

Improvement in Technology: evaluation of the biofeedback on TMP on two dialysis systems

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Introduction and Aim:

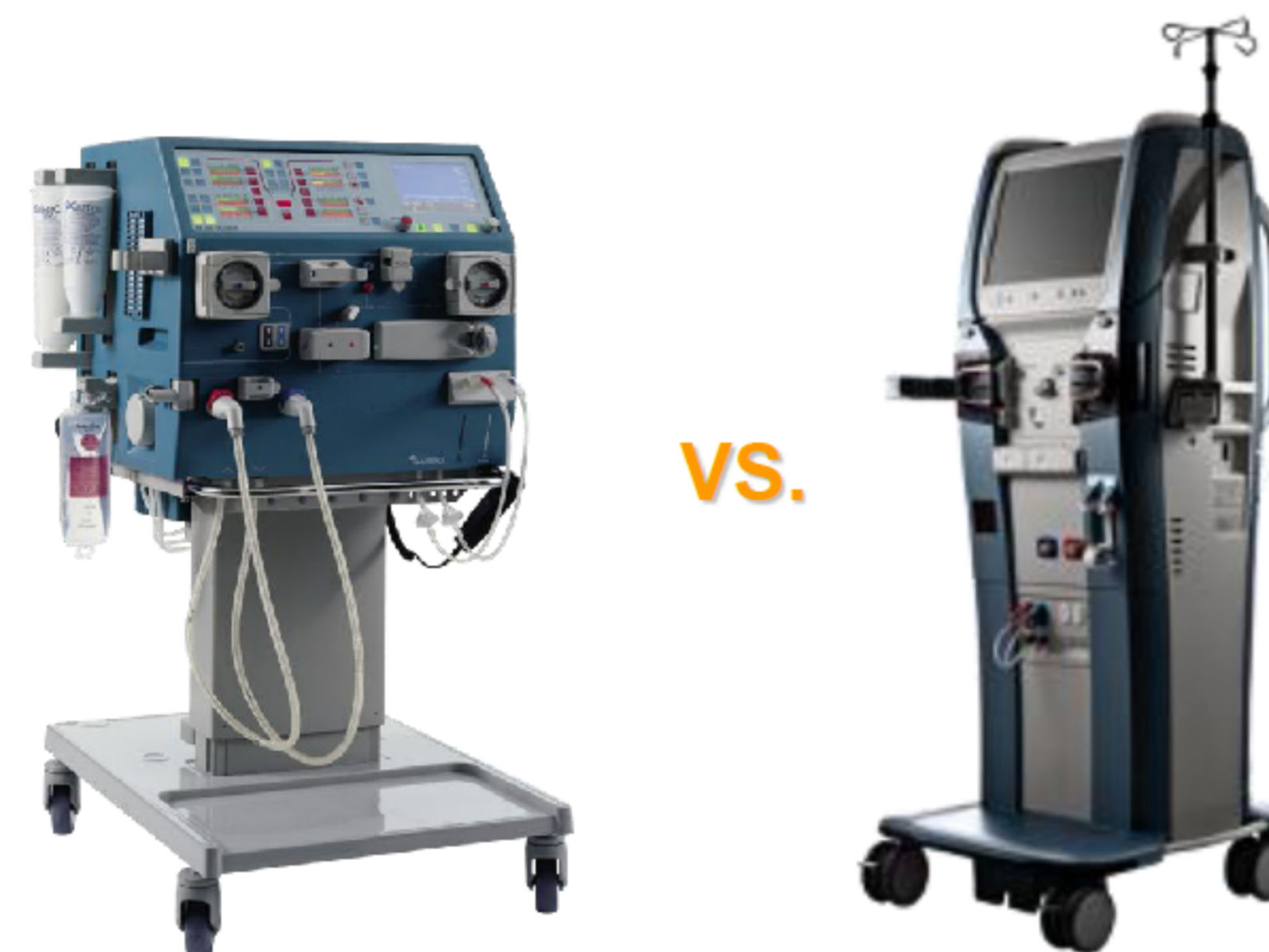
The biofeedback on TMP, as UltraControl (UC, Gambro), enhances and automatically adjusts the convective volume in hemodiafiltration online (OL-HDF). Moreover, the results of recent RCTs on postdilution OL HDF, such as ESHOL, CONTRAST and TURKISH, suggest that OL-HDF with high convective volume can improve the patient survival.

