

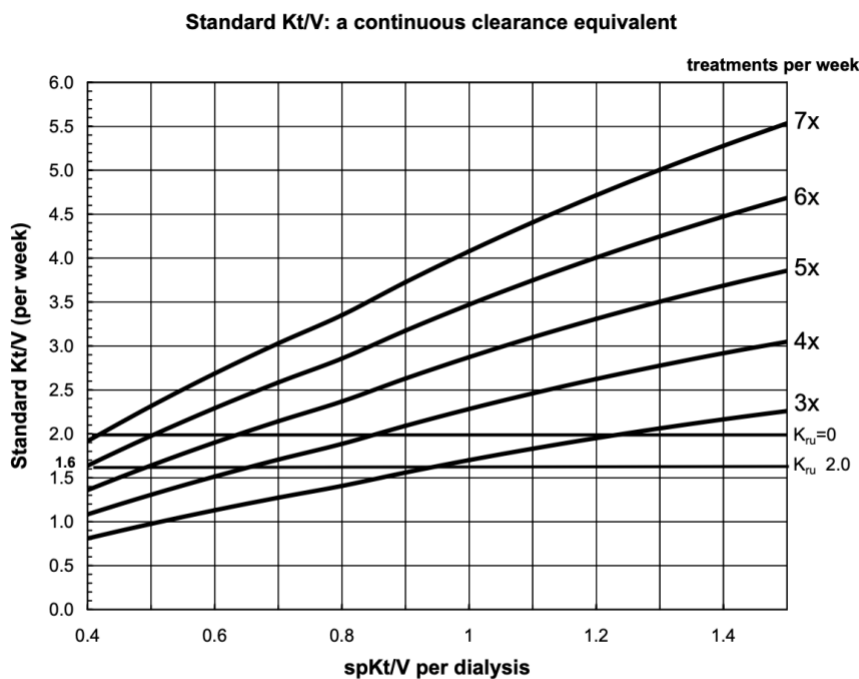
Q1 What is the first step in developing a HHD prescription?

- A. Choosing how many days per week to dialyze
- B. Choosing blood flow rate
- C. Choosing how dialysate volume per treatment
- D. Choosing time per HD session

The correct answer is A.

The first step is to choose how many days to dialyze. There are several routes to develop a HHD prescription, but the most straightforward is to first select how many days per week the patient will dialyze. This is determined by patient preference as well as clearance and volume needs. Once the number of days is selected, the next step is to determine the single pool Kt/V needed to ensure the weekly standard Kt/V ≥ 2.1 (based on the KDOQI guidelines).

The relationship between spKt/V, standard Kt/V, and dialysis days per week can be seen here below:



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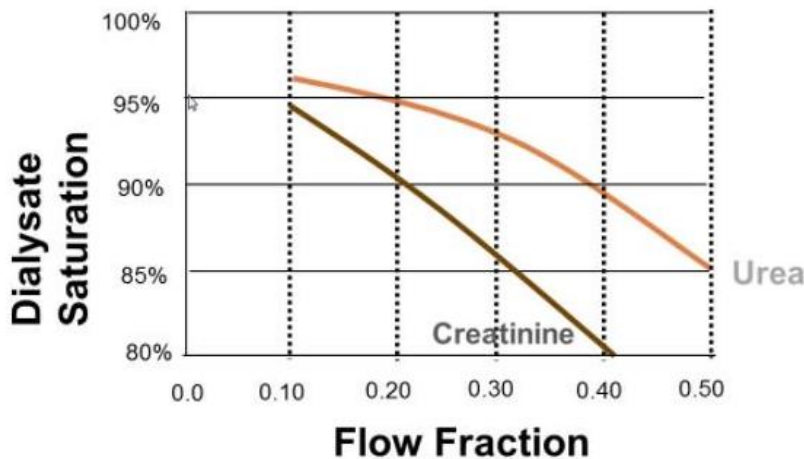
For this example, let us choose to dialyze 5 times per week. Doing so and selecting a spKt/V of 0.7 will theoretically result in a standard Kt/V ≥ 2.1 .

Once a spKt/V is determined (in this case 0.7), calculate the dialysate volume (Vd) needed to achieve the spKt/V of 0.7. In this case: $0.7 = Vd / (0.5 * 70L)$. The Vd needed is

24.5L.

Next step is to choose a flow fraction (FF). FF is the ratio of Q_d/Q_b . The lower the flow fraction, the more the dialysate will be saturated against the counter current blood flow. Because Q_b usually does not exceed 400-450 ml/min, to lower the FF any more requires decreasing the dialysate rate (in order to maximize dialysate saturation). The caveat is the lower the FF, the longer a dialysis session will need to be.

The relationship between FF and dialysate saturation can be seen below:



Leypoldt et al. ASN. 2005.

It is common to choose a flow fraction between 0.4-0.5. In our case, if we choose a FF of 0.4, dialysate saturation (of urea) will be approximately 90%. Therefore, if we needed a clearance volume of 24.5 L to achieve a $spKt/V$ of 0.7, applying a FF of 0.4 will result in only 22.1 L of clearance. Thus, it is important to back-calculate the actual dialysate volume such as $V_d(\text{needed}) = V_d(\text{originally calculated})/0.9$. In this case the $V_d(\text{needed}) = 27.2$ L dialysate per treatment.

If we choose a FF of 0.5 (85% urea saturation) then we would need 28.8 L dialysate per treatment

The NxStage PureFlow system will batch either 50L or 60L of dialysate, so for the sake of water conservation it is ideal to choose a dialysate volume that is divisible by 50 or 60. In our case, it is best to choose a dialysate volume of 30 L. This way the patient will have the NxStage make 60 L of dialysate, and go through the first 30 L on one day and the second 30L on the next day.

Because 30L is chosen, then there is really no difference between choosing a FF 0.4 or 0.5 because both will achieve an acceptable $spKt/V$. However, you will see below how FF 0.5 will result in a significantly shorter treatment duration per HD session.

Next is to choose Q_b . In order to minimize dialysate time, it is ideal to choose the highest Q_b the AVF can tolerate. If a Q_b of 400 ml/min is selected, then the dialysate rate can be calculated using the FF. Our FF is 0.5, so $0.5 = Q_d/400$. Q_d therefore will be 200 ml/min.

Lastly, in order to determine the total time per HD session, use the Q_d and V_d to solve for time. $\text{Time} = (30,000 \text{ ml}) / (200 \text{ ml/min}) = 150 \text{ min} = 2.5 \text{ hours}$.

To understand how much FF makes a difference on treatment time, if FF was 0.4 then treatment time would be 3.125 hours. Almost 38 minutes longer!

In summary, the steps are as follows:

1. Determine number of HD days per week
2. Determine goal spKt/V
3. Choose FF
4. Choose V_d
5. Choose Q_b

The following resultant variables will be the Q_d , and time per HD treatment.

The final prescription for this case is:

5 days per week, V_d 30L, Q_b 400 ml/min, FF 0.5

Additional reading:

<https://www.nxstage.com/wp-content/uploads/2019/08/Dialysate-Volume-Quick-Reference-Guide.pdf>

<https://www.nxstage.com/wp-content/uploads/2017/08/NxStage-Therapy-Handbook-APM907.pdf>