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Dialysis of Drugs

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Preface

Drug removal during dialysis is frequently of interest to those caring for patients receiving hemodialysis or peritoneal dialysis. The extent of drug dialyzability determines whether supplemental dosing is necessary during or following dialysis. The accompanying table is a reference regarding the effect of either form of dialysis on drug clearance. This table should be used as a general guideline.

The drugs included in the table are parent drugs. In some cases, these drugs are converted to pharmacologically active or toxic metabolites for which little dialysis information is known. Therefore, for a few drugs, a primary metabolite is also included in the table. When available, serum drug measurements may be appropriate for dosing individual patients. In all cases, patients should be monitored for clinical efficacy and toxicity.

What Determines Drug Dialyzability?

The extent to which a drug is affected by dialysis is determined primarily by several physicochemical characteristics of the drug that are briefly described in the text that follows. These include molecular size, protein binding, volume of distribution, water solubility, and plasma clearance. In addition to these properties of the drug, technical aspects of the dialysis procedure also may determine the extent to which a drug is removed by dialysis.

Molecular Weight

Dialysis is dependent upon the use of a dialytic membrane: either a synthetic membrane with fixed pore size, as in hemodialysis, or a naturally occurring peritoneal membrane, as in peritoneal dialysis. The movement of drugs or other solutes is largely determined by the size of these molecules in relation to the pore size of the membrane. As a general rule, smaller molecular weight substances will pass through the membrane more easily than larger molecular weight substances. A common assumption is that pore size of the peritoneal membrane is somewhat larger than that of the hemodialysis membrane. This would explain the observation that larger molecular weight substances appear to cross the peritoneal membrane to a greater extent than the hemodialysis membrane.

Protein Binding

Another important factor determining drug dialyzability is the concentration gradient of unbound (free) drug across the dialysis membrane. Drugs with a high degree of protein binding will have a low plasma concentration of unbound drug available for dialysis. Uremia may have an effect on protein binding for some drugs. Through mechanisms not completely understood, protein binding may decrease in uremic serum. Should this change in binding be substantial, increased dialyzability of free drug may occur.

Because the primary binding proteins for most drugs (albumin, α_1-acid glycoprotein) are of large molecular size, the drug-protein complex is often unable to cross the dialysis membrane, especially the hemodialysis membrane. Since the peritoneal membrane does permit the passage of some proteins, there may be some limited drug-protein removal with peritoneal dialysis. Increased protein concentrations often occur in peritoneal effluent during episodes of peritonitis.

Volume of Distribution

A drug with a large volume of distribution is distributed widely throughout tissues and is present in relatively small amounts in the blood. Factors that contribute to a large volume of distribution include a high degree of lipid solubility and low plasma protein binding. Drugs with a large volume of distribution are likely to be dialyzed minimally.

Water Solubility

The dialysate used for either hemodialysis or peritoneal dialysis is an aqueous solution. In general, drugs with high water solubility will be dialyzed to a greater extent than those with high lipid solubility. Highly lipid-soluble drugs tend to be distributed throughout tissues, and therefore only a small fraction of the drug is present in plasma and accessible for dialysis.

Plasma Clearance

The inherent metabolic clearance—the sum of renal and nonrenal clearance—is often termed the "plasma clearance" of a drug. In dialysis patients, renal clearance is largely replaced by dialysis clearance. If nonrenal clearance is large compared to renal clearance, the contribution of dialysis to total drug removal is low. However, if renal (dialysis) clearance increases plasma clearance by 30% or more, dialysis clearance is considered to be clinically important.

Dialysis Membrane

As mentioned previously, the characteristics of the dialysis membrane determine to a large extent the dialysis of drugs. Pore size, surface area, and geometry are the primary determinants of the performance of a given membrane. The technology of hemodialysis has evolved, and new membranes have been introduced for clinical use. Interpretation of published literature should be tempered with the understanding that newer hemodialysis membranes may have different drug dialysis characteristics. Little can be done to alter the characteristics of the peritoneal membrane.

Blood and Dialysate Flow Rates

The hemodialysis prescription includes the desired blood and dialysate flow rates. As drugs normally move from blood to dialysate, the flow rates of these two substances may have a pronounced effect on dialyzability. In general, increased blood flow rates during hemodialysis will deliver greater amounts of drug to the dialysis membrane. As the drug concentration increases in the dialysate, the flow rate of the dialysis solution also becomes important in overall drug removal. Greater dialysis can be achieved with faster dialysate flow rates that keep the dialysate drug concentration at a minimum.

During peritoneal dialysis, little can be done to alter blood flow rates to the peritoneum. However, dialysate flow rates are determined by the volume and frequency of dialysate exchange in the peritoneum. At low exchange rates, drug concentrations in the dialysate will increase during the time in which the dialysate resides in the peritoneum, thus slowing additional movement of drug across the membrane. More frequent exchanges will favor increased drug dialyzability, provided the drug's physicochemical characteristics permit its movement across the peritoneal membrane.

Special Considerations

HIGH PERMEABILITY DIALYSIS

Much of the information contained in this guide has been obtained from studies conducted under conditions of standard hemodialysis that employed conventional dialysis membranes. Changes in dialysis technology have led to more permeable dialysis membranes and the opportunity to employ higher blood and dialysate flow rates. These new technologies are often referred to as "high permeability," "high-efficiency," and "high-flux" dialysis. The United States Food and Drug Administration has classified high permeability dialysis membranes as those whose in vitro ultrafiltration coefficient (KUf) is greater than 8 mL/hour/mm Hg. Commonly included in this group of dialysis membranes are polysulfone, polyacrylonitrile, and high-efficiency cuprammonium rayon dialyzers. Changes in dialysis membranes and changes in blood and dialysis flow rates may have clinically important effects on drug removal through the membrane.

There are an increasing number of studies that examine the effects of high permeability dialysis on drug dialyzability. Results of these studies confirm predictions that drug removal from plasma is often enhanced as compared with more traditional dialysis membranes. Studies with high permeability dialysis also demonstrate that removal of drug from plasma often exceeds the transfer of drug from tissues to plasma. As a result, a rebound of plasma drug concentrations

following the conclusion of dialysis may occur as blood-tissue drug equilibration occurs. Patients receiving high permeability dialysis may require more drug compared with those receiving standard hemodialysis. Due to the many technical and physiological variables, individualized therapeutic drug monitoring may be necessary. The reader is referred to the primary literature for further details.

CONTINUOUS RENAL REPLACEMENT THERAPY

Another therapeutic development that will affect drug dialyzability is continuous renal replacement therapy (CRRT), known in its various forms as continuous arteriovenous hemofiltration (CAVH), continuous venovenous hemofiltration (CVVH), continuous arteriovenous hemodialysis (CAVHD), continuous venovenous hemodialysis (CVVHD), continuous venovenous hemodiafiltration (CVVHDF), continuous arteriovenous hemodiafiltration (CAVHDF), slow continuous ultrafiltration (SCUF), continuous arteriovenous high-flux hemodialysis (CAVHFD), and continuous venovenous high-flux hemodialysis (CVVHFD). These various techniques are used in the management of acute renal failure in critically ill patients.

Continuous renal replacement therapies differ considerably from intermittent hemodialysis. Relying heavily upon continuous ultrafiltration of plasma water, CRRT has the potential for the removal of large quantities of ultrafilterable

drugs contained in plasma. Unfortunately, few in vivo studies have been published, and very few drugs have been studied pharmacokinetically in intensive care patients. Therefore, many guidelines for drug dosing during CRRT are extrapolated from experiences with chronic hemodialysis or from theoretical considerations based upon general principles of drug removal derived from the physicochemical characteristics of the drug and the CRRT technique employed.

