

Successful Control of Nosocomial VRE Outbreak: Experiences of Hospital Infection Control Committee

Nozokomiyal VRE Salgınının Başarılı Bir Şekilde Kontrolü: Hastane Enfeksiyon Kontrol Komitesinin Deneyimleri

Güven Çelebi¹, Nefise Öztoprak¹, Canan Külah², Fatma Baruönü¹, Yurdağül Demiroğlu³

¹Zonguldak Karaelmas Üniversitesi Tıp Fakültesi, Enfeksiyon Hastalıkları ve Klinik Mikrobiyoloji Anabilim Dalı, Zonguldak, Turkey

²Zonguldak Karaelmas Üniversitesi Tıp Fakültesi, Tıbbi Mikrobiyoloji Anabilim Dalı, Zonguldak, Turkey

³Zonguldak Karaelmas Üniversitesi Uygulama ve Araştırma Hastanesi, Hastane Enfeksiyon Kontrol Komitesi, Zonguldak, Turkey

Abstract

Aim: The aim of this study is to describe the methods used to control the first monoclonal vancomycin resistant enterococcus (VRE) outbreak which emerged in September 2005 in a university hospital in Turkey.

Material and Methods: Following detection of the first VRE positive case, surveillance with stool or rectal swab cultures from all the hospital inpatients was performed. Patients were categorized according to their potential risk of exposure to VRE; VRE positive cases, primary contacts and secondary contacts. Isolation and cohorting of the patients were performed according to this categorization. Hospital wide information and training programs were conducted for healthcare workers (HCW) and strict contact isolation precautions were implemented in the hospital.

Results: Apart from the index case, three additional cases were detected. The recommendations of the Center for Disease Control and Prevention (CDC) were adopted and implemented in our hospital and the outbreak was controlled within one month.

Conclusion: Categorization of patients according to their possible risk of exposure to VRE may be useful in determining the form and extent of control measures, especially in the hospitals with limited resources. (Yoğun Bakım Derg 2011; 2: 44-8)

Key words: Vancomycin resistant enterococcus, VRE, outbreak, surveillance, infection control

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Özet

Amaç: Bu çalışmanın amacı Türkiye'de bir üniversite hastanesinde 2005 Eylül ayında ortaya çıkan ilk monoklonal vankomisine dirençli enterekok (VRE) salgınına kontrol etmek için kullanılan yöntemleri açıklamaktır.

Gereç ve Yöntemler: VRE pozitif ilk olgunun saptanmasını takiben hastanede yatan tüm hastalardan gaita ve a rektal sürüntü kültürleri alınarak VRE surveyanı yapıldı. Hatalar VRE ile potansiyel temas riskine göre; VRE pozitif olgular, birincil temaslilar ve ikincil temaslilar şeklinde sınıflandırıldı. Hastaların izolasyon ve kohortlaması bu sınıflamaya göre yapıldı. Sağlık çalışanları için hastane genelinde bilgilendirilme ve eğitim programları yapıldı ve hastanede temas izolasyonu önlemleri sıkı bir şekilde uygulandı.

Bulgular: İndeks olgudan itibaren üç yeni olgu daha saptandı. ABD Hastalık Kontrol ve Önleme Merkezi (CDC) önerileri hastanemiz koşullarına uyarlanarak uygulandı ve salgın bir ay içinde kontrol altına alındı.

Sonuç: Özellikle olanakları kısıtlı hastanelerde, hastaların VRE ile olası temas riskine göre sınıflandırılması alınacak kontrol önlemlerinin nitelik ve boyutunun belirlenmesinde yararlı olabilir. (Yoğun Bakım Derg 2011; 2: 44-8)

Anahtar sözcükler: Vankomisine dirençli enterekok, VRE, salgın, surveyanı, enfeksiyon kontrolü

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Introduction

Vancomycin resistant enterococcus (VRE) is an important nosocomial pathogen causing hospital outbreaks in many countries in the world (1-3). The Center for Disease Control and Prevention (CDC) and Society for Healthcare Epidemiology of America (SHEA) have published guidelines to control and prevent transmission of VRE in healthcare facilities (4, 5). In many hospitals, VRE transmission was successfully controlled by implementing the recommendations reported in these guidelines (6-10). However, some infection control teams have to perform additional precautions to control VRE transmission in their hospitals since they have failed to prevent VRE spread by implementing only the recommendations in these guidelines (11-15). In contrast, some researchers have modified the recom-

mendations of CDC due to the limited resources of their hospitals and succeeded in controlling the VRE outbreak (16, 17). VRE is not a frequent agent of nosocomial infections in Turkey, however, nosocomial outbreaks have been reported from some hospitals in the country (18-23). It has never been isolated in our hospital up to the first monoclonal outbreak which emerged in September 2005 (24). Here we report the rapid and successful control of the outbreak in our hospital with limited resources

