

Evaluating a new method to judge dialysis treatment using online measurements of ionic clearance

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New technology now supports direct online measurements of total dialysis dose per treatment, Kt . An outcome-based, nonlinear method for estimating target Kt in terms of ionic clearance measurements and body surface area (BSA) has been described recently. This is a validation study of the new method that evaluates the relationship between the (actual Kt –target Kt) difference and death risk. Patients with Kt measurements during March 2004 were identified ($N = 59\,644$). Target Kt was determined for each patient using the new method. Patients were then grouped by (actual Kt –target Kt) decile. They were also grouped by (actual URR–target URR) decile. Cox analysis-based risk profiles were constructed using those groupings. The (actual Kt –target Kt) difference profiles suggested improving death risk as Kt increased from below target to equal target. Risk ratios then flattened and remained so until (actual Kt –target Kt) reached the highest decile at which it appeared to improve, suggesting a possible biphasic profile. The (URR–target URR) risk profile was U-shaped. Death risk was related to the difference between the actual Kt and a target Kt value selected using the new nonlinear method. The method is therefore valid for prescribing and monitoring hemodialysis treatment.

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We have described a new method for prescribing total hemodialysis treatment (Kt : l/treatment) targets in terms of body surface area (BSA: m^2).¹ Small molecule clearance (K : ml/min) was measured using an established online ionic clearance (OLC) method² and multiplied by treatment time (t : min/treatment) to yield total treatment exposure or dose, Kt . Functional forms evaluating target Kt values in terms of BSA based on analyses of patient survival time were then tested to determine which fit best the empirical data.¹

Several curvilinear forms fit the data well and all suggested comparable treatment targets.¹ The best-fit form, however, was a simple algebraic expression that produces a curve proceeding from the 0, 0 origin (i.e., target $Kt = 0$; BSA = 0) increasing with BSA such that target Kt increases more rapidly at low BSA than at high BSA. A table showing target Kt in terms of BSA calculated using that best-fit form was appended to the manuscript¹ and is reproduced here also as an Appendix.

Validating new methods requires a different patient sample than the one used to develop the method. The purpose of this project, therefore, was to evaluate the association of the difference between the OLC-measured Kt actually delivered to patients and a target Kt value (actual Kt –target Kt) selected by the new method¹ using a different patient sample. The target Kt is a nonlinear function of BSA, not a linear function of body size as is, for example, a Kt/BSA or a Kt divided by a urea volume of distribution (V), Kt/V . Therefore, it was necessary to evaluate the method using an actual Kt minus target Kt difference instead of a value of Kt or Kt/BSA . We also performed similar analyses using a more familiar measure of dialysis dose, the urea reduction ratio (URR: %), to illustrate the process.

RESULTS

The patient population is described first. Risks profiles for BSA, Kt and URR will be presented before describing the (actual Kt –target Kt) and the (URR–target URR) relationships that are the primary focus of these validation analyses. Finally, the risk profiles evolving from those preplanned analyses suggested the possibility of follow-up analyses that will be presented last.

Patient sample and measurements

The original patient sample used to develop the new method included 32 763 patients treated 3 times weekly who had at

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least one online measurement of Kt during December 2002.¹ The current sample includes 59 664 patients treated 3 times weekly who had at least one online measurement of Kt during March 2004. A sizable subset of the sample (57 198; 95.9%) also had at least one URR measurement during the month.

Table 1 summarizes the attributes of the patient sample. The mean and median Kt were about 51 l/treatment. The mean and median (actual Kt–target Kt) were +0.3 l/treatment and +0.5, respectively. About 5% of patients were treated at actual Kt that was 14.7 l/treatment less than target and 5% were treated at Kt values that were 14.4 l/treatment or more than target.

The mean and median URR in the subsample of patients with a URR measurement were 73.4 and 74.1%, respectively. The 5th–95th percentile range was 61.3–82.9. The average (URR–75%) was about 1.6 percentage units lower than target; the 5th to 95th percentile for (URR–75%) was –13.7 percentage units to +7.9, respectively.

