

Urea and Creatinine Mass Transfer-Area Coefficients (KoAs) for Hemodialyzers Decrease at Low Dialysate Flow Rates (Qd)

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It has been previously shown that small solute KoAs are lower when Qd is below the conventional value of 500 ml/min, but the dependence of small solute KoAs on Qd, blood flow rate (Qb) and ultrafiltration flow rate (Qf) has not been studied extensively. We evaluated dialyzer (1.46 m² of PUREMA membranes) clearances and dialysate saturation (S=dialysate outlet concentration divided by blood inlet concentration) for urea and creatinine in vitro at Qb of 400 ml/min with Qd of 40-200 ml/min and Qf of 0-2 L/hr and at Qb of 200 ml/min with Qd of 40 and 80 ml/min and Qf of 0-0.5 L/hr. Clearances and S were determined (N=3) by perfusing bovine blood (hct of 33%) single pass through the dialyzer. Limited, additional studies were performed using Optiflux 160NR dialyzers. Mass balance error of urea for all 75 experiments was not different from zero (0.81±0.64%, mean±SEM). S was independent of Qb and Qf and was used to calculate urea and creatinine KoAs (ml/min):

<u>Qd</u>	<u>40</u>	<u>80</u>	<u>120</u>	<u>160</u>	<u>200</u>
Urea KoA	145±13	259±12	361±20	455±21	527±22
Creatinine KoA	125±9	219±20	279±28	302±9	365±15

KoAs for urea and creatinine increased approximately 4-fold and 3-fold, respectively, when Qd increased from 40 ml/min to 200 ml/min. At Qd of 160 ml/min, urea and creatinine KoAs for Optiflux 160NR dialyzers were comparable at 432±112 and 258±50 ml/min, respectively. These urea KoAs at low Qd are substantially lower than reported for PUREMA and Optiflux dialyzers of approximately 1200 and 1100 ml/min, respectively, under conventional conditions. Urea and creatinine KoA/Qd ratios were relatively independent of Qd and were 3.11±0.10 and 2.49±0.12, respectively. These decreases in KoA do not lower the clearance substantially, however, since clearance is limited largely by the low Qd. We conclude that dialyzers require specific characterizations at low Qd if they are used in novel daily hemodialysis therapies using low Qd.