and the index of settled bacteria, and prepare sterile dressings and protective equipment that meet the specifications to lay a solid foundation for the safety of the surgical environment.

4.2. The aseptic operation norms during the operation were followed

The entire process of aseptic operation during the operation must be strictly controlled. Nurses assist surgical personnel in completing hand disinfection and wearing aseptic clothing to ensure that the wearing process is standardized and correct. At the same time, they check the integrity and size compatibility of aseptic gloves. Instrument nurses implement precise management of aseptic instrument tables, reasonably place instruments in the order of use, and promptly replace contaminated instrument trays. Always keep the sterile area at the edge of the table clean and dry, and avoid crossing the sterile area during the transfer of instruments [4–6]. The mobile nurses closely monitor the flow of people in the operating rooms, restrict the entry of non-essential personnel, strictly control the frequency and duration of opening the operating room doors, closely monitor the compliance of aseptic operations by surgical personnel, immediately stop and correct any violations found, and ensure that each link in the operation meets the specific requirements of infection prevention and control.

4.3. Enhanced control of postoperative infection risk

Postoperative infection risk control should continue until 72 hours after the operation. Nurses should properly dispose of surgical waste. Contaminated dressings and discarded tissues should be sorted and placed in special medical waste bags. Sharp tools should be placed in puncture-proof containers to avoid contamination during the removal process. Immediately after the operation, conduct a preliminary cleaning of the surgical instruments. Use enzyme washing to remove organic residues. Select appropriate sterilization methods based on the material and precision of the instruments. Record the parameters of the entire cleaning and sterilization process. Terminal disinfection in the operating room must be implemented. Wipe the surfaces of objects with chlorine-containing disinfectants, disinfect the air through ultraviolet light or hydrogen peroxide fumigation, and replace all disposable protective equipment and cleaning tools. Create a sterile environment for the next operation.

4.4. The emergency response for infection prevention and control has been improved

The emergency response mechanism for infection prevention and control needs to be solidly established. Nurses should formulate response plans in advance for the risk of sudden infection during the operation. When the sterile package is damaged, the spare sterile package should be immediately activated, and the contamination range should be evaluated simultaneously and the disinfection area expanded. When a surgical personnel's skin was accidentally cut, assist in emergency wound treatment and replace the surgical personnel, and track the exposure to contaminants [7]. After the operation, suspected infection cases were found. Nurses assisted in tracing the operation records of the entire surgical process, verified data such as instrument sterilization and environmental monitoring, cooperated with the infection control department to conduct root cause analysis, recorded the handling process and

improvement measures, and formed an emergency response closed loop to prevent similar risks from recurring.

5. Guarantee for enhancing the infection control capabilities of operating room nurses

5.1. Construction of a professional skills training system

As a high-risk and high-tech department in a hospital, the operating room has high requirements for the professional ability and emergency response of nurses. Patient safety competence is a core competence that operating room nurses must possess, which is directly related to the success rate of surgeries and the life safety of patients. Operating room nurses must possess comprehensive knowledge, solid skills, and a positive attitude to ensure the maximum protection of patient safety. The construction of a hierarchical infection control training system focuses on the mastery of basic operations, such as aseptic techniques and hand hygiene for new nurses, while for senior nurses, it emphasizes the strengthening of advanced skills, such as risk assessment and emergency response [8]. Theoretical teaching is combined with scenario simulation for training. Video analysis and practical operation for identifying violations help enhance capabilities. Specialized training on disinfection techniques and sterilization methods is organized regularly, and experts are invited to interpret guidelines to ensure that nurses' skills are updated in real time to deal with infection risks.

5.2. Establishment of infection monitoring and feedback mechanisms

The establishment of a full-process infection monitoring and feedback mechanism has enabled nurses to record the environmental monitoring data of the operating room every day, including indicators such as temperature, humidity, and colony count. The sterilization parameters of the instruments and the monitoring results are recorded in detail, forming a traceable monitoring file. The infection control registration book is specially set up. The types of intraoperative non-compliant operations, corrective measures, and improvement suggestions are recorded one by one. Data summary and analysis are conducted weekly to identify high-frequency risk points. Infection control meetings are held monthly, where typical cases and prevention and control experiences are shared. Abnormal fluctuations in infection rates are included in special discussions. Monitoring data is transformed into specific improvement measures. Continuous feedback drives the quality of prevention and control to spiral upwards.