The median and modal numbers of Kt determinations during March 2004 were 12 and 13 measurements, respectively. Three-fourths of patients had 10 or more determinations and 92% had 5 or more. Ninety-two percent (92%) of patients with URR data, on the other hand, had only one URR determination.

BSA, Kt, and URR risk profiles

The risk profiles for BSA are shown in Figure 1. There appeared a progressive improvement of risk with increasing BSA throughout the range of BSA evaluated here whether the analysis was adjusted for case mix or not.

The risk profiles for Kt are shown in Figure 2. The unadjusted analysis suggests an improvement of risk with

increasing Kt that tended to level and then improve. Adjusting statistically for case mix and/or BSA similarly suggested improvement of risk with increasing Kt followed by leveling of risk. The adjustments for case mix, and particularly BSA, tended to reduce but not eliminate the risk gradient (i.e., the curve appears less steep) seen in these relationships. The general form of the risk to Kt relationship was similar no matter the statistical adjustments made to the data as found also during earlier studies.^{3,4}

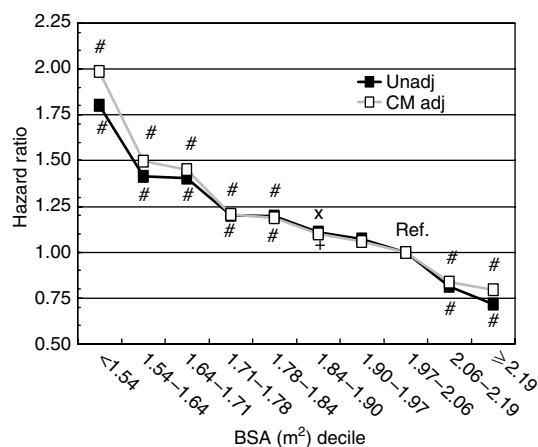


Figure 1 | Risk profiles for BSA showing the death hazard ratio for the deciles of BSA compared to a reference decile (Ref). Unadjusted (Unadj: ■) and case mix adjusted (CM Adj: □) analyses are shown. The hazard ratios are compared to a common reference decile (Ref) for each analysis and the probability that each ratio is not different from its reference value is shown by a symbol near the ratio: # $P < 0.01$, × $P < 0.05$, and + $P < 0.10$. No symbol means not different ($P > 0.10$).

Table 1 | Descriptive statistics

Variable	Mean or %	s.d.	Percentile						
			1st	5th	25th	50th	75th	95th	99th
Age (years)	61.0	15.0	25.0	34.0	51.0	62.0	73.0	83.0	89.0
Gender (% female)	46.8								
<i>Race</i>									
Black (%)	41.9								
White (%)	48.3								
Other (%)	9.8								
Diabetes (% yes)	52.0								
Post Wt (kg)	76.4	20.7	41.5	48.8	61.9	73.3	87.5	114.7	140.0
BSA (m ²)	1.86	0.25	1.34	1.47	1.68	1.84	2.01	2.30	2.53
K_{ecn} (ml/min)	233.2	35.6	139.0	169.5	211.5	236.5	257.0	286.0	309.5
t (min)	219.6	28.8	155	180	203	218	240	258	295
Kt (l/treatment)	51.0	10.3	28.2	34.7	43.9	50.7	57.7	68.1	77.2
Target Kt (l/treatment)	50.7	4.5	40.8	43.5	47.6	50.6	53.6	58.2	61.6
Kt – target (l/treatment)	0.3	8.9	–21.7	–14.7	–5.3	0.5	6.1	14.4	21.5
URR (%)	73.4	6.9	51.9	61.3	70.0	74.1	77.8	82.9	87.1
URR – 75 (%)	–1.61	6.94	–23.11	–13.71	–5.00	–0.93	2.78	7.93	12.10

BSA, body surface area; K_{ecn} , ionic clearance measured by OLC; Kt, the $K_{\text{ecn}} \times t$ product; t , treatment length; URR, the urea reduction ratio; Wt, body weight.

