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Published

2023

Journal Title

Australian Critical Care

Version

Accepted Manuscript (AM)

DOI

10.1016/j.aucc.2023.05.004

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How often are infusion sets for central venous catheters changed in Australian and New Zealand Intensive Care Units? A point prevalence survey

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Key words : intensive care; infusion sets; central venous catheters

Abstract

Background

Infusion sets (comprising the tubing, measuring burettes, fluid containers, transducers) that are connected to invasive vascular devices are changed on a regular basis in an effort to reduce bacterial colonisation and bloodstream infection. There is a balance between reducing infection and creating unnecessary waste. Current evidence suggests that for central venous catheters, changing infusion sets at 7 days does not increase infection risks.

Objectives

To describe the current unit guidelines in Australian and New Zealand ICUs for changing infusion sets for central venous catheters.

Methods

Prospective cross-sectional point prevalence study, as part of the 2021 ANZICS Point Prevalence Program.
Participants: ANZ adult ICUs and their patients on the day of the study.

Results

Data were collected from 51 ICUs across Australia and New Zealand (ANZ). One third of these (16/49) of ICUs had a guideline that specified a 7-day replacement period, with the rest having a more frequent replacement period.

Conclusion

Most ICUs participating in this survey had policies to change their CVC infusion tubing at 3-4 days, and recent high-level evidence supports an update to extend this to 7 days. There remains work to be done to spread this evidence to ANZ ICUs and improve environmental sustainability initiatives.

Introduction

An infusion set comprises multiple parts: thin plastic tubing, fluid containers, pressure monitoring transducers, blood sampling ports, measuring burettes, extension tubing and needleless connectors.(1) This tubing set is connected to a bag/syringe of medication or fluid to administer intravenous therapy via a central venous catheter (CVC) or similar invasive device. The timeframe for replacing infusion sets varies between institutions, and represents a balance between attempting to reduce catheter related bloodstream infections (CRBSIs), and the workload and financial and environmental waste that replacing them creates. (2–4)Prevention of CRBSIs is important as they are attributable for approximately 70% of all healthcare associated bloodstream infections.(5) On the other hand, replacement of infusion sets involves disconnecting the set from the catheter in situ with the potential for introduction of infection, and subsequent discarding and replacement of all tubing medication and fluids.(6,7)

A randomised controlled trial conducted by Rickard et al. in 2021 (RSVP trial), compared 7 day and 4 day infusion set replacement intervals for the prevention of CRBSIs, showing these to be equivalent.(7) The trial results confirm that extension of infusion set replacement to 7 days can be safely done with notable cost and workload reductions.[7] To understand the translation of this evidence into practice, we sought to understand the current guidelines in place in Australian and New Zealand ICUs.

Methods

We performed a prospective cross-sectional point prevalence study in Australian and New Zealand adult ICUs, as part of the Point Prevalence Program (PPP; a collaboration between the Australian and New Zealand Intensive Care Society Clinical Trials Group ANZICS CTG and The George Institute for Global Health), on the 8th or 23th June, 2021. There are 223 ICUs in Australia and New Zealand. The authors consulted prior related studies for relevant questions about ICU waste and environmental sustainability queries.(8–10) Two questions specific to replacement of infusion sets were included : “Does your ICU have a documented protocol/ policy or guideline for the replacement of CVC infusion sets” and “When is the replacement of the CVC infusion set as in the guideline?" (Appendix 1). All Australian sites had ethics approval with the majority of participating sites approved under one National Mutual Acceptance Low or Negligible Risk application approved by the lead ethics committee (Sydney Local Health District – Royal Prince Alfred Zone Ethics Committee; X18-0511 & HREC/18/RPAH/732) and New Zealand sites were approved by the Northern B Health and Disability Ethics Committee (HDEC ref: MEC/09/28/EXP). Research coordinators at each site entered the patient data via an online case report form using REDcap (Research Electronic Data Capture). Statistical analyses were performed using Stata 17 (StataCorp, Texas, USA). Categorical data were summarised using number (percentage), and proportions were compared using the Fisher exact test; continuous data were summarised as mean (standard deviation), or summarised as median (interquartile range [IQR]) and compared with Mann–Whitney (Wilcoxon rank sum) test.

Results

Data were collected from 51 ICUs across Australia and New Zealand (Table 1). 49 ICUs (96.1%) had a documented CVC infusion tubing set protocol, policy or guideline. One third of these (16/49) of ICUs had a guideline that specified a 7-day replacement period (Table 1). There was no association between the CVC infusion set replacement period and the characteristics of the ICU, having a hospital sustainability officer, being part of the Global Green and Healthy Hospitals network and the ICU infusion replacement set guideline.