The **Aim** of this study was to evaluate the convective performances of UC in post-dilution OLHDF on two Gambro dialysis machines: AK200 ULTRA S (AK) and ARTIS.

Methods:

We enrolled 14 stable pts (63±12 yrs), already treated by OL-HDF, in a sequential design study of two weeks for each monitor. Both monitors automatically set the infusion volume by a biofeedback on TMP (UltraControl, described by [1-2]), while AK measures the TMP value by 3 points formula (Pre-filter, venous and inlet dialysate pressure) and uses a TMP step of 25mmHg, ARTIS works with 4 points (Pre-filter, venous, inlet and outlet dialysate pressure) and TMP step of 20mmHg (see figure 1). For each patient the remaining technical parameters were kept unchanged. The infusion volume, TMP and Pre-filter pressure (PFP) were hourly collected. All the patients were treated with 2.1 m2 Polyflux H (Gambro).

Parameters	AK200 ULTRA S
TMP measurement	3 points
TMP step	25 mmHg
Qinf stop	AV limit opening
Timing of TMP scanning	5' and Every hour



Parameters	ARTIS
TMP measurement	4 points
TMP step	20 mmHg
Qinf stop	Control Loop
Timing of TMP scanning	3', 25' after the end of the first scanning, 50' after the end of the previous one

Fig.1 – Characteristics of AK200 ULTRA S and ARTIS regarding biofeedback on TMP (UC) in OL HDF.

Statistics: The descriptive analysis was based on the mean ± standard deviation. Inferential statistics included two tailed t-test for paired data, considering a probability value of less than 0.05 as significant.

Results:

No differences were found on main dialytic parameters, such as Qb (371±10 vs 370±12 ml/min, p=0.978), treatment time (265±16 vs 266±16 min, p=0.334) and total weight loss (1.8±0.7 vs 1.8±0.7 L, p=0.739), between the two periods. The ARTIS system, providing a different pressure trend (see figure 2-4), reached a smooth higher convective volume (see figure 5, p<0.01).