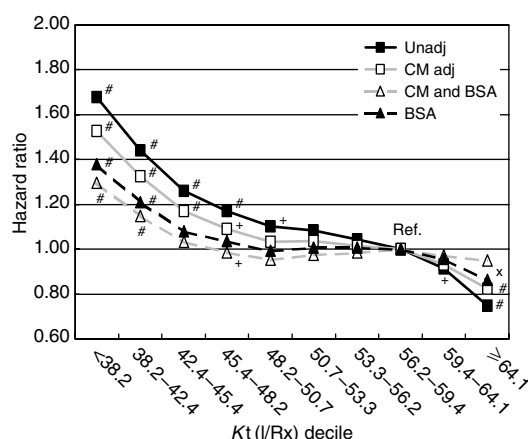


Figure 2 | Risk profiles for Kt. Four levels of statistical adjustment are shown: unadjusted (Unadj: ■), case mix adjusted (CM Adj: □), case mix and BSA adjusted (CM and BSA: △), and BSA adjusted (BSA: ▲). The hazard ratios are compared to a common reference decile (Ref) for each analysis and the probability that each ratio is not different from its reference value is shown by a symbol near the ratio: # $P < 0.01$, $\times P < 0.05$, and $+ P < 0.10$. No symbol means not different ($P > 0.10$).

Figure 3 presents similar constructs for the URR. The unadjusted risk profile suggests a U-shape in which risk is higher at the extremes of the URR distribution than at its middle. Minimum risk appeared close to URR=75%. Adjustments for case mix and/or BSA altered the relationships so that the risk gradient is steeper. Furthermore, continuing risk improvement is now observed throughout the range of URR. In other words, adjusting the URR risk profile, particularly for BSA, altered it to resemble the unadjusted risk profile for Kt again confirming earlier studies⁴ that suggest high risk at high URR is at least partially attributable to the predominance of low BSA patients in high URR deciles. Although the unadjusted profile suggests a URR target of about 75% (minimum risk), the BSA adjusted profile suggests a target exceeding 81%, the minimum value of the upper decile, because there is no clear zone of minimum risk.

Risk and the treatment to target difference for Kt and URR

The Kt therapy target was calculated for each patient from her/his BSA using the nonlinear method¹ and subtracted from the actual Kt that was administered to the patient. The hazard ratios for the (actual Kt–target Kt) deciles are shown in Figure 4 and are compared to the no difference decile that incorporates ‘0’ (–1.6 to +0.5 l/treatment).

There appeared a progressive increase of risk as actual treatment became less than target, that is, when (actual Kt–target Kt) became more negative. Risk appeared to flatten as (actual Kt–target Kt) moved into the positive range (i.e. actual Kt $\geq$ target Kt). Risk then appeared to remain stable until the last decile of (actual Kt–target Kt), for which the hazard ratio was lower than the 0-point reference value.

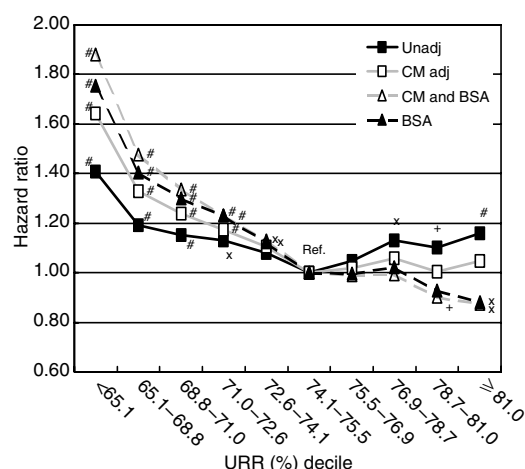


Figure 3 | Risk profiles for the URR. Four levels of statistical adjustment are shown: unadjusted (Unadj: ■), case mix adjusted (CM Adj: □), case mix and BSA adjusted (CM and BSA: △), and BSA adjusted (BSA: ▲). The hazard ratios are compared to a common reference decile (Ref) for each analysis and the probability that each ratio is not different from its reference value is shown by a symbol near the ratio: # $P < 0.01$, $\times P < 0.05$, and $+ P < 0.10$. No symbol means not different ($P > 0.10$).

