High convection volumes in on-line haemodiafiltration: Do we know what we prescribe?

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Background

Randomized controlled trials suggest that on-line hemodiafiltration (OLHDF) improves survival, provided that it reaches high convective volumes (1). However, there is scant information on the consequences of modifying convection volumes in vivo.

Objectives

To study the consequences of modifying convection volume in on-line HDF in vivo.

Methods

Twelve stable dialysis patients were sequentially treated with **XEVONTA 1.8 and 2.3 m²**, polysulphone dialyzers with different convection flows (Q_{UF}) guided by individual $_GK_{D\text{-}UF}$**-max** values (2) for 1 week each :

- **HD** (Q_{UF} = weight loss),
- $_GK_{D\text{-}UF}$**-max** (global ultrafiltration coefficient of a dialysis setting),
- **40% under** $_GK_{D\text{-}UF}$**-max** settings
- **40% over** $_GK_{D\text{-}UF}$**-max** settings (limited by a ratio Q_{UF}/Q_{blood} at max 30%)

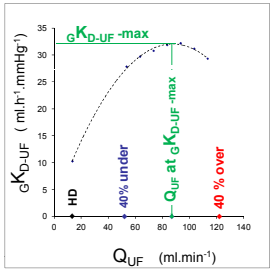

Fig 1. Example of Q_{UF} settings for a given patient, depending on the $_GK_{D\text{-}UF}$–max value

The **physics** (transmembrane pressure (TMP) and number of alarms) and **efficacy** (middle molecule removal in dialysate) were analyzed.

Results

Physics of dialysis

Overall **convection volumes** obtained with the 1.8 m² dialyzer were 3.1±0.2 L/session in HD (weight loss), 12.9±0.2 at Quf under, 20.6±0.4 at $_GK_{D\text{-}UF}$-max and 24.5±0.6 L/session at Q_{UF} over and were slightly greater with the 2.3 m² surface (table).

Mean TMP significantly increased with convection, particularly with the 1.8 m² (table), frequently resulting in alarms (table).

Table. Dialysis characteristics according to Q_{UF} condition and surface area

	Surface area	Q_{UF} condition				P-value
		HD	Under	$_GK_{D\text{-}UF}$-max	Over	
Convection volume (L)	1.8 m²	3.1 ± 0.2	12.9 ± 0.2	20.6 ± 0.4	24.5 ± 0.6	<0.001[a]
	2.3 m²	3.6 ± 0.2	13.5 ± 0.3	21.7 ± 0.4	24.3 ± 0.6	
Mean TMP (mmHg)	1.8 m²	79 ± 2	121 ± 2	185 ± 4	242 ± 4	<0.001[b]
	2.3 m²	75 ± 1	108 ± 2	162 ± 3	185 ± 5	
Proportion of sessions with alarms (%)	1.8 m²	0%	0%	9%	83%	<0.001[c]
	2.3 m²	0%	0%	3%	11%	

[a] Significant differences between all Q_{UF} conditions by surface area.
[b] Significant differences between all Q_{UF} conditions by surface area and significant effect of surface area at all Q_{UF} conditions.
[c] 40% over with the 1.8m² significantly different from all other conditions.

Prescription achievement

TMP over 300 mmHg was corrected with a reduction of Q_{UF}. Consequently, **prescribed convection volume** was not achieved in all treatments (only in 33% of the 'over' treatments with 1.8 m² dialyzer, table), while this was significantly improved with the larger dialyzer (figure 2).

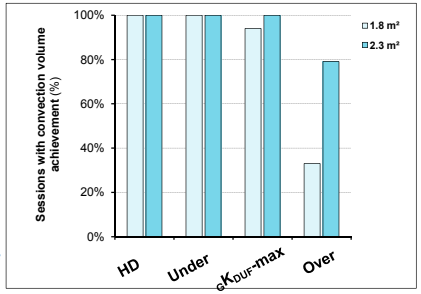

Fig 2. Proportion of achievement of prescribed convection volume

Dialysis efficacy

Convection enhanced removal of middle molecules of **higher mol weight** (figure 4) and total removal, particularly with 2.3 m².

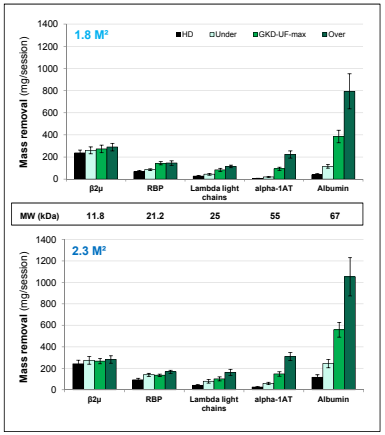

Fig 3. Dialysate removal of middle molecules by Q_{UF} condition using 1.8 m² (upper panel) **and 2.3 m² dialyzers** (lower panel). β2-microglobulin (β2m), retinol binding protein (RBP), λ light chains, α1-antitrypsin (alpha-1AT).

Conclusions

Setting an OL-HDF system at the **Q_{UF} of $_GK_{D\text{-}UF}$-max** resulted in high convection volumes as recommended by the recent RCTs (> 20L).

Beyond $_GK_{D\text{-}UF}$-max the **instability** of the system provoked **alarms**, rarely achieved the prescribed convection volumes and increased **albumin loss**.

Using a **2.3 m² dialyzer** reduced the number of alarms but further increased albumin loss.

References

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