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The Effect of Integrated Management under 8S Mode on the Detection Rate of MDROs and the Qualified Rate of ICU High-frequency Contact Objects

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Abstract: ***Objective**: To explore the effect of integrated management under 8S mode on the detection rate of MDROs and the qualified rate of articles in ICU high-frequency contact objects, so as to improve the medical quality of hospitals and the safety of patients. **Methods**: The high-frequency contact objects in the ICU ward of the Affiliated Hospital of Youjiang Medical University for Nationalities from May 2023 to December 2023 were selected as the observation objects, and the samples collected from the surface of high-frequency contact objects from May to August 2023 were used as the control group, and the routine management methods were implemented. The samples from September to December were taken as the observation group, and the integrated management method under the 8 S mode was implemented. The differences of MDROs detection rate, qualified rate of item surface and hand hygiene compliance of ICU staff between the two groups were compared. The results showed that after the implementation of integrated management under 8S mode, the detection rate of multidrug-resistant bacteria was lower than that before intervention, and the difference was statistically significant (P < 0.001). After the implementation of integrated management under 8S mode, the qualified rate of environmental object surface detection was higher than that before intervention, and the difference was statistically significant (P < 0.001). After the implementation of integrated management under 8S mode, the hand hygiene compliance of ICU staff was higher than that before the intervention, and the difference was statistically significant (P < 0.001). **Conclusion**: The implementation of integrated management under 8S mode can effectively reduce the detection rate of multidrug-resistant bacteria on the surface of high-frequency contact objects in ICU, improve the qualified rate of surface detection and hand hygiene compliance of ICU staff, which can provide reference for infection control management in medical institutions, and also provide a practical and feasible way to improve the level of infection control in medical institutions.*

Keywords: 8S mode, Integrated management, High frequency contact object surface, Multidrug-resistant bacteria.

1. Introduction

Multidrug-resistant organism (MDROs) infection has always been a problem of nosocomial infection that threatens the health of all mankind. Despite the rapid development of intensive care unit (ICU) in recent years, the incidence of nosocomial infection in ICU is still significantly higher than that in general wards [1-3]. The colonization and transmission of multi-drug resistant bacteria on the surface of high-frequency contact objects in ICU has been proved to be the key way of MDROs infection [4,5]. It is of great clinical significance to take active and effective preventive measures to control the colonization of MDROs on the surface of high-frequency contact objects in ICU. 8S management mode as a comprehensive management system. It includes eight aspects: Seiri, Seiton, Seiso, Seiketsu, Safety, Shitsuke, Save and Study. It aims to improve work efficiency and reduce waste through full participation and comprehensive management, so as to improve the working environment [6]. This management model has shown significant results in different fields [7-9], but there are relatively few studies on the control of multidrug-resistant bacteria in the medical environment (Seiso), cleaning (S). In view of this, this study will adopt the 8S model to carry out integrated management of the four groups of doctors, nurses, health assistants and cleaners in the ICU, and control the surface of high-frequency contact objects in the ICU by forming a unified standard, in order to improve the surface cleanliness of high-frequency contact objects in the adjacent patient area, reduce the occurrence of drug-resistant bacteria infection, and improve the quality of medical treatment. The report is as follows.

2. Data and Methods

2.1 Research Object

In this study, the high-frequency contact objects in the ICU ward of the Affiliated Hospital of Youjiang Medical College for Nationalities from May to December 2023 were selected as the observation objects. The samples collected from the surface of the high-frequency contact objects from May to August 2023 were used as the control group, and the samples collected from September to December 2023 were used as the observation group. The surface sampling positions of high-frequency contact objects include: bed rail, bedside cabinet, bed tail, treatment vehicle, ECG monitor, infusion pump, injection pump, stethoscope, ventilator, tower table, flashlight, door handle, sink faucet, power switch, telephone microphone and button, computer mouse, keyboard, nurse station table, etc. ICU staff includes doctors, nurses, health assistants and cleaners.