Molecular weight of a drug has been an important determinant of drug dialyzability in conventional hemodialysis. This drug characteristic becomes less important during CRRT because of the use of high-flux hemofilters that permit passage of larger molecules up to 5000 Da. As is true with conventional hemodialysis, drugs with a large volume of distribution are unlikely to be removed to a great extent during CRRT. Most of the body stores of such drugs are outside the vascular compartment and not accessible to the hemofilter for removal. Similarly, drugs that are highly bound to plasma proteins are not subject to significant removal during CRRT because the molecular weight of drug-protein complexes usually hinders passage of the complex across the filter. The fraction of unbound drug may change during renal failure, however, thus altering the likelihood of drug removal. If the unbound fraction increases, more drug clearance may occur. If the unbound fraction becomes less, there is likely to be less drug removal during CRRT.

A useful tool to predict the likelihood of a drug to cross the hemofilter membrane is the sieving coefficient. This term is defined as the ratio of drug concentration in the ultrafiltrate to the prefilter plasma water concentration of the drug. If the sieving coefficient is close to 1.0, the drug has relatively free passage across the filter. The following table presents sieving coefficient data from in vitro and in vivo evaluations.

SIEVING COEFFICIENT

Drug Name	Predicted	Measured	Condition	Filter
Amikacin	0.95	0.88	in vivo	PS[a]
Amphotericin	0.10	0.40	in vivo	PS[a]
Ampicillin	0.80	0.69	in vivo	PS[a]
Cefotaxime	0.62	0.51	in vivo	PS[a]
Cefoxitin	0.30	0.30	in vitro	PS[a]
Ceftazidime	0.90	0.90	in vivo	PS[a]
Ceftriaxone	0.10	0.71	in vivo	PS[a]
Cefuroxime	0.66	0.59	in vivo	PS[a]
Clindamycin	0.40	0.98	in vivo	PS[a]
Digoxin	0.80	0.96	in vivo	PS[a]
		0.35	in vitro	PS[a]
		0.18	in vitro	PS[b]
		1.21	in vitro	AN69[c]
		1.07	in vitro	PA[d]
Erythromycin	0.30	0.37	in vivo	PS[a]

Drug Name	Predicted	Measured	Condition	Filter
Gentamicin	0.95	0.81	in vivo	PS[a]
Metronidazole	0.80	0.86	in vivo	PS[a]
Mezlocillin	0.68	0.68	in vivo	PS[a]
N-acetylpro-cainamide	0.90	0.92	in vivo	PS[a]
Nafcillin	0.20	0.54	in vivo	PS[a]
Oxacillin	0.05	0.02	in vivo	PS[a]
Phenobarbital	0.60	0.86	in vivo	PS[a]
Phenytoin	0.10	0.45	in vivo	PS[a]
		0.14	in vitro	PS[a]
		0.12	in vitro	PS[b]
		0.08	in vitro	AN69[c]
		0.17	in vitro	PA[d]
		0.08	in vitro	PS[a]
Procainamide	0.86	0.86	in vivo	PS[a]
Theophylline	0.47	0.85	in vitro	PS[a]
		0.93	in vitro	AN69[c]
		0.78	in vivo	PA[d]
Tobramycin	0.95	0.78	in vivo	PS[a]
		0.90	in vitro	PS[a]
		0.75	in vitro	PS[b]
		0.59	in vitro	AN69[c]
		0.76	in vitro	PA[d]
Valproic acid	0.10	0.18	in vitro	PS[a]
		0.31	in vitro	AN69[c]
		0.16	in vitro	PA[d]

Drug Name	Predicted	Measured	Condition	Filter
Vancomycin	0.90	0.76	in vivo	PS[a]
		0.60	in vitro	PS[a]
		0.71	in vitro	PS[b]
		0.64	in vitro	AN69[c]
		0.58	in vitro	PA[d]

[a]Amicon diafilter (polysulfone)
[b]Renal System (polysulfone)
[c]Hospal (AN69)
[d]Gambro (polyamide)

The above table was published in the following article: Joy MS, Matzke, GR, Armstrong DK, Marx MA, Zarowitz BJ. A primer on continuous renal replacement therapy for critically ill patients. *Ann Pharmacother.* 1998;32:362-75. Reprinted with permission. Harvey Whitney Books Company.

The specific CRRT technique employed will influence the ultrafiltration rate and hence, the potential rate of drug removal. When CRRT relies solely on spontaneous blood flow without extracorporeal blood pumping, an ultrafiltration rate of 10-15 mL/min is anticipated. The addition of blood pumps and continuous dialysis may increase the ultrafiltration rate to 50 mL/min. Higher rates of ultrafiltration may lead to greater drug removal with a need for more frequent replacement doses. Drug removal can be determined by collection of the total volume of dialysate/ultrafiltrate and measurement of the concentration of drug in the effluent.

Because of the multiple techniques employed in CRRT, the variability in individual patient circumstances, and the lack of in vivo data, the tables in this guide do not contain information on drug removal during CRRT. Once again, the reader is referred to the primary literature for assistance with the dosing of specific drugs.

PLASMAPHERESIS

Plasmapheresis is another special consideration in which drug removal from plasma may be of concern. This technique is used for the treatment of certain immunologic, infectious, and metabolic diseases, as well as for the removal of toxins that cannot be removed by hemodialysis or peritoneal dialysis. Plasmapheresis removes plasma from the patient with replacement by crystalloid or colloid solutions. Solutes such as drug molecules that are present in the plasma may be removed from the patient. Unfortunately, little is known about the specific pharmacokinetic effects of plasmapheresis. The procedure may be most likely to remove substances that are lipophilic, that are highly protein-bound, and that have a small volume of distribution. The reader is referred to reference 5.

SUMMARY

Drug dialyzability is determined by a complex interaction of many factors, including the characteristics of the drug and the technical aspects of the dialysis system. Published studies on drug dialyzability should specify the conditions that pertain during dialysis. Results

from these studies should be applied with caution to other dialysis conditions.

About This Guide

These guidelines are designed to provide extensive, easy-to-read information regarding the dialyzability of drugs. Numerous literature sources have been used in preparing the guidelines. For many drugs, including newly-approved medications, no studies have been done to determine the effect of dialysis on drug removal. In some cases, the available data may conflict. Conditions of dialysis used in published studies may not necessarily reflect current dialysis procedures and technology. Variations in the duration of dialysis, flow rates, dialysis membranes, and whether peritoneal dialysis is continuous or intermittent will all affect drug removal. This educational review will distinguish between conventional hemodialysis and high permeability (often called high-flux) hemodialysis where such data are available. However, the review does not contain information on drug dialyzability with CRRT (See "Special Considerations," page 9) or with plasmapheresis. For additional information on specific drugs, the reader should consult the primary literature.

A designation of "Yes" in the Hemodialysis and Peritoneal Dialysis columns indicates that dialysis enhances plasma clearance by 30% or more. Supplemental dosing may be required or dosing after dialysis should be considered. "No" indicates that dialysis does not have a clinically important effect on plasma clearance.

Supplemental dosing is usually not required. As a general principle, usual methods of continuous ambulatory peritoneal dialysis (CAPD) provide relatively low drug clearances during any given dialysate exchange. However, cumulative drug removal may require dosage supplementation at appropriate intervals. Relatively little research has examined peritoneal drug clearance in PD techniques that utilize automated systems employing large volumes of short dwells at night, often accompanied by one or more longer daytime dwells (APD). Similarly, little data exists on the effects of tidal peritoneal dialysis on drug clearance. A few studies have confirmed that clearance of some drugs is increased by APD due to the increased drug concentration gradient between blood and dialysate. Increased drug dialyzability may occur with increased peritoneal dialysate flow rates or in the presence of peritonitis. A designation of "U" indicates that no dialysis studies have been published, but that the author of this guide has concluded that significant drug removal during dialysis is unlikely based upon the physicochemical characteristics of the drug, which are primarily a high degree of protein binding, a large molecular weight, or a large volume of distribution. A designation of "L" indicates that no published data exist on the removal of the drug during high permeability dialysis. However, the author has extrapolated data from studies using conventional dialysis to conclude that significant drug removal is likely to occur during high permeability dialysis. A designation of "ND" indicates that no data are available on drug dialyzability. In some cases, the literature reports the use of a high permeability, or

high-flux, dialysis membrane, however the type of membrane is not specified. A designation of "NS" indicates membrane type is not specified.