5.3. Teamwork and cultural construction

Strengthen the collaboration mechanism of the infection control team. Nurses take the lead in forming an infection prevention and control group, incorporating members from multiple positions such as doctors, technicians, and cleaning staff. Clearly define the prevention and control responsibilities and collaboration paths for each position. Before the operation, organize a collaborative meeting to determine the core points of infection prevention and control during the operation on that day. During the operation, the operational tacit understanding is maintained through non-verbal communication such as gestures and eye contact. Participate in the environmental cleaning quality inspection together after the operation. Promote the cultural construction activities of infection control, carry out activities such as the selection of "Aseptic operation experts" and prevention and control knowledge competitions, enhance the team's sense of identity in prevention and control, make infection control a consensus and voluntary action of the team, and create a collaborative atmosphere where "everyone has a responsibility and everyone fulfills their duties" [9–11].

5.4. The management system and assessment incentives have been improved

Improve the infection control management system and assessment framework. A special "Operating Room Infection Control Operation Manual" has been formulated, with clear standard procedures and evaluation indicators for each operation. Responsibilities for instrument management, environmental monitoring, etc., have been assigned to specific individuals. A three-level assessment mechanism of "daily inspection + monthly assessment + annual evaluation" has been established. The assessment results are directly linked to performance, and nurses with outstanding performance in epidemic prevention and control work have been commended and rewarded [12]. The accountability system for infection control is strictly implemented. In cases where infections are caused by operational violations, responsibility analysis is conducted. Non-punitive root causes are traced and preventive measures are formulated. The combined effect of institutional constraints and positive incentives stimulates the enthusiasm and sense of responsibility of nurses in prevention and control work.

6. Analysis of the effectiveness of infection control practices

6.1. The control of infection risks has achieved remarkable results

The standardized infection control practices of operating room nurses have effectively curbed risks at each link, and the risk of surgical site infection has decreased accordingly. The preoperative instrument sterilization verification mechanism was strictly implemented, the qualification rate of sterile items increased accordingly, the risk of infection caused by instruments was basically eliminated, the supervision of aseptic operation during the operation was continuously strengthened, the compliance of hand hygiene of surgical personnel and the standardization of aseptic area maintenance were both improved, the incidence of non-compliant operation decreased simultaneously, the terminal disinfection process after the operation was continuously optimized, and the cleanliness quality of the operating room environment always met the standards The risk of cross-infection is thus effectively controlled.

6.2. The team's prevention and control capabilities have been comprehensively enhanced

Under the guidance and initiative of the nurses, the team members' awareness of prevention and control has shifted from passive acceptance to active practice. Basic norms such as hand hygiene and aseptic techniques have been integrated into daily operation habits. New employees have quickly mastered the key points of prevention and control through systematic teaching. The standardization of team operations has significantly improved, and multi-disciplinary collaboration has become increasingly close. The cooperation and tacit understanding among nurses, doctors, and technicians in infection prevention and control have deepened. The mechanism of jointly assessing risks before the operation, supervising operations collaboratively during the operation and jointly reviewing and improving after the operation operates efficiently.

6.3. The quality of nursing practice has been continuously optimized

Infection control practices have driven the quality of operating room nursing to a higher level. The professional quality and operational standardization of nurses have been comprehensively enhanced. Nursing work has shifted from focusing on the completion of operations to paying attention to quality and safety. All operations strictly follow infection prevention and control standards, and the accuracy and rigor of operations have been significantly improved [13, 14]. The completeness and traceability of nursing records have been improved. Data records on

instrument sterilization, environmental monitoring, etc., are detailed and standardized, providing a reliable basis for quality analysis. Nurses are increasingly actively thinking and innovating in infection prevention and control. By optimizing operation processes and improving working methods, the efficiency of prevention and control has been enhanced, and the professionalism and value of nursing work have been fully highlighted [15].

7. Conclusion

The standardized operation execution, real-time risk monitoring, and team collaboration supervision of operating room nurses constitute the core guarantee for reducing the risk of infection. This article analyzes the role positioning and mechanism of action of nurses, and designs practical strategies such as preoperative preparation optimization and intraoperative standardized implementation. It has been verified through practice that it can effectively improve the quality of infection control and reduce surgical risks. The professional competence of nurses and their awareness of prevention and control are directly related to the effectiveness of infection control. Continuously strengthening the cultivation of nurses' infection control capabilities and improving team collaboration and incentive mechanisms are of great value for ensuring patient safety and enhancing medical quality. In the future, it is necessary to further promote the refinement and intelligence of prevention and control practices, so that the core value of nurses in infection control can be fully exerted.

Disclosure statement

The author declares no conflict of interest.

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