

FOLIA MEDICA CRACOVIENSIA

Vol. LVI, 4, 2016: 13–20

PL ISSN 0015-5616

Nursing care for patients infected or colonized with vancomycin-resistant enterococci (VRE)

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Abstract: Advances in medicine enable many patients to regain their health. But, at the same time, they become susceptible to hospital-acquired infections. The occurrence of vancomycin-resistant enterococci is a considerable problem in the modern health system. In order to limit the risk of VRE infection, proper patient care is vital, which is focused on compliance with relevant procedures (isolation, decontamination, education). Mutual cooperation between charge nurses and the ward sister and epidemiological nurse plays a major role in nursing surveillance of patients with VRE.

Key words: vancomycin-resistant enterococci, surveillance, isolation, epidemiological nurse, ward sister, charge nurse, hospital epidemic outbreaks.

Introduction

Continuous advances in medicine, such as: new techniques in surgery (transplants, implants), invasive diagnostic methods (endoscopy) and therapeutic methods involving the use of urinary catheters, central venous catheters (CVC) as well

as treatment with immunosuppressants, apart from the obvious benefits for the patient, can also result in negative effects which include hospital-acquired infections. Infections pose a threat not only to patients but also to medical staff. Hospital-acquired infections cause problems in the form of increased morbidity, mortality and costs of treatment for hospitalized patients. Infections develop caused by new microorganisms, previously deemed nonpathogenic (e.g. enterococci), and resistance of microorganisms to chemotherapeutics increases dramatically. Along with the development of medicine, there is an increase in the importance of nursing. Contemporary nursing sets new challenges for nurses. Appropriate knowledge and skills as well as reliability in professional conduct, accountability, also when working with a colonized/infected patient, will be essential for the completion of those challenges. Care of a patient colonized/infected with an alert pathogen encompasses maintaining hygiene, nutrition and satisfying physiological needs, wound and catheter care. It also requires knowledge of the pathogen, and clinical, epidemiological and therapeutic aspects that are involved in it. It also imposes on nurses duties regarding compliance with isolation, care and hygiene procedures [1–3]. Proper prevention of hospital-acquired infections, which professional care of an infected patient certainly contributes to, is currently considered the most important criterion in quality of work assessment. Infections control is a priority for many health care institutions.

VRE strains characteristics

Enterococci are part of the human gastrointestinal microbiota. Their numbers are scarce in healthy individuals, however, in hospitalized patients, there may be changes in the species and quantitative composition of microbiota, which makes colonization with resistant enterococcal strains (including vancomycin-resistant enterococci VRE) easier [4]. Presently, VRE enterococci are considered one of the most important causes of infections associated with health care [4, 5]. In Poland, VRE isolates are considered alert pathogens (Journal of Laws 2011 No. 294 item 1741) [6]. As such, VRE strains may constitute a significant clinical, epidemiological, and therapeutic problem.

Clinical aspect of VRE infection

Hospital-acquired infections caused by enterococci take the form of:

- urinary tract infections primarily in catheterized patients,
- bacterial endocarditis following open heart surgery,
- infections in the abdominal cavity after surgically opening the intestinal lumen, gynecological procedures, operations on the urinary tract in men,
- bloodstream infections during prolonged urinary catheterization, with central venous lines, trauma, long-term antibiotherapy,

- surgical site infections (SSIs), diabetic foot infections (DFIs), burn wounds,
- systemic infections in neonates following surgery [7].

VRE infections may result in prolonged hospitalization and its higher costs, as well as complications that can lead to the patient's death [7].

Epidemiological aspect of the presence of VRE strains in the environment

Enterococcus faecium (currently it is the most common species in the hospital environment) is characterized by natural resistance to cephalosporins, low concentrations of aminoglycosides, clindamycin, trimethoprim/sulfamethoxazole, lincosamides and decreased sensitivity to penicillin. Acquired resistance to antibiotics includes, among others, two phenotypes: High Level Aminoglycoside Resistance (HLAR) and resistance to glycopeptides. Resistance to glycopeptides may be expressed phenotypically as vancomycin resistance with simultaneous sensitivity to teicoplanin or simultaneous resistance to vancomycin and teicoplanin [4, 5]. VanA and VanB are the most common phenotypes of resistance to glycopeptides which are most relevant clinically and epidemiologically. VRE strains are also resistant to ampicillin and ciprofloxacin. They also have virulence genes, which facilitate the colonization of the hospital environment and the colonization and infection of a patient [4, 8, 9].