Key

Yes Indicates that dialysis enhances plasma clearance by 30% or more. Supplemental dosing may be required or dosing after dialysis should be considered.

No Indicates that dialysis does not have a clinically important effect on plasma clearance. Supplemental dosing is usually not required.

U Indicates significant drug removal is unlikely based on physicochemical characteristics of the drug such as protein binding, molecular size or volume of distribution

L Indicates no published data exist, but information extrapolated from studies using conventional dialysis techniques suggests significant drug removal is likely during high permeability dialysis

ND Indicates there are no data on drug dialyzability with this type of dialysis

NS Indicates the type of membrane was not specified

***** Removed with hemoperfusion

Note: *In these tables,* ***conventional*** *hemodialysis is defined as the use of a dialysis membrane whose in vitro coefficient of ultrafiltration (KUf) ≤8 mL/hour/mm Hg. Data also are placed in the conventional column if the literature does not specify the type of dialysis membrane employed.* ***High permeability*** *hemodialysis is defined as the use of a dialysis membrane whose KUf >8 mL/hour/mm Hg. In the tables, the KUf of the membrane(s) used is included in parentheses.*

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Abacavir	U	No (40)	ND
Abatacept	U	U	U
Abciximab	U	ND	U
Acamprosate	ND	ND	ND
Acarbose	ND	ND	ND
Acebutolol (diacetolol)	Yes (NS)	L	ND
Acetaminophen	Yes (NS)	L	No
Acetazolamide	U	ND	No
Acetohexamide	U	ND	U
Acetophenazine	U	ND	U
Acetylcysteine	Yes (7.5)	ND	ND
Acitretin	No (NS)	U	U
Acrivastine	ND	ND	ND
Acyclovir	Yes (NS)	L	No
Adalimumab	U	U	U
Adefovir	Yes (NS)	ND	ND
Adenosine	U	ND	U
Agalsidase alfa	No (7.5)	No (10)	U
Agalsidase beta	U	U	U
Albendazole	No (NS)	ND	U
Albumin	U	ND	U
Albuterol	No (NS)	ND	U
Aldesleukin	ND	ND	ND
Alefacept	ND	ND	ND
Alemtuzumab	U	U	U
Alendronate	No (NS)	ND	ND
Alfentanil	U	ND	U
Alfuzosin	U	U	U
Alglucerase	U	U	U
Alglucosidase	U	U	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Aliskiren	ND	ND	ND
Allopurinol	Yes (NS)	L	ND
Almotriptan	ND	ND	ND
Alosetron	ND	ND	ND
Alprazolam	No (NS)	ND	U
Alprostadil	U	No (11.1)	ND
Alteplase	U	ND	U
Altretamine	ND	ND	ND
Amantadine	No (NS)	ND	No
Ambenonium	ND	ND	ND
Ambrisentan	U	U	U
Amdinocillin	No (NS)	ND	No
Amifostine	ND	ND	ND
Amikacin	Yes (NS)	L	Yes
Amiloride	ND	ND	ND
Aminocaproic acid	Yes (NS)	ND	Yes
Aminoglutethimide	Yes (NS)	L	ND
Aminosalicylic acid	Yes (NS)	L	ND
Amiodarone	No (NS)	ND	No
Amitriptyline	No (NS)	ND	No
Amlodipine	No (NS)	U	No
Amoxapine	U	ND	U
Amoxicillin	Yes (NS)	L	No
Amphetamine	ND	ND	ND
Amphotericin B	No (NS)	No (10.1, 36)	No
Amphotericin B lipid complex	No (NS)	ND	U
Ampicillin	Yes (NS)	L	No
Amprenavir	U	ND	U
Amrinone	U	ND	No

