

VARIABILITY OF ACCESS BLOOD FLOW RATE WITHIN AND BETWEEN HEMODIALYSIS SESSIONS

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INTRODUCTION AND AIMS:

Decrease in vascular access blood flow (Qa) is a common sign of stenosis, albeit attenuation up to 20–25% can be in the physiological range and change in Qa requiring intervention can be up to 33%. Reduction in blood pressure is a common consequence of ultrafiltration generated by a hemodialysis (HD) session. Although the impact of this on Qa is controversial, the Qa measurement is suggested to be performed within the first 90 minutes of dialysis treatment (NKF K/DOQI Guidelines 2006 Updates). However differences in needle placement and haemodynamics may cause larger variability between the dialysis sessions than within the sessions. The aim of our study is to clarify: 1. Is there a clinically relevant change in Qa during HD? 2. Is there any correlation between the Qa and blood pressure during treatment? 3. Comparison of the variability of Qa within and between the sessions.

Distal			Proximal	Changed	
wrist	forearm	wrist/forearm	elbow	wrist/elbow	forearm/elbow
68	32	4	25	1	1

Table 1. Distribution of patients by fistula position

PATIENTS AND METHODS:

Between 2003 and 2010 in our fistula surveillance program we investigated 131 HD patients bearing native arteriovenous fistulas (age 60±17 years; male/female 58/42%; 40% diabetics; 79,4% distal fistula, 19,1% proximal, 1,5% both due to change during study) (Table 1). 3066 Qa measurements were performed in 1022 HD sessions at the beginning (Qa1), at half time (Qa2), and at the end of treatment (Qa3) with Fresenius blood temperature monitor. Systolic (SBP), diastolic (DBP) blood pressure and mean arterial pressure (MAP) were measured simultaneously and Qa corrected for 100 mmHg MAP (Qac) was calculated. Values of Qa2 and Qa2c as well as Qa3 and Qa3c were compared to Qa1 and Qa1c respectively. Correlation between Qa and MAP, and the variability of Qa calculated by coefficient of variation (CV) within sessions and between sessions were evaluated. 172 investigations of vascular access stenosis using angiography, ultrasonography or both confirmed stenosis in 41% of cases, corresponding to 36% of patients. Stenotic and non-stenotic cases and accesses by the fistula position were also evaluated separately. Statistical analysis: Results were evaluated by Student's t tests and Pearson's correlation coefficients. Comparisons of pooled CV were done with an F test.

RESULTS:

Qa decreased and Qac increased slightly, but significantly (Fig. 1, 5; Table 2, 3). Blood pressure parameters showed also slight but significant decrease during the treatment (Table 4; Fig. 2-4, 6-8). In cases without stenosis, neither Qa nor Qac changed significantly. In distal fistulas we observed slight but significant decrease in Qa. Qac did not show any significant changes. In proximal and/or stenotic fistulas there was no significant change in Qa, but Qac increased significantly (Table 3). MAP and Qa changes did not correlate significantly. Within-session pooled CV of Qa was 20.6%, while between-session CV was 31.3% (p<0.001) (Table 5).

	1. At the beginning	2. Half-time	3. End of treatment
Qa ml/min	1111±586	1082±579	1086±581
Qa ml/min at MAP 100 mmHg (Qac)	1216±665	1235±679	1247±688

Table 2. Qa values (mean±SD) during the treatments

	all cases	distal N=863	proximal N=144	stenosis N=70	without stenosis N=102
Qa2-Qa1(delta Qa2) ml/min	-29 309 p=0.0025	-35 314 p=0.001	-5 249 NS	-17 244 NS	-23 375 NS
Qa3-Qa1(delta Qa3) ml/min	-25 314 p=0,0113	-31 321 p=0.005	8 263 NS	44 309 NS	-51 324 NS
Qa2c-Qa1c(delta Qa2c) ml/min	19 385 NS	11 384 NS	46 318 NS	15 287 NS	27 436 NS
Qa3c-Qa1c(delta Qa3c) ml/min	31 400 p=0,0145	21 401 NS	82 377 p=0.010	93 366 p=0.036	-1 397 NS

Table 3. Qa and Qac changes during the HD treatments by fistula position and stenosis

