Equation to calculate the intraperitoneal residual volume. Residual volume is the volume of dialysate remaining in the peritoneal cavity after drainage over 20 minutes. The residual volume can be determined by knowing the dilution factor for solutes such as potassium, urea, and creatinine during the next instillation. The calculation of residual volumes is based on the assumption that the mixing of fluid in the peritoneal cavity is instantaneous and complete. This equation is used for the calculation, where \( V_{in} \) is instillation volume; \( S_1 \) is solute concentration in pretest exchange dialysate; \( S_2 \) is solute concentration in instilled dialysis solution; and \( S_3 \) is solute concentration immediately after instillation (0 dwell time). The residual volumes by urea, creatinine, glucose, potassium, and protein are calculated and averaged for accuracy. The measurement of residual volumes is of limited clinical usefulness; however, it is of great value in a research setting in which accurate determination of intraperitoneal volume is required.

Classification of peritoneal transport function. Based on the peritoneal equilibrium test results, peritoneal transport function may be classified into average, high (H), and low (L) transport types. The average transport group is further subdivided into high-average (HA) and low-average (LA) types. For the population studied by Twardowski and coworkers [6], the transport classification is based on means; standard deviations (SDs); and minimum and maximum dialysate to plasma ratio (D/P) values over 4 hours for urea, creatinine, glucose, protein, potassium, sodium, and corrected creatinine (panels A–G).

(Continued on next page)
The volume of drainage correlates positively with dialysate glucose and negatively with D/P creatinine values at 4-hour dwell times (panel H). (From Twardowski and coworkers [6]; with permission.)

FIGURE 4-11 (Continued)

CLINICAL APPLICATIONS OF THE PERITONEAL EQUILIBRATION TEST

Peritoneal membrane transport classification
1. Choose peritoneal dialysis regimen.
3. Diagnose acute membrane injury.
4. Diagnose causes of inadequate ultrafiltration.
5. Diagnose causes of inadequate solute clearance.
6. Estimate dialysate to plasma ratio of a solute at time t.
7. Diagnose early ultrafiltration failure.
8. Predict dialysis dose.

FIGURE 4-12
In clinical practice it is customary to perform the baseline standardized peritoneal equilibration test (PET) approximately 3 to 4 weeks after catheter insertion. The PET is repeated when complications occur. The standardized test for clinical use measures dialysate creatinine and glucose levels at 0, 2, and 4 hours of dwell time and serum levels of creatinine and glucose at any time during the test. The extensive unabridged test, as originally proposed by Twardowski and coworkers [6], has become a very important research tool.
Baseline peritoneal equilibrium test

Population distribution of peritoneal membrane transport types.
Baseline peritoneal equilibrium test results of patients on long-term peritoneal dialysis in the United States suggest that approximately 68% have average transport rates, 16% have high transport rates, and another 16% have low transport rates [6]. Similar distributions of transport types have been documented worldwide [14–16].

D/P—dialysate to plasma ratio.

Using transport type to select a peritoneal dialysis regimen. Because clearance rates continue to increase with time, patients with low transport rates are treated with long dwell exchanges, i.e., continuous cyclic peritoneal dialysis (CCPD). Owing to the low rate of increase in the dialysate to plasma ratio (D/P), the clearance rate per unit of time is augmented relatively little by rapid exchange techniques such as nightly intermittent peritoneal dialysis (NIPD). On the contrary, the clearance per exchange rate over long dwell exchanges would be less in patients with high transport rates. During the short dwell time, patients with high transport rates capture maximum ultrafiltration and small solutes are completely equilibrated. Therefore, these patients are best treated with techniques using short dwell exchanges, i.e., NIPD or daytime ambulatory peritoneal dialysis (DAPD). Patients with average transport rates can be effectively treated with either short or long dwell exchange techniques. CAPD—continuous ambulatory peritoneal dialysis.

Diagnosis of early ultrafiltration failure. The dialysate to plasma ratio (D/P) curve of sodium, during the unabridged peritoneal equilibrium test (2.5% dextrose dialysis solution), typically shows an initial decrease owing to the high ultrafiltration rate. Because of sodium sieving, the ultrafiltrate is low in sodium. Consequently, the dialysate sodium is lowered, resulting in a lower D/P ratio of sodium. Later, during the dwell when ultrafiltration ceases, dialysate sodium tends to equilibrate with that of capillary blood, returning the D/P ratio of sodium to baseline. Absence of the initial decrease of the D/P of sodium is an indication of ultrafiltration failure and is typically seen in the early phase of sclerosing encapsulating peritonitis. (From Dobbie and coworkers [17]; with permission.)