



A retrospective data analysis in a general ICU population: acute dialysis catheter type and dialysis efficiency

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Background and Objective

Background

- Acute kidney injury (AKI) affects over 50% of ICU patients¹, and dialysis efficiency is essential for patients and providers
- Renal Replacement Therapy (RRT) is commonly used in critical care settings to treat AKI²
- RRT efficiency is critical to delivering the prescribed dialysis dose, minimizing complications, and reducing alarm fatigue^{3,4,5}
- Literature is limited regarding the association between RRT efficiency and dialysis equipment^{2, 6-7}
- Findings from three single-centered Australian studies suggested a link between catheter type and circuit life
- Multicenter studies with a holistic approach to RRT efficiency are needed to investigate the potential impacts of dialysis catheters on patients and providers

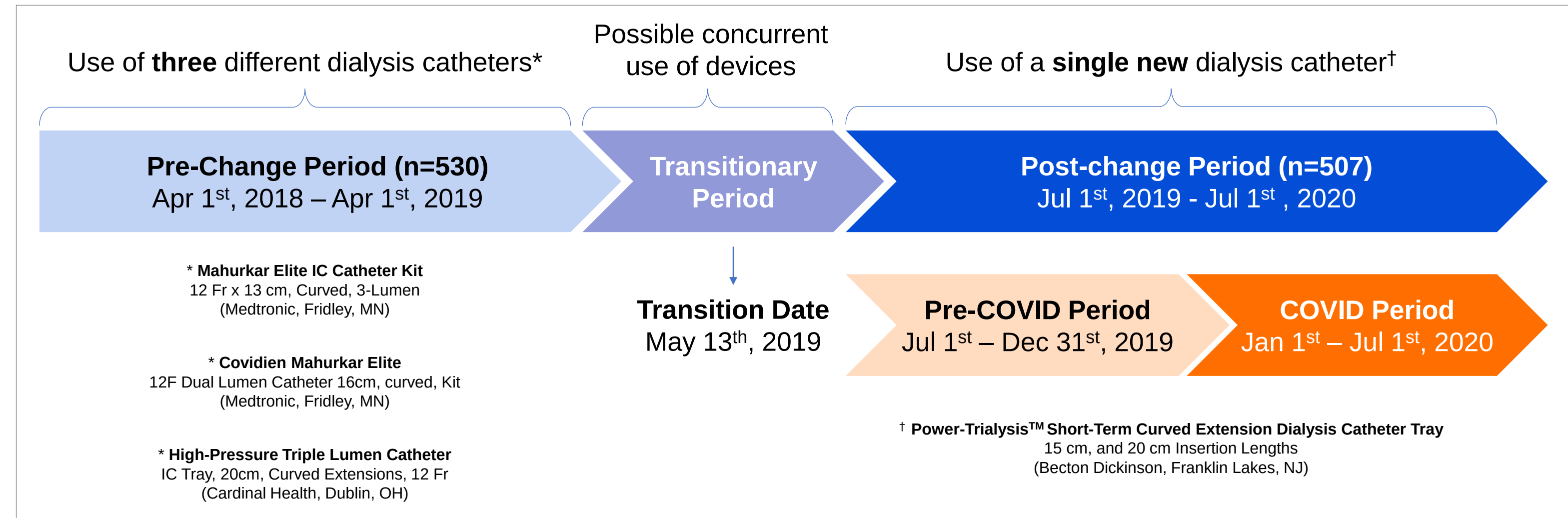
Objective

- This multicenter retrospective analysis evaluates the associations between catheter type and RRT efficiency in the ICUs of two U.S. hospitals using a comprehensive set of efficiency metrics

Methods

Study design

- A retrospective, multicenter study was conducted from April 2018 to July 2020 using data from 1,037 RRT sessions in two U.S. ICUs
- We collected the relevant data from the dialyzers and investigated the potential impacts of catheter selection on a set of efficiency metrics by comparing RRT sessions before and after the catheter change
 - Both units replaced three different acute dialysis catheters with a single new catheter in May 2019
 - Study intervals were divided into pre-/post-change periods, excluding a transition period (April-June 2019)
 - To evaluate the pandemic's effects, the post-change period was further divided into pre-COVID and COVID contemporaneous periods



Outcome Measures Utilized to Evaluate RRT Efficiency

Circuit life	Alarm interruptions	Type of treatment termination	Blood flow rate
Sum of filter run time from RRT initiation to termination	Freq. of alarms, and a subset indicating VA-related issues	Elective (i.e., intentional), and non-elective (i.e., unexpected)	Volume of blood (in mL) flowing per minute

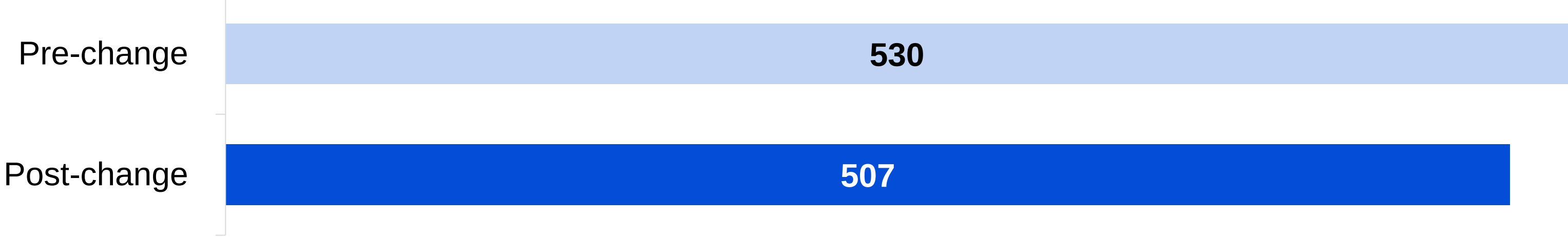
Results

Figure 1. Comparison of pre-change and post-change sessions in RRT efficiency metrics

