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MINIMAL ULTRAFILTRATION

This topic opened with a question on the topic of minimal ultrafiltration (UF) rate.

In the past it was necessary to have a minimal UF rate to prevent back filtration. Now that ultra pure water is more commonly used in hemodialysis units, where does that leave us in relation to UF rates? Is there a formula for the minimal UF according to flux of dialyzer?

The discussion developed into several directions: what is back filtration, machines capabilities, purity of water and dialysate, and UF needs.

What is back filtration?

Back-filtration occurs because at the arterial side of the dialyser the blood pressure is higher than the dialysate pressure (filtration) with the opposite towards the venous side (back-filtration). Back-filtration occurs during each haemodialysis session; this is the lowest using a low flux membrane with a high ultrafiltration rate

However as the porosity of dialysers increased over time that rate is effectively a net zero rate, there would usually be some transfer of dialysis fluid into the blood circuit from the proximal end of the dialyser fluid side to compensate for the higher ultrafiltrate movement at the proximal end of the blood side .

Different dialysis machines: Some machines allow a UF rate of 0 while others do not.

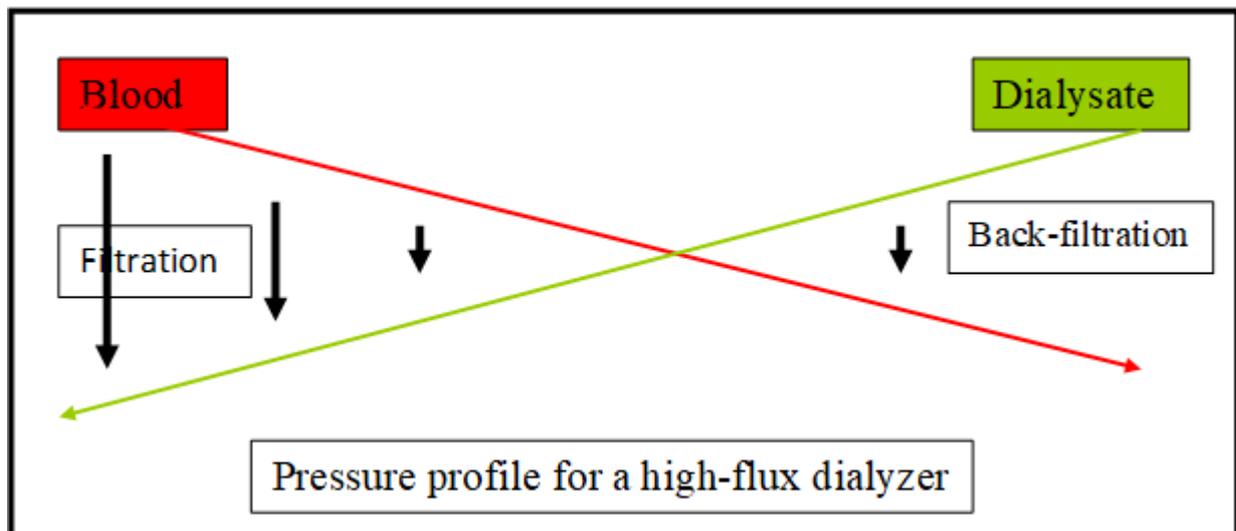
Some dialyzers, such as flat plate dialyzers could for technical reasons not have a zero UF rate due to the dialyser geometry, so a minimal rate was always required. That changed with the introduction of modern hollow fibre dialyzers and zero rates could be set.

A machine that allows 0 UF is advantageous for pediatric hemodialysis. In majority of patients we do need ultrafiltration needs. Some units mention a minimum UFrate, such as of 10ml/hr or 500 ml (200 ml for a drink + 300 ml for restitution of the blood at end of a session).

Some units mention using negative TMP to indicate backfiltration.

Other answers discussed the purity of dialysate and water:

Today, for medical reasons, high flux membranes are used in most dialysis patients entailing more back-filtration: a possible example of such pressure and back-filtration profile is illustrated below.



Therefore, dialysate purity is important, and this is repeatedly stressed. Today, even push-pull HDF is performed using a tidal increased UF followed by an increased back-filtration. This practice illustrates that you should not worry about the back-filtration phenomenon in routine dialysis. But the higher the membrane permeability and the back-filtration, the more important is the dialysate purity!

For bacteria and viruses back filtration has never been a concern (also intact low-flux membranes cut off bacteria and viruses); more worrying was the possible endotoxins being back-filtered into the bloodstream when ultra-filtrated dialysis fluid was not common practice.

Since the use of on-line HDF there is an increase in the use of ultra-pure water and ultra-pure dialysis fluid, which eliminates the problem of sterility issues in back-filtration.

Depending on how dialysate pressure was measured in the machine a negative TMP may not be displayed. TMP varies across the length of the fibres due to the pressure drop on the blood side caused by pushing blood through a narrow fibre, with no real pressure drop on the fluid side. Depending on the dialyser UF coefficient, unless there is a fairly large target UF volume in standard HD, or if HDF is being done, modern high flux dialysers will usually be back filtering dialysis fluid into the blood compartment. If there is good water quality and the dialysis fluid is ultra-filtered then there is no problem and this is even beneficial. Convection currents created by this fluid exchange will increase middle molecule clearance in standard HD -- basically a form of low volume HDF. This property is actively exploited by modern dialysis machines such as the Quanta SC1 and Physidia S3.

We found it interesting to read the development over time from back filtration being a risk (transfer of endotoxins from contaminated water to the blood through cellulosic membranes) to being a benefit (extra convective clearance, making HD more like HDF).

Thank you RenalPro members for participating in the discussion!

Questions? Comments? Corrections? Send us an email: renalpro@mailman.srv.ualberta.ca