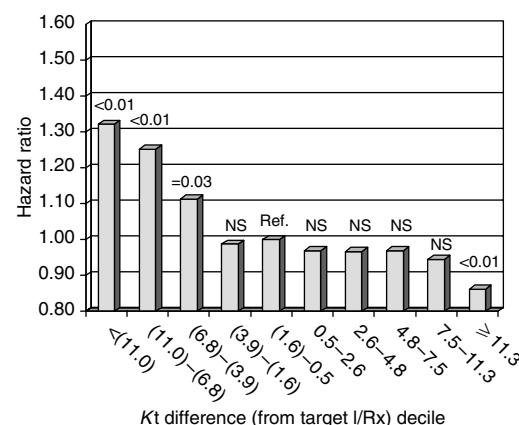


Figure 4 | Risk profile for the difference between delivered Kt and the target Kt (actual Kt–target Kt). Values in parentheses are negative values for the difference indicating that the delivered Kt was lower than the target Kt. Values not in parentheses are positive values indicating that the delivered Kt was higher than the target Kt. The hazard ratios were compared to a reference decile that incorporated ‘0’ indicating no difference between the delivered and target Kt. The probability that the hazard ratios were not different from the reference decile is shown above the bars; ‘NS’: not different ($P > 0.05$).

Thus, the risk curve may be biphasic showing improvements both before and after a region of level risk.

Figure 5 presents a similar construct for (URR–target URR). The reference group was –0.93 to +0.51 percentage units. Risk was minimum when URR was close to 75% and tended to increase when URR was less than 75%. Risk also tended to increase as URR exceeded 75%, however, suggesting a U-shaped, or reversed J-shaped, profile. Supplementary analyses using target URR of 70 and 65% also produced

U-shaped, or reversed J-shaped, profiles similar to those shown in Figure 5 (data not shown).

Additional analyses

The (actual Kt–target Kt) risk profile (Figure 4) suggested a flattening of death risk as the difference approached zero and moved into the positive range. The apparent improvement of risk in the highest decile of the distribution was surprising. Similarly, the reversed J-shaped forms of (URR–target URR) suggested the possibility of additional analyses. Therefore, possible differences of BSA among (actual Kt–target Kt) and (URR–75%) deciles were evaluated using an analysis of variance. Figure 6 summarizes the results.

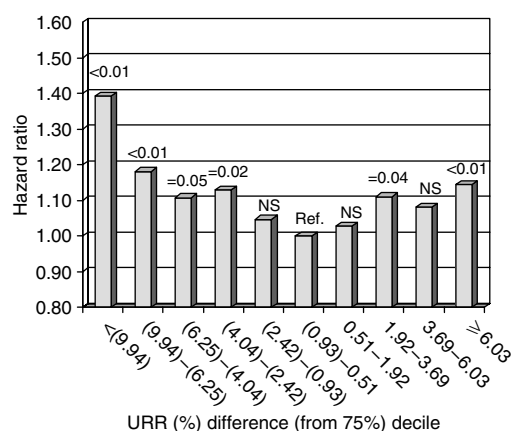


Figure 5 | Risk profile for the difference between delivered URR and the target URR (URR–75%). Values in parentheses are negative values for the difference indicating that the delivered URR was less than 75%. Values not in parentheses are positive values indicating that the delivered URR was greater than 75%. The hazard ratios were compared to a reference decile that incorporated '0' indicating no difference between the delivered and target URR. The probability that the hazard ratios were not different from the reference decile is shown above the bars; 'NS': not different ($P > 0.05$).