2.2 Specimen Sampling and Detection Methods

The surface of high-frequency contact objects was sampled a nd detected by bacterial detection method and target detection method. The colony count and MDROs culture were observe d, and the detection changes of pathogenic microorganisms w ere compared. After hand hygiene was performed by the sens ory control specialist, disposable medical masks, hats, and ste

rile gloves were worn. Sterile cotton swabs fully infiltrated wi th normal saline in independent packaging were applied horiz ontally and vertically on the surface of high-frequency contac t objects for 5 times. The sampling area was 10cm×10cm, and all irregular object surfaces were collected. Two cotton swab s were used to sample the same part at the same time (double sampling), and the hand contact part was cut off. The cotton s wabs were placed in a test tube containing 10ml sterile test el uent for inspection. After fully shaking the sampling tube, 1.0 ml of eluent with different dilutions was inoculated into the pl ate, and 15 ~ 20ml of the melted nutrient agar medium cooled to 40℃~45℃ was poured into each plate. The plate was cult ured at (36±1)℃ for 48 h, and the number of colonies was co unted. Another sample was inoculated in MDROs identificati on medium and immediately sent to (36±1)℃ incubator for c ulture. The colony formation was observed after 48 h. The det ected MDROs included carbapenem-resistant Pseudomonas a eruginosa (CRPA), Carbapenem-resistant Acinetobacter bau mannii (CRAB), oxacillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant Enterococcus (VRE), and car bapenem-resistant Enterobacter (CRE). Among them, 332 sa mples were collected from the control group and 332 samples were collected from the observation group.

2.3 Management Methods

2.3.1 Control group: Using routine management methods, un der the management of routine monitoring and on-site supervi sion in the hospital's sensory control department, strict enviro nmental disinfection was carried out regularly in the departme nt area, the hand hygiene of medical staff was strengthened, t he aseptic concept was strictly followed when the patients we re operated, and the related work of infection prevention and isolation was done. According to the "Environmental Surface Cleaning and Disinfection Management Specification for Me dical Institutions," the surface of high-frequency contact obje cts was disinfected twice a day by the cleaner, and the towels were replaced one by one during disinfection and wiping [8].

2.3.2 Observation group: On the basis of conventional management methods, integrated management under 8S mode is implemented, as follows:

(1) Establishment of infection control working group: The infection control working group was established, which was led by the department director and the head nurse. A full-time staff of the infection control department was responsible for the disinfection guidance and sampling of the infection control process.

(2) Full training: Weekly training for ICU doctors, nurses, he alth assistants, cleaners, including disinfection and isolation r elated knowledge, hand hygiene, MDROs infection preventio n and control measures, etc., using centralized teaching + on-site guidance form, found the problem at any time training gu idance, throughout the whole process. Regular assessment.

(3) The implementation of 8S management: 1) Seiri: All ICU bed units were divided according to the regional division of equipment and instruments for fixed-point, positioning, fixed number of processing. 2) Seiton: The patient's daily necessities and commonly used nursing supplies were placed according to the list. 3) Seiso: fixed two days a month on the regional cleaning and disinfection, all medical staff to participate. 4) Seiketsu: daily routine cleaning, 2 times a day according to the conventional management methods to clean the ward and bed bed rail, bedside cabinet, etc.; doctors, nurses and health assistants perform 'who uses who handles'. 5) Safety: Every Monday, the morning shift handover time is used to summarize and improve, and the infection control safety publicity activities are carried out. The theme and form of the activities are led by the director and the head nurse, so that the whole staff can participate in the infection control management of the ward, and develop a 'sense of responsibility' working environment in the work. 6) Shitsuke: The personal protection knowledge training was carried out by the department infection controller every 2 weeks to improve the awareness of all occupational prevention. 7) Save: set up a material team, responsible for consumables control, cost accounting and supplies registration. 8) Study: carry out monthly training on new knowledge of infection control, update the knowledge base of the whole staff, and conduct relevant assessments for the training content.