SBP2-SBP1(delta SBP2)mmHg	-8±17	p<0,0001
DBP2-DBP1(delta DBP2)mmHg	-3±9	p<0,0001
MAP2-MAP1(delta MAP2)mmHg	-4±10	p<0,0001
SBP3-SBP1(delta SBP3)mmHg	-9±20	p<0,0001
DBP3-DBP1(delta DBP3)mmHg	-3±11	p<0,0001
MAP3-MAP1(delta MAP3)mmHg	-5±12	p<0,0001

Table 4. Blood pressure changes during the HD treatments

N ^o of evaluated treatments	Within session	Between session (in 60 days)
1	1022	0
2	0	219
3		63
4	0	2
Pooled CV %	20,6	31,3*

Table 5. Pooled coefficient of variation (CV) within- and between-sessions
*p<0,001

Mean Qa values measured at different times during the session

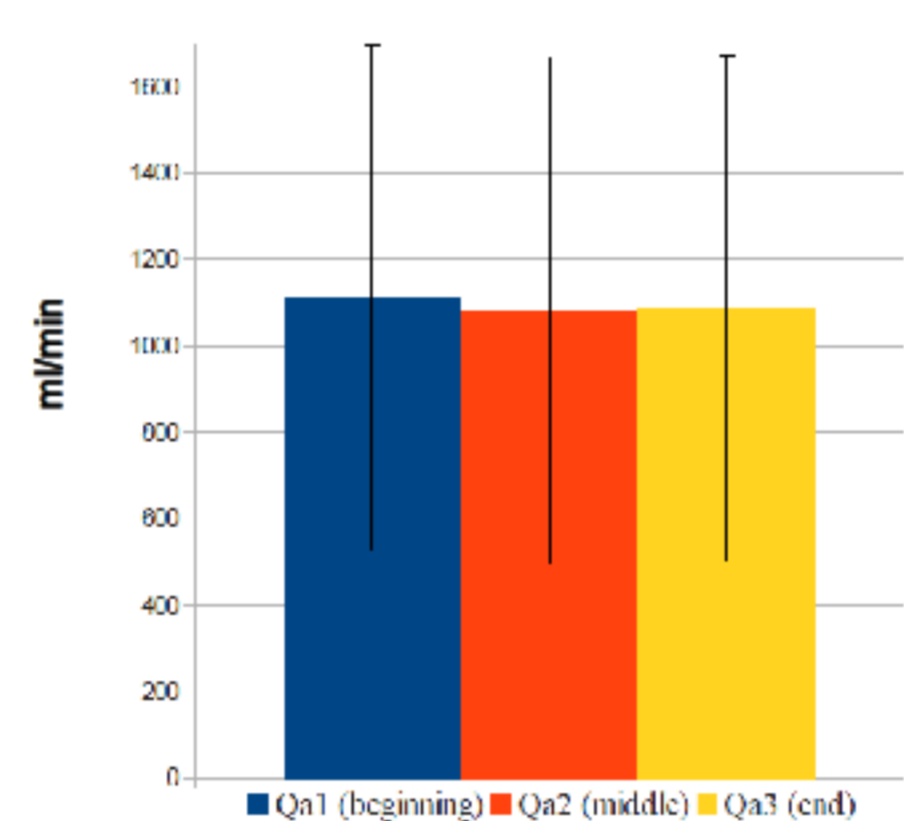


Fig. 1.

