

## Ultrapure Dialysate: What, How, and Why

Dialysate is a blend of water and chemicals that washes wastes and fluid out of the blood. During a treatment, dialysate comes in contact with your blood through the dialyzer membrane. So, it must be high quality to keep you safe.

Bacteria live in the tap water used to make dialysate. Live bacteria can grow and form colonies. Dead bacteria form endotoxin, which causes inflammation. Chronic inflammation can damage tissues, like your heart.

Per current AAMI guidelines\*, dialysate can have no more than 200 colony-forming units (CFU) of bacteria and 2 endotoxin units (EU) per milliliter (mL)<sup>1</sup>. These limits may prevent pyrogenic (fever) reactions. But they are not low enough to stop chronic inflammation. A 3 hour treatment with most machines will use 90 liters of dialysate. At the standard level, this could have as many as 18 million CFUs of bacteria.

*\*Medicare has not yet approved use of the new AAMI standards. Their standard is 200 CFUs of bacteria for water, and 2,000 CFUs of bacteria for dialysate.*

### How Ultrapure Dialysate is Made

Ultrapure dialysate is made with very pure water. A series of water treatment machines, each with a different function, is needed to make water this pure. The dialysate must also pass through an ultrafilter<sup>1</sup>, which takes out particles like bacteria and endotoxin. Per AAMI Guidelines, *ultrapure dialysate must have less than 0.1 CFU per mL* (2,000 times less than the AAMI standard level). Standards in Europe are even more strict.<sup>2</sup> At these low levels, the risk of chronic inflammation is much less.<sup>3,7,10</sup>

### Benefits of Ultrapure Dialysate

For you, studies show that using ultrapure dialysate may mean:

- Better response to EPO for anemia<sup>8</sup>
- Better nutrition<sup>4,8,10</sup>
- Slower loss of remaining kidney function<sup>9</sup>
- Less risk of amyloidosis<sup>4</sup>
- Less risk of blood pressure drops during treatment<sup>5,6</sup>
- Less risk of heart-related deaths<sup>7</sup>

<sup>1</sup> Ward RA. Ultrapure dialysate. *Semin Dial.* 2004 Nov-Dec; 17(6):489-97.

<sup>2</sup> Pontoriero G, Pozzoni P, Andrulli S, Locatelli F. The quality of dialysis water. *Nephrol Dial Transplant.* 2003 Aug; 18(Suppl 7):21-25.

<sup>3</sup> Arizono K, Nomura K, Motoyama T, Matsushita Y, Matsuoka K, Miyazu R, Takeshita H, Fukui H. Use of ultrapure dialysate in reduction of chronic inflammation during hemodialysis. *Blood Purif.* 2004; 22 Suppl 2:26-9.

<sup>4</sup> Furuya R, Kumagai H, Takahashi M, Sano K, Hishida A. Ultrapure dialysate reduces plasma levels of beta(2)-microglobulin and pentosidine in hemodialysis patients. *Blood Purif.* 2005 Jun 23; 23(4):311-16.

<sup>5</sup> Kjellstrand C M, Blagg C R, Twardowski Z, Bower J. Approaches to quotidian dialysis: the Aksys Personal Hemodialysis system. *Sem Dial.* 2004; 17:151-153.

<sup>6</sup> Kjellstrand C, Blagg CR, Twardowski ZJ, Bower J. Cardiovascular stability during dialysis - relative influence of dialysis purity, clearance and ultrafiltration speed - experience with the Aksys Phd system. 41st Congress. ERA-EDTA Abstract Book. 2004; 332. CSN and ASAIJ. 2004; 50:177.

<sup>7</sup> Lederer SR, Schiff H. Ultrapure dialysis fluid lowers the cardiovascular morbidity in patients on maintenance hemodialysis by reducing continuous microinflammation. *Nephron.* 2002 Jul; 91(3):452-5.

For example, a year-long cross-over study compared standard and ultrapure dialysate. Thirty-four patients were split into two groups. Each group had 6 months of treatment with standard and 6 months of treatment with ultrapure dialysate. Ultrapure dialysate led to less inflammation, lower EPO doses, and better use of iron.<sup>8</sup>

If you have some kidney function, you may keep it longer with ultrapure dialysate. A 2-year study randomly assigned 30 new patients to standard or ultrapure dialysate. Kidney function dropped in both groups—but was significantly worse for those on standard dialysate.<sup>9</sup>

### Conclusions

It's common sense to want fewer bacteria in your blood, and research supports that ultrapure dialysate has some pluses. Some clinics do not support its use because ultrapure dialysate costs more<sup>10</sup>, but other clinics do offer it—ask about your machine if you're not sure.

New technology allows some home machines to offer built-in filters to purify the dialysate to ultrapure or near-ultrapure levels. These include the:

- ✓ **Aksys PhD**, which pretreats tap water; filters out chemicals, bacteria, and viruses; and disinfects the whole system with heat, which kills bacteria
- ✓ **Allient Sorbent System**, which has less than 1 CFU of bacteria per mL and 0.3 endotoxin units per mL—and uses only 6 liters of dialysate per treatment
- ✓ **Fresenius 2008-K series machines**, which contain the Diasafe™ filter to purify dialysate

One of the unsung benefits of home dialysis may be a chance to reduce your risk of chronic inflammation. It's something more to think about when you choose a treatment.

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<sup>8</sup> Hsu PY, Lin CL, Yu CC, Chien CC, Hsiao TG, Sun TH, Huang LM, Yang CW. Ultrapure dialysate improves iron utilization and erythropoietin response in chronic hemodialysis patients – a prospective cross-over study. *J Nephrol.* 2004 Sep-Oct; 17(5):693-700.

<sup>9</sup> Schiff H, Lang SM, Fischer R. Ultrapure dialysis fluid slows loss of residual renal function in new dialysis patients. *Nephrol Dial Transplant.* 2002 Oct; 17(10):1814-8.

<sup>10</sup> Schiff H., Lang SM, Stratakis D, Fischer R. Effects of ultrapure dialysis fluid on nutritional status and inflammatory parameters. *Nephrol Dial Transplant.* 2001 Sep; 16(9):1863-9.