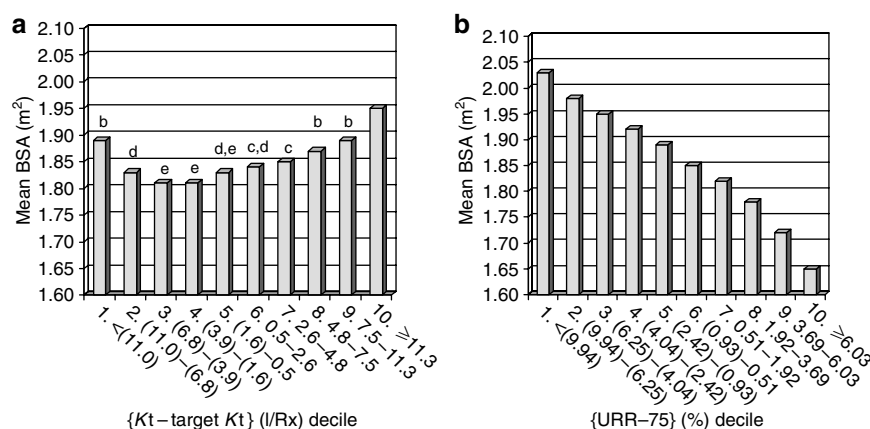


Figure 6 | The mean BSA is shown for the decile values of (actual Kt–target Kt) (left panel) and (URR–75) (right panel) differences from their respective target values. The analysis of BSA by Kt difference decile suggested that there were differences among the deciles ($F = 118$, $P < 0.001$). Deciles values for mean BSA with the same letter above the bar indicates their values were not significantly different from each other ($P > 0.05$). The analysis of BSA by URR difference decile suggested that there were differences among the deciles ($F = 1560$, $P < 0.001$). The mean BSA in all URR difference deciles were significantly different from all other deciles ($P < 0.05$). Thus, mean BSA became progressively lower with increasing URR difference from 75%.

There were differences of mean BSA among the (actual Kt–target Kt) deciles (Figure 6, left panel). The mean BSA of patients in the highest decile ($[\text{actual Kt} - \text{target Kt}] \geq 11.3$) was significantly greater than all other deciles. BSA in the first decile ($[\text{actual Kt} - \text{target Kt}] < 11.0$), on the other hand, was not different from BSA in either the eighth or ninth deciles. Similarly, the second, fifth, and sixth deciles were not different. The BSA versus (actual Kt–target Kt) relationship appeared as a shallow J-shape but the range of mean values was constrained between 1.81 m^2 (third and fourth deciles) and 1.95 m^2 (10th decile). The mean BSA in deciles 1 and 9 were 1.89 m^2 so the range of mean BSA was 0.14 m^2 across all deciles but only 0.08 m^2 if the 10th is not considered.

Mean BSA became progressively smaller as (URR–75%) became progressively greater (right panel of Figure 6) so that larger patients tended toward URR values lower than URR = 75% while smaller patients were treated at URR that exceeding that value. The mean BSA in the first (URR–75%) decile was 2.03 m^2 ; it was 1.65 in the 10th decile; the range of BSA was therefore 0.38 m^2 across the deciles. The mean BSA in each (URR–75%) decile was significantly different from all other deciles. The relationship between (URR–target URR) and BSA was strongly inverse.

DISCUSSION

This project was intended primarily as a formal validation exercise to evaluate a new nonlinear method for judging dialysis dose in terms of BSA using OLC technology.¹ Evaluating risk in terms of an actual minus target Kt difference was necessary because the target Kt is a nonlinear function of BSA and not a simple linear ratio like Kt/BSA or Kt/V. A ratio of Kt/V is constant across all values of V because $Kt = 0 + 1.2 V$ if the target Kt/V is 1.2. The ratio of Kt/V is not fixed, however, if the relationship is nonlinear as illustrated by Eq. 1) (see Materials and Methods). Prior work

(Lowrie *et al.*¹, Figure 8 in that paper), for example, implies a Kt/V of 1.67, 1.52, 1.39, 1.28, 1.18, 1.10, and 1.03 for urea volumes equaling 20, 25, 30, 35, 40, 45, and 50 l, respectively. That pattern, indicating falling Kt/V with increasing V, is similar to the one observed in clinical practice because clinicians generally use higher URR, and therefore Kt/V, for small patients than large.⁵

Profiles evaluating the association of death risk with (actual Kt–target Kt) suggested that negative values, indicating actual Kt < target Kt, were generally associated with higher risk than if (actual Kt–target Kt) was close to ‘0’. Risk flattened as (actual Kt–target Kt) increased into the positive range but appeared to improve when (actual Kt–target Kt) exceeded 11.3 l/treatment. Thus, the new method¹ leads to reasonable minimum target Kt values for small molecule directed treatment. The possibility remains, however, that increasing Kt to much higher levels might provide additional benefits for patients.

