Rigshospitalet

Linezolid-resistant *Staphylococcus epidermidis* at a tertiary hospital, Copenhagen, Denmark

Investigating an outbreak of Healthcare-Associated Infections (HAI) between 2017-2021

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HEALTHCARE-ASSOCIATED BLOODSTREAM INFECTIONS[1]

- *S. epidermidis* accounts for more than 75% of CoNS found in clinical specimens
- It is essential to distinguish between common contaminations and significant infections
- *S. epidermidis* possesses different determinants to facilitate survival, biofilm formation, adhesion to tissue and prosthetic surfaces and even serve as a reservoir for the transfer of virulence-related genetic information to *S. aureus*.
- Patients particularly at risk of significant CoNS infections include those with prosthetic devices and immunocompromised hosts.
- CoNS is the most common cause of nosocomial bloodstream infections, approximately one-third of those found in ICUs, with 15-25% having significant bloodstream infections.
- Health care-associated infections affect 7.1 % of all hospitalised patients in tertiary hospitals in the European Union.
- In the USA, 55% of ICU patients have a CVC.
- Studies point towards CoNS as responsible for at least 12% of all cases; among these pathogens, antimicrobial infections are a severe problem.
- CVC-associated bloodstream infections have a crude excess mortality rate in adult patients in ICU of 23.6% for those with central line-associated bloodstream infections.
- A German study estimated an additional 12.5 days of hospital stay.
- Estimated costs of HAI are approximately 7 billion euros annually.

INTRODUCTION

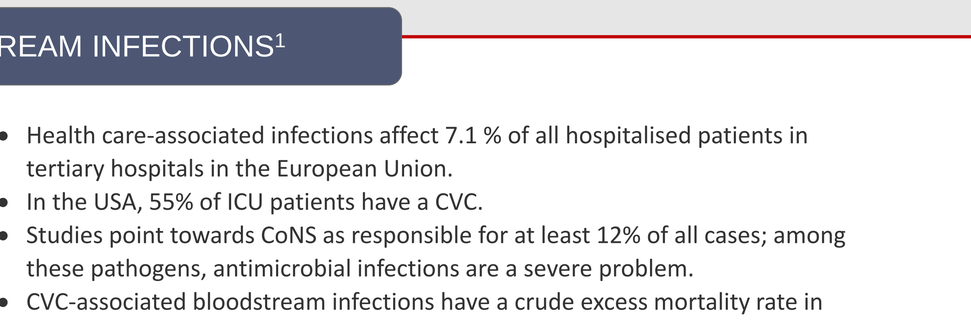
Linezolid-resistant *Staphylococcus epidermidis* (LRSE) is increasingly reported throughout the western world and is considered an important pathogen for immunocompromised patients and patients with prosthetic devices.

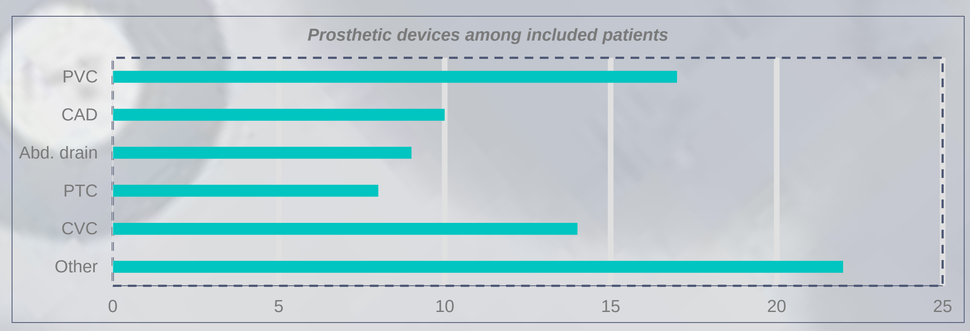
METHOD

Between 2017 and 2021, 26 clinical isolates were identified by routine cultivation and susceptibility testing, followed by whole-genome sequencing (WGS) on an Illumina platform. Bacdist performed SNP-analysis and phylogenetic tree. Environmental swabs and linezolid (LZD) consumption were analysed during the outbreak.

RESULTS & DISCUSSION

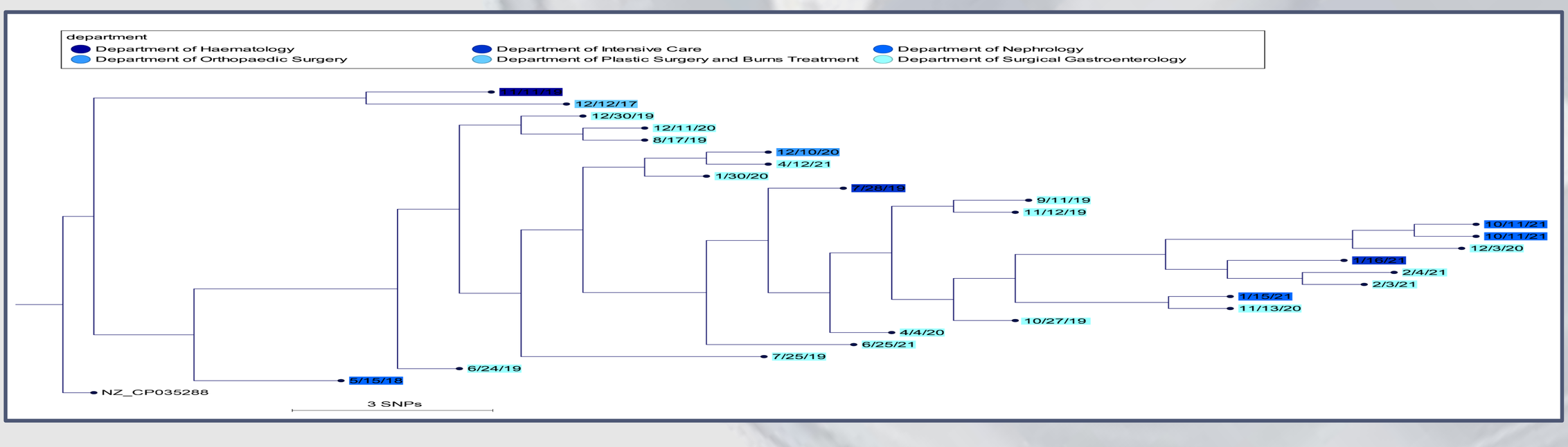
All isolates of LRSE were confirmed to belong to the clone ST22 with 1-60 SNP variations. Most patients had multiple prosthetic devices, which are thought to play an important portal of entry for LRSE, though LRSE was not found on any environmental swabs. During the outbreak, 0.15% of hospitalised patients at University Hospital of Copenhagen, Rigshospitalet were given LZD, and the Department of Surgical Gastroenterology constituted 21.4% of the overall consumption of Rigshospitalet.