Mean SBP values measured at different times during the session

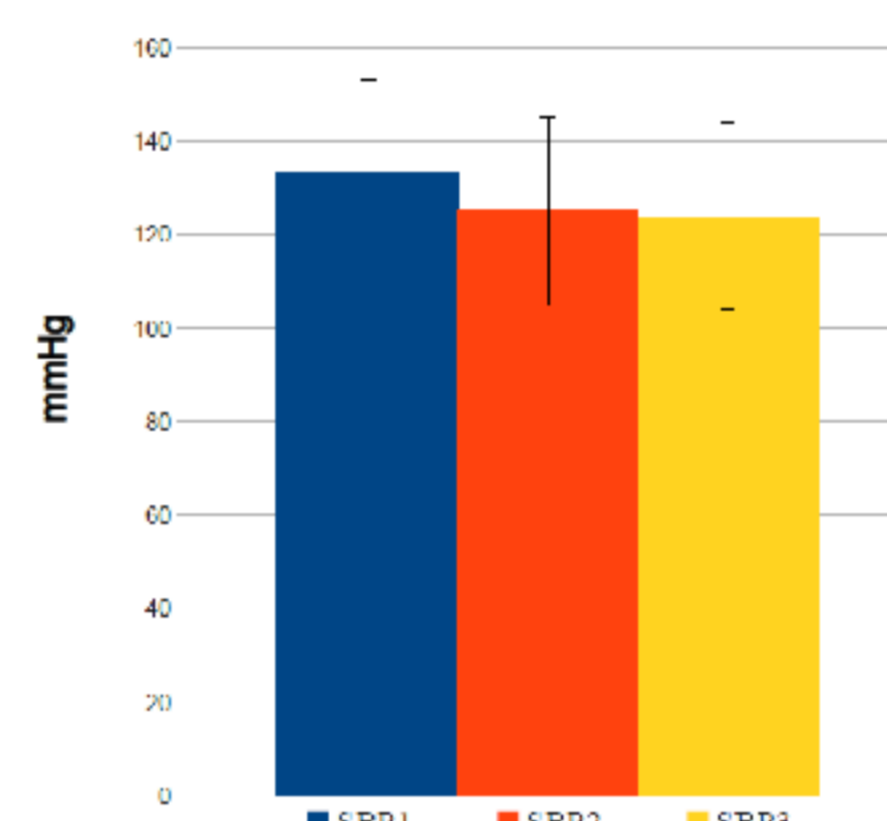


Fig. 2.

Mean DBP values measured at different times during the session

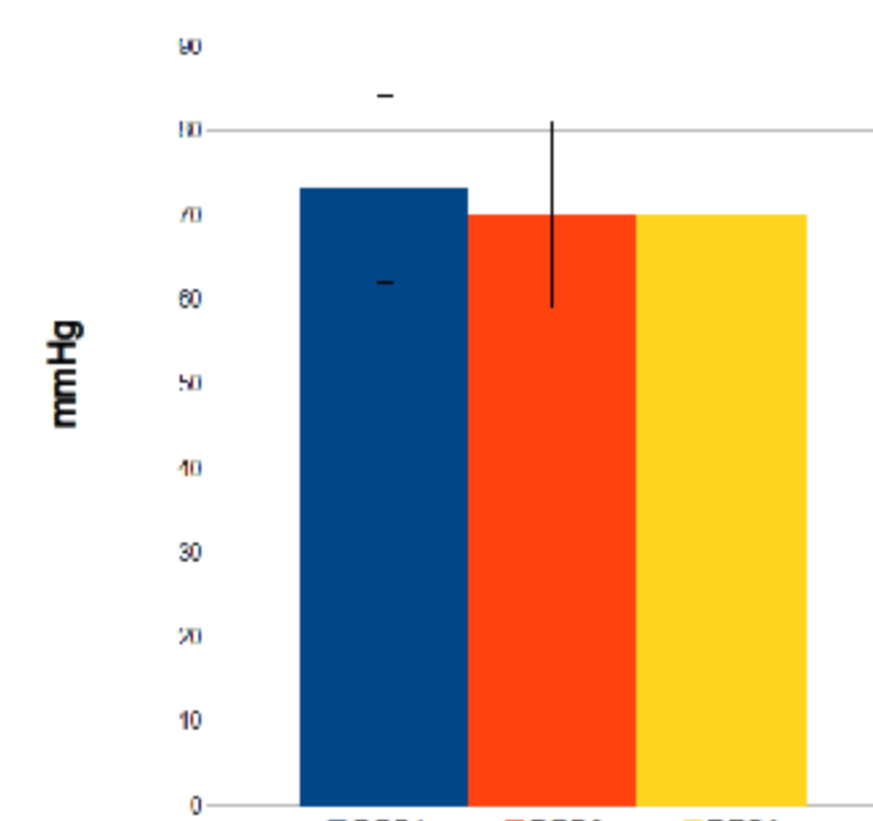


Fig. 3.