Material and Methods

The hospital:

Our hospital, a training and educational university hospital, provides primary and tertiary healthcare with 220 beds including 38 ICU

beds. The central ICU has 5 cubicles (A, B, C, D, E), each has 4-5 beds, and three single bed isolation rooms (F, G, H). Accidental trauma, geriatric and chronic respiratory diseases and malignancy are the most followed diseases in inpatient clinics and ICUs.

Definition of the index case and defining risk groups:

The index case (case 1), a 78-year-old man with bladder cancer, was admitted to room 208 in the surgery ward in August 26th, 2005 and operated on for radical cystectomy. Following the operation, the patient was transferred to cubicle E in the central ICU due to adult respiratory distress syndrome. On the 15th day of admission, VRE was isolated from the wound culture of the patient and the surveillance for VRE was initiated. The patient died in hospital two days after VRE isolation of causes unrelated to VRE.

The patients were categorized into three groups according to their VRE status and potential risk of exposure to VRE: (1) VRE positive cases (infected or colonized), (2) primary contacts and (3) secondary contacts. A case who shared the same room at the same time with a VRE positive case was defined as primary contact. Secondary contact was defined as the case who shared the same room at the same time with a primary contact.

Control Measures:

Control measures included informing and training HCW in the hospital about the epidemiological importance and transmission routes of VRE, implementing strict contact isolation precautions for isolated patients, enhanced environmental disinfection, patient and staff cohorting, and restriction of glycopeptide use (Table 1).

The patients were cohorted according to these groups; VRE positive patients were placed in single bed isolation rooms (if available) or multibed room/rooms in which only VRE positive patients were isolated. Strict contact isolation precautions were implemented for VRE positive patients (Table 1). Primary contacts were also isolated in separate room/rooms (not in the same room with VRE positive ones) and the same strict contact isolation precautions were implemented. Secondary contacts were regarded as carrying low risk for exposure to VRE, thus, secondary contacts were not isolated in separate rooms but their beds were labeled and standard contact isolation precautions were implemented for them. Patients with three consecutive negative VRE screening cultures performed at least seven day intervals were removed from the risk group.

Nursing staff were also cohorted and the ones, who were providing healthcare to VRE positive patients and primary contacts, were prohibited from nursing other patients. The inadequate number of isolation rooms, inadequate number of dedicated nursing staff and rapidly increasing number of isolated patients composed a potential risk to blocking routine hospital issues. Therefore, if possible, we targeted discharge of inpatients (especially primary and secondary contacts) and limited new admissions to the hospital during the outbreak.

VRE positive patients, the primary contacts and the secondary contacts, were electronically labeled and the same cohorting and isolation system were performed in the second admissions.

Patient and environmental screening:

When the outbreak was first detected, all the inpatients in the risk groups (defined above) were screened once through stool or rectal

Table 1. The list of strict contact isolation precautions which were implemented to prevent VRE transmission in the hospital

Strict contact isolation precautions which were implemented to prevent VRE transmission in our hospital
<ul style="list-style-type: none"> • Patient was placed in a single isolation room (if available), or cohorted in multibed room/rooms. • Informing signs and documents for health care workers (HCW) and visitors were pinned on the doors of the isolated rooms. • Alcohol based liquid disinfectants were used for hand disinfection • Hands were disinfected with hand disinfectant before entering an isolated room. • A clean, non-sterile and reusable gown was worn before entering an isolated room. • HCW were informed to limit entrance to the isolated rooms if not indicated. • HCW were informed to abstain from touching items and environmental surfaces with hands (unless necessary) in the isolated rooms. • If hands touched contaminated surfaces or if hands were visibly soiled or after removing gloves (if worn), hands were washed with soap and tap water, dried with paper towel and disinfected with hand disinfectant in the isolated rooms. • Gown was removed and placed in a linen hamper before leaving an isolation room and hands were disinfected immediately with hand disinfectant. • Frequently touched surfaces in healthcare facilities such as door knobs, bed rails, sinks, pressing buttons of the monitors etc, were fastidiously and periodically cleaned and disinfected with alcohol based surface disinfectants at 4-6 hours intervals daily in the isolated rooms. • When isolation was terminated in a room, the isolated room was disinfected consecutively with hypochlorite and alcohol and patient admission was not allowed until control environmental cultures obtained after disinfection procedures were found to be negative for VRE. • All the items, healthcare equipments and medical devices in an isolation room were stored and prohibited from being removed from the room. If required, an appropriate disinfection method was performed before removing from the room. • Covers and sheets used in the isolated rooms were separately collected, transported and washed in the laundry. The isolated patient was prevented from being moved from the isolated room (except on discharge). If required, transportation of the patient in the hospital was organized by a transporter team with the task of implementing strict contact precautions during transportation. • The number of visitors to the isolated patients was limited. Visitors were informed before entering the isolated room and they implemented the same strict contact isolation precautions. • Following the outbreak, VRE screening in ICU patients with rectal swabs has been routinely performed with one-two month intervals regardless of detection of new VRE positive case/cases.

