Best clinical practice of disinfection in intravenous device therapy contaminated with *Klebsiella pneumoniae*

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1. Background

- *Klebsiella pneumoniae* is a gram-negative bacteria. The treatment of infections from these bacteria in children is more challenging due to limited appropriate antibiotic use in this specific group (Akturk et al., 2016).

Image 1: *Klebsiella pneumoniae*. *Available at:* SCIENCE PHOTO LIBRARY/ALAMY STOCK PHOTO

1. Background

- Microbiological clinical research conducted in São Paulo, Brazil, with three-way surfaces, highlighting the presence of gram-negatives like *Klebsiella pneumoniae* in 9% of the devices (Rossini et al., 2017).

- Studies show deviations from scientific evidence, nurses' lack of knowledge about certain actions associated with the care of catheters and weakness in the professional training of nurses about infection control protocols (Salgueiro-Oliveira et al., 2019; Boeira et al., 2019).

1. Background and Research question

- Evidence-based research is necessary to understand best practice methods for the decontamination of needle-free devices (Kelly et al., 2017) such as network cables intravenous therapy new-born access (Polifix® - B Braun).

- Research question:

What are the best ways to disinfect peripheral venous catheter connectors that are contaminated with *Klebsiella pneumoniae*?

2. Aim

- To verify the effectiveness of two different chemical disinfection methods in reducing the bacterial load of *Klebsiella pneumoniae* in the Polifix® for peripheral venous catheters.

3. Methods

- Experimental research.

3. Methods

- Phase 1

Polifix® were contaminated with 0.5 McFarland in the proportion 1:100CFU/ml in 0.9%NaCl with *Klebsiella pneumoniae ATCC*® 700603 ™.

3. Methods

- Phase 2

Two disinfection methods were adopted: 70% Isopropyl Alcohol single-use cap (Site-scrub®) and 70% Ethanol alcohol in sterile gauze.

3. Methods

- Phase 3

The device passed thought vortex and ultrasonic bath 40kHz, for recuperation. Then, 100 µl of the solution was put on a plate with TSA and it was incubated for 24 hours at 35°C±1.

- The number of CFU was counted. The Kruskal-Wallis test and Post hoc teste de Conover were performed for data analysis.

4. Results

- The total of 27 in vitro experiments were performed. The experience was significant, with a p = 0.045169.

- The comparison between 70% Isopropyl Alcohol single-use cap (Site-scrub®) and 70% Ethanol alcohol in sterile gauze showed a difference, where Site-scrub® had a median of 101.00 CFU and the other had 139.50 CFU per plate.

4. Results

Table 1: Comparative effectiveness of each disinfectant type to reduce bacterial load

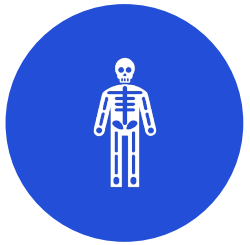
				Post-hoc (Conover)*
Treatments	n	CFU median	% reduction in bacterial load	Different from treatments
(1) Positive Control	6	637.5	-	(2) (3)
(2) 70% Ethanol	6	139.5	78.12	(1)
(3) 70% IPA single-use cap	9	101	84.16	(1)
(4) Non-treated Control	6	0	-	-

* p=0.045169

5. Brief Discussion

THERE IS A DIFFERENCE BETWEEN DISINFECTION METHODS.

HEALTH EDUCATION AND INTERVENTION PROTOCOLS FOR THE PREVENTION OF BLOODSTREAM INFECTIONS WHEN HANDLING CONNECTORS SHOULD BE A PRIORITY FOR PATIENT SAFETY.



THE REDUCTION IN THE RISK OF CONTAMINATION IS ASSOCIATED WITH DISINFECTION OF THE INTRAVENOUS CATHETER WITH AN APPROPRIATE ANTISEPTIC, FOR EXAMPLE, CHLORHEXIDINE, IPA OR ALCOHOL 70% (JANE ET AL, 2019).

6. Conclusions, implications for practice and limitations

The two different chemical disinfection methods were effective to reduce bacterial load in Polifix® device.