Mean MAP values measured at different times during the session

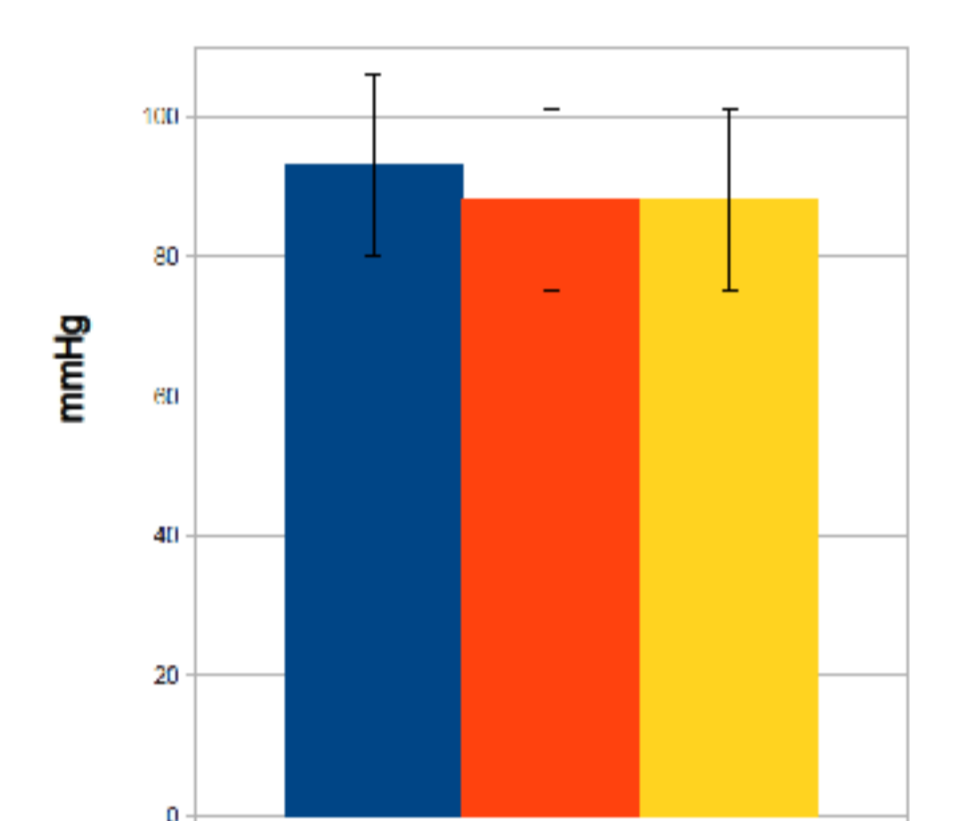


Fig. 4.

Mean Qa changes between measurements

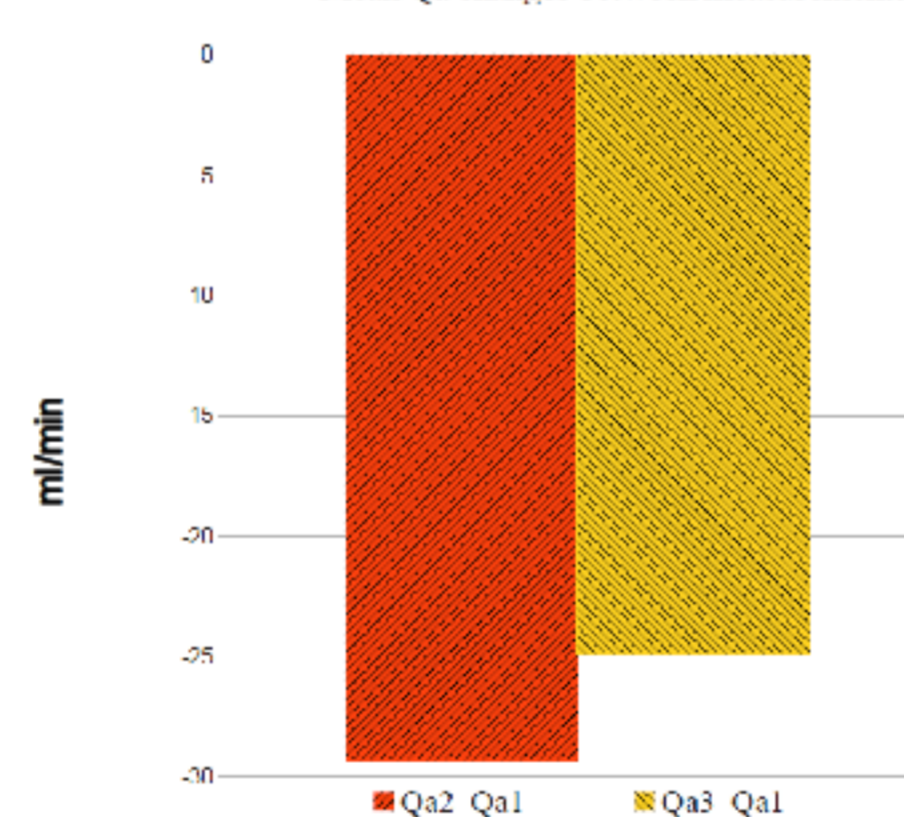


Fig. 5.