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Amsacrine	U	U	U
Anagrelide	ND	ND	ND
Anakinra	No (NS)	ND	No
Anastrozole	ND	ND	ND
Anidulafungin	No (NS)	ND	ND
Anisindione	U	U	U
Anisoylated plasminogen streptokinase activator complex	ND	ND	ND
Anistreplase	U	ND	U
Antithymocyte globulin (ATG)	U	ND	U
Apomorphine	U	U	U
Aprepitant	No (NS)	U	U
Aprotinin	U	ND	U
Arbutamine	ND	ND	ND
Argatroban	U	No (10.7-36)	ND
Aripiprazole	U	U	U
Armodafinil	ND	ND	ND
Arsenic trioxide	No (NS)	ND	U
Articaine	ND	ND	ND
Ascorbic acid	Yes (5.5)	Yes (8.8)	Yes
Asparaginase	U	ND	U
Aspirin	Yes (NS)	L	Yes
Atazanavir	U	U	U
Atenolol	Yes (NS)	L	No
Atomoxetine	U	U	U
Atorvastatin	No (NS)	ND	U
Atovaquone	U	ND	U
Atracurium	U	ND	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Atropine	No (NS)	ND	ND
Auranofin	No (NS)	ND	ND
Azacitidine	ND	ND	ND
Azathioprine	Yes (NS)	L	ND
Azelastine	U	U	U
Azithromycin	ND	ND	No
Azlocillin	Yes (NS)	L	No
Aztreonam	Yes (NS)	L	No
Baclofen	ND	Yes (60)	ND
Balsalazide	U	U	U
Basiliximab	U	ND	U
Benazepril (benazeprilat)	No (NS)	ND	ND
Bendroflumethiazide	No (NS)	ND	U
Benzphetamine	ND	ND	ND
Benzquinamide	U	ND	ND
Benztropine	ND	ND	ND
Bepridil	No (NS)	ND	U
Beractant	U	U	U
Betamethasone	ND	ND	ND
Betaxolol	No (NS)	ND	No
Bethanechol	ND	ND	ND
Bevacizumab	U	No (NS)	U
Bexarotene	U	U	U
Bezafibrate	No (NS)	ND	No
Biapenem	Yes (NS)	Yes (NS)	ND
Bicalutamide	U	ND	U
Biperiden	ND	ND	ND
Bisoprolol	No (NS)	ND	ND
Bivalirudin	Yes (NS)	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Bleomycin	No (NS)	ND	No
Bortezomib	ND	ND	ND
Bosentan	U	No (11.1)	U
Bretylium	Yes (NS)	L	ND
Bromfenac	No (NS)	ND	U
Bromocriptine	U	ND	U
Brompheniramine	ND	ND	ND
Budesonide	U	U	U
Buflomedil	No (NS)	No (20)	U
Bumetanide	U	U	U
Bupivacaine	U	U	U
Buprenorphine	U	U	U
Bupropion	No (NS)	No (10)	No
Buspirone	No (NS)	ND	ND
Busulfan	Yes (NS)	Yes (8.1)	ND
Butalbital	ND	ND	ND
Butoconazole	U	U	U
Butorphanol	U	ND	U
Cabergoline	ND	ND	ND
Caffeine	ND	ND	ND
Calcitonin	U	U	U
Calcitriol	No (4.2-5.3)	No (31)	U
Calfactant	ND	ND	ND
Candesartan	No (NS)	No (8.1)	ND
Capecitabine	ND	ND	ND
Capreomycin	Yes (NS)	L	ND
Captopril	Yes (NS)	L	No
Carbamazepine	No (NS)	Yes (22, 55)	No
Carbenicillin	Yes (NS)	L	No
Carbidopa/levodopa	ND/U	ND/U	ND/U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Carbinoxamine	ND	ND	ND
Carboplatin	Yes (NS)	L	ND
Carboprost	ND	ND	ND
Carisoprodol	Yes (NS)	L	Yes
Carmustine	No (NS)	ND	ND
Carprofen	U	ND	U
Carteolol	ND	ND	ND
Carumonam	Yes (NS)	L	ND
Carvedilol	No (NS)	ND	ND
Caspofungin	No (NS)	U	U
Cefaclor	Yes (NS)	L	Yes
Cefadroxil	Yes (NS)	L	No
Cefamandole	Yes (NS)	L	No
Cefazolin	Yes (6, 8)	Yes (8.1-36)	No
Cefdinir	ND	Yes (NS)	ND
Cefditoren	No (NS)	ND	ND
Cefepime	Yes (NS)	Yes (40)	Yes
Cefixime	No (NS)	ND	No
Cefmenoxime	Yes (NS)	L	ND
Cefmetazole	Yes (NS)	L	No
Cefodizime	No (NS)	ND	No
Cefonicid	No (NS)	ND	No
Cefoperazone	No (NS)	ND	No
Ceforanide	Yes (NS)	L	No
Cefotaxime	Yes (NS)	L	No
Cefoxitin	Yes (NS)	L	No
Cefpirome	Yes (NS)	Yes (40)	No
Cefpodoxime	Yes (NS)	L	No
Cefprozil	Yes (NS)	L	ND
Cefroxadine	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Cefsulodin	Yes (NS)	L	Yes
Ceftazidime	Yes (NS)	L	Yes
Ceftibuten	Yes (NS)	L	ND
Ceftizoxime	Yes (NS)	L	No
Ceftriaxone	No (NS)	ND	No
Cefuroxime	Yes (NS)	L	No
Celecoxib	U	ND	U
Cephalexin	Yes (NS)	L	No
Cephalothin	Yes (NS)	L	No
Cephapirin	Yes (NS)	L	No
Cephradine	Yes (NS)	L	Yes
Cetirizine	U	No (18.7-66.7)	U
Cetrorelix	ND	ND	ND
Cetuximab	U	U	U
Cevimeline	ND	ND	ND
Chloral hydrate	Yes (5.5)	L	ND
Chlorambucil	No (NS)	ND	No
Chloramphenicol	Yes (NS)	L	No
Chlordiazepoxide	No (NS)	ND	U
Chloroquine	No (NS)	ND	No
Chlorothiazide	No (NS)	ND	U
Chlorpheniramine	Yes (NS)	L	No
Chlorpromazine	No (NS)	ND	No
Chlorpropamide	No* (NS)	ND	No
Chlorprothixene	U	ND	U
Chlorthalidone	No (NS)	ND	U
Chlorzoxazone	ND	ND	ND
Cholecalciferol	U	U	U
Cholestyramine	U	U	U
Choriogonadotropin	U	U	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Ciclesonide	U	U	U
Cidofovir	ND	Yes (60)	No
Cilastatin	Yes (NS)	L	ND
Cilazapril	Yes (NS)	L	ND
Cilostazol	U	ND	U
Cimetidine	No (NS)	ND	No
Cinacalcet	No (NS)	U	No
Cinafloxacin	No (6.4)	No (8.1, 8.8)	ND
Cinoxacin	No (NS)	ND	U
Ciprofloxacin	No (NS)	ND	No
Cisapride	No (NS)	ND	U
Cisatracurium	U	ND	U
Cisplatin	No (NS)	Yes (NS)	ND
Citalopram	No (8)	No (40)	U
Cladribine	ND	ND	ND
Clarithromycin	ND	ND	ND
Clavulanic acid	Yes (NS)	L	Yes
Clemastine	ND	ND	ND
Clindamycin	No (NS)	ND	No
Clodronate	ND	Yes (8.1)	No
Clofarabine	ND	ND	ND
Clofazimine	No (NS)	ND	No
Clofibrate	No (NS)	ND	No
Clomiphene	ND	ND	ND
Clomipramine	U	ND	U
Clonazepam	No (NS)	ND	U
Clonidine	No (NS)	ND	No
Clopidogrel	U	ND	U
Clorazepate	No (NS)	ND	U
Clotrimazole	U	U	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Cloxacillin	No (NS)	ND	No
Clozapine	U	ND	U
Codeine	No (NS)	ND	U
Colchicine	No (NS)	ND	No
Colesevalam	U	U	U
Colestipol	U	U	U
Colistin	No (NS)	ND	No
Conivaptan	U	U	U
Cortisone	No (NS)	ND	No
Cromolyn sodium	U	U	U
Cyanocobalamin	No (NS)	No (40, 65)	ND
Cyclacillin	Yes (NS)	L	No
Cyclobenzaprine	U	U	U
Cyclophosphamide	Yes (6.4)	L	ND
Cycloserine	ND	Yes (30, 52)	ND
Cyclosporine	No (NS)	ND	No
Cyproheptadine	ND	ND	ND
Cystadane	ND	ND	ND
Cysteamine	ND	ND	No
Cytarabine	ND	Yes (NS)	No
Dacarbazine	ND	ND	ND
Daclizumab	U	ND	U
Dactinomycin	ND	ND	ND
Dalteparin	U	ND	U
Danaparoid	ND	ND	ND
Dantrolene	ND	ND	ND
Dapsone	Yes (NS)	L	ND
Daptomycin	No (NS)	ND	No
Darbepoetin alfa	U	No (11.1-55)	U
Darifenacin	U	U	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Darunavir	U	U	U
Dasatinib	U	U	U
Daunorubicin	ND	ND	ND
Decitabine	ND	ND	ND
Deferasirox	U	U	U
Deferoxamine	Yes (NS)	L	ND
Deflazacort	No (NS)	ND	U
Delavirdine	U	ND	U
Demeclocycline	ND	ND	ND
Desipramine	No (NS)	ND	No
Desloratadine	No (NS)	ND	No
Desmopressin	ND	ND	ND
Desogestrel	U	U	U
Dexamethasone	No (NS)	ND	No
Dexchlorpheniramine	Yes (NS)	L	No
Dexfenfluramine	ND	ND	ND
Dexmedetomidine	U	U	U
Dexmethylphenidate	ND	ND	ND
Dexrazoxane	ND	ND	ND
Dextroamphetamine	ND	ND	ND
Dezocine	ND	ND	ND
Diazepam	No (NS)	ND	U
Diazoxide	Yes (NS)	L	Yes
Dibekacin	Yes (NS)	L	ND
Diclofenac	U	ND	U
Dicloxacillin	No (NS)	ND	No
Dicyclomine	ND	ND	ND
Didanosine	No (7.9)	No (40)	No
Diethylpropion	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Diethylstilbesterol (fosfestrol)	No (NS)	ND	ND
Diflunisal	No (NS)	ND	U
Digitoxin	No (NS)	ND	No
Digoxin	No (NS)	ND	No
Digoxin immune Fab	No (NS)	U	No
Dihydrocodeine	ND	ND	ND
Dihydroergotamine	ND	ND	ND
Diltiazem	No (NS)	ND	No
Dimenhydrinate	ND	ND	ND
Dimyristoyl lecithin	ND	ND	ND
Dinoprostone	ND	ND	ND
Diphenhydramine	U	ND	U
Diphenoxylate/ Atropine	ND	ND	ND
Dipyridamole	U	ND	ND
Dirithromycin	No (NS)	ND	No
Disopyramide	No (NS)	U	U
Disulfiram	U	U	U
Divalproex	No (NS)	ND	No
Dobutamine	No (NS)	ND	No
Docetaxel	No (NS)	U	U
Dofetilide	ND	ND	ND
Dolasetron	ND	ND	ND
Domperidone	U	U	U
Donepezil	U	ND	U
Dopamine	No (NS)	ND	U
Doripenem	Yes (NS)	ND	ND
Dornase alfa	U	U	U
Doxacurium	No (NS)	ND	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Doxapram	ND	ND	ND
Doxazosin	No (NS)	ND	No
Doxepin	No (NS)	ND	No
Doxercalciferol	No (NS)	U	U
Doxorubicin	No (NS)	ND	ND
Doxycycline	No (NS)	ND	No
Doxylamine	ND	ND	ND
Dronabinol	U	ND	U
Droperidol	U	ND	U
Drosperinone	U	U	U
Drotrecogin alfa	U	U	U
Duloxetine	U	U	U
Dutasteride	U	U	U
Eculizumab	U	U	U
Edetate calcium (ETDA)	Yes (NS)	L	Yes
Edrophonium	ND	ND	ND
Efalizumab	U	U	U
Efavirenz	No (NS)	ND	No
Eletriptan	ND	ND	ND
Emtricitabine	Yes (NS)	ND	ND
Enalapril (enalaprilat)	Yes (NS)	L	Yes
Encainide	No (NS)	ND	ND
Enfuvirtide	U	U	U
Enoxacin	No (NS)	ND	No
Enoxaparin	No (NS)	Yes (11.5-55)	No
Entacapone	U	U	U
Entecavir	No (NS)	ND	No
Ephedrine	ND	ND	ND
Epinephrine	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Epirubicin	ND	ND	ND
Eplerenone	No (7)	ND	ND
Epoetin alfa	No (NS)	No (11.1-55)	No
Epoprostenol	ND	ND	ND
Eprosartan	U	No (60)	U
Eptacog alfa	U	U	U
Eptifibatide	ND	ND	ND
Ergocalciferol	ND	ND	ND
Ergotamine	ND	ND	ND
Erlotinib	U	U	U
Ertapenem	Yes (NS)	L	ND
Erythromycin	No (NS)	ND	No
Escitalopram	ND	ND	ND
Esmolol (ASL-8123)	Yes (NS)	L	Yes
Esomeprazole	U	U	U
Estazolam	U	ND	U
Estradiol	No (NS)	ND	ND
Estramustine	ND	ND	ND
Estrogens, conjugated	ND	ND	ND
Estrone	No (NS)	ND	ND
Estropipate	ND	ND	ND
Eszopiclone	ND	ND	ND
Etanercept	No (NS)	U	U
Ethacrynic acid	No (NS)	U	U
Ethambutol	No (NS)	No (80)	U
Ethanolamine oleate	ND	ND	ND
Ethchlorvynol	No* (NS)	ND	No
Ethinyl estradiol	U	U	No
Ethionamide	U	No (30, 52)	U
Ethosuximide	Yes (NS)	L	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Ethotoin	ND	ND	ND
Etidronate	ND	ND	ND
Etodolac	No (NS)	ND	U
Etonogestrel	ND	ND	ND
Etoposide	No (NS)	No (NS)	No
Etoricoxib	No (NS)	U	U
Everolimus	ND	ND	ND
Exemestane	U	U	U
Exenatide	ND	ND	ND
Ezetimibe	U	U	U
Famciclovir (penciclovir)	Yes (NS)	L	ND
Famotidine	No (NS)	ND	No
Felbamate	ND	ND	ND
Felodipine	No (NS)	ND	U
Fenfluramine	ND	ND	ND
Fenofibrate	No (NS)	U	U
Fenoldopam	U	ND	No
Fenoprofen	No (NS)	ND	U
Fentanyl	U	No (10.1)	ND
Ferric gluconate	No (NS)	ND	U
Ferrous (iron) salts	U	ND	U
Ferumoxytol	No (NS)	ND	ND
Fexofenadine	No (NS)	ND	U
Filgrastim	No (NS)	ND	U
Finasteride	U	ND	U
Flavoxate	ND	ND	ND
Flecainide	No (NS)	ND	U
Fleroxacin	U	No (8.1, 22)	No
Floxuridine	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Fluconazole	Yes (NS)	L	Yes
Flucytosine	Yes (NS)	L	Yes
Fludarabine	ND	ND	ND
Fludrocortisone	ND	ND	ND
Flumazenil	ND	ND	ND
Fluorouracil/FBAL	No (NS)/ND	No (40)/Yes (40)	ND
Fluoxetine	No (NS)	ND	No
Fluoxymesterone	ND	ND	ND
Fluphenazine	U	ND	U
Flurazepam	No (NS)	ND	U
Flurbiprofen	ND	ND	No
Flutamide	No (NS)	ND	U
Fluticasone	U	U	U
Fluvastatin	No (NS)	ND	U
Fluvoxamine	U	No (NS)	U
Folic acid	Yes (NS)	L	ND
Follitropin alfa	ND	ND	ND
Follitropin beta	ND	ND	ND
Fomepizole	Yes (NS)	L	ND
Fondaparinux	No (NS)	ND	U
Fosamprenavir	U	U	U
Foscarnet	Yes (4.1)	Yes (18-60)	ND
Fosfomycin	Yes (NS)	L	ND
Fosinopril (fosinoprilat)	No (NS)	ND	No
Fosphenytoin	U	ND	U
Frovatriptan	ND	ND	ND
Fulvestrant	U	U	U
Furosemide	No (NS)	U	U
Fusidic acid	No (NS)	ND	No
Gabapentin	Yes (NS)	L	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Gadobenate	ND	ND	ND
Gadobutrol	Yes (5.5)	L	ND
Gadodiamide	Yes (NS)	L	No
Gadolinium	Yes (NS)	ND	ND
Gadopentetate	Yes (NS)	L	ND
Gadoteridol	ND	ND	ND
Gadoversetamide	ND	Yes (NS)	ND
Galantamine	ND	ND	ND
Gallium	ND	ND	ND
Gallopamil	U	ND	U
Galsulfase	U	U	U
Ganciclovir	Yes (NS)	L	ND
Ganirelix	ND	ND	ND
Garenoxacin	No (NS)	ND	No
Gatifloxacin	ND	ND	ND
Geftinib	U	U	U
Gemcitabine	Yes (7)	L	ND
Gemfibrozil	No (NS)	ND	No
Gemifloxacin	No (NS)	ND	ND
Gemtuzumab	U	U	U
Gentamicin	Yes (NS)	Yes (60)	Yes
Gestodene	U	U	U
Glatiramer	ND	ND	ND
Gliclazide	U	U	U
Glimepiride	U	ND	U
Glipizide	U	ND	U
Glucagon	U	ND	U
Glutethimide	No* (NS)	ND	No
Glyburide	No (NS)	ND	U
Glycopyrrolate	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Gold sodium thiomalate	No (NS)	ND	U
Goserelin	ND	ND	ND
Granisetron	ND	ND	ND
Grepafloxacin	ND	ND	ND
Griseofulvin	ND	ND	ND
Guaifenesin	ND	ND	ND
Guanabenz	U	ND	ND
Guanadrel	ND	ND	ND
Guanethidine	ND	ND	ND
Guanfacine	No (NS)	ND	No
Guanidine	ND	ND	ND
Halofantrine	ND	ND	ND
Haloperidol	No (NS)	ND	No
Heparin	No (NS)	ND	No
Hexobarbital	No (NS)	ND	U
Hirudin	No (4.3-6.5)	Yes (20-90)	ND
Hydralazine	No (NS)	ND	No
Hydrochlorothiazide	No (NS)	ND	U
Hydrocodone	ND	ND	ND
Hydrocortisone	U	ND	U
Hydromorphone	ND	ND	ND
Hydroxychloroquine	ND	ND	ND
Hydroxyurea	No (NS)	ND	U
Hydroxyzine	No (NS)	ND	No
Ibandronate	ND	Yes (8.1)	ND
Ibritumomab	U	U	U
Ibuprofen	No (NS)	ND	U
Ibutilide	ND	ND	ND
Idarubicin	U	ND	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Idursulfase	U	U	U
Ifosfamide	Yes (1.6)	L	ND
Iloprost	ND	ND	ND
Imatinib	No (NS)	U	U
Imidapril (imidaprilat)	No (NS)	U	U
Imiglucerase	U	U	U
Imipenem	Yes (NS)	L	Yes
Imipramine	No (NS)	ND	No
Immune globulin	U	ND	U
Indapamide	No (NS)	ND	U
Indinavir	U	No (40)	ND
Indomethacin	No (NS)	ND	U
Infliximab	U	U	U
Insulin	No (NS)	ND	No
Insulin aspart	U	ND	U
Insulin glargine	U	ND	U
Insulin glulisine	U	ND	ND
Insulin lispro	U	ND	U
Interferons	No (NS)	Yes (20-33)	No
Iodipamide	ND	ND	ND
Iodixanol	Yes (3.1, 4.2)	L	ND
Iohexol	Yes (NS)	Yes (15.5)	ND
Iomeprol	Yes (6.8)	L	Yes
Iopamidol	Yes (4.8)	L	Yes
Iopromide	Yes (5.5-6.8)	Yes (8.1-62)	ND
Iotrolan	Yes (NS)	L	ND
Ioversol	Yes (6.3)	L	ND
Ioxaglic acid	L	L	ND
Ioxilan	Yes (NS)	L	ND
Ioxitalamic acid	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Irbesartan	No (NS)	ND	ND
Irinotecan/ SN-38 metabolite	Yes/No (NS)	ND	ND/U
Iron dextran	U	No (8.1-10.1)	U
Iron sucrose	U	No (11.1-55)	U
Isocarboxazid	ND	ND	ND
Isoniazid	No (NS)	No (80)	No
Isoproterenol	ND	ND	ND
Isosorbide dinitrate	No (NS)	ND	No
Isosorbide mononitrate	Yes (NS)	L	No
Isotretinoin	U	U	U
Isradipine	No (NS)	ND	No
Itraconazole	No (NS)	No (65)	U
Ivermectin	ND	ND	ND
Ixabepilone	ND	ND	ND
Kanamycin	Yes (NS)	L	Yes
Ketamine	No (NS)	ND	U
Ketoconazole	No (NS)	ND	No
Ketoprofen	U	ND	U
Ketorolac	U	ND	U
Ketotifen	ND	ND	ND
Labetolol	No (NS)	ND	No
Lactulose	U	U	U
Lamivudine	No (NS)	No (11.4)	No
Lamotrigine	No (NS)	ND	U
Lanreotide	ND	ND	ND
Lansoprazole	No (NS)	ND	U
Lanthanum carbonate	No (NS)	U	U
Lapatinib	U	U	U
Laronidase	U	U	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Leflunomide	No (NS)	No (8.1)	No
Lenalidomide	ND	ND	ND
Lepirudin	No (4.3-6.2)	Yes (20-90)	ND
Letrozole	ND	ND	ND
Leucovorin	ND	ND	ND
Leuprolide	ND	ND	ND
Levamisole	ND	ND	ND
Levetiracetam	Yes (NS)	L	ND
Levobupivacaine	U	ND	U
Levocarnitine	Yes (NS)	L	ND
Levocetirizine	No (NS)	ND	U
Levodopa	U	U	U
Levofloxacin	U	No (13.2)	U
Levomethadyl	U	U	U
Levonorgestrel	U	ND	U
Levorphanol	ND	ND	ND
Levosimendan	No (6.4)	U	U
Levothyroxine	U	ND	U
Lidocaine	No (NS)	ND	U
Lincomycin	No (NS)	ND	No
Linezolid	Yes (NS)	Yes (9.3-65)	ND
Liothyronine	ND	ND	ND
Lisdexamfetamine	ND	ND	ND
Lisinopril	Yes (NS)	L	ND
Lithium	Yes (NS)	Yes (40, 70)	Yes
Lomefloxacin	No (NS)	ND	No
Lomustine	No (NS)	ND	U
Loperamide	ND	ND	ND
Lopinavir	U	U	U
Loracarbef	Yes (NS)	L	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Loratadine	No (NS)	ND	No
Lorazepam	No (NS)	ND	U
Losartan	No (NS)	No (10.1-52)	No
Lovastatin	U	ND	U
Loxapine	ND	ND	ND
L-tryptophan	U	No (8.1-40)	ND
Lubiprostone	U	U	U
Mangafodipir	ND	ND	ND
Mannitol	Yes (NS)	L	Yes
Maprotiline	No (NS)	ND	U
Maraviroc	ND	ND	ND
Mecamylamine	ND	ND	ND
Mecasermin	ND	ND	ND
Mechlorethamine	No (NS)	ND	No
Meclofenamate	U	ND	U
Medroxyprogesterone	U	U	U
Mefenamic acid	No (NS)	ND	U
Mefloquine	U	ND	U
Megestrol acetate	ND	ND	ND
Meloxicam	No (NS)	U	U
Melphalan	No (NS)	ND	ND
Memantine	ND	ND	ND
Menadiol	ND	ND	ND
Menotropins	ND	ND	ND
Mepenzolate	ND	ND	ND
Meperidine/ normeperidine	No (NS)/ND	No (8.1)/Yes (8.1)	U/ND
Meprobamate	Yes (NS)	L	Yes
Mercaptopurine	Yes (NS)	L	ND
Meropenem	Yes (NS)	L	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Mesalamine (5-ASA)	Yes (NS)	ND	U
Mesna	ND	ND	ND
Mesoridazine	U	ND	U
Metaproterenol	ND	ND	ND
Metaxalone	ND	ND	ND
Metformin	Yes (NS)	L	ND
Methadone	No (NS)	ND	No
Methaqualone	No (NS)	ND	No
Methenamine	ND	ND	ND
Methicillin	No (NS)	ND	No
Methimazole	No (NS)	ND	No
Methocarbamol	ND	ND	ND
Methohexital	U	U	U
Methotrexate	Yes (NS)	Yes (20, 60)	No
Methoxsalen	ND	ND	ND
Methoxypolyethylene glycol-epoetin beta	U	U	U
Methscopolamine	ND	ND	ND
Methsuximide	ND	ND	ND
Methyldopa	Yes (NS)	L	Yes
Methylergonovine	ND	ND	ND
Methylphenidate	U	ND	U
Methylprednisolone	Yes (NS)	L	ND
Methysergide	ND	ND	ND
Metoclopramide	No (NS)	ND	No
Metolazone	No (NS)	ND	U
Metoprolol	Yes (NS)	L	ND
Metronidazole	Yes (NS)	Yes (56)	No
Mexiletine	Yes (NS)	L	No
Mezlocillin	Yes (NS)	L	No