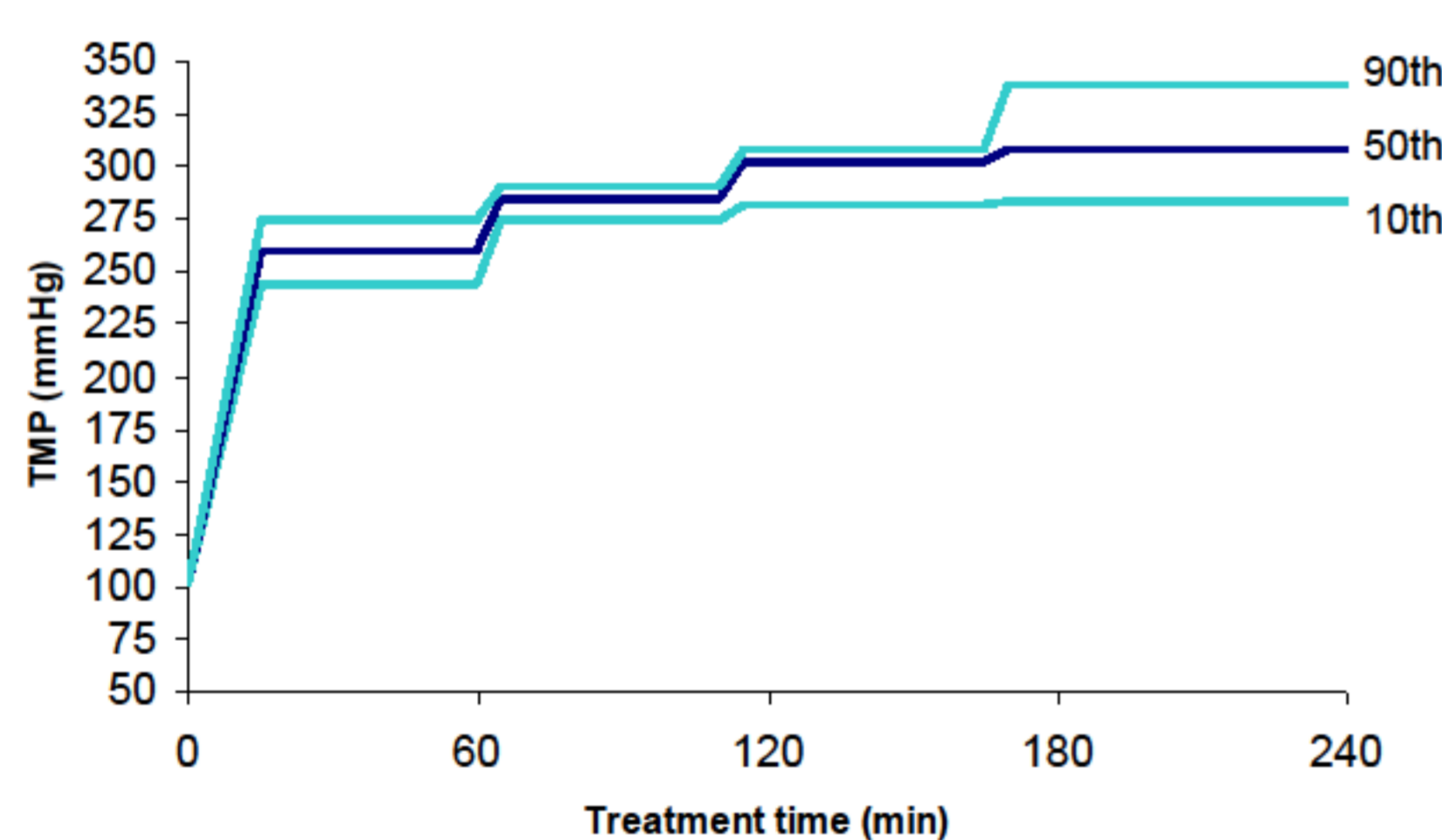


Fig.2 – Trend over the time of TMP in OL HDF with UltraControl performed by AK200 ULTRA S, given as 10th, 50th, and 90th percentiles.