Mean SBP changes between measurements

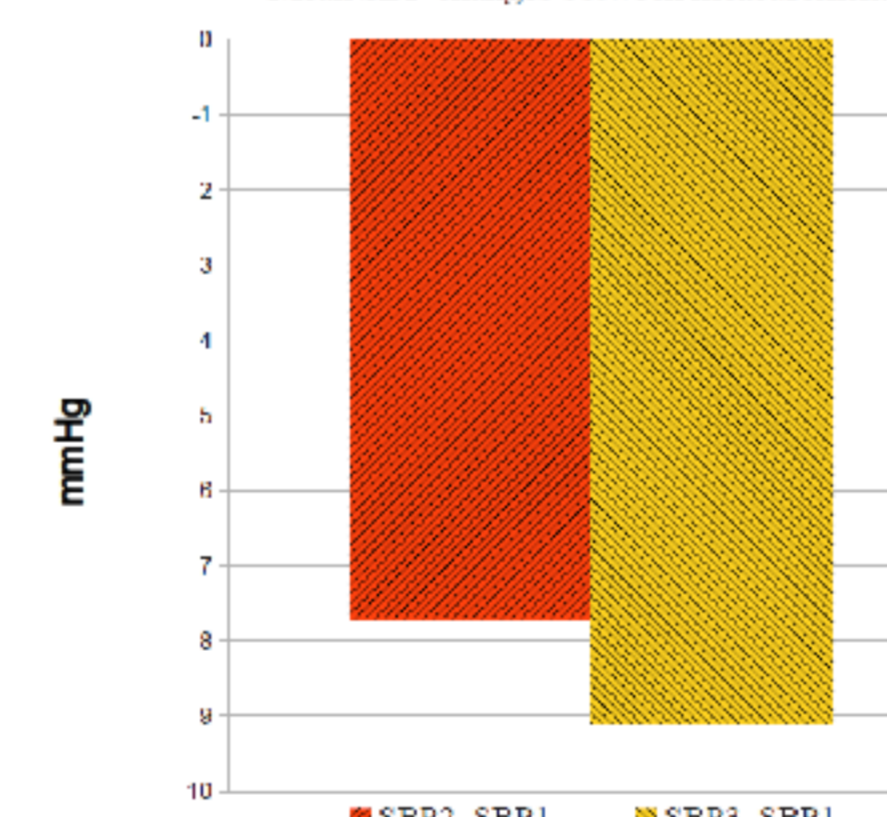


Fig. 6.