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Micafungin	U	U	U
Miconazole	No (NS)	ND	No
Midazolam	No (NS)	ND	U
Midodrine (de-glymidodrine)	ND	Yes (8.1)	ND
Mifepristone	U	U	U
Miglitol	ND	ND	ND
Miglustat	ND	ND	ND
Milrinone	ND	ND	ND
Minocycline	No (NS)	ND	No
Minoxidil	Yes (NS)	L	Yes
Mirtazapine	U	ND	U
Misoprostol	U	ND	U
Mitomycin	ND	ND	ND
Mitotane	ND	ND	ND
Mitoxantrone	No (NS)	ND	No
Mivacurium	ND	ND	ND
Modafinil	ND	ND	ND
Moexipril	ND	ND	ND
Molindone	U	ND	U
Montelukast	U	ND	U
Moricizine	U	ND	U
Moroctocog alfa	U	U	U
Morphine	ND	Yes (8.1, 10.1)	No
Moxifloxacin	ND	ND	ND
Muromonab-CD3	U	ND	U
Mycophenolate (mycophenolic acid)	No (NS)	ND	No
Nabilone	ND	ND	ND
Nabumetone	No (NS)	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Nadolol	Yes (NS)	L	ND
Nadroparin	ND	ND	ND
Nafarelin	ND	ND	ND
Nafcillin	No (NS)	ND	No
Nalbuphine	ND	ND	ND
Nalidixic acid	U	U	U
Nalmefene	No (4.1-5.9)	ND	U
Naloxone	ND	ND	ND
Naltrexone	No (NS)	ND	ND
Nandrolone	ND	ND	ND
Naproxen	No (NS)	ND	U
Naratriptan	ND	ND	ND
Natalizumab	U	U	U
Nateglinide/ M1 metabolite	U/Yes (NS)	U/Yes (NS)	U/ND
Nedocromil	ND	ND	ND
Nefazodone	U	ND	U
Nelarabine	U	U	U
Nelfinavir	U	No (71)	No
Neomycin	Yes (NS)	L	Yes
Nesiritide	U	U	U
Netilmicin	Yes (NS)	L	Yes
Nevirapine	ND	Yes (40)	Yes
Niacin	ND	ND	ND
Niacinamide	ND	ND	ND
Nicardipine	No (NS)	ND	U
Nicotine	ND	ND	ND
Nicotinic acid	ND	ND	ND
Nifedipine	No (NS)	ND	No
Nilotinib	U	U	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Nilutamide	ND	ND	ND
Nimodipine	No (NS)	ND	No
Nisoldipine	No (NS)	ND	No
Nitazoxanide	U	U	U
Nitrendipine	No (NS)	ND	U
Nitrofurantoin	Yes (NS)	L	ND
Nitroglycerin	No (NS)	ND	No
Nitroprusside	Yes (NS)	L	Yes
Nizatidine	No (NS)	ND	No
Nomifensine	ND	ND	ND
Nonacog alfa	U	U	U
Norepinephrine	ND	ND	ND
Norethindrone	ND	ND	No
Norfloxacin	No (NS)	ND	U
Norgestimate	U	U	U
Norgestrel	ND	ND	ND
Nortriptyline	No (NS)	ND	No
Nylidrin	ND	ND	ND
Nystatin	U	U	U
Octreotide	Yes (NS)	L	ND
Ofloxacin	Yes (6.0)	Yes (8.5)	No
Olanzapine	No (NS)	ND	No
Olmesartan	U	U	U
Olsalazine	U	ND	U
Omapatrilat	No (NS)	ND	ND
Omega-3-acid ethyl esters	ND	ND	ND
Omeprazole	U	ND	U
Ondansetron	U	ND	U
Oprelvekin	U	U	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Orbofiban	Yes (NS)	L	ND
Orlistat	U	U	U
Ornidazole	Yes (NS)	L	No
Orphenadrine	ND	ND	ND
Oseltamivir	Yes (NS)	ND	Yes
Oxacillin	No (NS)	ND	No
Oxaliplatin	ND	ND	ND
Oxandrolone	U	U	U
Oxaprozin	No (NS)	ND	U
Oxazepam	No (NS)	ND	U
Oxcarbazepine	ND	ND	ND
Oxtriphylline	Yes (NS)	L	No
Oxybutynin	ND	ND	ND
Oxycodone	ND	Yes (48)	ND
Oxymetholone	ND	ND	ND
Oxymorphone	ND	ND	ND
Paclitaxel	No (NS)	ND	U
Palifermin	U	ND	ND
Paliperidone	ND	ND	ND
Palivizumab	U	U	U
Palonosetron	ND	ND	ND
Pamidronate	Yes (6.4)	L	ND
Pancuronium	ND	ND	ND
Panitumumab	U	U	U
Pantoprazole	No (5.1)	ND	ND
Papaverine	U	U	U
Para-aminosalicylate	U	No (30, 60)	U
Paricalcitol	No (5.5)	ND	ND
Paroxetine	No (NS)	ND	U
Pefloxacin	No (NS)	ND	No

