Status of Evidence-based Nursing in the Prevention and Control of Multi-drug Resistant Bacteria in ICU

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Abstract: The problem of MDRO resistance and nosocomial infections is increasing due to the inappropriate use of antibiotics, the use of immunosuppressive drugs, and the advance of invasive medical procedures. The intensive care unit is considered to be one of the highest prevalence areas of multi-drug-resistant bacterial infections in the hospital, the occurrence of such infections has a serious adverse impact on patient prognosis, resulting in increased mortality, and to a certain extent, increasing the financial burden of ICU patients. Therefore, it is extremely important to strengthen the prevention and control of MDRO infection in intensive care unit. Based on this situation, this paper reviews the research status of evidence-based nursing for the prevention and control of MDR-infection in ICU, in order to provide reference for clinical prevention and control of MDRO infection.

Keywords: Multi-drug Resistant, Infection Prevention, Intensive Care Unit, Evidence-Based Nursing

1. Introduction

In recent years, multidrug—resistant organism (MDRO), which shows resistance to 3 or more classes of antimicrobial agents in clinical use, has become an important cause of nosocomial infections[1,2]. Due to bacterial variation and overuse of antimicrobials, bacterial resistance is enhanced and multi-drug-resistant strains are generated, which increases the difficulty of clinical antibiotics and brings great challenges to the prevention and control of nosocomial infections[3]. Evidence-Based Nursing Practice (EBNP) is a working method of clinical problem solving[4], in which nurses take the specific problems found in clinical nursing practice as the starting point. The best evidence from scientific research to solve this problem is combined with clinical scenarios, patients' wishes, and their own professional judgment, and applied to patient nursing practice, including defining problems, retrieving evidence, evaluating evidence, integrating evidence, disseminating evidence, applying evidence, and evaluating effect [5, 6]. Patients in the ICU have a higher incidence of nosocomial infections and MDRO infections than those in general wards due to their critical condition, immunocompromise, invasive procedures, and extensive use of antimicrobial drugs [7].As the nurses who have the most daily contact with patients, good prevention and control awareness and compliance are extremely important. Based on this situation, this study summarized the research status of evidence-based nursing for preventing MDRO resistance in ICU multi-drug resistant bacteria infection, in order to provide a reference for clinical prevention and control of MDRO infection.

2. Origin and concept of evidence-based nursing

Starting with the introduction of evidence-based practice into the nursing profession, the integration of research evidence by healthcare providers into their practice has slowly become a global consensus. Evidence-based care has multiple positive outcomes, such as improved quality of care, safety, and reduced cost of care [8]. Evidence-based Nursing Practice (EBNP) is a clinical problem-solving approach, in which nurses take specific problems found in clinical nursing practice as a starting point, and combine the best Evidence from scientific research to solve the problem with clinical scenarios, patients' wishes, and their own professional judgment. It is also applied to the nursing practice of patients, including defining problems, retrieving evidence, evaluating evidence, integrating evidence, disseminating evidence, applying evidence and evaluating effect. Some scholars said that although with the continuous

development of evidence-based nursing, most clinical nurses are clear that evidence-based nursing is more scientific and can better meet the needs of patients, but there are big problems in understanding and practice, they think that their knowledge and skill level is not enough to carry out evidence-based practice, so they do not use this method in actual work.

3. MDRO infection status and risk factors

The emergence of pathogen resistance to multiple antimicrobials has become a major public health threat, with most studies defining MDRO as "resistance to three or more antimicrobials." Research by Marchaim etal[9] shows that multidrug-resistant Gram-negative bacteria (MDR-GNB) identified in the 2019 Antibiotic Resistance Report pose many of the urgent threats to the U.S. Centers for Disease Control and Prevention (CDC). According to studies[10-12], in recent years, with the wide application of antibiotics, immune agents and other drugs in clinical practice, the number of clinical drug-resistant strains is increasing, and the situation in intensive care units is especially serious. The infection rate of nosocomial infection in ICU patients was about 20%, the infection site was mainly respiratory tract, and the pathogens were mainly gram-negative bacteria. Once MDRO infection occurs in the body, the range of antimicrobial drugs available in the clinic shrinks and the difficulty of treatment increases. Improper control can easily lead to explosive epidemic of nosocomial infection. Relevant studies[13-15] have shown that the main risk factors for multi-drug resistant bacterial infections in ICU patients include the duration and unreasonable number of antibiotics, post-operative, invasive procedures (including indignant catheters, gastric tubes, ventilators, infusion devices, etal.), and the use of hormones or immunosuppressants.