Analyses of (URR–target URR), similar to the analysis of (actual Kt–target Kt), were also performed. Those risk profiles suggested that negative values, indicating that actual therapy was less than URR = 75%, were associated with higher risk than if the value of (URR–75%) was near ‘0’. Risk then appeared to increase as the difference proceeded into the positive range so that the risk profile appeared U-shaped indicating that high URR was associated with greater risk.

The finding suggesting better survival in the highest decile of (actual Kt–target Kt) deserves discussion. The new method¹ may underestimate true target Kt for some patients. That is unlikely because the risk profile appeared biphasic, improving both before and after a region of flat risk. By alternative, there may be a real survival advantage associated with treatment at very high Kt so that the risk profile may be truly biphasic. The management of mortal risk attributable to small molecule associated pathology, for example, may be adequately managed when actual Kt equals or exceeds target. However, treatment at much higher levels may be associated with a survival advantage attributable to better management of other chemical species. Additional research is needed to explain, and refute, or confirm this interesting finding.

The U-shaped risk profiles for URR, and the actual minus target URR difference, also deserves comment. High values of URR could be ‘toxic’ to patients by removing essential nutrients, for example. That explanation is unlikely because comparable U-shaped risk profiles associated with URR have been reported before⁶ and no toxicity-related explanation has yet been forthcoming. Furthermore, statistical adjustment for body size, whether described as V^6 or other measures,^{3,4,7,8} extinguishes the U shape to the profiles. That would not be likely if the U shape were due to direct toxicity. It is therefore more likely a function of body size differences among the deciles as confirmed by Figure 6, right panel.

U-shaped risk profiles are observed with the single pool and equilibrated values of Kt/V as well as simple division of Kt by BSA, Kt/BSA.⁸ The extinction of the U shapes by statistical adjustment for body size has been reported

before.^{3,4,6,7} Adjusting a Kt/V statistically for V, or close correlates of V like height and weight⁴ or BSA, reduces the analysis to the evaluation of Kt because the risk associated with Kt/V is evaluated at a statistically constant value of V.⁹ Risk differences associated with Kt/V evaluated at constant V must logically be due to differences of Kt.

Some argue from such observations that Kt/V and URR, dimensionless parameters evolving from urea pharmacokinetic models, are not well suited to prediction of a clinical outcome like survival.¹⁰ The equations underlying the models treat V simply as a diluent for urea without other biological or epidemiological properties.¹¹ However, body size, V, is strongly associated with death risk in dialysis patients.^{3,12} Thus, an important premise on which the urea models are based is incorrect. The ratio Kt/V divides one measure positively associate with survival, Kt, by another, V.¹⁰ A high Kt/V, or URR, can therefore indicate either a high Kt, favorable to survival, or a low V, unfavorable to survival.

There is no biological imperative requiring that Kt, or physiological functions generally, be judged as simple ratios of body size like Kt/BSA or Kt/V. Indeed, the universal scaling law suggests that physiological functions increase with body size as a power function^{13,14} that has nonlinear mathematical properties very similar to the method used here.¹

We first reported routine use of OLC-related methods on 15 570 patients treated during April 2002;⁸ that increased to 33 328 by December.¹ These data show that the OLC-tested population was 59 664 in March 2004 – an increase of more than 280% in 2 years. Thus, OLC-related technology is finding widespread and increasing clinical use.

