Are all polysulfone-based dialyzers equally efficient in removing high molecular weight uremic toxins?

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Introduction & objectives

The target of modern dialyzers is to maximize the permeability of small and middle molecular weight (MW) toxins while retaining albumin.

Reduction ratio (RR) of small water-soluble compounds like urea and middle MW molecules like β2 microglobulin are well studied for each dialysis membrane. Differences in clearance of substances with higher MW are less known.

Based on higher Stokes' radius and MW, we measured myoglobin RR as a surrogate for uremic toxins with higher MW.

Methods

In a prospective study, 15 ESRD patients on chronic thrice weekly HD, were consecutively dialyzed with 8 different high flux polysulfone-based dialyzers. RR of β2 microglobulin and myoglobin was assessed. Dialysis settings were identical for every session in each patient: same blood and dialysate flow, duration, monitor (Fresenius 5008) and priming procedure.

In a second phase we evaluated the influence of sterilization technique comparing Phylther G and Phylther UP (Bellco), respectively γ-rays and steam sterilized. Finally we compared HD, using the most performant dialyzer (Phylther UP), and high volume (25L) post dilution HDF with Phylther G and FX1000.

Results

Comparing the different membranes, the RR of β2 microglobulin was similar but the RR of myoglobin was significantly higher with Toray TS (Toray) (RR 48.8%, p<0.001) and Phylther G (Bellco) (RR 39.8%, p<0.05) (Table 1). The RR of myoglobin was significantly higher with Phylther UP compared to Phylther G (RR of 62% versus 39.8%, p<0.0001) (Table 2). HD with Phylther UP didn't show statistical difference in RR of myoglobin compared to HDF (Table 3).

Table 1
Differ high flux dialyzers from each other in clearance ?

Dialyzers	β2 Microglobulin RR (%)	Myoglobin RR (%)
Phylther G (Bellco)2.2m²	70.0^{NS}	**39.8***
APS 21H (Asahi Kasei) 2.1m²	69.9^{NS}	26.4^{NS}
FX 1000 (Fresenius) 2.3m²	70.7^{NS}	32.1^{NS}
Elisio 21H (Nipro)2.1m²	68.0^{NS}	32.7^{NS}
Rexeed 21A (Asahi Kasei) 2.1m²	70.1^{NS}	31.4^{NS}
Leoceed21H (Asahi Kasei) 2.1m²	69.3^{NS}	25.4^{NS}
Toray TS (Toray) 2.1m²	71.0^{NS}	**48.8¥**
Revaclear 400 (Gambro) 1.8m²	69.6^{NS}	38.1^{NS}

* p < 0.05 for 1 versus 2-6
¥ p < 0.001 for 7 versus all others

Table 2
Does sterilization method influence clearance ?

	Phylther G (γ-rays)	Phylther UP (steam)	P
Myoglobin RR (%)	39.8	62	<0.0001

Table 3
Is HD with performant dialyzer comparable with HDF?

	HD Phylter Up	HDF Phylter G	HDF FX1000
Myoglobin RR (%)	62.0	66.1†	63.8‡

† NS (p = 0.14 versus HD)
‡ NS (p = 0.57 versus HD)

Conclusions

- **Efficiency of myoglobin RR varies significantly among different high flux polysulfone-based dialyzers**
- **Sterilization method can influence dialyzer performance**
- **Using a high performance dialyzer, HD is can be equally efficient as post dilution HDF for myoglobin clearance**

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