4. MDRO infection prevention and control of nursing status

4.1. Standard preventive

4.1.1. Hand hygiene

According to the investigation results of Zheng Leigang etal[16-18]. The intern nursing students' cognition of MDRO infection control knowledge is one-sided and their cognition of MDRO infection control knowledge is not deep enough. In most teaching hospitals, a large number of non-department staff are vulnerable to MDRO prevention and control, and their relevant systems are unfamiliar and their compliance with hand hygiene is poor. Some studies[19] pointed out that during the COVID-19 epidemic, the hand hygiene compliance rate of staff has improved significantly. Liu Sidi etal[20]. Observed that the hand hygiene compliance rate of medical staff in a top-three hospital increased year by year from 2016 to 2020, reaching 71.65% in 2016, 73.27% in 2017, 75.94% in 2018, and 77.04% in 2019. Notably, from January to August 2020, compliance grew to 84.16%. Although HCWs adherence rates have increased over the past five years for all of the hand hygiene indicators, there are differences in the HCWs adherence rates for health care workers across the five hand hygiene indicators, especially after exposure to patient fluid risk. The compliance rate of HCWs hand hygiene reached the highest level, and the compliance rate of HCWs hand hygiene after exposure to the surrounding environment of patients was the lowest, which was basically consistent with relevant studies[21-23] at home and abroad. These results indicate that most HCWs have a sense of self-protection for the visible blood and body fluids of patients, but they ignore that "invisible" pathogenic microorganisms can be infected and transmitted after contact with the surrounding environment of patients. It is necessary to strengthen the hand hygiene training on the weak points of HCWs, gradually develop the cultural awareness of hand hygiene, and realize the integration of knowledge, faith and practice. The management team of the department should strengthen the supervision of the hand hygiene of the department staff, especially the mobile department staff. Strengthen the training of hand hygiene knowledge for nursing staff, and group after the training.

4.1.2. Catheter-associated infection

Central venous catheterization (CVC) is often used in the rescue of critical patients, providing safe infusion, nutritional support, and hemodynamics testing for patients in the intensive care unit, and intravascular catheterization is an indispensable means of treatment[27]. Studies at home and abroad have shown that[28,29] ICU nurses lack relevant knowledge based on evidence and blindly follow the previous regulations of nursing department or department in clinical operations. Nurses have a low awareness rate of the latest evidence based on evidence-based CVC maintenance operations and do not know how to acquire relevant knowledge. Members of the evidence application team should train general practice

nurses on evidence-based CVC maintenance practices. The study of Zhang Ye etal[30-32]. Showed that the cognition level of ICU doctors and nurses on flow-associated infection was related to factors such as education level, working years, and whether they participated in relevant training, and there was still room for improvement. Evidence-based medical literature confirmed that the incidence of femoral vein and internal jugular vein infection was significantly higher than subclavian vein. According to the requirements of the "Practice Guide for Intravenous Infusion Nursing" (2011 edition) issued by the American Association of Intravenous Infusion Nursing, the subclavicular vein indignant needle should be selected as far as possible, and chlorhexidine should be used to disinfect the skin, and the disinfection area should be strictly controlled at 15 cm×15 cm. Select a silver ion, breathable dressing containing disinfecting ingredients to cover the puncture site, such dressings do not easily generate water internally. At present, interventions for CVC-RI can be carried out according to the "Norms for the Prevention of Vascular Catheters Associated Infection", but the incidence rate of CVC-RI is still high in clinical practice, especially in critically ill patients. How to improve the situation of CVC-RI in critically ill patients, the judgment of high risk is particularly important, and targeted prevention and control can be carried out through the evaluation of risk factors, and rational use of resources[33,34]. The study of Hu Ling etal[35]. Showed that chronic underlying diseases, high APACHE II score, catheter retention time >5 days and ICU stay time >10 days are independent risk factors affecting CVC-associated infection in ICU patients. The incidence of adverse reactions can be reduced and hospital stay shortened by using risk warning and pre-control nursing intervention for patients. Reduce hospital expenses. Venkataraman[36] has a high proportion of hospitalized patients with catheters implanted, and long-term indwelling catheters are prone to urinary tract infections. Yan Wanru etal[37]. Studied that ventilator associated pneumonia is a common nosocomial infection, which often occurs in patients with mechanical ventilation. Quality control circle airway model nursing management has a significant effect on preventing nosocomial infection in patients with multi-drug resistant bacteria. It is particularly important for nurses to prevent catheter-associated infection with evidence-based methods in daily nursing. It is necessary to evaluate the necessity of catheter indwelling in time and extubation as soon as possible. At present, most domestic and foreign studies suggest that medical staff should strengthen their compliance with relevant guidelines, strengthen the study of relevant theoretical knowledge, and standardize daily nursing behavior. At present, there are many studies on risk prediction models. You can refer to relevant risk prediction models to formulate relevant nursing measures for high risk factors, so as to prevent MDRO infection from the root cause.

