

Microbiologic profile of hospitalized healthcare workers

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SUMMARY

Objective: according to the epidemiologic and antimicrobial resistance profile, infections are usually classified as community-acquired or nosocomial. Reports on patients without the classic criteria for nosocomial infection with multidrug-resistant germs are increasing. There is a particular concern regarding which microbiological profile must be addressed in case of infections in healthcare workers. This study was carried out with the purpose of identifying the prevalence of infection by multidrug-resistant germs in healthcare workers exposed to occupational contact with such germs at work.

Methods: observational and retrospective study. In a 7-year period, healthcare worker hospitalizations were identified and the cultures results were assessed in order to identify the prevalence of infection by multidrug-resistant pathogens.

Results: 1,487 healthcare workers hospitalizations were identified. In 105 of these hospitalizations, cultures were collected on the first 5 days after admission, and in 22 patients, 24 germs were identified. Multidrug-resistant pathogens were not found.

Conclusion: in our sample, composed of workers from a tertiary public hospital who were hospitalized, none of the individuals presented MDR colonization or infection. These results suggest that when healthcare workers present infections, they must receive antibiotic therapy directed to community-acquired pathogens. In light of the limitations of this study, further larger and multicenter studies must be developed to enlighten such issue.

Keywords: nosocomial infection, antibacterial resistance, community-acquired infection, healthcare workers.

Study conducted at Hospital Nossa Senhora da Conceição

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INTRODUCTION

Knowing the colonization profile of the population addressed is crucial to determine an empirical antibiotic therapy to be employed.^{1,2} Historically, infections are defined as community-acquired (patients from extra-hospital setting) or nosocomial (acquired after at least 48 hours of admission or due to it), and empirical therapy is based on the germs commonly involved in each situation. More recently, the literature has used the expression “healthcare-associated infections”^{3,4} to designate infections caused by multidrug-resistant organisms in outpatients with risk factors and exposure to MDRs, including those residing in

nursing homes, or who had extended contact with intra-hospital or hemodialysis facilities in the past 30 days, required hospitalization in emergency units for a period exceeding 48 hours in the last 90 days, or who underwent intravenous therapies in past 30 days.²⁻⁴

Recent reports have associated exposure to hospital germs to the development of infections by these pathogens. Thus, health professionals as well as patients with “infections associated with healthcare”, even without hospital admission, would be prone to colonization or infection with these germs. Because of that, it is argued which

single empirical antibiotic therapy would be correct in case of infection in a healthcare worker: empirical coverage directed to community germs or MDR bacteria?⁵⁻⁸

Based on that, defining the colonization profile of healthcare workers is a matter of great importance and aims to avoid prescription of inadequate empirical antibiotic therapy, which is associated with increased morbidity and mortality (if using limited spectrum antibiotic medication to treat patients with MDR bacteria), as well as the development of antimicrobial resistance within the population and unnecessary hospitalizations (in cases of improper use of broad-spectrum antibiotics).⁹⁻¹² To corroborate the elucidation of this question, we developed this retrospective observational study aimed to identify the microbiological profile of infections in healthcare professionals who required hospitalization.

METHODS

An observational study was conducted through search of electronic medical charts at the Nossa Senhora da Conceição Hospital (HNSC), located in Porto Alegre, state of Rio Grande do Sul, Brazil. Admissions of employees of the Conceição Hospital Group (GHC), which includes the Nossa Senhora da Conceição Hospital, Cristo Redentor Hospital, Fêmeina Hospital, and the Conceição Children's Hospital, were identified retrospectively. The GHC is composed of tertiary level hospitals with endemic rates of colonization with MDR bacteria. All hospitalizations occurred at the Nossa Senhora da Conceição, since this is the hospital for clinical admissions in the GHC.