2.4 Observation Indicators

1) The detection rate of MDROs; 2) The qualified rate of surface detection of environmental objects (when the bacterial culture, the number of colonies ≤5cfu/cm^2, and did not detect the bacteria to be monitored can be judged as qualified); 3) Hand hygiene compliance of medical staff (3 doctors, 5 nurses, 1 nurse and 1 cleaner were randomly observed by full-time staff in the infection control department every month, and the number of hand hygiene before and after contact with items and patients was counted).

2.5 Statistical Analysis

After the collected data were input by double check, SPSS25.0 software was imported for statistical analysis. When $P<0.05$, the difference was statistically significant. The count data were expressed as frequency (n) and rate (%), and the data of the two groups were compared by 2 test.

3. Results

3.1 Basic Information

From May to August 2023, the number of ICU inpatients was 166, the bed utilization rate was 75.00 %, the average length of stay was (16.65 ± 5.79) d, and the number of MDROs was 8 cases, the incidence rate was 4.82 %. From September to December 2023, the number of ICU inpatients was 170, the bed utilization rate was 76.78 %, the average length of stay was (15.63±5.74) d, and the number of MDROs was 7 cases, the incidence rate was 4.12 %.

3.2 Comparison of the Detection Rate of MDROs on the S urface of Objects in High Frequency Contact Environmen t

The results (Table 1) showed that the detection rate of MDROs on the surface of high-frequency contact objects in the observation group was lower than that in the control group, and the difference was statistically significant ($P<0.001$).

3.3 Comparison of Qualified Rate of Object Surface Detection in High Frequency Contact Environment

The results (Table 2) showed that the qualified rate of object surface detection in high-frequency contact environment in the observation group was higher than that in the control group, and the difference was statistically significant (P<0.001).

3.4 Comparison of Hand Hygiene Compliance Rate of ICU Ward Staff

The results (Table 3) showed that the hand hygiene compliance rate of doctors, nurses, care workers and cleaning after intervention was higher than that before intervention, and the difference was statistically significant (P<0.05).

Table 1: Detection of MDROs on the surface of high-frequency contact objects in ICU (n, %)

peer group	numbers of specimen (n)	Number of cases of pathogen detection(n)					Total number of detected copies (n, %)
		CRPA	CRAB	MRSA	VRE	CRE	
control group	332	31	38	26	22	19	136(8.19)
observer group	332	15	20	12	10	11	68(5.86)
χ^2							32.719
P							<0.001

Table 2: Comparison of qualified rates of surface detection of objects in various high-frequency contact environments between the two groups of subjects (n, %)

peer group	Number of samples(n)	Number of Qualifying Shares (n)	percent of pass (%)	χ^2	P
control group	332	243	73.19	26.486	<0.001
observer group	332	295	88.86		

Table 3: Comparison of hand hygiene compliance rate of ICU ward staff (n, %)

category	Before intervention			postintervention			χ^2	P
	Number of times to be performed (times)	Actual execution times (times)	compliance rate (%)	Number of times to be performed (times)	Actual execution times (times)	compliance rate (%)		
Doctors	288	238	82.64	312	288	92.31	12.949	<0.001
Nurses	640	526	82.19	652	608	93.25	36.834	<0.001
Care workers	160	114	71.25	158	136	86.08	10.384	0.001
Cleaners	136	91	66.91	140	117	83.57	10.312	0.001
total	1224	969	79.17	1262	1149	91.05	69.526	<0.001

4. Discussion

4.1 Application Advantages of Integrated Management under 8S Mode

Because ICU is a gathering place for critically ill patients, the workload of treatment and nursing is large, the staff flows frequently, and the multidrug-resistant bacteria are easy to spread and colonize. If the comprehensive cleaning and disinfection is not carried out for a long time, it will lead to bacterial residue, pathogenic microorganism breeding, and even iatrogenic cross infection [10,11]. The 8S mode is an advanced quality management mode at present, which aims to standardize the environmental order, improve efficiency and reduce costs. Because of its high efficiency and scientific characteristics, it has been well applied in hospital management in recent years [12-14]. Compared with the previous model, 8S management can assess risks in advance, strictly control links, train personnel, avoid potential safety hazards, and improve the quality of care. In this study, the occurrence of nosocomial infection is focused on the high-frequency contact of the surface of the object. The 8S model is used to control the four square personnel of doctors, nurses, health assistants and cleaners in the whole process, and cooperate with each other to avoid only starting from a single population. Fundamentally and effectively cut off the route of infection, control the incidence of nosocomial infection, and have certain advantages in hospital infection control management.