CONCLUSION

The molecular epidemiology of the outbreak showed an HAI outbreak with the same clone of LRSE. LZD consumption and lack of infection control are thought to play an important role.



References

1. Richards MJ, Edwards JR, Culver DH, Gaynes RP. Nosocomial infections in medical intensive care units in the United States. National Nosocomial Infections Surveillance System. Crit Care Med 1999; 27:887.
2. Wisplinghoff H, Bischoff T, Tallent SM, et al. Nosocomial bloodstream infections in US hospitals: analysis of 24,179 cases from a prospective nationwide surveillance study. Clin Infect Dis 2004; 39:309.
3. Weinstein MP, Towns ML, Quartey SM, et al. The clinical significance of positive blood cultures in the 1990s: a prospective comprehensive evaluation of the microbiology, epidemiology, and outcome of bacteremia and fungemia in adults. Clin Infect Dis 1997; 24:584.
4. Herwaldt LA, Geiss M, Kao C, Pfaller MA. The positive predictive value of isolating coagulase-negative staphylococci from blood cultures. Clin Infect Dis 1996; 22:14.
5. Pfaller MA, Herwaldt LA. Laboratory, clinical, and epidemiological aspects of coagulase-negative staphylococci. Clin Microbiol Rev 1988; 1:281.
6. Gemmell CG. Virulence characteristics of Staphylococcus epidermidis. J Med Microbiol 1986; 22:287.
7. Males BM, Rogers WA Jr, Parisi JT. Virulence factors of biotypes of Staphylococcus epidermidis from clinical sources. J Clin Microbiol 1975; 1:256.
8. Suetens C, Latour K, Kärki T, Ricchizzi E, Kinross P, Moro ML, Jans B, Hopkins S, Hansen S, Lyytikäinen O, Reilly J, Deptula A, Zingg W, Plachouras D, Monnet DL, The Healthcare-Associated Infections Prevalence Study Group. Prevalence of healthcare-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016 to 2017. Euro Surveill. 2018 Nov;23(46) [PMC free article] [PubMed]
9. Vincent JL, Bihari DJ, Suter PM, Bruining HA, White J, Nicolas-Chanoin MH, Wolff M, Spencer RC, Hemmer M. The prevalence of nosocomial infection in intensive care units in Europe. Results of the European Prevalence of Infection in Intensive Care (EPIC) Study. EPIC International Advisory Committee. JAMA. 1995 Aug 23-30;274(8):639-44. [PubMed]
10. Souvenir D, Anderson DE Jr, Palpant S, et al. Blood cultures positive for coagulase-negative staphylococci: antisepsis, pseudobacteremia, and therapy of patients. J Clin Microbiol 1998; 36:1923.
11. Kirchhoff LV, Sheagren JN. Epidemiology and clinical significance of blood cultures positive for coagulase-negative staphylococcus. Infect Control 1985; 6:479.
12. Climo M, Diekema D, Warren DK, Herwaldt LA, Perl TM, Peterson L, Plaskett T, Price C, Sepkowitz K, Solomon S, Tokars J, Fraser VJ, Wong E. Prevalence of the use of central venous access devices within and outside of the intensive care unit: results of a survey among hospitals in the prevention epicenter program of the Centers for Disease Control and Prevention. Infect Control Hosp Epidemiol. 2003 Dec;24(12):942-5. [PubMed]
13. Rosenthal VD, Maki DG, Jamulitrat S, Medeiros EA, Todi SK, Gomez DY, Leblebicioglu H, Abu Khader I, Miranda Novales MG, Berba R, Ramirez Wong FM, Barkat A, Pino OR, Duenas L, Mitrev Z, Bijie H, Gurskis V, Kanj SS, Mapp T, Hidalgo RF, Ben Jaballah N, Raka L, Gikas A, Ahmed A, Thu le TA, Guzmán Siritt ME., INICC Members. International Nosocomial Infection Control Consortium (INICC) report, data summary for 2003-2008, issued June 2009. Am J Infect Control. 2010 Mar;38(2):95-104.e2. [PubMed]
14. Arefian H, Hagel S, Fischer D, Scherag A, Brunkhorst FM, Maschmann J, Hartmann M. Estimating extra length of stay due to healthcare-associated infections before and after implementation of a hospital-wide infection control program. PLoS One. 2019;14(5):e0217159. [PMC free article] [PubMed]