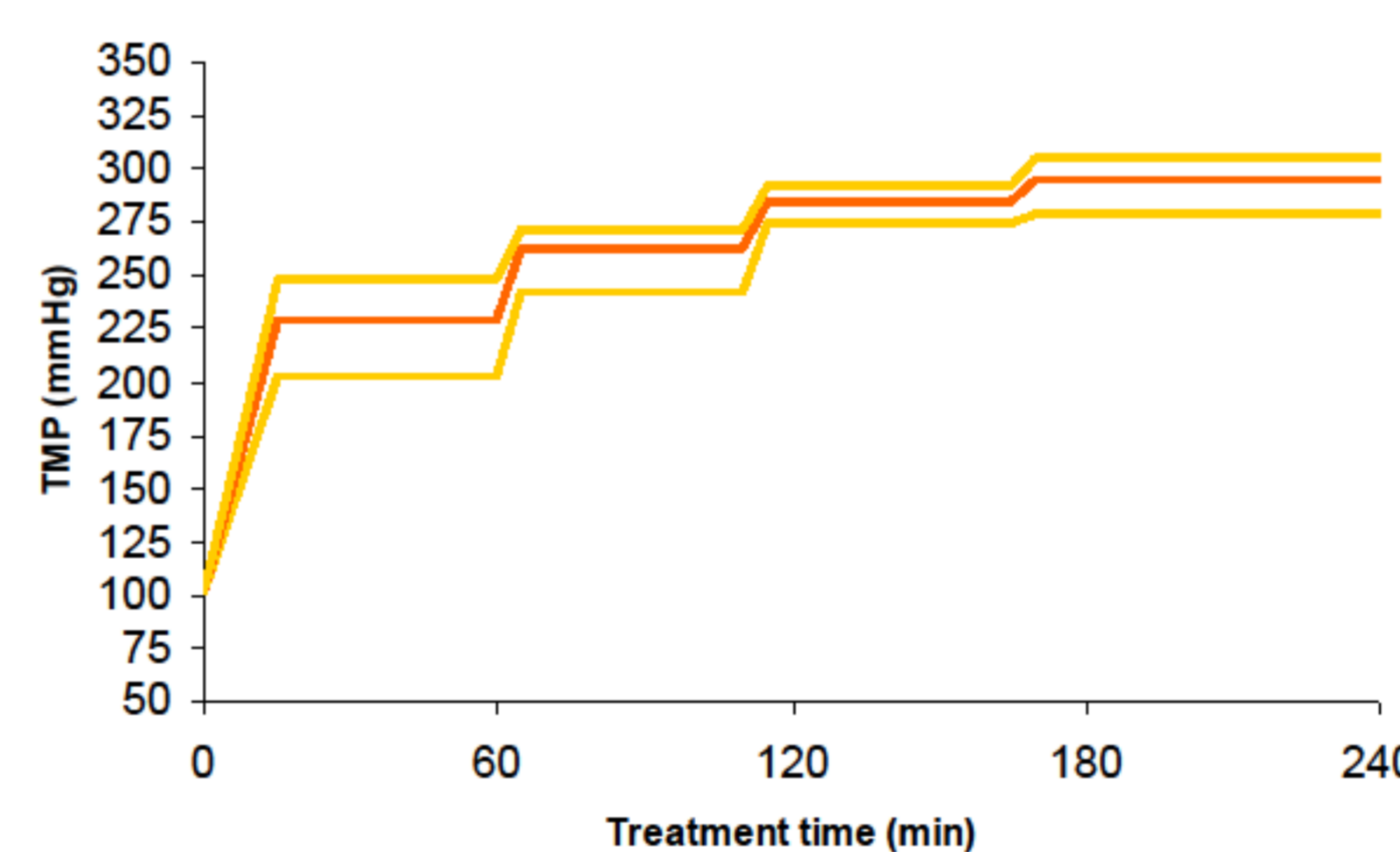


Fig.3 – Trend over the time of TMP in OL HDF with UltraControl performed by ARTIS, given as 10th, 50th, and 90th percentiles.

