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Multidrug-resistant bacteria colonization amongst patients newly admitted to a geriatric unit: A prospective cohort study

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Summary *Objectives:* To determine prevalence, incidence and risk factors of colonization by extended-spectrum β-lactamase-producing *Enterobacteriacae* (ESBLE), methicillin-resistant *Staphylococcus aureus* (MRSA), and vancomycin-resistant *Enterococcus* (VRE) in aged subjects admitted to an acute geriatric unit at a teaching hospital.
Methods: During 12 months, 337 patients were screened by nasal, oropharyngeal, groin, axillary and rectal swabs upon admission and at discharge.
Results: The prevalence of ESBLE, MRSA and VRE carriage upon admission was 11.6%, 7.5% and 0.6%, respectively. The incidence density of ESBLE and MRSA carriage was respectively of 1.77 and 2.40 new cases for 1000 patient-days. No cases of VRE acquisition were found. Risk factors for ESBLE colonization on admission were: multiple contacts with the hospital within the previous year, chronic catheter use and a high level of dependency. For MRSA, risk factors were: chronic wounds, anti-acid use and a high level of dependency.
Conclusion: This study shows a high prevalence of asymptomatic colonization of ESBL-producing *Escherichia coli* in patients admitted to an acute geriatric ward, as high as MRSA carriage. A low functional status is a common risk factor both for ESBLE and for MRSA colonization and it highlights the need to reinforce infection control measures.

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Introduction

Multidrug-resistant microorganisms (MDRO) carriage and transmission constitute a major and growing health concern worldwide in the era of the twenty-first century.[1] Infections due to antibiotic resistant pathogens are associated with poor outcomes: delay in effective therapy, longer hospital stay and subsequent higher morbidity or mortality.[2,3] Furthermore, colonization by MDRO is known as a potential source of cross-transmission and as a risk factor for the development of subsequent infection.[4] Most surveillance programmes, including the European Antimicrobial-Resistant Surveillance System-Network (EARS-Net) of the European Center for Disease and Control (ECDC) do mainly focus on deep seated clinical isolates hence yielding relevant epidemiological data for invasive infections. Among participating European countries in the EARS-Net programme, the proportion of *Escherichia coli* resistant to third-generation cephalosporins isolated from bloodstream infections increased from 1.7 to 8% between 2002 and 2009 while the proportion of methicillin-resistant *Staphylococcus aureus* (MRSA) slightly decreased from 21.5% to 19.7% over the same period.[5] Since microbiological screening for colonization by Gram-negative MDRO is still an uncommon practice in most hospitals, these surveillance programmes do however not address asymptomatic carriage of MDRO as a potential reservoir for cross-transmission and subsequent risk for infection. Moreover, there have been only few studies addressing a broader scope of the MDRO epidemiology in acute geriatric settings, not only considering MRSA but also other MDRO such as vancomycin-resistant *Enterococcus* (VRE) and extended-spectrum β-lactamase-producing *Enterobacteriacae* (ESBLE).

Therefore, we conducted an observational study in an acute geriatric ward with as primary objective to determine the prevalence and potential risk factors associated with asymptomatic colonization by three important MDRO, namely: ESBLE, MRSA and VRE. The secondary aims were to estimate the incidence of MDRO carriage at the time of discharge and the potential impact of colonization by these organisms on several outcome variables such as mortality, length of hospital stay and the subsequent risk of development of health-care associated infections. We report here the results of our study according to the STROBE statement.[6]

Materials and methods

Study design and setting

This prospective observational cohort study took place at the University Medical Center of Mont-Godinne (Catholic University of Louvain), a 420-beds tertiary-care teaching hospital located in a rural area in the southern part of Belgium. This hospital hosts a 27-bed acute geriatric ward. Since 1998, weekly multidisciplinary round staffs were initiated in order to optimise diagnostic procedures and appropriateness of antibiotic use.[7] According to recommendations of the Healthcare Infection Control Practices Advisory Committee,[8] other principal measures of prevention of MDRO transmission used in the unit were: promotion of hand hygiene, use of hydro-alcoholic antiseptic solution (during the study period, 1952 ml/10,000 hospitalization-days of hydro alcoholic antiseptic solution was used in the ward), standard and contact precautions according to local infection control programme and standard environmental measures. For MRSA carriers, an automatic computer alert system was provided. All patients carrying MRSA or VRE at admission were isolated in a single room with contact precautions. During the study period, no cohorting of patients was proposed. For MRSA carriers, decolonization was applied by a 5-day regimen of baths and nasal therapy with povidone iodine.

The study started on January 15th 2010 and inclusion ended on January 15th 2011. Sample size was calculated on the basis of results of a recent survey which found prevalence rates of 8% for ESBLE rectal carriage and 9% for MRSA colonization among patients admitted to a general hospital in Israel.[9] To achieve an absolute precision of estimate of ±3% with an expected prevalence of 8% and a confidence level of 95%, a sample of 314 patients is required.

Participants

After written informed consent, all patients admitted to the geriatric unit were prospectively enrolled. Exclusion criteria were: refusal to participate, readmission during the study period, end-of-life (death expected by physicians within the following 7 days of admission), duration of hospital stay expected to be shorter than 3 days, a time lag of more than 48 h between admission and informed consent or the omission or lack of obtaining a complete set of screening swabs.

Variable and data collection

Clinical data were collected prospectively and included several demographic variables such as age, gender, geographic area of residency, living in a farm, the presence of pets at home, specific professional care at home (like physiotherapist, nurses or meals on wheels), type of admission to hospital (elective or emergency), transfer from another department of the same hospital or from another hospital and length of hospital stay (prior to admission in the unit and during the stay in the geriatric ward). Autonomy level in basic activities of daily living (ADL) was measured by the 6-point Katz scale where 0/6 and 6/6 represent respectively a high and low level of dependency in the six following activities: bathing, dressing, walking, going to the toilet, continence and eating.[10] Instrumental activities of daily living (IADL) were measured by the 7-point Lawton scale rated from 0 (high level of dependency) to 7 (low level of dependency).[11] Functional data were obtained according to the situation of the patient before development of the acute condition leading to hospitalization or two weeks before admission at hospital. Risk of functional decline was measured through the Identification of Senior at Risk (ISAR) screening tool rated from 0 (low risk of functional decline) to 6/6 (high level of functional decline) using a cut-off score above 2/6.[12,13] Co-morbidity was assessed at admission by the Cumulative Illness Rating Scale for Geriatrics (CIRS-G).[14,15] Cognitive status was