Clinical Procedure Adequacy

APD Specimen Collection

Baxter

The goal of the adequacy collection is to obtain the most accurate representation of waste removal (Kt/V_{urea}) as possible. An APD adequacy collection procedure may involve several variables depending on the patient's APD prescription and the facility's protocol. The following procedures provide adequacy collection methods for APD patients using either the batch or aliquot method as described by K/DOQI.[1]

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Batch Method

1. Collect all drain bags for 24 hours [APD drain bag(s) and any manual day exchange(s)].
2. Have patient bring all drain bags to the dialysis unit.
3. Weigh or measure dialysate in each drain bag to determine total volume. Record measurements.
4. Combine effluent from all drain bag(s) into one container. [See Figure 1]
5. Thoroughly agitate dialysate in one container and obtain specimen.
6. Send dialysate effluent specimen(s) to the laboratory for dialysate creatinine and urea nitrogen measurement. Check with laboratory for correct tube/container for processing specimen. Follow laboratory specific guidelines for proper handling and transport of effluent specimen for dialysate creatinine and urea nitrogen measurement.
   - If measuring Creatinine Clearance, dialysate creatinine concentration should be corrected for the presence of glucose, which interferes with some creatinine measurement methodologies. Each facility must determine this by specifically inquiring of its laboratory whether the creatinine assay used by that lab is altered by high glucose concentrations. Each laboratory should establish its own correction factor and should reestablish the correction factor if the laboratory's methodology changes.[1]
7. Provide laboratory with total weighed/measured drain volume.*
8. Record the patient's height and weight per laboratory procedure.

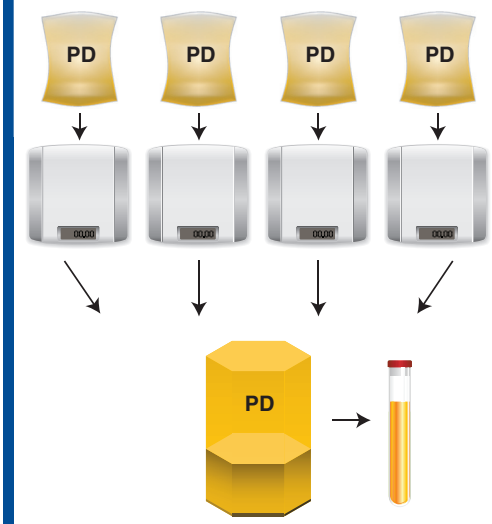

FIGURE 1. BATCH METHOD

For the batch method, each full drain bag of dialysis fluid is weighed. The effluent is then combined into one container. This solution is agitated thoroughly prior to obtaining a dialysate effluent specimen.

Batch Method (cont.)

9. Send a serum specimen to laboratory for creatinine and blood urea nitrogen (BUN), preferably in the afternoon.
    a. If using **PD Adequest** software, in addition to urea and creatinine, serum specimen should be sent for albumin and glucose measurements.
    b. Serum specimens drawn in the morning after completion of a 24-hour collection can underestimate average serum concentrations and thus lead to an overestimation of clearance in APD and Tidal PD patients. It is recommended, but not an absolute requirement, that serum specimens be drawn between 2:00 p.m. and 5:00 p.m. of the afternoon following the 24-hour collection in order to more closely estimate time averaged steady-state serum urea and creatinine concentrations.[1]

*While the total drain volume may contain purged unexposed dialysate, the dialysate urea and creatinine will be diluted proportionately resulting in an accurate total waste removal assessment ($[U_{urea}] \times [V_{effluent}]$).

To summarize the batch method, all effluent bags in a 24-hour period are brought to the center. While this batch method is simple in concept, it may be difficult for an APD patient to carry out because it means transporting all the dialysate bags, which are heavy and bulky.[1]

ATTENTION:
If you reprogram the Last Fill Volume to 0, this change may impact the number of cycles delivered during the night portion of the therapy. The clinician should review all prescription parameters when making a prescription change.

Another adequacy collection method is commonly referred to as the aliquot method.[1] Effluent bags are not brought to the center. Rather, specimens (aliquots) of defined volume are obtained from each effluent drain bag based on the measured/weighed drain volume of the bags.

IMPORTANT CONSIDERATIONS WHEN USING ALIQUOT COLLECTION

If the patient will be using an APD therapy which requires the cycler program "Dextrose: Different," there is the potential of unused heater bag dialysate being purged into the drain bag prior to the delivery of the Last Fill. If cycler programming remains "Dextrose: Different," ensure the total night therapy solution bag volume does not significantly exceed the programmed therapy night volume. Alternatively, discuss with the physician the following programming option to prevent dilution of effluent by purged unexposed PD fluid:

- **Reprogram the Last Fill Volume to "0." The clinician may then want to consider having the patient perform a manual daytime exchange (in lieu of the usual cycler-delivered Last Fill)**

The default setting for FLUSH: YES is strongly recommended to reduce infectious risk.[2] If Flush is enabled (YES), during priming the system automatically flushes up to 175 mL of solution from the heater line, and up to 155 mL from each connected supply line and last fill line to the the drain. If FLUSH is enabled (YES) and all solution lines are used (heater line, supply lines and the last fill line) the flush volume could be 225–485 mL, which may impact the accuracy of the Kt/V in patients using low volume APD therapy (e.g. less than 10 liters). In this clinical situation, clinicians should consider using a batch collection method to avoid the dilutional effect of the flush which may result in an underestimation of the total Kt/V.