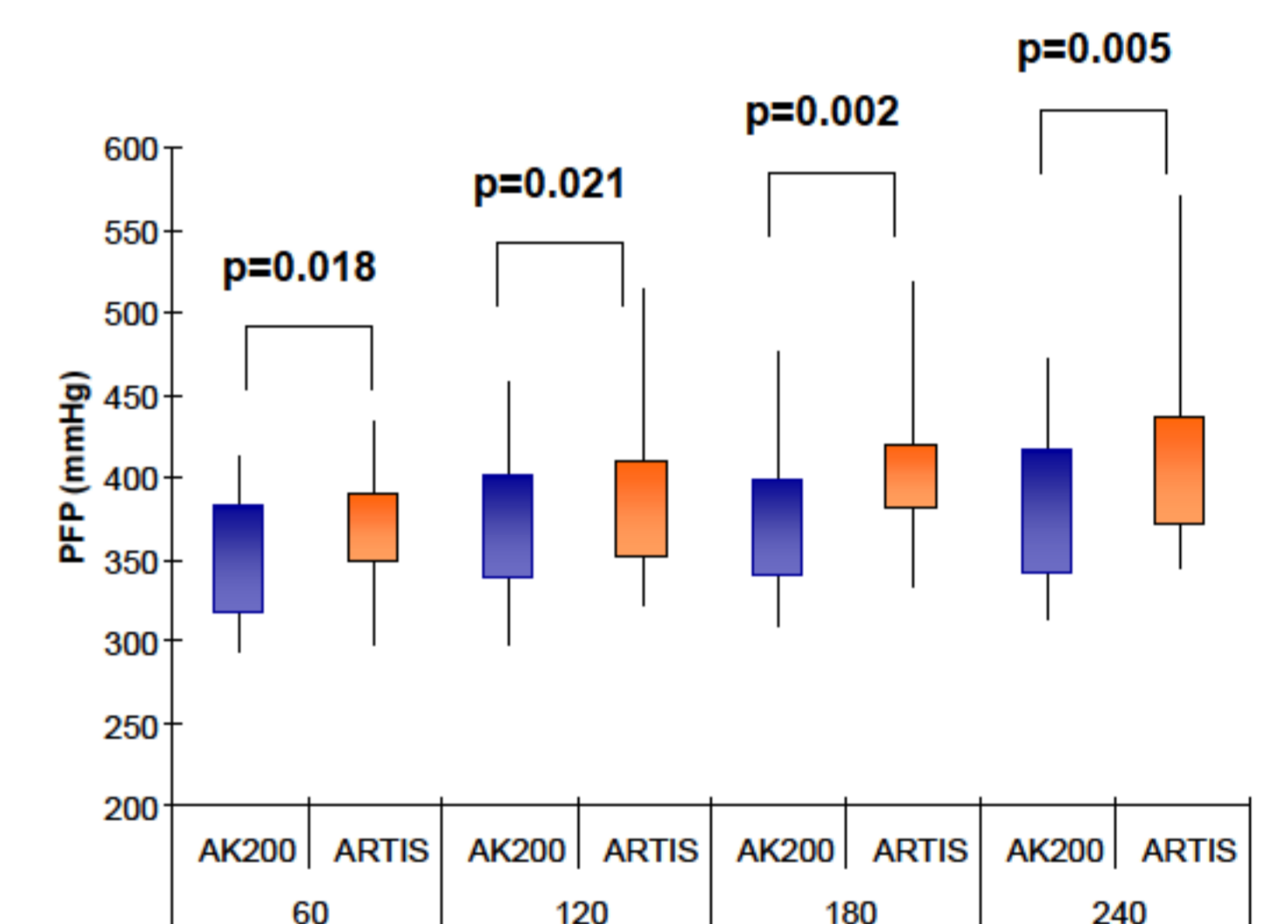


Fig.4 – A different trend over the treatment time of Pre-Filter Pressure (PFP) with OL HDF on AK200 ULTRA S (blue) and ARTIS (orange) machine (p<0.01 ANOVA for repeated measures).

The intra-patient coefficient of variability on infusion volume was lower with ARTIS machine than AK machine (7.8±3.4 vs 6.4±3.4%).

