

Original article

Outbreak of extended spectrum beta-lactamase-producing *Klebsiella pneumoniae* in an intensive care unit (Brest)

Épidémie à Klebsiella pneumoniae productrice de bêta-lactamase à spectre étendu dans deux services de réanimation (Brest)

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Abstract

Introduction. – We had for aim to describe control and investigation of an outbreak caused by a strain of Extended spectrum beta-lactamase producing *Klebsiella pneumoniae* in intensive care units of the Brest teaching hospital.

Patients and method. – The case definition was a patient infected by or carrying the epidemic strain. Control measures and investigations are presented. A case-control study was conducted in the surgical intensive care unit. Each case was matched with two controls based on admission times in the unit. The study focused on diagnostic and therapeutic procedures, and potential contacts with healthcare workers, in this context of cross transmission.

Results. – Between February and May 2011, nine cases were reported in the surgical ICU and two in the medical ICU. Eighteen controls were matched with the nine surgical ICU cases. Several factors were found to be statistically associated with infection or colonization by the epidemic strain: the surgical block in which patients had been operated and the ward of first hospitalization; the number of trans-esophageal and trans-thoracic echocardiographies, of central venous catheter insertions, and of surgical operations; intubation. The total number of invasive procedures was also found to be statistically higher among cases.

Conclusion. – This study identified factors associated with colonization or infection by the epidemic strain. These factors might have been involved in the transmission tree, and be vulnerable elements for the prevention of nosocomial infections and colonisations, and their epidemic spread.

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Keywords: *Klebsiella pneumoniae*; Multiple antibacterial drug resistance; Nosocomial infection

Résumé

Introduction. – L'objectif de cette étude est de décrire le contrôle et l'investigation d'une épidémie causée par une souche de *Klebsiella pneumoniae* productrice de bêta-lactamase à spectre étendu, survenue dans les services de réanimations chirurgicale et médicale du centre hospitalier régional universitaire de Brest.

Patients et méthode. – Les cas étaient les patients infectés ou colonisés par la souche épidémique. Les mesures de contrôle et les investigations sont présentées. Une étude cas-témoin a été menée en réanimation chirurgicale. Deux témoins ont été appariés à chaque cas d'après leur date

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d'admission. Dans ce contexte de transmission croisée, l'étude s'est intéressée en particulier aux actes diagnostiques et thérapeutiques et aux passages des professionnels de santé.

Résultats. – Entre février et mai 2011, neuf cas en réanimation chirurgicale et deux cas en réanimation médicale ont été observés. Dix-huit témoins ont été appariés aux neuf cas de réanimation chirurgicale. Plusieurs facteurs ont été trouvés associés à la colonisation ou à l'infection : le bloc opératoire d'origine et le service d'origine; les nombres d'échographies trans-œsophagiennes et trans-thoraciques, le nombre de poses de cathéters veineux centraux et d'interventions chirurgicales; l'intubation. Le nombre total d'actes invasifs était également statistiquement plus élevé chez les cas.

Conclusion. – Cette étude a mis en évidence des facteurs associés à la colonisation ou à l'infection des patients par la souche épidémique, qui pourraient avoir caractérisé la chaîne de transmission et constituer des éléments de vulnérabilité dans la prévention des infections ou colonisations nosocomiales et de leur diffusion épidémique.

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Mots clés : *Klebsiella pneumoniae* ; Multirésistance bactérienne ; Infection nosocomiale

1. Introduction

The prevalence of extended spectrum beta-lactamase (ESBL producing) enterobacteria has been increasing for several years in Europe, this is especially true for *Klebsiella pneumoniae* [1]. The resistance rate to 3rd generation cephalosporins de (3GC) is an indirect measure of this resistance. Eleven European countries (including France) reported a rate of *K. pneumoniae* resistant to 3GC higher than 10% in 2009 [1,2]. It was estimated at 17.8% in France in 2010, and the incidence in hospital settings was 0.07 per 1000 patient days. ICU are especially concerned by this issue and its implications [3–5]. Individually, these bacteria are a menace in case of invasive infection and raise the problem of antibiotic choice. The risk of cross transmission and spreading of resistance make each case of colonization an infectious menace on a greater scale. This data has led the High Council for Public Health (French acronym HCSP) to issue recommendations recently [6]. Finally, outbreaks systematically put to test hygiene practices and healthcare organization, and raise the issue of factors implicated in the transmission chain.

The objectives of this study were to describe the investigations and means implemented to control an outbreak of ESBL producing *K. pneumoniae* colonizations and infections having occurred in the medical and surgical ICU of the Brest University and Regional Hospital Center (URHC).

2. Patients and methods

2.1. Description of the hospital

The Brest URHC is a 2100-bed hospital. The outbreak occurred in the medical and surgical ICU. These two units each group 15 contiguous single-bed rooms.

2.2. Chronology and control measures used

2.2.1. Phase 1: 4th to 7th April, 2011

A protocol for the screening of MRSA and ESBL producing was implemented in the Brest URHC ICU in 1996. It includes screening every patient at admission then once a week for ICU patients.

ESBL producing *K. pneumoniae* were isolated in four ICU patients in early April 2011 (two in the surgical ICU and two

in the medical ICU), with similar antibiograms; the strains were analyzed by PFGE gel electrophoresis (PFGE). The outbreak was confirmed after identification of a same clone by pulsed field on 7th April. All the antibiograms concerning the isolation of ESBL producing *K. pneumoniae* in medical or surgical ICU patients since January 2011 were analyzed. PFGE was performed in case of similitude with the epidemic strain.

As soon as the first warning was issued for ESBL producing *K. pneumoniae* colonization, the operational hygiene team (OHT) reminded the ICU personnel about standard and complementary precautions. A commission for the management of the outbreak (CMO) was created after confirmation of a same strain of ESBL producing *K. pneumoniae*. The CMO included medical and administrative personnel of the two ICU, bacteriologists, the OHT, and the hospital management representatives. Two weekly meetings were held so as to adapt the control strategy.

The outbreak was rapidly controlled in the medical ICU, and the two patients colonized by the epidemic strain were discharged on 8th April 2011.

2.2.2. Phase 2: 8th to 22nd April 2011

Two new patients were screened positive (11th and 20th April) in the surgical ICU, despite the implementation of complementary precautions for contact. The CMO suggested performing an audit of hygiene practices in the surgical ICU. The audit was made in 1 day and demonstrated an inadequate observance of hand hygiene (HH) (68% of the global observance), with heterogeneous results between the various professional categories. The less observant categories were non-ICU personnel (43% of observance) and physicians (57%). Furthermore, hydro-alcoholic gel (HAG) was insufficiently used (73% of HH with HAG).

2.2.3. Phase 3: 22nd April to 2nd May 2011

Complementary measures were adopted by the CMO because of the outbreak (confirmation of a new case on April 20, and three cases still hospitalized) and audit results: admissions to the surgical ICU were cancelled; patients were cohorted in a single sector with dedicated paramedical teams and shutdown of the two continuous surgical care beds. Information sessions on the outbreak and reminders of good practices (standard and complementary precautions for contact, bio cleaning) were held for the surgical ICU medical and paramedical personnel.

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