Table 1: Characteristics of the ICU and infusion set policy

Characteristics of ICU	**n = 51 (to nearest %)**
Metropolitan Rural	46/51 (90%) 5/51 (10%)
Public Private	45/51 (88%) 6/51 (12%)
Hospital part of Global Green & Healthy Hospitals Network	25/51 (49%)
Hospital has a sustainability officer	28/51 (55%)
ICU participates in recycling - yes	47/51 (92%)

- no	4/51 (8%)
Documented CVC infusion tubing set protocol, policy or guideline - yes - no	49/51 (96%) 2/51 (4%)
Documented CVC infusion tubing set protocol, policy or guideline interval - 12 hours 2 days 3 days 4 days 7 days	n = 49 1/49 (2%) 1/49 (2%) 12/49 (24%) 19/49 (39%) 16/49 (33%)

Discussion

Most ICUs participating in this survey had policies to change their CVC infusion tubing at 3-4 days, and recent high-level evidence supports an update to extend this to 7 days. Based on the cost outcomes of Rickard et al, changing to a 7-day cycle would have considerable economic (mean cost savings of AU$483 per central venous catheter) and waste benefits,, but most notably, a reduction in nursing workload of multiple hours (median 174 minutes) per device.(7)

There was no association between membership in the Global Green and Healthy Hospitals network or a hospital sustainability officer and the likelihood of changing the infusion tubing set interval. This is important as it reflects the need for local ICU champions who are aware of the latest evidence to bring about change, and the integral role of clinicians in leading the ICU away from low value/high carbon care. ICU expertise is required as there are significant nuances involved, such as the types of lines not included in the primary literature – lipid containing infusions (propofol, TPN) and vasoactive agents. At the hospital of one of the authors, an effort to alter this guideline required: the authorisation of the infection control department, and extended time to negotiate with stakeholders since the ICU guideline was part of a larger hospital wide guideline. While the RSVP trial showed no difference in infection rates, as with any ICU behaviour changes potentially altering iatrogenic infections, ongoing vigilance is required by the ICU and infection prevention teams.

Finally, it is important to note that our survey took place only one year after the publication of the RSVP trial, which may or may not have been enough time for change to have occurred. At the time of the design of the RSVP trial, co-production was not incorporated into the design, which is a feature that might augment the translation of research into practice.(11) Furthermore, not all ICUs in Australia and New Zealand participated and non-responders may have been more or less likely to have policies or updated policies. Nonetheless, with the recent publication of the ANZICS sustainability toolkit, this is an area of practice that ICUs could look at to improve their impact and nursing workload.(12)

Conclusions

This survey has highlighted the need for further interventions to assist with units changing to CVC infusion set replacement intervals of 7 days.

Funding : No funding was provided for this study.

CREDIT statement

MAn: Conceptualization, Investigation, Methodology, Writing-original, Analysis, Supervision **NM** : Writing-original, Analysis. **CR:** Methodology, Writing- Reviewing and Editing. **NH & SK***:* Data curation, Investigation. Writing- Reviewing and Editing, **FM**: Conceptualization, Methodology, Writing - Reviewing and Editing.

Acknowledgements:

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Maroondah Hospital, Ringwood East, VIC	Graeme Duke, Stephanie Hunter, Julie Evans, Dianne Parker, Clare Loughnan, Marina Doyle
Mater Hospital, Brisbane, QLD	Katherine Jongebloed, Mackenzie Finnis, Jane Wilson
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Royal Perth Hospital, Perth, WA	Anton Leonard, Sharon Waterson
Royal Prince Alfred Hospital, Sydney, NSW	Jennifer Coles, , Heidi Buhr, ,Duncan Newman, Piyaporn Boorawong, Vanessa Bregolin, Ji-Hyun Yun
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Conflicts of interest : Dr Anstey, McGain are members of the Doctors for the Environment Australia.

Dr Rickard's employers (the University of Queensland/Griffith University) have received investigator initiated research/education grants from 3M, BD, Cardinal health, Eloquest and consultancy payments from 3M, and ITL Biomedical, unrelated to this project.

Data availability: The data that support the findings of this study are available from the corresponding author, MA, upon reasonable request, and subsequent approval from the governing ethics committee.

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Appendix 1. Questions from the point prevalence survey.

Sustainability

16 I__ __ . __I °C Ambient temperature in the ICU during study day

17 I__ __ . __I °C Maximum outside temperature during study day

18 Y N Staff in ICU can adjust the temperature within the ICU/unit

19 Y N ICU participates in recycling

If No, *(go to question* ***21****)*

If Yes, *(go to question* ***20****)*

20 Items recycled in your ICU *(select all that apply)*

- Y Soft plastics
- Y Hard plastics
- Y Paper
- Y PVC
- Y Metal

21 Y N Does your hospital have a sustainability officer?

22 Y N Is your hospital part of the Global Green and Healthy Hospitals Network or similar network of hospitals working on sustainability?

23 Y N Does your ICU have a documented protocol, policy or guideline for the replacement of CVC infusion tubing sets?

If No, *(go to question* ***25****)*

If Yes, *(go to question* ***24****)*

24 When is replacement of CVC infusion tubing sets as documented in the protocol, policy or guideline *(select only one)*

- Y 7 days
- Y 4 days
- Y Other *(please specify)* ______________________________