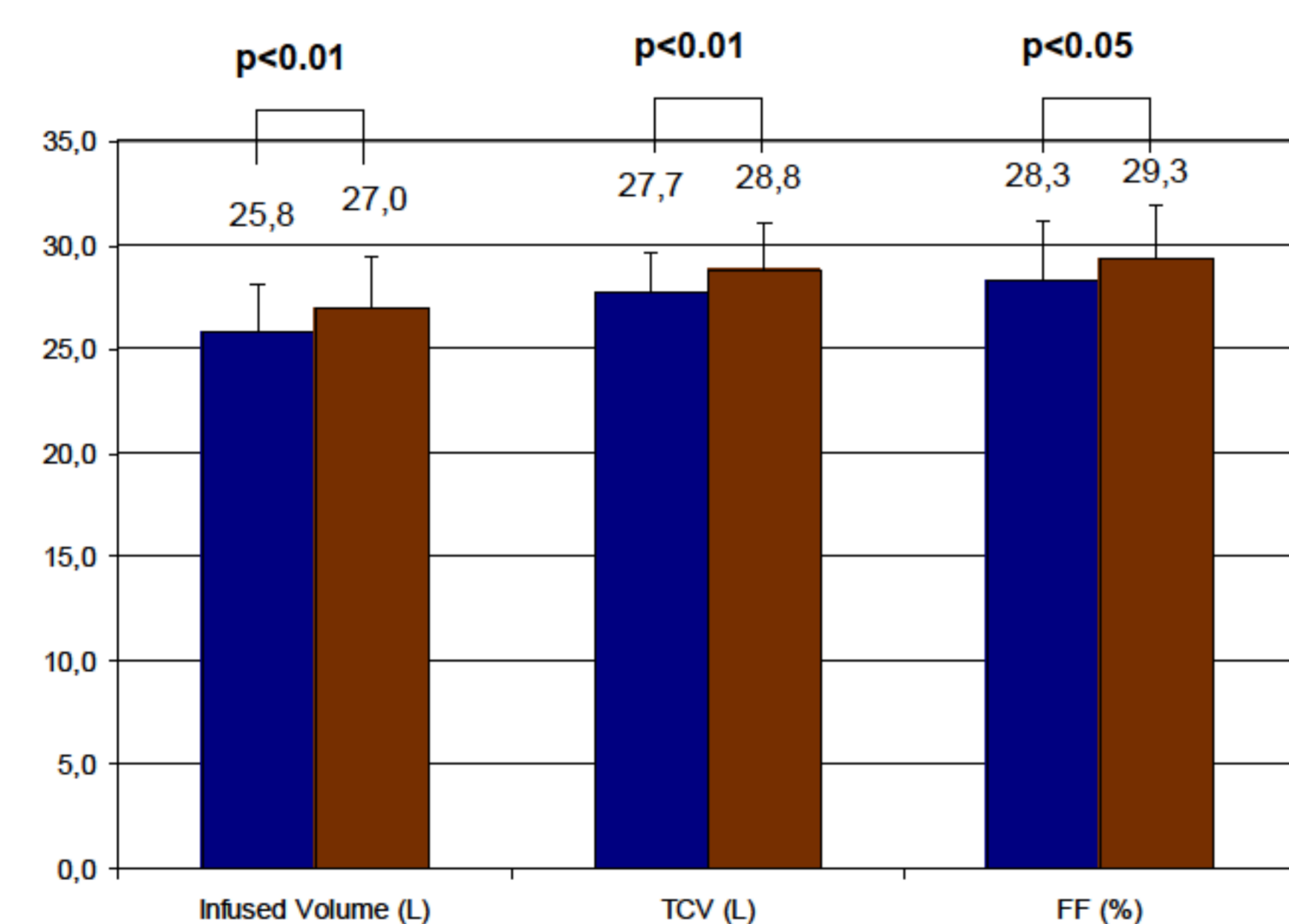


Fig.5 – Comparison on Total Convective Volume (TCV), Filtration Fraction (FF) and Infused Volume (IV) between AK200 ULTRA S (blue columns) and ARTIS (orange columns) machine (T-test pair data)