↑ ⌚	31% increase in mean <u>circuit life</u>	(p < 0.001) ^a 7.8 ± 10.4 to 9.9 ± 10.6 hrs
↓ ❤️	20% decrease in mean freq. <u>VA-related interruptions</u>	(p = 0.014) ^b 2.5 ± 4.4 to 1.7 ± 3.2
↓ ⚡	5% decrease in mean freq. <u>all alarm interruptions</u>	(p = 0.31) ^b 7.4 ± 7.1 to 6.6 ± 5.7
↓ ✖	58% decrease in likelihood <u>non-elective terminations</u>	(p < 0.001) ^c 484/530 to 417/507
↑ 💧	3% increase in mean <u>blood flow rate</u>	(p = 0.003) ^a 223.3 ± 34.5 to 231.7 ± 32.1 mL/min

Statistical models used: ^a Generalized Linear Model with gamma distribution and log link function, ^b Generalized Linear Model with negative binomial distribution and log link function, ^c Logistic regression

Figure 2. RRT session volume in pre-change and post-change sessions



After adjusting for potential confounding variables*, changing the catheter type improved:

- Circuit life
- Alarm interruptions
- VA-related alarm frequency
- Proportion of unexpected session terminations
- Blood flow rate

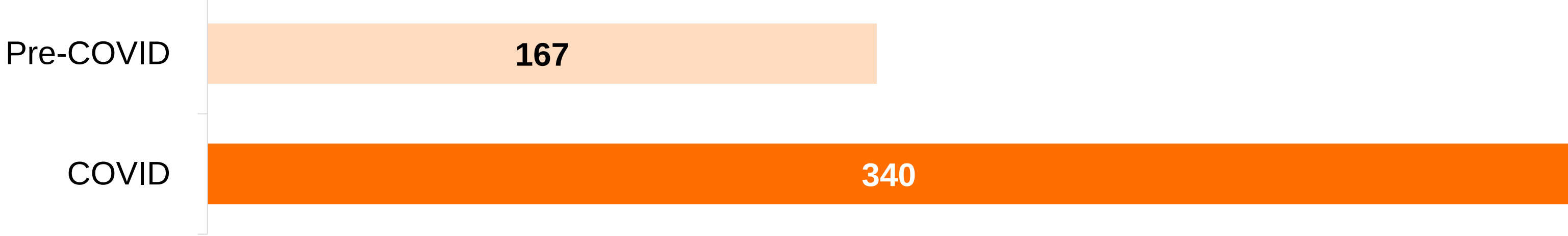
*All models were adjusted for differences in mean values of Access Pressure, Vascular Pressure, Effluent Pressure, Ultrafiltration Rate, and Therapy Rate

Figure 3. RRT efficiency metrics in post-catheter change: Pre-COVID and COVID sessions

⌚	Circuit life (p = 0.99) ^a 9.9 ± 12.0 to 9.9 ± 9.9 hrs	❤️	VA-related interruptions (p = 0.991) ^b 1.7 ± 3.5 to 1.7 ± 3.0
⚡	All alarm interruptions (p = 0.304) ^b 6.3 ± 6.0 to 6.8 ± 5.6	💧	Blood flow rate (p = 0.276) ^a 229.3 ± 31.0 to 232.9 ± 32.6 mL/min
↓ ✖	61% decrease in proportion of <u>non-elective terminations</u>		(p = 0.002) ^c 151/507 to 266/507

Statistical models used: ^a Generalized Linear Model with gamma distribution and log link function, ^b Generalized Linear Model with negative binomial distribution and log link function, ^c Logistic regression

Figure 4. RRT session volume in post-change: pre-COVID and COVID sessions



In the post-change period, after adjusting for potential confounding variables*

- RRT sessions that occurred during and before the COVID-19 pandemic were similar regarding the dialysis efficiency
- The only significant difference was a decreased proportion of non-elective terminations in the COVID contemporaneous period
- There was also a notable increase in RRT session volume (167 vs. 340) after the onset of the pandemic

*All models were adjusted for differences in mean values of Access Pressure, Vascular Pressure, Effluent Pressure, Ultrafiltration Rate, and Therapy Rate

Conclusions

- Our findings suggest that changing catheter type may lead to longer and more efficient RRT sessions with fewer interruptions
- More efficient RRT sessions may have significant benefits for patients and providers such as reducing complications, minimizing provider burnout, and improving clinical efficiency
- RRT sessions during and before the COVID-19 period were largely similar from an efficiency perspective; however, the session volume increased during the pandemic, which may be due to:
 - An increase in the number of ICU patients admitted during the pandemic months
 - Patients diagnosed with COVID-19 were more likely to develop AKI and require RRT⁸

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