VRE infections are usually endogenous. The source of VRE infections is most commonly the colonized patient whose stool samples contain VRE strains. If the patient suffers from diarrhea, the spread of VRE strains is made easier [4]. The greatest risk factor for colonization and/or infection with VRE strains is a frequent and aggressive antibiotic therapy with, among others, cephalosporins, penicillins, aminoglycosides, clindamycin, metronidazole and carbapenems, as well as the use of vancomycin [4, 5]. Other risk factors for development of infection with VRE strains are physical proximity to patients infected or colonized with VRE, prolonged hospitalization, previous hospitalization in an extended care facility (ECF), previous hospitalization in another hospital, hospitalization in surgical units or intensive care units (ICU), solid organ and bone marrow transplantation, renal failure or hemodialysis, the use of invasive medical procedures (e.g. placing a central venous catheter (CVC) and/or a Foley catheter) [4, 8, 10].

The VRE strains reservoir is the hospital environment. Enterococci can survive on dry inanimate surfaces for up to 4 months. Most commonly contaminated equipment pieces are bed frames and bedside tables, less often door bells at sick beds and trays, and the least often they include chairs, door handles, restroom surfaces and sinks [11]. Diagnostic and medical devices can also be subject to contamination. They include stethoscopes, tourniquets, blood pressure cuffs, otoscopes, as well as air [10, 12]. VRE strains spread mainly by contaminated hands but also by medical staff clothing [12]. Enterococci are resistant to high temperatures, chlorine

compounds and some alcoholic preparations, which may explain their adaptation to the hospital environment [4]. The contaminated environment can play a major role in the transmission of VRE strains during outbreaks [13, 10].

VRE strains can spread in the hospital environment via various routes, primarily from patient to patient but also through transiently contaminated hands of health care workers [13]. Nurses, doctors, orderlies, diagnosticians and all employees who have contact with patients can transfer VRE strains on their hands from VRE-positive patients to VRE-negative patients and to their surroundings (environment) from where, potentially, VRE strains have a possibility to spread at each contact. The more VRE-positive patients come in contact with medical personnel, the more often bacteria transfer occurs [4].

Therapeutic difficulties in infections caused by VRE strains

Due to various resistance mechanisms coexisting with resistance to vancomycin in VRE strains, treatment options are limited. For instance, the presence of high levels of resistance to aminoglycosides (confirmation of HLAR phenotype) excludes the use of combination therapy of aminoglycoside with penicillins or glycopeptides [4, 5, 14].

The nurse's role in reducing the risk of VRE infections

Treatment of a patient who is known to have been colonized or infected with VRE requires the implementation of appropriate actions on the part of the whole therapeutic team (TT). Of particular importance is the nursing staff since they provide the care and, hence, come in contact with the patient more often than other members of TT. The nurse caring for a VRE-positive patient will obviously follow the same guidelines as with any other patient, i.e. observe The Nurses and Midwives Act [15]. Therefore, nursing care for patients colonized/infected with VRE does not differ fundamentally from the care provided to any hospitalized patient. However, there is a kind of an epidemiological aspect, which is connected with limiting the risk of VRE transmission. Appropriate procedures, their possession and strict adherence become significant.

Execution of nursing tasks in terms of caring for a patient with a hospital-acquired infection or colonized with an alert microorganism is varied. Charge nurses, ward sisters, and epidemiological nurses should all participate in the care of the patient. Each one should act according to her responsibilities. A detailed range of nurses' tasks is presented in Table 1.

The epidemiological aspect that should be kept in the care of a patient with VRE is, according to the available recommendations, patient isolation [16–18]. Infection Control Team (ICT) decides if action should be taken in order to isolate the patient(s). Supervision of compliance with isolation guidelines is conducted by the head of the

Table 1. Range of nurses' tasks in relation to the patient infected or colonized with VRE (own study).

Charge nurse	Departmental sister	Epidemiological nurse
has knowledge of: basics of microbiology, microbial transmission routes, incubation periods and infectivity of diseases, rules for use of personal protective equipment	is responsible for providing the unit with necessary equipment and resources serving to ensure isolation procedures	devises isolation principles following the current scientific knowledge, CDC recommendations, and national guidelines taking into consideration architectural and financial capabilities of the hospital
complies with the isolation procedures	conducts continuous surveillance of compliance with the rules of isolation	prepares, implements, supervises and modifies procedures when the need arises; procedures should be described in writing
plans care concerning the isolated patient	organizes trainings on isolation procedures in the unit which raise awareness among the staff	organizes trainings on how to care for an isolated patient
eliminates stress and anxiety experienced by patients and caused by the isolation	cooperates with the epidemiological nurse as regards working out the best patient isolation procedures, adjusted to the unit's capabilities	gives professional advice and information to the nursing team in difficult situations
participates in trainings	supervises compliance with procedures aiming at limiting the risk of infection	determines the demand for resources and equipment necessary to provide isolation procedures
takes material for microbiological testing		controls compliance with procedures aiming at limiting the risk of infection