The population enrolled included workers of the GHC, admitted to the Nossa Senhora da Conceição Hospital in the period from January 2005 to January 2012, identified by means of their punch-in cards, regardless of the reason for hospitalization. Of these, patients with risk factors for colonization that did not arise from work activities were excluded: previous hospitalization for less than six months, with cultures collected after the fifth day of hospitalization, or with the absence of cultures. Data collection was initiated once the project was approved by the Research Ethics Committee-GHC, being performed from April to October 2012. The information was collected using searches for the following variables: gender, age, occupation (physician, nurse, nursing assistant/technician, or positions with no direct contact with patients), comorbidities, reason for hospitalization, ICU admission, and type outcome (hospital discharge *vs.* death).

Contact with MDR bacteria was defined based on occupation and sector of activity. Doctors, nurses or nursing technicians who worked in areas with high rates of infec-

tion or colonization with MDR bacteria, such as emergency rooms, ICUs, recovery rooms and wards, were regarded as professionals in contact with MDRs. Professionals who did not work in these sectors or who worked in these sectors performing activities without direct patient contact were considered as workers not in contact with MDRs. The reason for admission was classified as infectious or non-infectious and, in the case of infection, its focus was established. Patients with positive cultures who did not receive antibiotic treatment, on account of being asymptomatic despite bacterial growth on culture or whose medical charts did not mention infection, were defined as colonized patients (carriers). Empirical antibiotic therapy was considered adequate if the bacteria were sensitive to the antibiotic used. De-escalation of antimicrobial treatment after culture results was also assessed. Research sources were the admission form, the hospital discharge form and the outpatient consultation charts kept electronically by the hospital. The first chest radiography on admission was assessed. The chest X-ray was classified as compatible or not with bronchopneumonia, being compatible in case of new lobar consolidation, interstitial infiltrates or cavitating lesions. To define multidrug-resistant germs, we adopted the definition of ESKAPE pathogens previously created to emphasize the pathogens that most often correlate with hospital infections and that "escape" the effects of antibacterial drugs. They include: *Vancomycin*-resistant *enterococci*, *methicillin*-resistant *Staphylococcus aureus*, *Klebsiella* species and ESBL-producing *Escherichia coli*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and extended spectrum *beta-lactamase* (ESBL)- or *carbapenemase*-producing *Enterobacteriaceae*.¹³ Importantly, the data were subjected to total secrecy, not allowing the identification of patients/staff. Since this was a retrospective chart review, no consent form was applied, as approved by the local ethics committee.

Statistical analysis was performed with SPSS 17.0 software (statistical package software, SPSS Incorporation, Chicago, IL, USA). The χ^2 was used to evaluate categorical variables and Student's *t* test for parametric continuous variables. For sample size calculation, the prevalence of positive cultures in 50% of the hospitalizations was estimated with a confidence level of 90%, being thus required the identification of 97 admissions.

RESULTS

1,487 admissions of health workers were assessed in the study. In 1,155, there was no culture collection in the first five days of hospitalization, and in 227, the employee had already been hospitalized in the past six months. Of the 105 admissions with cultures collected in the first five

days, 83 were negative, and 22 hospitalizations had 24 bacteria isolated (Table 1 and Figure 1): *Escherichia coli* (10), *Coagulase-negative staphylococci* (CoNS,5), *Klebsiella pneumoniae* (2) and 7 other germs: *Enterococcus faecium*, *Enterococcus faecalis* (both sensitive to ampicillin), *Serratia marcescens*, *Staphylococcus epidermidis* (oxacillin susceptible), *Pseudomonas aeruginosa* (sensitive to quinolones, cefepime, piperacillin-tazobactam and carbapenems), *Streptococcus agalactiae* and *Cryptococcus neoformans*. Multiresistant bacteria were not isolated from any employee.

The profile of the sample is shown in Table 1. Among the 22 patients, 10 (45.5%) were nursing technicians and 12 (54.5%) had positions without direct patient contact: supervisors, administrative technicians, elevator operators, nutrition attendants, managers, pharmacy assistants, biomedical technicians, dispensers and cast technicians. There were no physicians or nurses in the sample. Based on workplace and job function, 10 employees had possible contact with MDR bacteria, 11 had no contact and 1 (4.5%) could not be determined.