Mean DBP changes between measurements

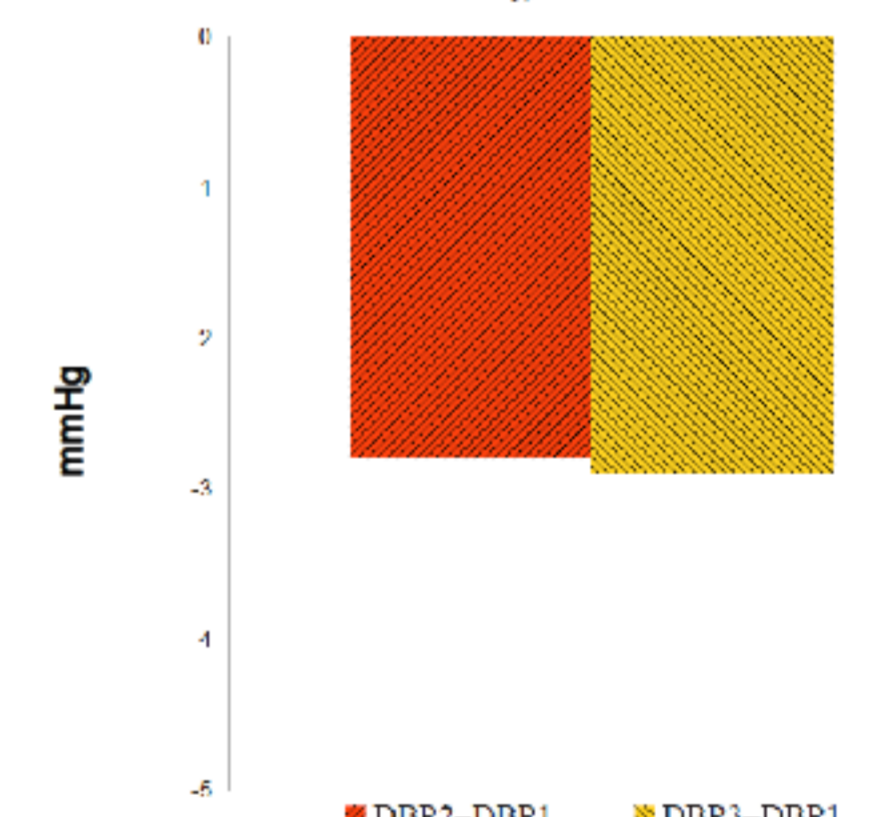


Fig. 7.

Mean MAP changes between measurements

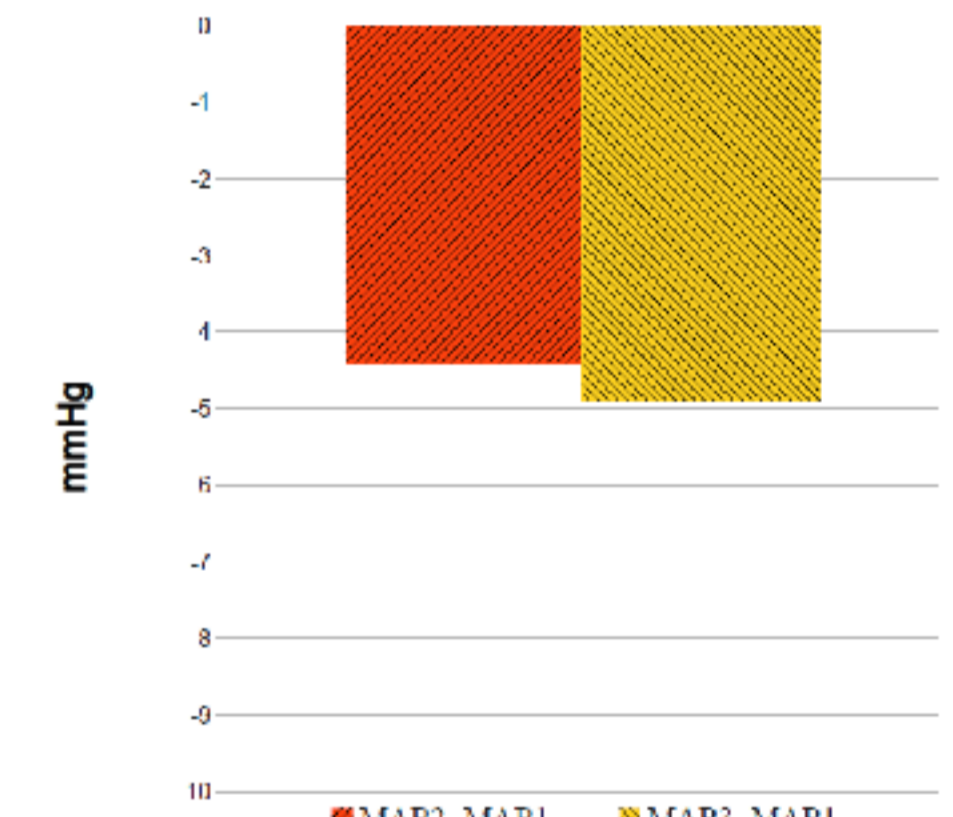


Fig. 8.

CONCLUSIONS:

- Changes in Qa and Qac during HD are significant, but differences are very slight and clinically not relevant.
- Although no direct statistically significant correlation between MAP changes and Qa was found, the inverse tendency of Qac implies a relationship between the MAP and Qa. We suggest correction of Qa for MAP only for distal fistulas, which balances the significant decrease of Qa in the late period of HD.
- Within-session CV of Qa is significantly lower than between-session CV, and it is within the physiological range. Consequently Qa measurements can be useful during the whole dialysis session.

