Haemodiafiltration Relative Infection Risk: A Comparative Analysis of Two Dialysis Machines

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Introduction

Cleansing blood in an extracorporeal circuit carries an inherent risk of introducing bacteria and viruses into a patient's bloodstream. This has a number of patient-, health service- and economy-related repercussions:

- Infection is the second leading cause of death among dialysis patients, accounting for 33 deaths/1,000 patient-years in the US Renal Data System cohort 2001–2003[1]
- The cost associated with haemodialysis (HD) central venous catheter (CVC) infections is estimated at 17,000–32,000 USD per episode and is predicted to drive the majority of the cost associated with dialysis use[2]
- Healthcare professionals and operators are subject to high levels of stress which can significantly affect quality of care[3,4]

The risk of infection to patients and to HD machine operators is primarily associated with a series of necessary handling steps in the dialysis process, and the need to open the blood circuit for reinfusion of blood to terminate HD treatment. Reducing the number of handling steps in the dialysis process may minimise the likelihood of dialysis-related infections and lead to reduced anxiety for the patient and the operator, allowing increased time for direct patient care and education.

Objectives

The primary objective of this head-to-head comparative analysis was to assess points at which infection could be transmitted when using two HD machines — 5008 CorDiax (current standard of care) and 6008 CAREsystem — to establish whether relative infection risk was lower with one machine than the other.

A secondary objective was to establish whether operating complexity could be reduced without affecting dialysis performance in the haemodiafiltration (HDF) setting, to free up more time for operators to focus on providing high-quality patient care.

Methods

A comparison of the set-up and use of 5008 CorDiax and 6008 CAREsystem was undertaken across two patient groups: single-fistula patients and catheter patients. A series of parameters, including an observation grid, video analysis, patient groups, and environment, were measured on each machine to assess:

- The number of major touchpoints relevant to infection transmission
- The number of operator process handling steps when performing HDF

Results

- In contrast to 5008 CorDiax, 6008 CAREsystem uses a closed disposable cassette, the 6008 CAREset (Figure 1), that connects automatically with the integrated infusion port. The 6008 CAREset requires no manual manipulation and does not need to be connected to an external substitution port, thereby helping to substantially reduce infection-related risk steps
  - The proportion of touchpoints critical to hygiene and major process steps was 27% less with 6008 CAREsystem than with 5008 CorDiax (22 *vs* 30) for fistula patients, and 23% less (27 *vs* 35) for catheter patients (Table)
  - The switch from an infusion line to an integrated infusion port, and the lack of venous chamber in 6008 CAREset compared with 5008 CorDiax blood line, resulted in fewer opportunities for microbial infection
  - The weight and volume of 6008 CAREset also reduced costs associated with contaminated waste
  - Unlike 5008 CorDiax, 6008 CAREsystem allowed the operator to reinfuse blood through the extracorporeal blood line without disconnecting the arterial line from the arterial needle (single-fistula patient group), further reducing operator handling steps and promoting aseptic practice

Table: Number of major touchpoints critical to patient safety and hygiene

	5008 CorDiax		6008 CAREsystem	
	Catheter	Fistula	Catheter	Fistula
Total number of major critical touchpoints	35	30	27	22

- There was at least a 24% reduction in the number of major handling steps per HDF treatment (fistula patients) with 6008 CAREsystem compared with 5008 CorDiax (93 *vs* 122; Figure 2)
- The reduction in steps was a result of several factors, including pre-connected blood line tubes, streamlined setup, and the straightforward nature of manual connections in 6008 CAREsystem (Figure 3)