Although both reduced *Klebsiella pneumoniae* bacteria load, Site Scrub® showed better performance to reduce the CFU per plate.

It is necessary to test the disinfection methods by clinical research as a next step.

6. Conclusions, implications for practice and limitations

Limitations:

Non-use of alcoholic chlorhexidine for active disinfection.

Another limitation is the use of only one microorganism for contamination, which does not reflect the reality of clinical practice.

Other variables need to be tested.

7. Acknowledgments and conflict of interest

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- No conflict of interest.

8. References

- Bassetti M, Poulakou G, Ruppe E, Bouza E, Van Hal SJ, Brink A. Antimicrobial resistance in the next 30 years, humankind, bugs and drugs: a visionary approach. Intensive Care Med. 2017;43:1464–75
- Bhatia M, Loomba P S, Mishra B, Dogra V, Thakur A. Reduced susceptibility of carbapenem-resistant Klebsiella pneumoniae to biocides: An emerging threat. Indian J Med Microbiol [serial online] 2016 [cited 2020 Mar 15];34:355-8. Available from: http://www.ijmm.org/text.asp?2016/34/3/355/18834
- Jane D. Siegel, MD; Emily Rhinehart, RN MPH CIC; Marguerite Jackson, PhD; Linda Chiarello, RN MS; the Healthcare Infection Control Practices Advisory Committee. 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings Last update: July 2019. Link: https://www.cdc.gov/infectioncontrol/pdf/guidelines/isolation-guidelines-H.pdf
- Kelly L, Jones T, Kirkham S. Needlefree devices: keeping the system closed. Br J Nurs. 2017;26(2):S14–9. Available at: https://www.magonlinelibrary.com/doi/full/10.12968/bjon.2017.26.2.S14
- Karruli A, Andini R, Corcione A, Durante-Mangoni E. Prevention and control of intensive care unitacquired carbapenem-resistant Klebsiella pneumoniae: need for a multimodal approach. Ann Transl Med 2019;7(Suppl 8):S325. doi: 10.21037/atm.2019.09.130
- Rosenthal, Victor Daniel. Impact of needle-free connectors compared with 3-way stopcocks on catheter-related bloodstream infection rates: A meta-analysis. American Journal of Infection Control, Volume 48, Issue 3, March 2020, Pages 281-284. Doi: https://doi.org/10.1016/j.ajic.2019.08.015
- Salgueiro-Oliveira AS, Bastos ML, Braga LM, Arreguy-sena C, Melo MN, Parreira PMSD. Práticas de enfermagem no cateterismo venoso periferico: a flebite e a segurança do paciente doente. Texto Contexto Enferm [Internet]. 2019 [acesso MES ANO DIA]; 28:e20180109. Disponivel em: http://dx.doi.org/10.1590/1980-265X-TCE-2018-0109
- Akturk, Hacer, Sutcu, Murat, Somer, Ayper, Aydın, Derya, Cihan, Rukiye, Ozdemir, Aslı, Coban, Asuman, Ince, Zeynep, Citak, Agop, & Salman, Nuran. (2016). Carbapenem-resistant Klebsiella pneumoniae colonization in pediatric and neonatal intensive care units: risk factors for progression to infection. Brazilian Journal of Infectious Diseases, 20(2), 134-140. Available at: https://dx.doi.org/10.1016/j.bjid.2015.12.00
- Rossini FP, Andrade D, Santos LCS, Ferreira AM, Tieppo C, Watanabe E. Microbiological testing of devices used in maintaining peripheral venous catheters. Rev. Latino-Am. Enfermagem. 2017;25:e2887. DOI: http://dx.doi.org/10.1590/1518-8345.1528.2887. mês dia ano
- Flynn JM, Larsen EN, Keogh S, Ullman AJ, Rickard CM. Methods for microbial needleless connector decontamination: A systematic review and meta-analysis. Am J Infect Control. 2019;47(8):956–962. doi:10.1016/j.ajic.2019.01.002

Thank you very much!

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