

ABSTRACT

Multiresistant bacteria and dental practice

It is impossible to know definitely which patients are colonized with resistant bacteria, but the risk is known to be associated with certain risk factors. The guideline, in dental practice, for prevention of the spread of resistant bacteria is to strictly follow recommended universal infection control practices. This applies to instrument and dental unit hygiene, surface decontamination and to working hygiene, including the use of adequate personal barrier protection. If the patient is known to be colonized with resistant bacteria, extra protective clothing and covering of excreting wounds in the contact area is recommended. Meticulous hand hygiene is of the utmost significance in preventing the spread of nosocomial bacteria.

Patient colonized with multiresistant bacteria and dental practice

Hannamari Välimaa, senior lecturer and consultant, DDS, MD, ph.d., Haartman Institute, Department of Virology, University of Helsinki, Finland

Mari Kanerva, senior lecturer, MD, ph.d., Helsinki University Central Hospital, Department of Infectious Diseases, Helsinki, Finland

Hospitalized patients and inhabitants of the nursing homes are at increased risk of becoming colonized with multiresistant microbes. Colonization means carrying a certain bacterium on the mucosa or skin asymptotically and should be differentiated from nosocomial infection, which is defined as having a healthcare-associated infection.

The risk of colonization or infection by multiresistant nosocomial bacteria is associated with the use of antimicrobials, advanced age, prolonged hospitalisation, exposure to invasive medical devices, surgical treatment, institutional patient transfer, severe underlying medical condition and immunosuppression (1). In addition to hospitals, resistant bacteria may be a problem in nursing homes. However, transmission can also take place outside hospital through contact from one person to another, via contaminated surfaces or items and also by food.

Effect of antimicrobial treatment on normal microbiota

Antimicrobials disturb the normal microbiota and existing resistant bacteria in patients own microbiota become more dominant. Under selective pressure bacteria also develop mechanisms to tolerate antimicrobials, i.e. resistance. Resistant strains may spread clonally and if resistance is encoded by mobile resistance genes in extrachromosomal genetic material, the plasmids, or in transposons, resistance may be transferred between bacteria even from one species to another. Antimicrobial use decreases the colonization resistance to exogenous microbes normally exerted by normal microbiota. The colonizing microbiota of a hospitalized patient changes within 24-48 hours under the selective antimicrobial pressure (2).

KEY WORDS

Drug resistance, microbial; infections, nosocomial; practice, dental; hygiene

Both skin and mucosal surfaces, including oral cavity, may become colonized with resistant microbes. Oral cavity is most likely to become colonized with resistant strains of those bacterial species that are frequently isolated, for

example, different species of staphylococci. Hospital or nursing home patients, staff or environment may be colonized by resistant bacteria and become a new source of colonization.

In addition to resistance problems, disturbance of normal microbiota can result in antimicrobial therapy induced infectious colitis most often caused by *Clostridium difficile*. It has become an increasingly common hospital-acquired microbe and received much attention recently due to hospital epidemics of the hypervirulent strains and in particular, ribotype 027 (3).

Multiresistant bacteria

Characteristic to all multiresistant bacteria is that their antimicrobial sensitive strains are typical for normal microbiota of either mucosal surfaces or the skin. The infections which multiresistant bacteria cause are similar to those caused by a sensitive strain of the same bacterial species, but obviously antimicrobial treatment of these infections is more challenging and patients are prone to severe complications.

Methicillin-resistant *Staphylococcus aureus* (MRSA) is the most feared of the healthcare-associated multiresistant microbes. Staphylococci are typical for the skin and are also frequently isolated in oral samples (4). Approximately 20-30 % of healthy people are carrying methicillin-sensitive *Staphylococcus aureus* asymptomatically. Anterior nares and the nasopharynx are typical reservoir sites for MRSA.

Other significant resistant microbes are vancomycin-resistant enterococci (VRE) and certain resistant Gram-negative bacilli, e.g. extended-spectrum β -lactamase producing *Enterobacteriaceae* (ESBL). Carbapenemase producing Gram-negative bacilli are a new threat associated particularly with international hospital transfers from epidemic areas. Sweden and Norway (5) as well as Finland have had single hospital outbreaks of these bacteria, whereas Denmark has only had sporadic cases and Iceland has this far been entirely spared (5). Enterococci and aerobic Gram-negative bacilli are part of the normal microbiota of the intestines, but also typical colonizers of skin wounds.

Transmission and colonization

Inhibiting cross-contamination by multiresistant bacteria is one prerequisite for the prevention of infections by these microbes. Hospitals and long-term facilities are favourable environments for the spread of microbes. Microbes are mainly transmitted from patient-to-patient via healthcare workers hands and sometimes through droplets and aerosols or indirectly from contaminated environment. Good hand hygiene including the use of alcohol hand rub before and after each patient contact is a key component in prevention of spreading multiresistant bacteria. Hand rub should always be used before putting on gloves and also after removal of gloves and protective clothing. If hands are visibly contaminated, they should first be washed with water and soap to allow a hand rub to have a maximal effect. Hand washing is also indicated if patient is known to carry toxigenic *C. difficile* or if working in an institution with *C. difficile* or

norovirus epidemic, because hand rub alone is inefficient for hand disinfection of these microbes. Persons known or suspected to be colonized with multiresistant microbes are placed in single rooms or cohorts and contact isolation procedures are applied depending on the mode of transmission of the microbe. Active screening of contacts and prudent use of antimicrobials in the care unit are important aspects in the control of multiresistant microbes.