Figure 2: Number of major handling steps per HDF treatment

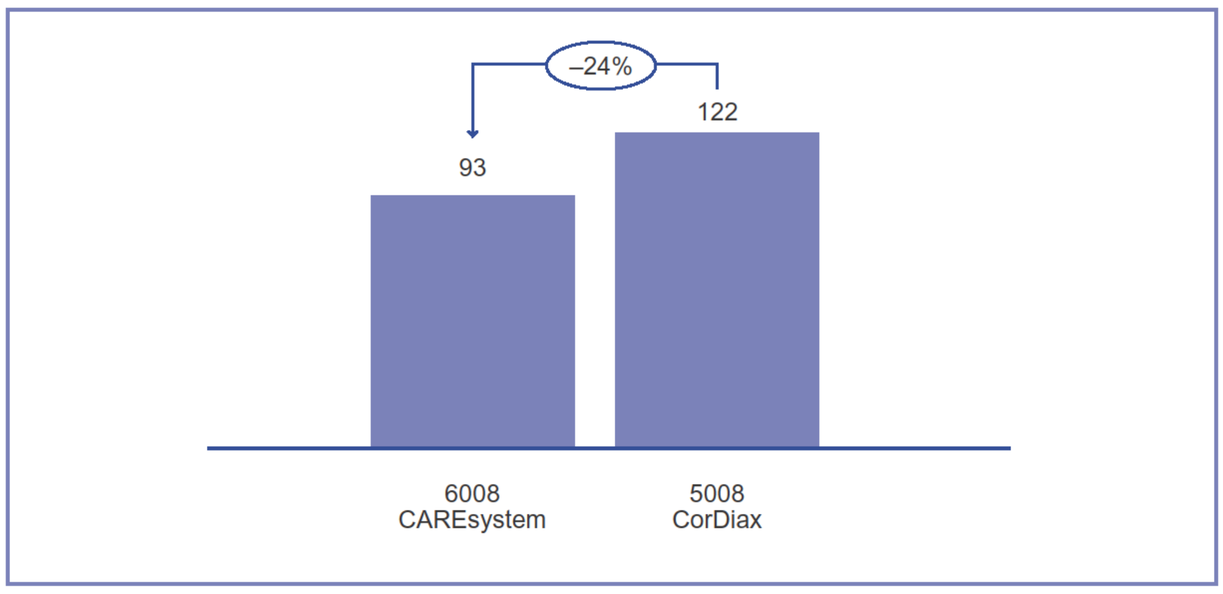


Figure 3: Operator steps critical to successful machine use

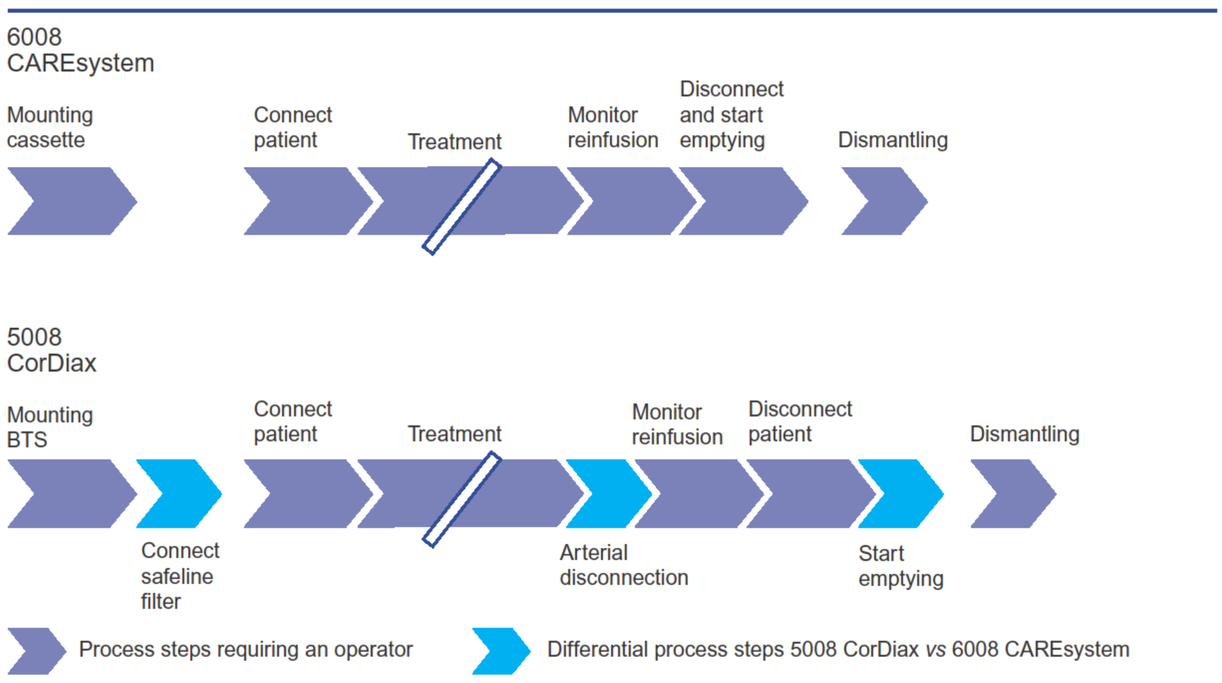
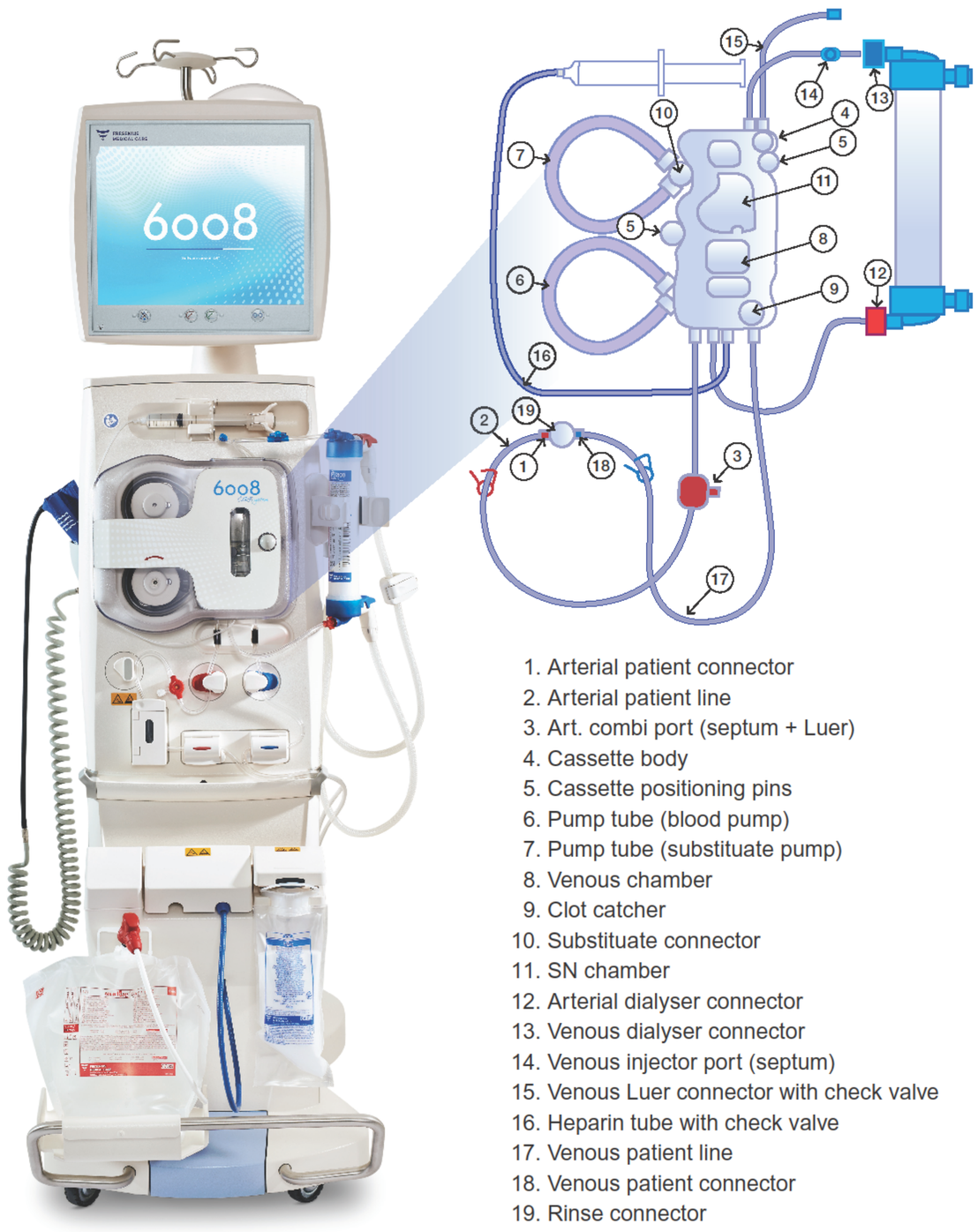


Figure 1: 6008 CAREsystem and 6008 CAREset



Conclusions

Our findings indicate that the potential risk for HD infection transfer is lower with 6008 CAREsystem than with 5008 CorDiax and, potentially, other available HD systems not incorporating an integrated, low-touch disposable component with minimal handling instead of a standard blood line system. These results are especially relevant to CVC patients, for whom infection is a particular source of morbidity and mortality.[5]

As well as reducing the risk of infection, our findings show that, compared with 5008 CorDiax, 6008 CAREsystem offers a more efficient HDF operating process, providing the potential to reduce work-related pressure for operators and resulting in more patient face-time — potentially translating into an overall improved level of care quality and safety than with existing HD equipment.

References

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