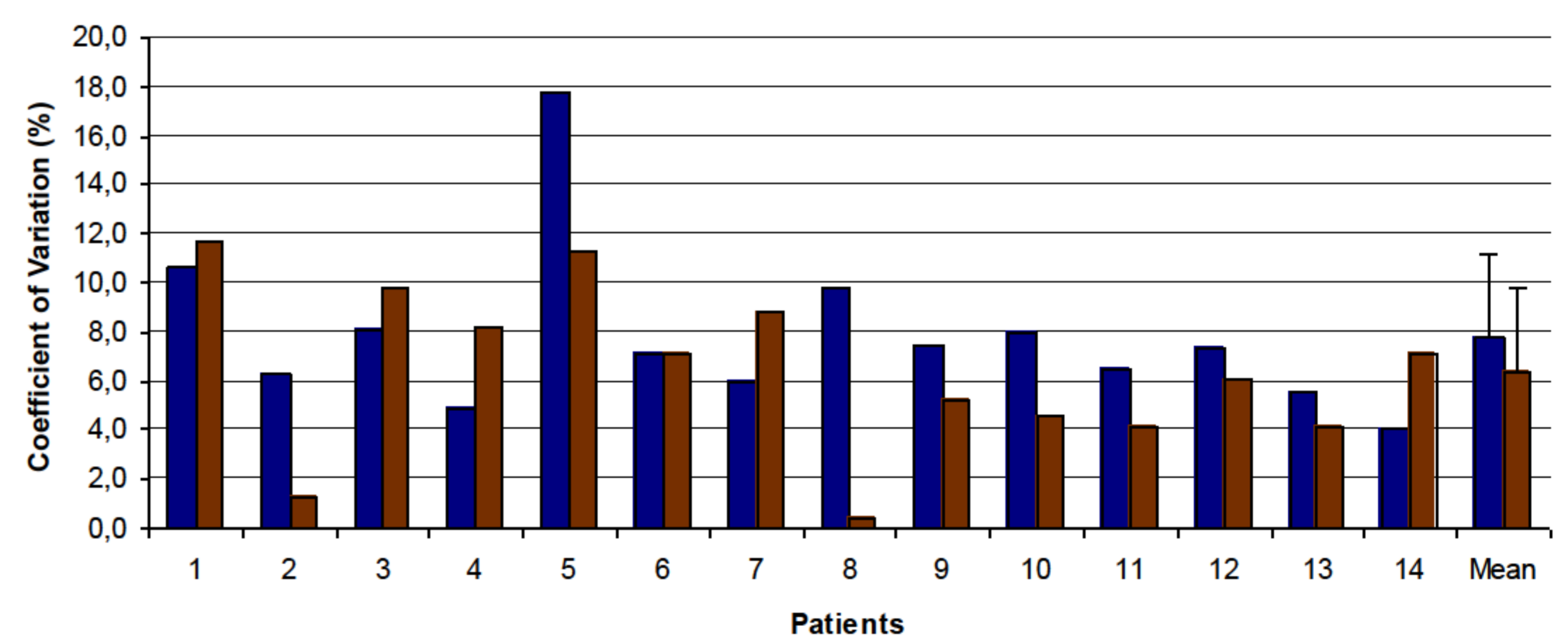


Fig.6 – Coefficient of variation on the infusion volume between the subjects grouped by machines: AK200 ULTRA S (blue columns) and ARTIS (orange columns).

Conclusions:

UltraControl reached high convective volumes (>20 L) in postdilution OL HDF with AK and ARTIS machine. The introduction of 4 points TMP measuring and a smaller increment TMP step resulted in more optimized TMP set-point, leading to an increase of infusion volume and reduction of the intra-patient variability on ARTIS machine. Therefore UltraControl system on ARTIS seems to be the best technique for Postdilution OL-HDF.

References:

- [1] Teatini U, Steckiph D, Romei Longhena G. Evaluation of a new online hemodiafiltration mode with automated pressure control of convection. *Blood Purif.* 2011;31(4):259-67.
 [2] Panichi V, De Ferrari G, Saffiotti S, Sidoti A, Biagioli M, Bianchi S, Imperiali P, Gabbriellini C, Conti P, Patrone P, Falqui V, Rombolà G, Mura C, Icardi A, Mulas D, Rosati A, Santori F, Mannarino A, Tomei V, Bertucci A, Steckiph D, Palla R. Divert to ULTRA: Differences in infused volumes and clearance in two on-line hemodiafiltration treatments. *Int J Artif Organs.* 2012; 35(6): 435-43