Aliquot Method

1. Once the APD treatment is complete, record the following information from the cycler. Instruct the patient to bring this information to the dialysis unit. The clinician will then record this information on the Therapy Volume Worksheet:
   a. Total Therapy Volume
   b. Last Fill Volume
   c. Initial Drain Volume
   d. Total UF
2. Have patient save all drain bags [APD drain bag(s) and any manual day exchange(s)].
3. Based on patient's APD prescription, obtain APD specimen(s).
   a. **One APD drain bag** – agitate the drain bag thoroughly just prior to obtaining the specimen to ensure homogenous mixing of effluent. A specimen size of any volume may be obtained and brought to the dialysis unit. For example, the specimen size could be 10 mL or 100 mL.
   b. **Two APD drain bags** – agitate drain bags thoroughly to ensure homogenous mixing of effluent just prior to obtaining specimens.
      i. If equal filling of the two effluent drain bags is apparent, an equal volume aliquot from each bag (e.g. 10 mL total: 5 mL from each bag) can be pooled and that single combined aliquot brought to the dialysis unit. This entire specimen can be sent to the laboratory for determination of urea and creatinine.

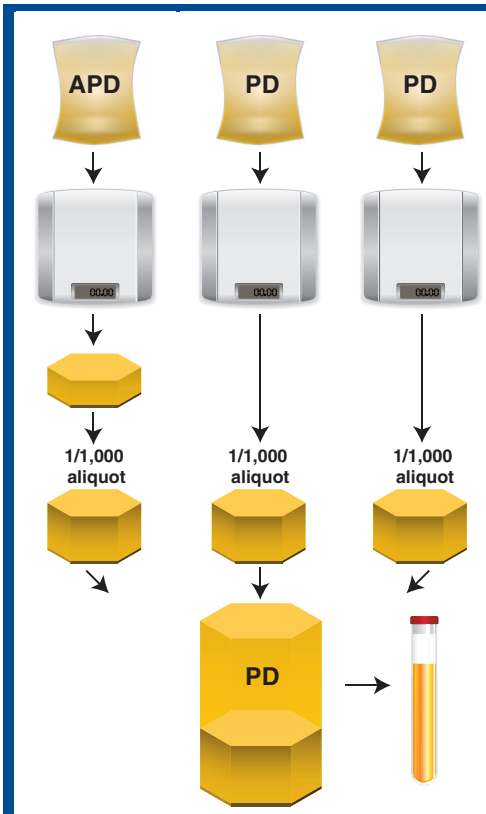

FIGURE 2. ALIQUOT METHOD
Example of combination of therapy modes

Each full drain bag of dialysis fluid is weighed. For the APD drain bag, a sample size greater than 50 mL is obtained. A 1/1,000 aliquot is taken from the APD drain specimen based on the Total APD Volume Drained. A 1/1,000 aliquot is taken from the manual drain bag(s). The specimens are mixed and a dialysate effluent specimen is sent to the lab.

Aliquot Method (cont.)

ii. If it is apparent that the effluent draining into the bags is ***not*** freely mixing and distributing evenly, a specimen from each drain bag is required, as well as the exact volume of each drain bag. For example, if one drain bag has a drain volume of 13,000 mL and the other drain bag has a volume of 5,000 mL, 1/1,000 aliquots of each would be 13 mL and 5 mL respectively. These respective 1/1,000 aliquots should then be combined (13 mL + 5 mL = 18 mL) in one container. This blended specimen will be submitted to the laboratory for determination of urea and creatinine.

c. **Combination of therapy modes** [for example, an APD therapy and manual day exchange(s)]. [See Figure 2]

i. For an APD drain bag, agitate drain bag to thoroughly mix contents prior to obtaining specimen. A specimen size greater than 50 mL should be obtained and brought to the dialysis unit.

ii. All manual day drain bag(s) should be brought to the dialysis unit.

iii. At the dialysis unit, the clinician will obtain a 1/1,000 aliquot from the APD drain specimen based on the Total APD Volume Drained. For example, a 1/1,000 aliquot for a therapy volume drained of 12,000 mL would be 12 mL.

iv. Agitate manual day drain bag(s) thoroughly prior to obtaining a specimen. Take 1/1,000 aliquot of the drain volume from each manual drain bag. For example, if the manual drain bag volume is 2,500 mL, take a 1/1,000 aliquot or 2.5 mL from this bag. Make sure the manual drain specimen size(s) is the same fraction of the total manual drain as that of the APD specimen (i.e. 1/1,000).

v. Mix together the manual specimen(s) with the APD specimen(s). This blended specimen will be used to provide the mean dialysate concentration of creatinine and urea.

