How-to Guide

Introducing Blood-flow Dependent Dialysate Flows in Haemodialysis

Published in November 2025 by :

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How-to Guide: Introducing Blood-flow Dependent Dialysate Flows in Haemodialysis

Project: Sustainable Kidney Care – Implementing Best Practice

Collaboration: UK Kidney Association and Centre for Sustainable Healthcare

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Although this guide has been developed by experts in sustainability and sustainable kidney care, local teams should use their discretion in its implementation according to local context and requirements

Introduction

Haemodialysis is a resource-intensive therapy, contributing significantly to the carbon footprint of kidney care. Among the factors influencing resource use, dialysate flow rate (Qd) represents a modifiable element that can lead to substantial environmental and financial savings through minimising demand for purified water as well as concentrates. Traditionally, many haemodialysis units operate machines at a fixed Qd in a range between 700 - 800 ml/min, regardless of patient characteristics or clinical need. Emerging evidence and technological advances now support a more individualised and sustainable approach without compromising dialysis adequacy. Newer machines (such as Fresenius Autoflow (TM) , Nipro Dialysate Flow Factor, Nikkiso Flow Adaptor) feature a mode that moderates Qd in relation to Qb (blood flow) within a programmable range of factors, e.g. Qd 1.2 (for haemodiafiltration) or 1.5 (for haemodialysis) × Qb. (1)

This guide outlines a practical and safe method to implement dialysate flow reduction, supported by clinical evidence, quality improvement data, and experience from centres already trialling this intervention, such as the TRUNC-HD project.(2)

Step-by-Step Implementation

1. Understand the Rationale

Blood flow (Qb) should remain the main focus when ensuring dialysis clearance; the impact of increasing dialysate flow (Qd) from 500 to 800 ml/min is marginal relative to the impact of a 50 ml/min increase in Qb, Figure 1. (3-5)

Thus, reducing Qd from 800 to 500 ml/min results in a marginal reduction in spKt/V (approx. 0.08) and URR (~3.4%) (6)—differences not typically clinically significant, especially in patients with adequate dialysis duration and blood flow.

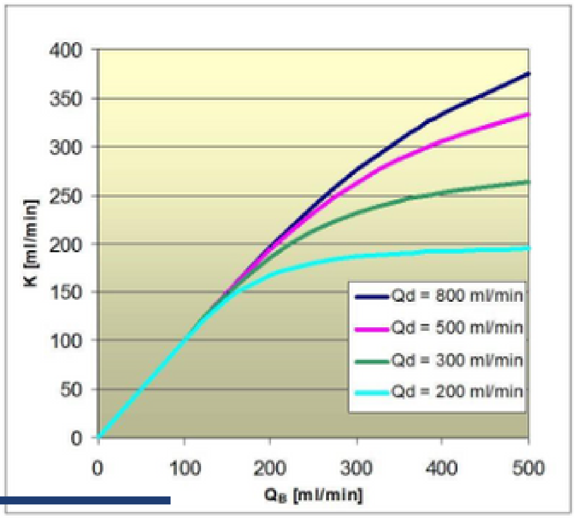

Fig 1. Impact of blood flow related to dialysis clearance

Preliminary data from a small multicentre evaluation in Northern England (TRUNC-HD project) suggest that extending dialysis time by 9–11 minutes may achieve equivalent urea clearance to increasing Qd from 500 to 800 mL/min. Greater Glasgow and Clyde monitored all patients' urea reduction ratio (URR) for 3 months pre- and post-implementation of a 1.5 x Qb ratio dialysate flow. Fewer than 5% of patients had a reduction in their average URR. While both cases are unpublished, these findings align with prior evidence and support time-based rather than dialysate flow-based adequacy optimisation.

Environmental benefits include significant reductions in water, dialysate concentrate (estimated between 9% and 28% depending on comparison Qd, and HD versus HDF) (7,8), electricity, and bicarbonate usage (i.e. less dialysate permits the use 650g bibags rather than 900g bibags in case of Fresenius).

2. Identify Suitable Patients

Any patient can be considered to switch to blood-flow dependent dialyse flow . The full benefits of reducing dialysate flow will be realised in treatments using central acid delivery (CAD). Seek clinical endorsement of any change to treatment.

Begin with patients who (Table 1):

- Have spKt/V consistently >1.4 and URR >65%
- Are clinically stable

For patients on twice-weekly dialysis:

- Do not exclude
- Consider increasing dialysis time slightly to compensate if needed
- Consider measures to maintain residual kidney function (RKF) as discussed in the "How-to Implement Incremental HD Guide"

Patients at risk of a drop in adequacy:

- Have spKt/V consistently <1.4 and URR <65%
- Are of large body mass, or already doing extended hours
- Have poorly functioning vascular access

Qb (mL/min)	Membrane Type	Duration (min)	Recommendation	Kt/V Target[5]
≥350	High-flux	≥210	Safe to implement autoflow/ equivalent / reduce Qd to 500 mL/min	Expected Kt/V ≥1.2
≥300	High-flux	≥240	Likely safe, reduce Qd and monitor	Monitor Kt/V for ≥1.2
<350	Any	<240	Use with caution or individualize	Risk of <1.2, reassess

Table 1. Simplified Decision Table: When It May Be Safe to Reduce Dialysate Flow Rate

3. Engage the Team

Present the evidence and environmental impact to clinical and nursing staff. Highlight that many units have already implemented this change e.g. like Bradford Teaching Hospitals NHS or the Northern General Hospital's (Sheffield), the latter as part of the TRUNC-HD project: after lowering Qd to 500 ml/min, no negative impact on dialysis adequacy was observed over 2 months in both cases. Staff should be reassured that the change will be managed to ensure that care quality will be prioritized, and any questions or concerns should be addressed.

Dialysis unit nursing staff or renal technicians can easily set machines to deliver variable flow rate, although a brief recorded video of someone doing so may facilitate implementation.

4. Communicate with Patients

Although the decision to adjust dialysate flow is a clinical one, it is good practice to inform patients about the rationale behind the change—particularly the environmental and efficiency benefits—using clear, accessible language. Patients should be reassured that the change does not compromise care quality, and any questions or concerns can be addressed as part of routine consultations.

5. Monitor and Adjust

Track adequacy metrics monthly (spKt/V, URR, KRU, urine volume). Consider increasing Qb, add time or finally increase Qd if clinically necessary. Evaluate reductions in water and supply use (bicarbonate and acid concentrate), and afterwards estimate carbon savings.

6. Environmental Impact Example

These are the savings in a satellite dialysis unit of 66 patients

- Estimated annual GHG savings: >5,000 kgCO_2e per
- Water savings: 646 m^3
- Dialysate acid concentrate: 14,676 L
- Electricity: 6,136 kWh
- Bicarbonate: 424 kg

Conclusion

Reducing dialysate flow rate for appropriately chosen and monitored patients receiving in-centre haemodialysis is a low-risk, high-impact intervention to cut carbon emissions. When implemented with patient monitoring, it does not compromise dialysis adequacy and can align clinical care with sustainability goals. Individualising care while thinking globally benefits both patients and the planet.

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- HighVolumeHDF with Fresenius Medical Care as your partner | Fresenius Medical Care: "Internal calculation is based on an example at QB = 300 mL/min and a 240-minute treatment. There are savings of 34 L of dialysis fluid with post HDF at AutoFlow factor 1.2, with QD = 360 mL/min, compared to post HDF, with a fixed QD = 500 mL/min."
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