4.1.3. Contact isolation measures

Xiao-hua wang research [38,39] said in patients were diagnosed with MDRO after infection, the physician should immediately open quarantine orders, the implementation of the isolation and detection work. MDRO patient is isolated in a single room or the same patient is placed in a centralized place, the isolation mark is eye-catching, and the medical equipment and articles are dedicated by special people; In addition, patients with weak resistance, such as after transplantation, extracorporeal membrane oxygen (ECMO) patients, are subjected to protective isolation [18]. Relevant nursing staff should take quarantine measures, including standard hand hygiene, wearing isolation clothes, gloves and disinfection measures, and patients' diagnosis and treatment supplies and waste buckets should be dedicated to avoid cross-infection. The treatment equipment/environment of the MDRO infected/colonized patient should be wiped with a non-woven cloth containing at least 500 mg/L effective chlorine disinfectant, 3 times/day. The MDRO hospital infection outbreak drill is conducted once or twice a year, and the participants include logistics personnel (nurses and cleaning personnel) to ensure smooth connection between logistics personnel and medical personnel in the emergency response to the MDRO hospital infection outbreak, and ensure the implementation of cleaning and disinfection effect and contact isolation measures [40]. According to Huang Kejing [41], timely analysis of risk factors and formulation and implementation of preventive measures against high-risk factors can effectively reduce bacterial infection.

4.2. Accurate use of antibiotics

Oladele[42] improper use antimicrobial drugs is the main driving factors of antimicrobial drug resistance, reduce the use of antibiotics, can reduce the incidence of drug-resistant bacteria infection. Optimization of antimicrobial therapy in critically ill patients involves multiple approaches, and pharmacodynamics, pharmacokinetic optimization, and infectious sources fully demonstrate the need to give the drug at the optimal time of administration, while considering potential interactions, changes in dispensing volume, and decreased or increased renal clearance [43]. A comprehensive antimicrobial management plan helps to make clinically relevant recommendations and recommendations in terms of

antibiotic selection, dosage, administration mode, therapeutic drug monitoring indications, and source control[44-46]. Tabah etal[47], showed that hospital-acquired bloodstream infections (HA-BSI) in ICU patients were mainly caused by gram-negative bacteria with extensive carbapenem resistance and refractory resistance (DTR). Antibiotic resistance is associated with delay and prolongation of adequate antimicrobial treatment. At present, there is a lack of relevant research on the precise use of antibiotics at home and abroad. Doctors should calculate the optimal administration time and dosage according to the situation of patients before issuing medical orders. Nurses should pay attention to check the rationality of medical orders during implementation, carefully check and use infusion pumps for precise administration, so as to achieve the purpose of treating infections and preventing drug resistance.

4.3. Environmental quality control

Dimitriadou[48] through the qualitative study shows that the nurse except usually emphasize more aspects, such as hand hygiene, on the environment quality control to prevent MDRO do much less. Su Qingqing etal[49], said that a multidisciplinary collaborative team could be organized to provide nursing staff with one-month guidance training, including the basic knowledge of MDRO, epidemiology, preventive measures and disinfection points, etal. To ensure that nursing staff can master the knowledge and skills of MDRO infection prevention and management. Daily bedsheets should be disinfected, items should be dedicated by individuals, public items should be wiped with disinfectant wipes after use, waste items should be disposed of rationally, and terminal disinfection should be standardized[50]. Intensive environmental surface cleaning and disinfection can reduce the incidence of multidrug-resistant bacteria infection by 10% to 30%[42]. Li Yangyang[51], through the practice of evidence-based nursing on the prevention and management of environmental infection in ICU, showed that the clinical application of the best evidence played a positive role in improving nurses environmental cleaning and disinfection behavior. Domestic research results based on evidence-based nursing practice show that according to the "6S" model search, from the top to the next search for environmental infection prevention and management of relevant evidence; The quality of evidence was evaluated according to relevant quality evaluation standards, and the best evidence obtained was summarized, including medical staff management and training, environmental cleaning and disinfection tool processes and methods, optimization measures and environmental surface monitoring, etal. Combined with clinical practice, the outcome indicators could be effectively improved.

5. Summary

To sum up, the evidence-based nursing in clinical nursing practice found that the specific issue as a starting point, from the best evidence to solve the problem of the scientific research and clinical situation and the aspirations of the patients, and their own professional judgment combined with, and applied to the patient's nursing practice, can effectively reduce the incidence of ICU patients with multiple drug-resistant bacteria infection. Relevant studies at home and abroad have shown that nursing practices based on evidence-based hand hygiene, prevention of bloodstream related infections, precise use of antibiotics, isolation and environmental surface disinfection have better effects, which can improve nurses' compliance with relevant norms, enhance infection prevention awareness, and reduce the incidence of MDRO infection compared with conventional nursing. Studies have shown that most nurses are aware of the advantages of evidence-based nursing, but lack the initiative to apply it to practical work. They think that their knowledge and ability cannot be based on evidence-based nursing. Therefore, managers need to strengthen nurses' evidence-based thinking and ability training, so that nurses can better grasp relevant knowledge and apply it to practical work.

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