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Pegaspargase	U	ND	U
Pegfilgrastim	U	U	U
Peginterferon alfa-2a	U	No (8.7-33)	U
Peginterferon alfa-2b	U	No (8.7) Yes (20-33)	U
Pegvisomant	U	U	U
Pemetrexed	ND	ND	ND
Pemoline	Yes (NS)	L	No
Penbutolol	No (NS)	ND	No
Penicillamine	Yes (NS)	L	ND
Penicillin	Yes (NS)	L	No
Pentamidine	No (NS)	ND	No
Pentazocine	Yes (NS)	L	ND
Pentobarbital	No (NS)	ND	U
Pentosan polysulfate	ND	ND	ND
Pentostatin	ND	ND	ND
Pentoxifylline	U	ND	ND
Perflexane	ND	ND	ND
Perflutren	ND	ND	ND
Pergolide	U	ND	U
Perindopril (perindoprilat)	Yes (NS)	L	ND
Perphenazine	U	ND	U
Phenacetin	ND	ND	ND
Phenazopyridine	ND	ND	ND
Phenelzine	ND	ND	ND
Phenobarbital	Yes (NS)	Yes (60)	Yes
Phenoxybenzamine	ND	ND	ND
Phentermine	ND	ND	ND
Phentolamine	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Phenylbutazone	No (NS)	ND	U
Phenytoin	No (NS)	Yes (36)	No
Phytonadione	ND	ND	ND
Pilocarpine	ND	ND	ND
Pimagedine (aminoguanidine)	Yes (NS)	ND	ND
Pimozide	ND	ND	ND
Pinaverium	U	U	U
Pindolol	ND	ND	ND
Pioglitazone	U	ND	U
Piperacillin	Yes (NS)	L	No
Piroxicam	U	ND	U
Pizotyline	U	U	U
Plicamycin	ND	ND	ND
Polyethylene glycol	U	U	U
Polythiazide	No (NS)	ND	No
Poractant alfa	ND	ND	ND
Porfimer	No (NS)	U	U
Posaconazole	No (NS)	ND	ND
Pralidoxime	ND	ND	ND
Pramipexole	No (NS)	ND	U
Pramlintide	ND	ND	ND
Pravastatin	No (5.3)	ND	ND
Prazepam	No (NS)	ND	U
Praziquantel	No (NS)	ND	ND
Prazosin	No (NS)	ND	No
Prednisolone	U	No (NS)	U
Prednisone	No (NS)	ND	No
Pregabalin	Yes (NS)	L	ND
Primaquine	No (NS)	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Primidone	Yes (NS)	L	ND
Probenecid	U	U	U
Probucol	No (NS)	ND	No
Procainamide/N-acetyl procainamide (NAPA)	Yes (NS)/ Yes (NS)	L/L	No/No
Procarbazine	ND	ND	ND
Prochlorperazine	U	ND	U
Procyclidine	ND	ND	ND
Progesterone	U	U	U
Proguanil	No (NS)	ND	ND
Promazine	U	ND	U
Promethazine	No (NS)	ND	ND
Propafenone	No (NS)	ND	No
Propantheline	ND	ND	ND
Propofol	U	ND	U
Propoxyphene	No (NS)	ND	No
Propranolol	No (NS)	ND	No
Propylthiouracil	No (NS)	ND	ND
Protriptyline	No (NS)	ND	No
Pseudoephedrine	No (NS)	ND	U
Pyrantel	ND	ND	ND
Pyrazinamide	Yes (NS)	Yes (80)	No
Pyridostigmine	ND	ND	ND
Pyridoxine	ND	Yes (36)	ND
Pyrilamine	ND	ND	ND
Pyrimethamine	ND	ND	ND
Quazepam	U	ND	U
Quetiapine	ND	ND	ND
Quinapril (quinaprilat)	No (NS)	U	No
Quinidine	No* (NS)	ND	No

