Burkholderia cepacia complex outbreak originating from contaminated wash gloves

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SUMMARY

Burkholderia cepacia complex isolates were detected from four patients who were admitted to the heart centre of southern Switzerland, between April and June 2019. An outbreak investigation was conducted. The three available patient samples were whole genome sequenced, showing that they all are Burkholderia cepacia species, and that two are identical. Isolates grown from sealed packages of disinfectant-free wash gloves used for personal hygiene were also genomically identical. The wash gloves appear to be the origin of the outbreak, contamination of which most likely occurred at the manufacturing site.

Introduction

Burkholderia cepacia complex (BCC) is a group of environmental gram-negative bacteria found in soil and water. Isolates are associated with human infections mainly in the setting of hospital-acquired infections linked to use of contaminated medical products [1,2], a contaminated environment or healthcare workers hands [3], and in cases of person-to-person transmission in cystic fibrosis sufferers [4]. This complex raises particular concern because of its multidrug resistance profile and high mortality rate associated with infection [5]. Herein, we report an outbreak of BCC associated with the use of contaminated pre-moistened disinfectant-free wash gloves, detected in the heart centre of southern Switzerland, a 30-bed university-affiliated clinic comprising a cardiology ward, a cardiac surgery ward and an intensive care unit.

Description of the index cases

Patient 1

A 54 year old male patient was admitted to the cardiology unit after a non-ST-elevation myocardial infarction on March 2019. During the coronary angioplasty he developed severe cardio-circulatory compromise and needed support with femoro-femoral extracorporeal membrane oxygenation (ECMO). Subsequently, he developed acute right limb ischemia after ECMO removal, owing to a right femoral artery dissection that required surgical repair with a biosynthetic vascular...
interpretation to CLSI guidelines [6]. Whole genome testing was performed using ETests (Biomerieux) and results after 48 hours during the outbreak period. Antimicrobial sensitivity (Oxoid Limited). All cultures were incubated for at least 48 hours.

NexteraXT library preparation (Illumina) to mean coverage 23X was performed on the selective medium, *Burkholderia cepacia* complex isolates (MIC interpreted according to the Clinical and Laboratory Standards Institute (CLSI). Performance standards for antimicrobial susceptibility testing, 29th ed. CLSI; 2019. Supplement M-100). Performance standards for antimicrobial susceptibility testing. 29th ed. CLSI; 2019. Supplement M-100)

| Patient | Ceftazidime (MIC mg/L) | Interpretation | Meropenem (MIC mg/L) | Interpretation | Levofoxacin (MIC mg/L) | Interpretation | Trimethoprim-sulfamethoxazole (MIC mg/L) | Interpretation |
|---------|------------------------|----------------|----------------------|---------------|------------------------|---------------|-----------------------------------|---------------|
| 1       | 1.5                    | $S$            | 8.0                  | I             | 3.0                    | I             | 0.12                              | I             |
| 2       | 1.5                    | $S$            | 8.0                  | I             | 3.0                    | I             | 0.12                              | I             |
| 3       | 2                      | $S$            | 8.0                  | I             | $>32$                  | R             | 0.25                              | I             |

Patient 2

An 87 year old male patient was admitted to the cardiology unit because of severe cardiac decompensation related to non-ST elevation myocardial infarction in April 2019. A coronary angioplasty was performed under femoro-femoral ECMO support, which was removed at the end of the procedure. He developed progressive signs of deep surgical site infection on the right groin that required surgical debridement in May 2019. The intraoperative biopsies showed growth of *Escherichia coli* and *Hafnia alvei*. A superficial swab of the left groin performed on May 2019 showed growth of BCC.

Methods

A case was defined as a patient with a BCC isolate from any clinical specimen, detected from January 2019 onwards. The reference microbiology laboratory database was retrospectively reviewed for cases. We established a line list and performed onsite audits to identify possible environmental sources and breaches in the infection control practices. Clinical samples were cultured on MacConkey Agar, Chocolate Agar + Polyvitex™ (Biomerieux) or Columbia Agar + 5% sheep blood (Becton Dickinson); environmental samples were cultured on the selective medium, *Burkholderia cepacia* Agar (Oxoid Limited). All cultures were incubated for at least 48 hours during the outbreak period. Antimicrobial sensitivity testing was performed using ETests (Biomerieux) and results interpreted according to CLSI guidelines [6]. Whole genome sequencing (WGS) was performed using an ISO/IEC 17025 accredited NextSeq500 Illumina sequencing platform following NexteraXT library preparation (Illumina) to mean coverage over 50X. All read data is available from the ENA (https://www.ebi.ac.uk/ena) under project PRJEB34276.

Results

An outbreak investigation was launched in May 2019, because of an unusual detection of BCC in clinical samples from two index patients. The retrospective case finding through the microbiology laboratory database identified a further suspected case in April 2019, involving a patient with urinary colonisation with BCC (patient 3). A fourth case (patient 4) was prospectively detected on June 2019, also involving a patient with urinary colonisation with BCC. All patients were hospitalized in the heart centre of southern Switzerland before the detection of the first positive sample for BCC; no other common location was identified. A summary of the patients is shown in Supplementary Table S1.

