Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Informed consent and patient details

The authors declare that this report does not contain any personal information that could lead to the identification of the patient(s) and/or volunteers.

Disclosure of interest

The authors declare that they have no competing interest.

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Author contributions

All authors attest that they meet the current International Committee of Medical Journal Editors (ICMJE) criteria for Authorship.

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R. Guery [a,*]
C. Delaye [a]
N. Brule [b]
V. Nael [b]
L. Castain [c]
F. Raffi [a]
L. De Decker [d]
[a] *Service de Maladies Infectieuses et Tropicales, CIC UIC 1413 inserm, CHU de Nantes, 44093 Nantes, France*
[b] *Service de Santé au Travail, CHU de Nantes, Nantes, France*
[c] *Service de Virologie, CHU de Nantes, Nantes, France*
[d] *Service de Médecine Aigue Gériatrique, CHU Nantes, Nantes, France*

* Corresponding author.
E-mail address: romain.guery@yahoo.fr (R. Guery)

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Serratia marcescens outbreak in the intensive care unit during the COVID-19 pandemic: A paradoxical risk?

INFO ARTICLE

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COVID-19
Serratia marcescens
Hospital-acquired infection

As coronavirus disease 2019 (COVID-19) patient management requires personal protective equipment (PPE) and rigorous environment cleansing and disinfection, strengthened hospital infection control was expected.

Surprisingly, between mid-February and mid-April 2020, five patients including four out of the 95 COVID-19 patients managed in our intensive care unit (ICU) presented blood and respiratory specimen cultures positive for *Serratia marcescens*, resistant to amoxicillin, amoxiclav, 1st and 2nd generation cephalosporins (inducible AmpC β-lactamase) and with low-level resistance to amikacin (chromosome-borne *aac(6')-Ic*). Isolates were clonal based on whole genome sequencing using Illumina™ procedures. Noteworthy, *S. marcescens*, a saprophytic environmental Enterobacteriaceae transitory found in human microbiota [1], was commonly implicated in nosocomial infections, especially in neonatal ICUs [2].

After the Infection Prevention and Control Team (IPCT) investigation, an environmental reservoir was suspected as the five patients stayed for at least one day in the same double room (Fig. 1). The source patient had been admitted to this room for septic shock due to community-acquired *S. marcescens* infection from his dialysis catheter, a few days before the COVID-19 outbreak started. Thereafter, *S. marcescens* acquisition by the COVID-19 patients was likely promoted from the environment due to invasive procedures, high antimicrobial selective pressure and immunomodulatory therapy administration [1–3]. Additionally, difficulties in applying optimal bio-cleaning procedures during the COVID-19 outbreak may have contributed to facilitating the bacterial reservoir [3]. Transmission between caregivers and patients was facilitated by increased patient density and severity, enhanced workload, and reduced space (e.g., two mechanically ventilated patients managed in rooms routinely dedicated to single patients).

Due to the severity of COVID-19 pneumonia, our patients extensively received cefotaxime (82%) to treat a possible bacterial coinfection. They also extensively received azithromycin (93%) as empirical antibiotic treatment in addition to its alleged antiviral and immunomodulatory properties, especially combined with hydroxychloroquine [4]. However, despite these almost systematic antibiotic prescriptions in our COVID-19 patients, we suspected an additional condition that had promoted the *S. marcescens* outbreak, by contrast to the multidrug-resistant bacteria outbreaks usually attributed to the density of antimicrobial prescriptions in the ICU.

In our ICU, PPE included FFP2 masks, long-sleeved disposable gowns, aprons, goggles, and gloves, as recommended [5]. Care-

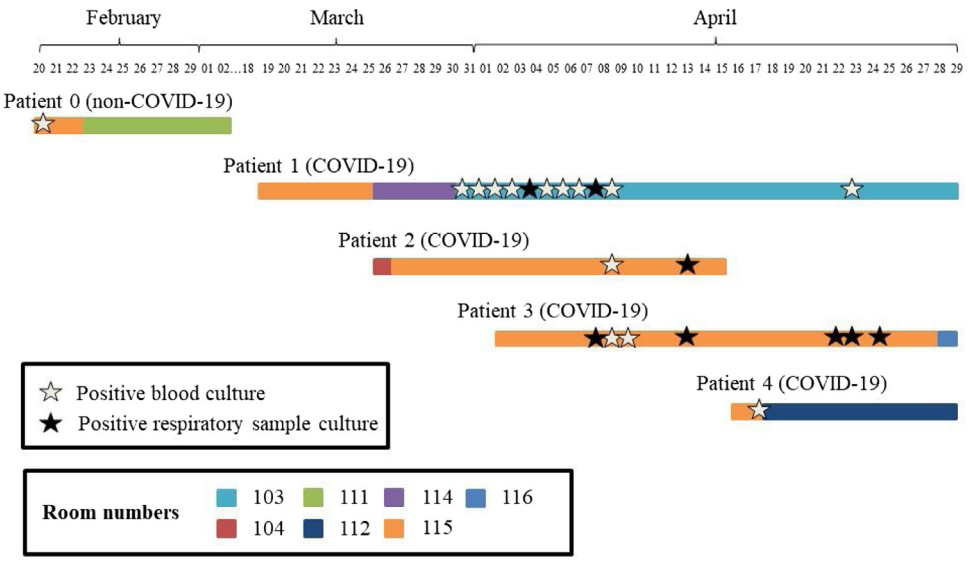

Fig. 1. Serratia marcescens outbreak in an adult intensive care unit during the COVID-19 pandemic. Five patients including the non-COVID-19 source patient and four COVID-19 patients stayed for at least one day in the same room (room 115) with a suspected environmental reservoir. The very specific conditions related to patient care during the COVID-19 pandemic facilitated bacterial acquisition and cross-transmission between patients.

givers were encouraged to wear gloves during patient care if contact with blood or other body fluids could be reasonably anticipated. They were advised to systematically carry out hand hygiene with alcohol-based hand rub after removing gloves. However, inappropriate excessive glove use, especially in additional staff not trained to manage ICU patients, resulted in poor compliance with hand hygiene, as reported [6]. Unexpectedly, strengthening PPE combined to the fear of self-contamination by SARS-CoV-2 pushed caregivers to wear gloves systematically, even when not required, as soon as entering the patient room. The IPCT observed that several caregivers did not change their gloves between the cares of two patients. This malpractice likely contributed to the room contamination and *S. marcescens* cross-transmission between patients. Interestingly, cross-transmission due to continuous glove and gown wearing had been responsible for increase in methicillin-resistant *Staphylococcus aureus* acquisition rate and change in pathogen pattern during an outbreak of severe acute respiratory syndrome in a Hong Kong ICU [7].

Here, once the *S. marcescens* epidemic was identified, intensive bio-cleaning of the room was performed and recommendations to improve hand hygiene were provided to caregivers. No further cases occurred.

During the COVID-19 outbreak, implementation of additional infection control procedures was expected to be associated with a decrease in healthcare-associated infections. Our experience suggests that extra procedures could, by contrast, lead to counterproductive effects if not adequately applied.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki declaration and its later amendments.

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Disclosure of interest

The authors declare that they have no competing interest.

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R. Amarsy [a]
G.r Pean de Ponfilly [b]
H.a Benmansour [b]
H. Jacquier [b]
E.e Cambau [b]
B. Mégarbane [c,*]
[a] *Infection Prevention and Control Team, Lariboisière Hospital, University of Paris, Inserm IAME UMRS-1137, Paris, France*
[b] *Laboratory of Microbiology, Lariboisière Hospital, University of Paris, Inserm IAME UMRS-1137, Paris, France*