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Quinine	No (NS)	ND	No
Quinupristin/ dalfopristin	ND	ND	No/No
Rabeprazole	U	U	U
Raloxifene	U	ND	U
Raltegravir	ND	ND	ND
Raltitrexed	ND	ND	ND
Ramelteon	ND	ND	ND
Ramipril (ramiprilat)	No (NS)	ND	ND
Ranitidine	No (NS)	Yes (NS)	No
Ranolazine	ND	ND	ND
Rapacuronium	ND	ND	ND
Rasagiline	ND	ND	ND
Rasburicase	U	U	U
Recainam	No (NS)	ND	U
Remifentanil	U	U	U
Repaglinide	U	No (60)	U
Reserpine	No (NS)	ND	No
Reteplase	ND	ND	ND
Reviparin	No (NS)	ND	U
Ribavirin	No (NS)	ND	U
Rifabutin	U	No (40)	U
Rifampin	No (NS)	No (80)	No
Rifapentine	U	ND	U
Rifaximin	U	U	U
Rilmenidine	No (NS)	ND	U
Riluzole	U	U	U
Rimantadine	No (NS)	ND	U
Risedronate	ND	ND	ND
Risperidone	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Ritodrine	Yes (NS)	L	Yes
Ritonavir	U	No (40)	No
Rituximab	No (NS)	U	U
Rivastigmine	ND	ND	ND
Rizatriptan	ND	ND	ND
Rocuronium	ND	ND	ND
Ropinirole	U	U	U
Ropivacaine	U	U	U
Rosiglitazone	No (NS)	ND	U
Rosuvastatin	No (NS)	ND	U
Rotigotine	U	U	U
Roxithromycin	ND	ND	No
Ruboxistaurin	U	U	U
Rufloxacin	ND	ND	ND
Sacrosidase	ND	ND	ND
Salsalate	Yes (NS)	L	No
Saquinavir	U	No (40)	U
Sargramostim	ND	ND	ND
Secobarbital	No (NS)	ND	No
Secretin	ND	ND	ND
Selegiline	ND	ND	ND
Sermorelin	ND	ND	ND
Sertindole	No (NS)	ND	ND
Sertraline	No (NS)	ND	U
Sevelamer	U	U	U
Sevoflurane	ND	ND	ND
Sibutramine	U	ND	U
Sildenafil	U	No (65)	U
Silver	No (NS)	ND	U
Simethicone	U	U	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Simvastatin	U	ND	U
Sirolimus	U	U	U
Sisomicin	Yes (NS)	L	ND
Sitagliptin	No (NS)	ND	ND
Sitaxsentan	U	U	U
Sodium diatrizoate	L	Yes (NS)	ND
Sodium oxybate	ND	ND	ND
Sodium polystyrene sulfonate	U	U	U
Solifenacin	U	U	U
Somatropin	No (NS)	U	U
Sorafenib	U	U	U
Sotalol	Yes (NS)	L	ND
Sparfloxacin	ND	ND	ND
Spectinomycin	Yes (NS)	L	Yes
Spirapril (spiraprilat)	U	ND	U
Spironolactone	U	ND	U
Stanozolol	ND	ND	ND
Stavudine	Yes (NS)	Yes (NS)	ND
Streptokinase	U	U	U
Streptomycin	Yes (NS)	L	Yes
Streptozocin	ND	ND	ND
Sucralfate	No (NS)	ND	No
Sufentanil	U	ND	U
Sulbactam	Yes (NS)	L	No
Sulfadiazine	ND	ND	ND
Sulfadoxine	ND	ND	ND
Sulfamethoxazole	Yes (NS)	L	No
Sulfapyridine	ND	ND	ND
Sulfasalazine	U	U	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Sulfinpyrazone	No (NS)	ND	ND
Sulfisoxazole	Yes (NS)	L	Yes
Sulindac	No (NS)	ND	U
Sumatriptan	ND	ND	ND
Sunitinib	U	U	U
Tacrine	ND	ND	ND
Tacrolimus	No (NS)	ND	U
Tadalafil	No (NS)	U	U
Talinolol	No (NS)	ND	ND
Tamoxifen	ND	ND	ND
Tamsulosin	U	ND	U
Tazobactam	Yes (NS)	L	No
Tefibazumab	No (NS)	ND	U
Tegaserod	No (NS)	ND	ND
Teicoplanin	No (NS)	ND	No
Telbivudine	No (NS)	ND	ND
Telithromycin	ND	ND	ND
Telmisartan	No (NS)	ND	U
Temazepam	No (NS)	ND	U
Temocillin	Yes (NS)	L	No
Temozolomide	ND	ND	ND
Temsirolimus	U	U	U
Teniposide	U	ND	U
Tenofovir	ND	Yes (50)	ND
Terazosin	No (NS)	ND	No
Terbinafine	U	U	U
Terbutaline	ND	ND	ND
Teriparatide	ND	ND	ND
Testolactone	ND	ND	ND
Testosterone	No (NS)	ND	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Tetracycline	No (NS)	ND	No
Thalidomide	U	No (65)	U
Thallous chloride	ND	ND	ND
Theophylline	Yes (NS)	L	No
Thiabendazole	ND	ND	ND
Thiamine	No (NS)	ND	U
Thiethylperazine	ND	ND	ND
Thioguanine	ND	ND	ND
Thioproperazine	ND	ND	ND
Thioridazine	U	ND	U
Thiotepa	ND	ND	ND
Thiothixene	U	ND	U
Thyrotropin alfa	U	U	U
Tiagabine	No (NS)	ND	ND
Ticarcillin	Yes (NS)	L	No
Ticlopidine	U	ND	U
Tigecycline	No (NS)	ND	U
Tilidine	No (NS)	ND	U
Tiludronate	U	ND	U
Timolol	No (NS)	ND	No
Tinidazole	Yes (NS)	L	ND
Tinzaparin	U	ND	ND
Tipranavir	U	U	U
Tirofiban	Yes (NS)	L	ND
Tizanidine	ND	ND	ND
Tobramycin	Yes (NS)	L	Yes
Tocainide	Yes (NS)	L	ND
Tocopherol	ND	ND	ND
Tolazamide	U	ND	U
Tolbutamide	No (NS)	ND	U