4.2 Four Integrated Management based on 8S Can Reduce the Incidence of Multidrug-resistant Bacteria Infection

Studies have shown that microorganisms persist on contaminated environmental surfaces and equipment. If they are not cleaned and disinfected in a timely and correct manner, they can easily spread [15]. Therefore, high-frequency contact surfaces are reservoirs of pathogenic microorganisms and play an important role in hospital infections. The results of this study showed that the detection rate of MDROs decreased from 8.19% to 5.86% after intervention. The difference in the detection rate of MDROs between the two groups was statistically significant (p<0.001), indicating that the management based on the 8S model can reduce the occurrence of multidrug-resistant bacteria infection. Microorganisms persist in contaminated environmental surfaces and equipment. If the environmental surfaces and equipment are not cleaned and disinfected in a timely and correct manner, it is easy to cause transmission. Therefore, the high-frequency contact surface is a reservoir of pathogenic microorganisms and plays an important role in hospital infection. This study found that the current situation of high-frequency contact surface pollution is not optimistic, and multi-drug resistant bacteria are common in the surface colonization. It can be seen from the data that CRAB is detected more frequently in the sample, which indicates that CRAB is dominant in the multi-drug resistant bacteria on the surface of high-frequency contact objects, which is consistent with the results of many studies [10,16,17]. CRPA, MRSA, VRE and CRE were also detected in multiple samples, and the positive rate was high. The presence of these bacteria suggested that high-frequency contact with the surface of the object became a potential source of multi-drug resistant bacteria transmission. The high detection rate of MDROs means that there are more drug-resistant bacteria in the hospital environment, which increases the risk of cross-infection of patients, leading to an increase in hospital infection rates and affecting the quality of medical services. Therefore, the use of 8S four-in-one integrated manage

ment includes standardized operating procedures, which can ensure the homogenization of environmental sanitation cleaning and disinfection, help reduce the exposure of infection sources, and also emphasize clean hygiene standards, ensure adequate infection control facilities and training resources, optimize medical resources, require everyone to comply with standardized standards, maintain a clean working environment, reduce bacterial transmission in medical facilities, and reduce the risk of drug resistance transmission.

4.3 Four-digit Integrated Management based on 8S Can Improve the Qualified Rate of Surface Detection of Objects in ICU High-frequency Contact Environment

The results showed that the qualified rate of object surface detection in the high-frequency contact environment of the control group was 73.19 %, and the qualified rate of the experimental group was 88.86 %. After the intervention, the qualified rate of objects in high-frequency contact environment was improved. There was a statistical difference in the qualified rate of surface detection between the two groups ($p < 0.001$), which further indicated that the integrated management based on 8S mode could improve the qualified rate of surface detection of objects in high-frequency contact environment and improve the overall environment of ICU ward. In the guidelines for the prevention and control of nosocomial infections [18], it is pointed out that pathogenic microorganisms will become an important source of hand contamination for medical staff if the contaminated environmental surface is not cleaned in time or the terminal disinfection is not standardized. When the hands of medical staff are contaminated, if hand hygiene disinfection is not carried out, pathogenic microorganisms will be transmitted to patients through the hands of medical staff, resulting in the occurrence of multidrug-resistant bacteria infection in patients. In ICU, stethoscopes and flashlights are easy to be ignored and disinfected incompletely due to their small size and frequent movement, resulting in more bacterial residues. If these small items used in high frequency are infected by MDROs, they are easy to cause iatrogenic cross infection. The results of this study showed that the qualified rate of high-frequency contact environmental objects in the observation group was higher than that in the control group ($P<0.001$), indicating that the integrated management under 8S mode could improve the qualified rate of bacterial detection on the surface of high-frequency contact environmental objects and improve the sanitary environment of ICU. 8S management principles through regular and thorough cleaning and disinfection, orderly placement and standardized management of items, as well as staff training and education to enhance health awareness and operational skills, effectively reduce the number of bacteria on the surface of the object and man-made pollution, thereby improving the detection pass rate; at the same time, the 'inspection' principle ensures that problems are discovered and solved in a timely manner through continuous monitoring and evaluation of management effectiveness, so as to maintain and improve the continuous improvement of the qualified rate of bacterial detection.