This new method has several advantages for those clinics able to measure OLC. First, OLC actually measures Kt but not V or Kt/V.^{2,15} Second, dialysis dose can be measured with each treatment as suggested by the observation that the average number of Kt measurements in a month was 12 compared to a single URR measurement. Third, the urea kinetic premise issue¹⁰ is avoided and one need not worry about U-shaped risk profiles or which statistical adjustment is favored for evaluating the profiles to judge appropriate treatment targets.⁴ Fourth, the now accepted underprescription of Kt for small patients using a fixed Kt/V ratio^{7,8} is avoided because the Kt prescribed for small patients is proportionally higher than it is for large patients. Fifth, the urea V is ambiguous; it is said to be about 15% less than V estimated by anthropometric methods in chronic dialysis patients¹⁶ but more than anthropometric V in acute dialysis patients.^{17,18} The best value of V for division into OLC-measured Kt is uncertain. BSA, on the other hand, is a simple fixed transformation of height and weight¹⁹ that is well understood by most clinicians. Sixth, post-dialysis blood sampling is not necessary thereby avoiding cost, needle stick risk, and the staff efforts necessary to assure that the post-dialysis blood sample is properly drawn.

Finally, the new method is easily implemented at no incremental cost in clinics able to measure OLC. A target Kt

is selected for the patient's BSA from a table, like the one shown in the Appendix, and divided by t to estimate a target OLC-measured K . The blood and dialysate flow rates necessary to estimate an initial K are then selected from manufacturers' specifications for the dialyzer and used to initiate the first treatment. K is then adjusted using OLC information by manipulating the flow rates to achieve the target Kt. Cumulative Kt can be monitored during the course of treatment and the length of treatment can be extended if necessary to achieve the target. The actual Kt at treatment's end can be compared to the target Kt and the difference used to plan the next treatment.

These comments should be qualified in several ways. First, the data are retrospective. Trials in which the Kt is delivered at prespecified levels above and below target may give different insights. Similarly, other analyses exploring different ranges of Kt, or different (actual Kt–target Kt) ranges, may suggest other conclusions. Second, the technology used to measure Kt in this study is available only through a single supplier and these patients were treated in clinics owned and/or operated by the same company. Other suppliers (e.g., Gambro, AB: Stockholm, Sweden and Lakewood, CO, USA) offer machines incorporating OLC technology;¹⁵ however, other technologies have been suggested to support that capability.²⁰ Third, possibilities for interest of conflicts exist in this work. All these co-authors are employees of, or paid consultants to, the company that owns the technology evaluated here. As such, however, the penalties could be severe if this work is someday deemed false or misleading. Fourth, describing the new method¹ for prescribing dialysis dose to the clinical community, and particularly to clinicians practicing at FMC(NA)-affiliated clinics, could have altered traditional practice patterns. The new method was first published in September 2005; however, all data for this project were collected before that date. It was not described to the clinical public by memoranda or verbal presentations, even to FMC(NA)-affiliated clinics.

Finally, we chose the URR as the familiar dialysis dose measure. Others may prefer a different measure such as one of the Kt/V values. There are several such possibilities, however, and several methods by which each is computed. The URR is an acknowledged measure of dialysis dose²¹ and is the measure routinely reported to the United States government (Form UB-92 HCFA-1450) as part of its ongoing management of the dialysis payment program. As such, it is an appropriate and familiar illustrative example to use for our purpose.

A debate has occurred in the clinical literature during the past several years about whether Kt or a urea kinetic parameter, like the URR or a Kt/V, is the better outcome-based measure of hemodialysis dose. Those arguments are well developed elsewhere.^{10,22} Measures like the URR and Kt/V are well accepted and have been used in a recent study of dialysis dose²³ and as clinical guidelines for therapy.²¹ Some suggest that OLC technology should be used primarily to measure a K value for use in formal urea kinetic models.² The

various models have been recently well summarized and compared.²⁴ The new method¹ evaluated here, however, proposes a more direct use for the new technology that is predictably associated with death risk. As such, it is a valid method for judging dialysis dose if OLC measurements are available. It is fortunate that clinicians can now choose to use either direct Kt measurements or a urea-based method²⁴ to prescribe and monitor dialysis dose for their patients.