4. Send dialysate effluent specimen, as described above, to the laboratory for dialysate creatinine and urea nitrogen measurement. Check with laboratory for correct tube/container for processing specimen. Follow laboratory specific guidelines for proper handling and transport of effluent specimen for dialysate creatinine and urea nitrogen measurement.

a. If measuring Creatinine Clearance, dialysate creatinine concentration should be corrected for the presence of glucose, which interferes with some creatinine measurement methodologies. Each facility must determine this by specifically inquiring of its laboratory whether the creatinine assay used by that lab is altered by high glucose concentrations. Each laboratory should establish its own correction factor and should reestablish the correction factor if the laboratory's methodology changes.[1]

Aliquot Method (cont.)

5. Provide the laboratory with the Total Effluent Volume Drained as calculated on the Therapy Volume Worksheet.
6. Record the patient's height and weight.
7. Send a serum specimen to laboratory for creatinine and blood urea nitrogen (BUN), preferably in the afternoon.
    a. If using **PD Adequest** software, in addition to urea and creatinine, serum specimen should be sent for albumin and glucose measurements.
    b. Serum specimens drawn in the morning after completion of a 24-hour collection can underestimate average serum concentrations and thus lead to an overestimation of clearance in APD and Tidal PD patients. It is recommended, but not an absolute requirement, that serum specimens be drawn between 2:00 p.m. and 5:00 p.m. of the afternoon following the 24-hour collection in order to more closely estimate time averaged steady-state serum urea and creatinine concentrations.[1]

Urine Collection

1. Have the patient completely empty their bladder; discard this urine and record the time. This time marks the beginning of the test.
2. Collect all subsequent urine voided for the next 24 hours.
3. End the test by having the patient empty their bladder. This final urine should be added to the 24-hour collection.
4. Send the entire 24-hour urine specimen to laboratory for determination of total volume and urine creatinine and urea nitrogen (UUN) measurement.

- The average of 24-hour urea nitrogen and creatinine clearance has been shown to have a reasonable approximation of RKF. However, the accuracy of this measurement depends on the careful collection of 24-hour urine. Especially in patients with very little function, inaccuracy in the timing of the collection can lead to incorrect results. Accuracy perhaps can be improved by the collection of a 72-hour specimen and dividing the result by 3; however, this is a time-consuming and cumbersome process. Patients will need to be instructed on the careful collection of 24-hour urine and make it a habit to bring these collections as part of the regular clinic visit.[3]
- Check with laboratory specific guidelines for proper handling and transport of 24-hour urine collection.

APD Therapy Volume Worksheet

THERAPY VOLUME INFUSED

Total APD Therapy Volume _____
(Night cycle volume, Last Fill volume and any Hi-Dose exchange volume)

Manual Day Exchange Volume(s) (exchanges not delivered by the cycler) +_____

Total Therapy Volume Infused =_____

EFFLUENT VOLUME DRAINED

Total APD Therapy Volume _____

Last Fill Volume -_____

Initial Drain Volume (I-Drain) +_____

Total APD UF +_____

Total APD Volume Drained =_____

Total Manual Exchange(s) Volume Drained +_____

Total Effluent Volume Drained =_____

EXAMPLE
APD Therapy with Manual Day Exchanges

THERAPY VOLUME INFUSED

Total APD Therapy Volume	12000 mL
Manual Day Exchange Volume(s)	+ 2000 mL
Total Therapy Volume Infused	**= 14000 mL**

EFFLUENT VOLUME DRAINED

Total APD Therapy Volume	12000 mL
Last Fill Volume	- 2000 mL
Initial Drain Volume (I-Drain)	+ 1400 mL
Total APD UF	+ 600 mL
Total APD Volume Drained	= 12000 mL
Total Manual Exchange(s) Volume Drained	+ 2500 mL
Total Effluent Volume Drained	**= 14500 mL**

References

1. National Kidney Foundation. K/DOQI Clinical Practice Guidelines for Peritoneal Dialysis Adequacy, 2000. *Am J Kidney Dis.* 2001;37(Suppl 1):S65-S136.
2. The HomeChoice and HomeChoice PRO APD Systems Trainer's Guide. Baxter Healthcare Corp. 07-19-61-245. October 2, 2009.
3. National Kidney Foundation. 2006 Updates Clinical Practice Guidelines and Recommendations. Available at www.kidney.org. Accessed November 1, 2011.

Please see Baxter product labeling and user manuals for complete operating instructions and troubleshooting.

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