4.4 Four Integrated Management based on 8S Can Improve the Hand Hygiene Compliance of ICU Staff

Studies have shown that contact transmission is the most important way for the spread of multidrug-resistant bacteria in hospitals. Effective hand hygiene can effectively cut off the transmission of pathogens, thereby reducing the incidence of nosocomial infections in patients [19]. The results of this study showed that the overall hand hygiene compliance of the staff increased from 79.17% to 91.05% ($p<0.05$) after the systematic management of doctors, nurses, nursing workers and cleaning staff based on the 8S model. It shows that the implementation of four-in-one management based on 8S can strengthen the understanding of medical staff, nursing workers, cleaning and other personnel on the environmental cleaning, disinfection and isolation of ICU wards, and the smooth flow of regular training and communication channels helps to ensure that all medical workers understand and comply with infection control measures, so as to continuously improve the compliance with effective hand hygiene and effectively reduce the spread of pathogens. In the ICU ward, the patient 's condition is usually heavier, and there are many invasive and invasive operation treatments, and the environmental quality of the ward is higher, so as to improve the hand hygiene compliance rate of ICU staff, which is conducive to avoiding and reducing the occurrence of infection. However, the data of this study showed that the hand hygiene compliance rate of nursing staff and cleaning staff in ICU ward was relatively low. The reasons for the analysis may be related to the educational background of nursing workers and cleaning workers. The educational background of nursing workers and cleaning workers is relatively low, and they are not medical professionals. They have little knowledge of the infection control of multidrug-resistant bacteria and lack relevant knowledge training. Secondly, the lack of hand hygiene resources such as hand washing facilities and hand sanitizers may also reduce the compliance of staff with hand hygiene. At the same time, the ward usually faces high work intensity and time pressure, which may make staff feel that there is not enough time to carry out hand hygiene procedures, or there may be a sense that hand hygiene is not a key operation, and there is insufficient awareness of the importance of hand hygiene ; the lack of monitoring and timely feedback on the compliance rate of hand hygiene may lead to staff 's lack of understanding of their compliance. Therefore, it is necessary to strengthen the infection control training of care workers and cleaners, provide regular hand hygiene training, emphasize the correct hand hygiene procedures and their importance to the safety of patients and staff, and establish a culture of emphasizing hand hygiene through publicity, advocacy and example display, so that all staff are aware of its importance and raise awareness of infection control.

In summary, this study has achieved positive results in controlling the spread of multidrug-resistant bacteria in the medical environment through integrated management under the 8S model. Through the implementation of comprehensive management strategies, the infection of multidrug-resistant bacteria on the surface of high-frequency contact objects in the medical environment can be reduced, which provides a practical and feasible way to improve the level of infection control in medical institutions. In the future, we will further increase the sample size and extend the intervention time to comprehensively evaluate the long-term effectiveness and practical feasibility of the management strategy, and continue to optimize in practice to cope with the changing infection control challenges in the medical environment.

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References

[1] Cao Liqin, Shi Lijuan, Liu Jie et al. Survival analysis of multidrug-resistant bacteria infection in patients with different catheters in intensive care unit [J]. Chinese Journal of Hospital Infection, 2024,34 (14): 2230-2234.

[2] Zhao Xue, Liu Guomei, Zhang Wenhui, et al. Analysis of influencing factors of multidrug-resistant bacterial infection/colonization in ICU patients based on active screening [J]. China General Practice, 2023,21 (03): 377-380.