swab cultures. In addition, all the inpatients in the risk groups with chronic open wounds (such as diabetic foot wound, decubitus wound) were screened with wound cultures for colonization with VRE. Family members of the VRE positive patients who were attending them in the hospital were also screened by stool cultures. Environmental surface cultures, obtained by using sterile swabs moistened with sterile saline, were obtained from all the rooms in which VRE positive or primary contact patients stayed and from all the cubicles in the central ICU. Environmental surface cultures were not repeated unless they were positive for VRE.

The patients in the central ICU were screened with rectal swab cultures at one week intervals and after termination of the outbreak; they were screened at one month intervals for 11 months.

Identification of VRE and molecular typing of the strains

Bile-esculine agar including 6 µg/ml vancomycin and 64 µg/ml ceftazidime was used for screening cultures (25). The swabs used for environmental surface sampling were incubated in tryptic soy broth including the same antibiotics and then subcultured on bile-esculine agar plates. Strains were presumptively identified as *Enterococcus* species based on conventional microbiological methods, as described previously (24). Confirmation of the genus and identification to species level was performed by RapID STR (Remel, USA) and API 20 Strep (bioMérieux, France) systems. The Kirby-Bauer disc diffusion method was used for testing the susceptibilities (26). Minimal inhibitory concentrations (MICs) for vancomycin and teicoplanin were determined by the E-test (AB Biodisk, Sweden).

Analyses of bacterial DNA were performed by pulsed-field gel electrophoresis (PFGE). Genomic DNA was prepared as described by Elliott et al (27). Genomic DNA was restricted with 24 U SmaI (Sigma, Germany) at 25°C for 24 hours. PFGE was performed on a CHEF-DR II system (BioRad, Belgium) at 10°C for 22 hours, using pulse times of 5-40 s at 200 V. DNA restriction patterns were interpreted using the criteria of Tenover et al. (28).

Results

Case detection:

The index case had stayed in room 208 in the surgery ward and was staying in cubicle E in the central ICU when VRE was first detected. At first, we listed all the patients who shared any of the rooms at the same time with the index case and screened the ones who were present in the hospital for VRE. One new case (case 2) in cubicle E and two new cases (case 3 and case 4) in room 208 were positive for VRE (Figure 1). The number of contacts of the VRE positive cases reached 90 in the updated list. At that point, we decided to screen not only the risk group step by step but all the inpatients in the hospital for two reasons: 1- The number of contacts was relatively high and, due to patient movement between the wards and rooms, it was difficult and confusing to detect new contacts. 2- The conventional method for VRE identification used in our hospital was able to identify VRE within a minimum 72-96 hours and undetected VRE positive patients might continue to spread VRE during this time. No new VRE positive case was detected with hospital-wide screening. Although discharging most of the primary contacts, the number of isolated rooms and blocked beds in those rooms reached 7 and 26 respectively during the outbreak. This was 12% of the total bed capacity of the hospital.