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Tolcapone	U	U	U
Tolmetin	U	ND	U
Tolterodine	U	U	U
Topiramate	Yes (NS)	L	ND
Topotecan	Yes (8.0)	L	ND
Torsemide	No (NS)	U	U
Tosufloxacin	No (NS)	ND	ND
Tramadol	No (NS)	Yes (50)	ND
Trandolapril (trandolaprilat)	Yes (NS)	L	ND
Tranexamic acid	ND	ND	ND
Tranylcypromine	ND	ND	ND
Trapidil	ND	ND	ND
Trastuzumab	U	U	U
Trazodone	U	ND	U
Treprostinil	U	U	U
Tretinoin	ND	ND	ND
Triamterene	ND	ND	ND
Triazolam	No (NS)	ND	U
Trientine	ND	ND	ND
Trifluoperazine	No (NS)	ND	No
Triflupromazine	U	ND	U
Trihexyphenidyl	ND	ND	ND
Trimeprazine	ND	ND	ND
Trimethobenzamide	ND	ND	ND
Trimethoprim	Yes (NS)	L	No
Trimetrexate	U	ND	U
Trimipramine	U	ND	U
Triprolidine	ND	ND	ND
Triptorelin	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Tropisetron	U	ND	U
Trospium	ND	ND	ND
Trovafloxacin	No (NS)	ND	ND
Urofollitropin	ND	ND	ND
Ursodiol	U	U	U
Valacyclovir	Yes (NS)	L	No
Valganciclovir	Yes (NS)	ND	ND
Valproic acid	No (NS)	Yes (62)	No
Valrubicin	ND	ND	ND
Valsartan	No (NS)	ND	U
Vancomycin	No (NS)	Yes (10.1-60)	No
Vardenafil	ND	ND	ND
Varenicline	Yes (NS)	ND	ND
Vecuronium	U	ND	U
Velosulin	U	U	U
Venlafaxine	No (NS)	ND	U
Verapamil	No (NS)	ND	No
Verteporfin	ND	ND	ND
Vigabatrin	Yes (NS)	L	ND
Vinblastine	ND	ND	ND
Vincristine	ND	ND	ND
Vinorelbine	ND	ND	ND
Voriconazole	No (NS)	ND	No
Vorinostat	ND	ND	ND
Warfarin	No (NS)	ND	No
Zafirlukast	U	ND	U
Zalcitabine	ND	ND	ND
Zaleplon	ND	ND	ND
Zanamivir	ND	ND	ND

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Zidovudine/GZDV	No (NS)/ Yes (NS)	ND/L	No/Yes
Zileuton	U	No (8.3, 10.1)	U
Zinc	ND	ND	ND
Ziprasidone	No (NS)	U	U
Zoledronic acid	ND	ND	ND
Zolmitriptan	ND	ND	ND
Zolpidem	No (NS)	ND	U
Zonisamide	Yes (NS)	ND	ND

Drugs of Abuse

Drug	HEMODIALYSIS		Peritoneal Dialysis
	Conventional (KUf)	High Permeability (KUf)	
Amphetamine	ND	ND	ND
Cocaine	No (NS)	ND	U
Ethanol	Yes (NS)	L	ND
Heroin	U	ND	U
Lysergide (LSD)	U	ND	U
Marijuana (THC)	U	ND	U
MDMA (Ecstasy)	ND	ND	ND
Mescaline (peyote)	U	ND	U
Nicotine	ND	ND	No
Phencyclidine (PCP)	U	ND	U
Psilocybin	ND	ND	ND

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