Isolates from patient 1 and 2 exhibited the same antimicrobial resistance phenotypic profile with sensitivity to ceftazidime, trimethoprim-sulfamethoxazole and intermediate level of resistance to meropenem and levofoxacin (Table 1). The isolate from patient 3 was resistant to levofoxacin and exhibited a higher MIC for ceftazidime and trimethoprim-sulfamethoxazole. Isolate from patient 4 was no longer available for further testing.

Through a line list, the intensive care unit and the cardiology unit were identified as possible common locations. Because of the initial detection of BCC in clinical samples from the groin, ultrasound gel used for vascular ultrasound, disinfectant used for groin wound care and personal hygiene products were first tested. A total of six single products (each in two different Lot number) were sent to the microbiology laboratory. On June 21, 2019, growth of BCC was detected in two sealed packages from the two different Lot numbers of disinfectant-free wash gloves (COCUNE, Stöppler Medical B.V, and the Netherlands). The remaining ten sampled medical products showed no bacterial growth. All clinical and environmental isolates grew within 24 hours incubation.

The sequenced bacterial isolates from patients and wash gloves were assembled by Unicycler v 0.3.0b [7]. PubMLST (https://pubmlst.org/bcc/; [8]) was used on the assemblies to identify the species as *Burkholderia cepacia*, and all isolates showed novel sequence types. The WGS typing results showed that two clinical isolates (Patient 1, Patient 2) are genomically identical to each other and to the two isolates from the two sealed glove packages (Figure 1). Patient 3 was not related to the outbreak (>66,000 SNPs divergence between isolates); Patient 4 isolates were not available for testing.

The incident was announced on June 21, 2019 to the Swiss agency for therapeutic products (Swissmedic) and to the local distributor of the wash gloves. No other hospital in the region of southern Switzerland was found to use the same medical...
Despite being non-invasive devices, wash gloves can still be associated with outbreaks with potentially serious consequences in acute care settings. In our opinion, additional steps are necessary to standardise quality assessment requirements for this class of products when they are used for acute patient care.

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Conflicts of interest
All authors report no conflicts of interest relevant to this article.

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Appendix A. Supplementary data
Supplementary data to this article can be found online at https://doi.org/10.1016/j.infpip.2020.100039.

References
[1] Becker SL, Berger FK, Feldner SK, Karllova I, Haber M, Mellmann A, et al. Outbreak of Burkholderia cepacia complex infections associated with contaminated octrinidine mouthwash solution, Germany, August to September 2018. Euro Surveill 2018;23(42).
[2] Sommerstein R, Fuhrer U, Lo Priore E, Casanova C, Meinel DM, Seth-Smith HM, et al. Burkholderia stabilis outbreak associated with contaminated commercially-available washing gloves, Switzerland, May 2015 to August 2016. Euro Surveill 2017;22(49).
[3] Graindorge A, Menard A, Neto M, Bouvet C, Miollan R, Gaillard S, et al. Epidemiology and molecular characterization of a clone of Burkholderia cenocepacia responsible for nosocomial pulmonary tract infections in a French intensive care unit. Diagn Microbiol Infect Dis 2010;66(1):29–40.
[4] Steir MM. Burkholderia cepacia complex infections: More complex than the bacterium name suggest. J Infect 2018;77(3):166–70.
[5] El Chakhtoura NG, Saade E, Wilson BM, Perez F, Papp-Wallace KM, Bonomo RA. A 17-Year Nationwide Study of Burkholderia cepacia Complex Bloodstream Infections Among Patients in the United States Veterans health administration. Clin Infect Dis 2017;65(8):1253–9.
[6] CLSI. Performance Standards for antimicrobial susceptibility testing. In: CLSI supplement M100. 29th ed. Wayne, PA: Clinical and Laboratory Standards Institute; 2019.
[7] Wick RR, Judd LM, Gorrie CL, Holt KE. Unicycler: Resolving bacterial genome assemblies from short and long sequencing reads. PLoS Comput Biol 2017;13(6):e1005595.
[8] Jolley KA, Bray JE, Maiden MCJ. Open-access bacterial population genomics: BIGSdb software, the PubMLST.org website and their applications. Wellcome Open Res 2018;3:124.
[9] Martin M, Christiansen B, Caspari G, Hogardt M, von Thomsen AJ, Ott E, et al. Hospital-wide outbreak of Burkholderia contaminans...
caused by prefabricated moist washcloths. J Hosp Infect 2011;77(3):267–70.

[10] The European Parliament and the Council of the European Union. Regulation (EU) 2017/745 of 5 April 2017 on Medical Devices, amending Directive 2001/83/EC, Regulation (EC) No 178/2002 and Regulation (EC) No 1223/2009 and repealing Council Directives 90/385/EEC and 93/42/EEC 2017. Available from: https://eur-lex.europa.eu.