[3] Wang Yun, Chen Qichao, Liu Yuqi, et al. The distribution of drug-resistant bacteria on the surface of ICU objects in a hospital [J]. Chinese Journal of Nosocomial Infection, 2023,33 (10): 1584-1587.

[4] Yan Li, Kong Qingfang, Zhang Hongfang. Hand hygiene investigation and intervention effect evaluation of high-frequency contact surface and staff in intensive care unit of a hospital [J]. Chinese Journal of Disinfection, 2024, 41 (12): 928-931.

[5] Li Rui, Fu Longsheng, Wang Shaojin. Exploration of innovative management mode of scientific research laboratories in agricultural and forestry universities based on 8S concept [J]. University, 2022 (25): 84-87.

[6] Zhang Xia, Zhang Zhaojing, Meng Xiangxia, et al. Application of innovative '8S' lean management in quality management of medical and health institutions [J]. Chinese Health Standard Management, 2024, 15 (24): 106-109.

[7] MICOL-PONCER, SARMIENTO-MANUS R, FONTCUBERTA-CERVERA S, et al. SMALL ORGAN4 Is a Ribosome Biogenesis Factor Involved in 5.8S Ribosomal RNA Maturation [J]. Plant Physiol, 2020, 184(4): 2022-2039.

[8] Environmental surface cleaning and disinfection management specification for medical institutions WS/T512-2016 [J]. Chinese Journal of Infection Control, 2017,16 (04): 388-392.

[9] Feng Fang, Zhong Suping, Lin Qingxia. Analysis of risk factors and nursing strategies for multi-drug resistant bacterial infection in ICU [J]. Anti-Infective Drugs, 2023, 20(02): 169-171.

[10] Zhang Zhaohui, Chen Yu, Wang Jiahui. Progress in prevention and treatment of multi-drug resistant bacteria infection in ICU [J]. Bachu Medicine, 2022,5 (03): 114-117.

[11] Xie Rui. The effect of 8S management model in the management of outpatient injection room [J]. China Rural Medicine, 2022, 29(10): 70-71.

[12] Jie Min, Liu Saiping, Sun Geqin, et al. Application value of 8S management model in the management of foreign instruments in the sterile supply department [J]. Modern Hospital, 2022, 22(10): 1540-1543

[13] DAS S, ZHANG Z, KALVAKOTA S, et al. Parallel actin monomers in the 8S complex of actin-INF2[J]. J Biomol Struct Dyn, 2023, 41(8):3295-3304.

[14] HAN B, PORTA J C, HANKS J L, et al. Structure and assembly of CAV1 8S complexes revealed by single particle electron microscopy [J]. Sci Adv, 2020, 6(49): 1242.

[15] Zhu Yuanyuan, Huang Ying, Peng Shifu, et al. The spread and prevention of respiratory pathogenic microorganisms in hospitals [J]. Journal of Environmental Hygiene, 2023,13 (12): 875-881.

[16] Wang Yun, Chen Qichao, Liu Yuqi, et al. The distribution of drug-resistant bacteria on the surface of ICU objects in a hospital [J]. Chinese Journal of Nosocomial Infection, 2023,33 (10): 1584-1587.

[17] MUHLBERG E, UMSTATTER F, KLEIST C, et al. Renaissance of vancomycin: approaches for breaking antibiotic resistance in multidrug-resistant bacteria [J]. Can J Microbiol, 2020, 66(1):11-16.

[18] Huang Xun, Deng Zide, Ni Yuxing, etc. Chinese Expert Consensus on Prevention and Control of Multidrug-Resistant Organisms Nosocomial Infection in China [J]. Chinese Journal of Infection Control, 2015,14 (01): 1-9.

[19] Zhang Jing, Zhang Bo, Ni Xiaoping. The implementation of 'Environmental Surface Cleaning and Disinfection Management Standards for Medical Institutions' [J]. Chinese Journal of Nosocomial Infection, 2018, 28 (03): 473-476.

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