Of the 22 admissions with bacterial isolates, 15 (68.2%) were hospitalizations due to infectious causes and 7 (31.8%), non-infectious. Thirteen patients received antibiotics. In 8 patients, the initial antibiotic therapy was considered appropriate to the pathogen, being maintained in 5 cases and de-escalated in 3, according to antibioticogram. In the other 2 patients, antibiotics were initiated after culture results. Among the 3 hospitalizations in which the empirical antibiotic therapy was considered inappropriate, one had the antibiotic therapy discontinued once the infection was attributed to *cryptococcal meningitis*, and in 2 the antibiotic therapy was adjusted after culture results (amoxicillin-clavulanate was replaced by piperacillin-tazobactam and metronidazole was replaced by cephalothin). The bacteria isolated in these cultures were *Pseudomonas aeruginosa* and *Staphylococcus epidermidis*, respectively. In the other 9 hospitalizations, antibiotics were not used because they were considered cases of colonization or sample contamination.

In this study, MDR bacteria were not found among the 24 cultures isolated from biological material taken from 22 employees of a general hospital. It is essential to point out that ten of these employees worked in areas with endemic presence of MDR bacteria. Reports prepared by the Commission of Hospital Infection at the Nossa Senhora da Conceição Hospital highlight the high pre-

TABLE 1 Patient profile (n = 22)

	Results
Age (years)	49.3 ± 10.6
Gender (F/M)	13 (59%) / 9 (41%)
Comorbidities	
- Congestive heart failure	1 (4.5%)
- High blood pressure	7 (32%)
- Chronic obstructive pulmonary disease	1 (4.5%)
- Smoking	6 (27%)
- Diabetes mellitus	2 (9%)
- Acute renal failure requiring dialysis	1 (4.5%)
- Tuberculosis	2 (9%)
- Depression	3 (13.5%)
- Acquired immunodeficiency syndrome	1 (4.5%)
- Neoplasm	5 (23%)
Occupation	
- Nurse technician	10 (45%)
- Other positions	12 (55%)
Microorganisms isolated	
- <i>Escherichia coli</i>	10 (42%)
- <i>Coagulase-negative staphylococci</i>	5 (21%)
- <i>Klebsiella pneumoniae</i>	2 (8%)
- Other	7 (29%)
Source of microorganism isolates	
- Blood cultures	7 (31.8%)
- Urocultures	10 (45.5%)
- Sputum	1 (4.5%)
- Cerebrospinal fluid	1 (4.5%)
- Cutaneous abscess	1 (4.5%)
- Pulmonary lymph node	1 (4.5%)
- Abdominal fluid	1 (4.5%)
Origin	
- Respiratory	8 (36.4%)
- Abdominal	3 (13.6%)
- Urinary	9 (40.9%)
- Cutaneous	1 (4.5%)
- Central nervous system	1 (4.5%)
Work location	
- Hospital Nossa Senhora da Conceição	12 (54.5%)
- Hospital Cristo Redentor	6 (27.3%)
- Hospital Fêmeina	2 (9.1%)
- Conceição Children's Hospital	1 (4.5%)
- Not identified	1 (4.5%)

N = number of patients.

Results are expressed in absolute numbers (n) and percent (%) and mean ± standard deviation.