MATERIALS AND METHODS

All data were taken from the Fresenius Medical Care (North America) clinical data system. The data management techniques were similar to those used before.¹ Target values for Kt based on the patients' BSA were subtracted from the actual Kt delivered during each dialysis treatment (actual Kt–target Kt) and was the primary focus for this project. The differences between the URR and a target URR (target = 75%) were also determined for each URR measurement. The medians for all values of BSA, Kt, URR, (actual Kt–target Kt) and (URR–URR target) measured for each patient during March 2004 were determined and used as predictor measures in Cox-based analyses of survival time during the 1 year period from April 1, 2004 through March 31, 2005.

The primary analysis evaluated the association of survival time with (actual Kt–target Kt). Comparable analyses using a more familiar treatment measure evaluated (actual URR–target URR). Risk profiles were also constructed for Kt, URR, and BSA to evaluate their comparability with similar analyses reported in the past.^{3,4,6–8} The variables were grouped according to the decile values of their distributions. Kt and URR risk profiles were adjusted and not for BSA and/or certain case mix measure as done in the past. The case mix measures included age (years), gender (female/male), race (black/white/other), and diabetic status (diabetic/nondiabetic).

The target Kt (l/treatment) was calculated as a function of BSA (m^2) for each patient using the double reciprocal algebraic form:¹

$$\text{Target } K_t = \frac{1}{a + b/\text{BSA}} \quad (1)$$

The coefficients 'a' and 'b' were 0.0069 and 0.0237.¹ The URR was calculated as follows:

$$\text{URR} = 100 \times \left(1 - \frac{\text{Post-dialysis BUN}}{\text{Pre-dialysis BUN}} \right) \quad (2)$$

where BUN means blood urea nitrogen concentration.

The primary target value for URR (75%) was chosen because it was a convenient value close to the median URR and in the range of minimum risk identified by the URR risk profiles. BSA was calculated by the DuBois equation.¹⁹ Kt was measured using previously described technology^{1,2,8} embodied in the model 2008H and 2008K dialysis hardware systems manufactured and distributed by the Medical Products Division of Fresenius Medical Care (North America).

Additional analysis

Possible BSA differences among the deciles of (actual Kt–target Kt) and (URR–75%) were evaluated using an analysis of variance. Differences among the decile means for each measure were evaluated using a multiple range test (Scheffe's test).

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Appendix | Selecting a target Kt by BSA based on Eq. (1).

BSA	Kt	BSA	Kt	BSA	Kt
1.20	37.6	1.74	48.8	2.28	57.9
1.22	38.0	1.76	49.2	2.30	58.2
1.24	38.5	1.78	49.5	2.32	58.5
1.26	38.9	1.80	49.9	2.34	58.8
1.28	39.4	1.82	50.3	2.36	59.1
1.30	39.8	1.84	50.6	2.38	59.4
1.32	40.3	1.86	51.0	2.40	59.7
1.34	40.7	1.88	51.3	2.42	60.0
1.36	41.2	1.90	51.7	2.44	60.3
1.38	41.6	1.92	52.0	2.46	60.6
1.40	42.0	1.94	52.4	2.48	60.8
1.42	42.4	1.96	52.7	2.50	61.1
1.44	42.9	1.98	53.1	2.52	61.4
1.46	43.3	2.00	53.4	2.54	61.7
1.48	43.7	2.02	53.7	2.56	62.0
1.50	44.1	2.04	54.1	2.58	62.2
1.52	44.5	2.06	54.4	2.60	62.5
1.54	44.9	2.08	54.7	2.62	62.8
1.56	45.3	2.10	55.1	2.64	63.1
1.58	45.7	2.12	55.4	2.66	63.3
1.60	46.1	2.14	55.7	2.68	63.6
1.62	46.5	2.16	56.0	2.70	63.9
1.64	46.9	2.18	56.3	2.72	64.1
1.66	47.3	2.20	56.7	2.74	64.4
1.68	47.7	2.22	57.0	2.76	64.6
1.70	48.0	2.24	57.3	2.78	64.9
1.72	48.4	2.26	57.6	2.80	65.2