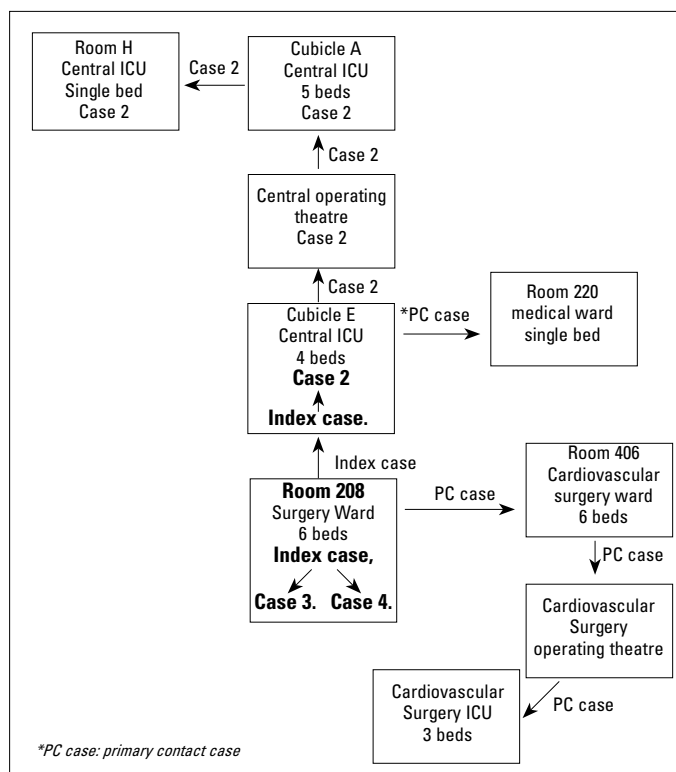


Figure 1. Shows spreading route of VRE in the hospital

Patient and environmental screening results:

During the outbreak and within the follow up period (11 months after termination of the outbreak) a total of 309 rectal swab cultures, 67 wound swab cultures and 123 environmental surface cultures were screened for VRE colonization. Environmental surfaces cultures were all negative for VRE. The outbreak was terminated within one month and no new VRE positive case was detected within the following six months. However, seven and nine months after the outbreak, two new cases colonized with VRE were detected. The former one (case 5), an infant (aged 4 months) diagnosed with myofibromatosis, stayed in the pediatric ward for seven days and VRE was identified from the urine culture of the patient which was obtained the day before being discharged from the hospital. No new positive result was detected by screening patients with rectal swabs in the pediatric ward. The latter one (case 6), a 78 year old woman with diabetic foot and multi-organ failure, was transferred to our hospital from a distant hospital. She continuously stayed in the single room F in the central ICU. VRE was identified from the stool culture of the patient and she died two months after VRE detection of causes unrelated to VRE. Neither repeated cultures obtained from multiple sites of the patient nor environmental surface cultures of room F revealed VRE. All the VRE screening cultures periodically obtained from the patients in the central ICU were also negative.

The only infected case (case 2) was admitted to hospital due to accidental trauma. VRE was identified from his rectal swab and surgical wound. Eradication of VRE and healing of the wound were achieved after treatment with linezolid.

Case 4 was transferred from a small nearby hospital to our hospital and placed in room 208 on July 5th 2005. We performed an interview and screening program also in that hospital. He had no roommates during his stay in that hospital and screening the environmental surfaces in his room was negative for VRE.

Informing and training programs for HCW in the hospital:

Once the VRE epidemic emerged, we rapidly performed an information and training program for HCW in the hospital. It was obligatory for all of the personnel (unless they had critical tasks) to join this training program and it was performed three times within two days. In total, 243 (33%) HCW attended this program. An additional meeting was conducted with heads of academic departments, directors of medical units and director nurses of wards to emphasise their trainer and controller role in preventing VRE transmission in their departments.

The VRE isolates:

The disc diffusion test demonstrated similar results for the isolates 1, 2, 3, 4, 6; except gentamycin120. Isolates from cases 1 and 2 were susceptible to gentamycin120, while isolates from cases 3, 4 and 6 were resistant. The isolates were resistant to vancomycin, teicoplanin, penicillin, ampicillin, erythromycin, tetracycline, rifampicin and streptomycin, but susceptible to chloramphenicol and linezolid; isolate 5 mainly differed from this group (isolates 1, 2, 3, 4, 6), being sensitive to tetracycline and resistant to chloramphenicol. It was also susceptible to gentamycin120. Vancomycin and teicoplanin MICs were determined as >256 µg/ml for all VRE isolates

PFGE of the isolates demonstrated two PFGE types. Isolates of cases 1, 2, 3, 4 and 6 represented the same PFGE type (designated as PFGE type 1), and the isolate of case 5 represented a different PFGE type (designated as PFGE type 2) Isolates of cases 3, 4 and 6 was designated as PFGE subtype 1a; differing in two bands from isolates of cases 1 and 2 (Figure 2).