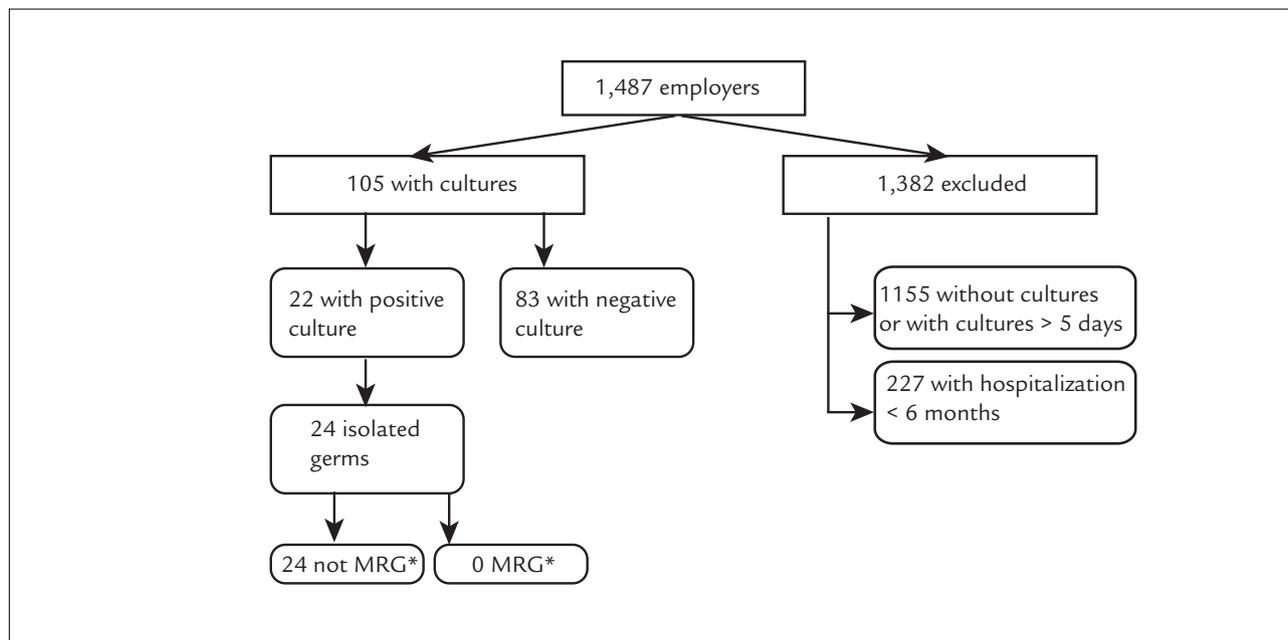


FIGURE 1 Flowchart allocation of employees with hospitalization.

MRG: multidrug-resistant germs.

valence of germs such as *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Acinetobacter baumannii* and *Klebsiella pneumoniae* among local cultures, stressing local rates of imipenem resistance at 93% among isolates of *Acinetobacter baumannii* and 37% positivity for plasmid resistance for *Klebsiella pneumoniae carbapenemase* (KPC) in the genomic regions blaKPC-1 until blaKPC-7.^{14,15}

Two microorganisms were isolated from urine culture and abdominal fluid samples. Of the pathogens isolated, 14 (58.3%) were considered infectious and 10 (41.7%) colonizing. Among the admissions analyzed, 3 (13.6%) refer to ICU stays and 1 (4.5%) progressed to death. The only healthcare worker admitted to ICU and who progressed to death was diagnosed with Acquired Immunodeficiency Syndrome and *Cryptococcus neoformans* isolated in CSF. Despite immunosuppression and ICU admission, this patient had no positive cultures for MDR bacteria.

DISCUSSION

This study shows the largest sample described to date with profiles of colonization and infection in healthcare workers who required hospitalization. The result of our study suggests that health professionals, even when exposed to MDR bacteria, show no infections or colonization by such germs.

The current evidence on healthcare-associated infections suggests that the bacteria involved in this new classification have resistance profiles different from those commonly associated with community-acquired infections, in addition to being associated with higher morbidity and mortality.^{2,4,12,16,17} Few studies that evaluate healthcare-associated infections address healthcare workers. Given the occupational exposure, it is important to study the microbiological profile of workers in the health segment. The few studies conducted in this context are limited to exceptional case reports describing rare events of direct transmission, with both patient and caretaker affected by the same pathogen.^{6,7} Other reports have also associated infections in healthcare workers with certain scenarios from medical practice such as cardiopulmonary resuscitation rooms,^{18,19} operating rooms²⁰ and intensive care units.^{21,22} The report of unusual cases tends to wrongly magnify the fear of MDR infection in healthcare workers. Our sample seems more representative of the actual scenario: the incidence of infections in healthcare workers was low and mostly the clinical presentation did not reveal increased severity, being associated with community-acquired germs.

Importantly, in 83 workers who were hospitalized, the physician found it necessary to collect samples for culture, and this was done in the first 5 days after admis-

sion; nevertheless, no bacterial growth was found. This may have occurred for several reasons such as methodological limitation, technical issues, cultures collected after antibiotics were given, or possibly the absence of patient colonization/infection. We observed that in most patients hospitalized for infectious reasons, the causative germ was isolated. Some, though presenting active infection, had culture results suggestive of colonization, but the possible microorganism involved in the infection was not identified.