The overall length of colonization by certain bacteria is variable and can last from weeks to years. This is affected by the status of the host and external factors such as antimicrobial therapy, which may prolong the carriage due to disturbances in the normal microbiota. The colonization may also be temporarily masked and reoccur, for example, in association with antimicrobial treatment. Decolonization treatment may be attempted in MRSA carriers if considered beneficial, e.g. prior to major surgical treatment.

Oral cavity and multiresistant microbes

The majority of multiresistant bacteria are transient colonizers of the oral cavity with MRSA being a potential exception. That is because staphylococci are frequently colonizing oral cavity and are able to adhere to foreign materials. Oral MRSA colonization has been reported even in the absence of nasal carriage (6). MRSA has been diagnosed in oral samples, including samples from angular cheilitis, denture stomatitis, implant infections, dental abscesses, acute parotitis and mucositis (4,7,8). Also dentures may be colonized with MRSA. Therefore, if MRSA decolonization treatment in nasopharyngeal carriers is attempted, heat sterilization of dentures and daily disinfection during the treatment should also be included to avoid denture-born recolonization of mucosal surfaces. Further, two cases of dental abscesses with MRSA has been reported as a result of cross-infection from a dentist to a patient (8).

Also infrequent transient colonizers may give rise to oral infections. Enterococci are a common finding in refractory endodontic infections (9) and Gram-negative bacilli are occasionally recovered from oral cavity, for example, in samples from periimplantitis (10). It should also be noted that anything colonizing the facial skin or wounds inevitably gets into working area of dental personnel and poses a risk for further spread by contact. ➔

CLINICAL RELEVANCE



Dental practice may pose a risk of spreading resistant bacteria if hygiene practices are insufficient.

Patients treated in dental practice may be colonized with resistant bacteria. Colonization means carrying a certain bacterium asymptomatically on the mucosa or the skin. Risk is increased in hospitalized patients and residents of nursing homes. Following meticulous hygiene practices is crucial for the prevention of transmission.

If resistant nosocomial bacteria are diagnosed in oral samples, this should be notified to the local hospital hygiene unit for further instructions.

Infection control practices

In post discharge care or when treating patients in hospitals and long-term facilities, dental practice personnel are in contact with patients potentially colonized with multiresistant microbes. This may happen unwittingly, as when the patient is not known to be colonized. Therefore regular infection control practices should be such that the spread of these microbes is prevented.

Personal barrier protection should always include a mask, gloves, large protective glasses and short sleeved clothing to enable disinfection of forearm skin which is heavily exposed to aerosols generated in dental practice. If a patient is known to be colonized with resistant bacteria, the use of a disposable protective coat is recommended for contact with the patient and a head-dress if the treatment procedure generates aerosols. In the working area, excreting wounds should be covered with an impermeable cover. Careless removal of protective clothing may contaminate hands and face of the user. Skin breaks and artificial nails are risk factors for permanent colonization. Good hand care is important.

In dental practice, aerosols are a significant source of airborne contamination. Aerosols are generated when using an ultrasonic scaler, high-speed rotating or abrasive devices or an air-water syringe (11). Aerosols contain material from the area of instrumentation, e.g. saliva, blood and water from dental unit water line. Aerosol release from the operation area can be reduced by efficient use of high-volume evacuators. The use of preprocedural rinse with chlorhexidine mouthwash and the use of a rubber dam diminish the microbial contamination of the aerosol. From the operation site aerosols spread centrifugally contaminating a regular sized operation room entirely (12). To avoid cross-contamination, small devices on table surfaces should be reduced to minimum and instrument drawers

should always be closed when treating patients. All devices, instruments and gloves are to be stored protected from splatters and aerosols. Surface disinfection should be efficient to avoid cross-contamination via indirect contact through contaminated surfaces. If table surfaces are covered by devices and other materials, surface disinfection cannot be carried out adequately. For surface disinfection of certain electronic devices, sprayable disinfectants tolerated by electronic devices are practical. MRSA, for example, can remain viable on dry surfaces for weeks and dental unit surfaces have been shown to serve as a reservoir for MRSA (13). Regarding the personal barrier protection, one could argue that in addition to universal personal barrier protection, a disposable head-dress should be worn whenever aerosols are generated in dental practice to avoid colonization of the worker's hair. Long hair should always be tied up.

Certain Gram-negative bacilli, e.g. *Pseudomonas aeruginosa*, prefer moist surfaces. In a dental unit, water lines can be colonized with bacteria and the dominant species isolated are Gram negative bacilli (14). Bacteria in water lines end up in the operational area and closer to the source of the aerosol. Running water through lines is not sufficient to remove bacterial biofilms attached to the waterline inner wall. Inhibition of biofilm formation requires regular use of disinfectants. Gram-negative bacilli have also been isolated from soap, hand rub hangers and shower hand pieces emphasizing the importance of overall proper surface disinfection.

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