Discussion

CDC and SHEA have published guidelines to prevent nosocomial transmission of VRE (4, 5). However, characteristics of the hospitals, extent and dissemination of VRE in healthcare facilities are variable between hospitals and countries (8, 12, 22). Therefore, the size and method of VRE control programs may also be variable between the hospitals in relation to the economic and personnel resources of the hospitals (11, 16, 17). VRE is an infrequently reported agent of nosocomial outbreaks in Turkey and it has never been identified in our hospi-

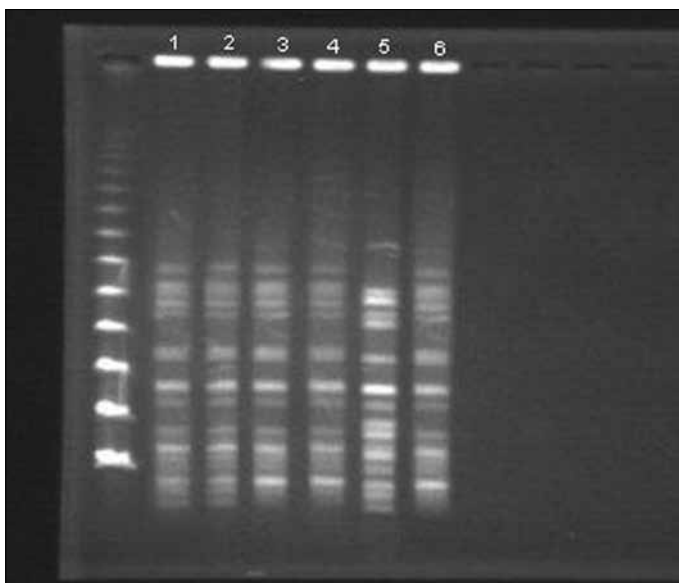


Figure 2. Shows PFGE images of six VRE isolates

tal up to this outbreak (18, 24). The antibiotics used for infections caused by VRE such as linezolid, daptomycin and quinupristin/dalfopristin, were not marketed in our country when the outbreak emerged in our hospital (linezolid was marketed in 2006 in Turkey). So we targeted control of transmission and eradication of the agent of an “untreatable” disease from the hospital in the shortest time. Successful control of VRE outbreak in our hospital depended mainly on three points.

Firstly, we rapidly conducted an information and training program about VRE and made most of the HCW mandatory rules to join this program. Strict contact isolation precautions and enhanced environmental disinfection procedures were fastidiously implemented

Second, we screened not only the departments and the patients with high risk for cross-transmission of VRE, but all the inpatients in the hospital to determine the extent and spread of the outbreak. VRE can easily spread from patient to patient through the hands of HCW or through patient-care equipment (1, 2, 23). The VRE detection method with conventional cultures, also used in our hospital, cannot identify it before three days (12). The “three days” time is quite an adequate duration for transmission of VRE from one patient to another or from one ward to another. At this point, the infection control committee has to decide whether to follow a screening and isolation route step by step (screening only the patients with high risk for exposure to VRE and isolating the positive ones) or to screen all the inpatients (regardless of exposure status) at the same time to identify the entire reservoir of the colonized patients in the hospital. With the former route, the unknown VRE positive cases can go on spreading VRE during the waiting time for culture results and it may be difficult to control the outbreak in a short time (11). On the other hand, by the latter route, hospital-wide screening of all the low-risk patients may be unnecessary and may cause wasted money, time and personnel effort.

Third, categorization of the patients according to their VRE status was very useful for us to determine the patients who required to be isolated. Isolating all the contact patients without categorization according to their potential risk for exposure to VRE may interrupt routine hospital issues since the number of contact patients and the number of the required isolation rooms may reach a huge level. In contrast, inadequate level of isolation criteria for patients may result in failure to control VRE transmission. Our categorization was based on the suggestion that primary contacts had more risk of exposure to VRE than secondary contacts. VRE screening results during the outbreak in our hospital supported our hypothesis and usefulness of our categorization system since none of the secondary contacts were positive, while three of the primary contacts were positive for VRE.

The VRE outbreak was terminated at our hospital within one month. However, nine months after the outbreak, we detected a new VRE isolate from case 6 who demonstrated the same PFGE as the isolates detected at the beginning of the outbreak. We could not definitely explain this situation. However, we assumed that VRE isolates which demonstrate similar PFGE might be present in the community or in some hospitals in the country, since case 6 was transferred to our hospital from a distant hospital.

Limitations of our methods for controlling the outbreak and eradicating VRE from the hospital were; hospital wide VRE screening could be performed only once periodic follow-up screening cultures were obtained only from the patients in the central ICU, follow-up screening cultures were obtained monthly instead of weekly and a rapid VRE identification method was not available in our laboratory.

Conflict of Interest

No conflict of interest was declared by the authors.

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