The average age of our sample was low (49 years) and predominantly comprised staff members without multiple comorbidities. The fact that these are individuals economically and socially active, also without relevant comorbidities, explains the low incidence of infections in this population and the lack of data regarding this topic, as well as the impossibility of carrying out prospective trials, either observational or clinical in nature.

Our study has several limitations. First, let us remember that this is a unicentric study. Therefore, we consider it relevant to the literature that many centers report the incidence of infections and the profile of antibacterial resistance in infections occurring in healthcare workers. The retrospective design and the definition of contact with MDRs derived from occupation and the identification of the work segment of the worker do not allow accurate determination of direct contact between the worker and carriers of MDR bacteria, even though the commission of hospital infection control in this group does report high rates of colonization with MDR bacteria in the wards.¹⁴ Let us keep in mind that out of 1,487 admissions screened, only 22 had pathogens identified. As possible explanations, we can mention: a significant number of admissions due to non-infectious causes (individuals economically and socially active, with few comorbidities), the non-systematic collection of samples for cultures in the first five days from patients hospitalized with infection, the presence of recurrent hospitalizations, and negative cultures in the first 5 days. In our sample, the population was limited to nursing technicians and other occupations previously mentioned; doctors and nurses were not included. The fact that HNSC is a hospital that treats exclusively patients from the Brazilian Unified Health System (SUS public system) can in part justify this limitation, since those who can afford health insurance plans are usually admitted to the private network of hospital care. Likewise, some employees may have been hospitalized in other public hospitals, without our knowledge. Another possible limitation is due to the low number of infectious cultures in our sample,

since in many cases, even the blood cultures were characterized as colonizing.

CONCLUSION

In our sample, composed of employees of a public tertiary care hospital with high rates of colonization by MDR undergoing clinical hospitalization, we found a low prevalence of both infections and colonization. Although evidence from the literature suggest that the antibiotic spectrum for empirical treatment of patients with healthcare-associated infections should be expanded, our results suggest that healthcare workers should not be included in this new classification when presenting infections. Thus, we suggest that antibiotic therapy is directed towards pathogens with resistance profiles of community-acquired bacteria, since no employee showed colonization or infection with MDRs. In light of the limitations of this study, further larger and multicenter studies must be developed to enlighten the issue.

RESUMO

Perfil microbiológico de profissionais de saúde com internação hospitalar.

Objetivo: conforme perfil epidemiológico e resistência antimicrobiana, as infecções costumam ser divididas entre comunitárias e nosocomiais. É crescente o relato de pacientes sem critérios clássicos para infecções nosocomiais com infecções por germes multirresistentes (GMR). Há particular preocupação perante qual perfil microbiológico deve ser coberto na presença de infecções em profissionais de saúde. Realizamos este trabalho com intuito de identificar a prevalência de infecção por GMR em profissionais de saúde expostos a contato laboral com tais germes.

Métodos: estudo observacional, retrospectivo. Em um período de 7 anos, foram identificadas internações hospitalares de profissionais de saúde e aferidos resultados de culturas visando a identificar prevalência de infecção por GMR.

Resultados: identificamos 1.487 internações de profissionais de saúde. Em 105 internações, foram solicitadas culturas nos primeiros 5 dias de internação. Em 22 internações, foram identificados 24 germes. Não houve isolamento de GMR.

Conclusão: na amostra, composta por funcionários de um hospital público de nível terciário que apresentaram internação hospitalar, nenhum funcionário apresentou colonização ou infecção por GMR. O resultado sugere que trabalhadores da área de saúde, ao apresentar infecções,

devem receber antibioticoterapia voltada para patógenos comunitários. Tendo em vista as limitações deste estudo, são necessários estudos maiores e multicêntricos para elucidar essa questão.

Palavras-chave: infecção hospitalar; resistência antimicrobiana; infecção comunitária; pessoal da saúde.

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