department (head of the unit, ward sister) in consultation with ICT. An important part of surveillance is the application of the isolation procedure with a patient who is readmitted to the unit, when it is known that the patient had been colonized/infected with VRE. Such a person should be isolated until the moment of obtaining a negative result of microbiological tests [16]. The aim of isolation is preventing the transmission of a pathogen from the infected/colonized patient to other patients, staff, visitors. The isolation system should be clear and accurate in formulating conduct procedures, encourage its implementation through its simplicity, and the rules of conduct should be followed by all employees in any situation which requires such conduct [19].

An isolation room should be equipped with a plumbing system. There should be an anteroom before entering. The anteroom should be equipped with hand decontamination station, personal protective equipment and a waste container operated contactlessly or by the foot. If this solution is somehow impossible to obtain, clean and dirty zones should be clearly determined. In the clean area, there should be

a small table next to the entrance, where personal protective equipment is to be kept. In the dirty zone, there should be a waste bin with lid. Next to the exit, there should be a dispenser containing a hand antiseptic. There should be sufficient amounts of disposable equipment in patient rooms to perform care procedures. Some reusable equipment should be dedicated to the patient, such as a stethoscope, blood pressure monitor, thermometer. The dedicated equipment should be disinfected after use, with the application of measures recommended by the infection control team in a given facility. After using the stethoscope, it is advisable to disinfect the whole equipment and not only the diaphragm. Equipment used for many patients (e.g. ear thermometer, ECG machine) must be strictly decontaminated after use for isolated patients [20, 21]. One cannot enter the isolation room with isolation carts, carts for linen, medical records, personal items, e.g. cell phones. The number of staff that enters the room should be limited to the bare minimum [20]. Procedures and guidelines in force in the isolation room should be strictly followed by nurses taking care of the patient with VRE, especially during an epidemic outbreak caused by VRE.

Nurses need to pay due care and attention while performing the hand hygiene procedure as it can break the VRE transmission route [22]. World Health Organization (WHO) recommendations should therefore be observed defining the Five Moments for Hand Hygiene [23]. Hands must be particularly disinfected: before and after contact with the patient, before clean/aseptic procedure, upon contact with potentially infectious biological material, and after contact with the patient environment. An important issue in the case of implementation of isolation procedures is an additional hand disinfection after removing personal protective equipment.

When a nurse enters an isolation room, she has to wear gloves (clean, non-sterile). It is imperative to wear a non-sterile disposable lab coat while performing different tasks (procedures) for patients, especially for those who suffer from urinary and/or stool incontinence, hemorrhage, wound drainage. When performing bronchial tree hygiene procedures, it is necessary to put on a protective mask. It should be kept in mind that, when exiting the room, the coat and gloves should be taken off and treated as infectious medical waste and placed in a red bag [24, 25].

All waste generated in the isolation room should be treated as contagious and segregated into a red bag. Hospital linen coming from patients with VRE is to be treated as contagious [20] and segregated into appropriate (preferably plastic) bags of the color code adopted at the facility.

Patient's transport and movements should be limited to a minimum. The means of transport should be disinfected after use [20].

The nursing staff should have knowledge of the source of infection, transmission routes and VRE infection prevention, as well as procedures in force during outbreaks [22, 26]. Medical personnel (nurses and doctors) have a duty of conveying essential

knowledge and skills to the patient's family and visitors as regards the application of personal protection equipment, as well as their behavior in the isolation room.

It should be noted that the use of VRE-positive patient isolation system is to bring the expected result only if all the rules are followed constantly and appropriately, not only by the nursing staff but also by other hospital employees that come in contact with patients during their hospitalization.

Conclusion

A growing number of hospitalized patients are undergoing immunosuppression. They are treated in intensive care units, mechanically supported and subjected to aggressive antibiotic therapy, which is conducive to causing infections by multidrug-resistant enterococci. Infections caused by VRE require proper therapeutic conduct in the form of implementation of targeted antibiotherapy, but also the application of professional nursing care for the affected patients. Nursing care in this case does not differ from the care given to any other patient, however, a certain epidemiological aspect is present. It is connected with compliance with procedures which are aimed at preventing infections with alert pathogens such as VRE. Compliance with isolation guidelines, including hand and tool decontamination, appropriate waste sorting and conduct regarding bed linen, as well as education of staff and patients will allow to limit the spread of VRE in the hospital environment. Professional nursing care may contribute to providing a high level of medical services.

Conflict of interest

None declared.

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