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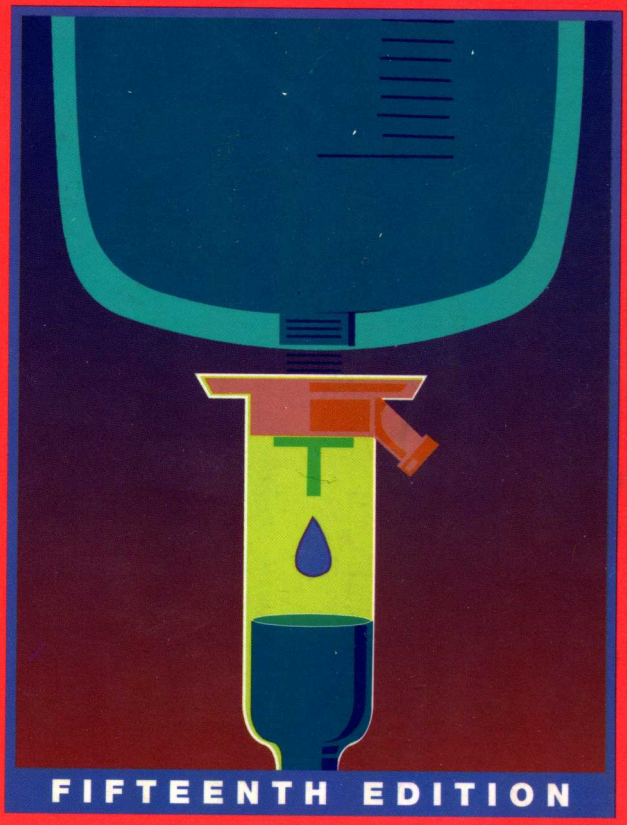
1999
INTRAVENOUS MEDICATIONS



FIFTEENTH EDITION

BETTY L. GAHART
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Mosby

INTRAVENOUS MEDICATIONS

A Handbook for Nurses and Allied Health Professionals

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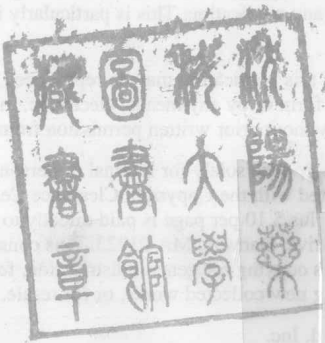

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Preface

This 1999 edition marks the twenty-sixth year of publication of *Intravenous Medications*.

The prolific approval of new IV drugs by the FDA continues. Twelve newly approved drugs are included in this fifteenth edition. In addition, at the request of users of *Intravenous Medications,* alfentanil (now being used for monitored anesthesia care) has been included to bring the total to twelve. The new drugs, and additions of the last several years, represent phenomenal changes and improvements in drug development and methods of delivery (e.g., liposomal and recombinant preparations). In addition, there are many important updates, such as changes in dose, new pediatric doses, additional disease-specific doses, refinements in dosing applications, new indications, new drug interactions, additional precautions, and new information in antidotes. Helpful charts for dilution and/or rate of administration are incorporated in selected monographs. A diluent compatibility chart is inside the back cover. Appendix E provides a generic dilution chart to simplify calculations. To maintain our commitment to provide the most current information available, any new drugs that are released after the composition of this edition is completed are made available in Appendix G. Front material provides a key to abbreviations and Important IV Therapy Facts.

Health care today is an intense environment. The speed of change is overwhelming, but the authors and publisher of *Intravenous Medications* have a commitment to provide all health professionals who have the responsibility to administer IV medications with annual editions incorporating complete, accurate, current information in a clear, concise, accessible, and reliable tool. Each specific drug must be able to be interpreted for a specific patient. All drugs currently approved for intravenous use (with the exception of opaque dyes used in radiology, some general anesthetics used only in OR, and a few rarely used drugs [see Appendix B]) are included. In addition, all information has been thoroughly revised to incorporate the most current documented knowledge available.

Intravenous Medications is designed for use in critical care areas, at the nursing station, in the office, in public health and home care settings, and by students and the armed services. Pertinent information can be found in a few seconds. Take advantage of its availability and quickly review every intravenous medication before administration.

The nurse is frequently placed in a variety of difficult situations. While the physician verbally requests or writes an order, the nurse must evaluate it for appropriateness, prepare it, administer it, and observe the effects. Intravenous drugs are instantly absorbed into the bloodstream, leading, it is hoped, to a prompt therapeutic action, but the risk of an inappropriate reaction is a constant threat that can easily become a frightening reality. It will be the nurse who must initiate emergency measures should adverse effects occur. This is an awesome responsibility.

If, after reviewing the information in *Intravenous Medications*, you have any questions about any order you are given, clarify it with the physician, consult with the pharmacist, or consult your supervisor. The circumstances

will determine whom you approach first. If the physician thinks it is imperative to carry out an order even though you have unanswered questions or concerns, never hesitate to request that the physician administer the drug, drug combination, or dose himself or herself. In this era of constant change, the physician should be very willing to supply you, your supervisor, and/or the pharmacist with current studies documenting the validity and appropriateness of orders.

All information presented in this handbook is pertinent only to the intravenous use of the drug and not necessarily to intramuscular, subcutaneous, oral, or other means of administration.

Our sincere appreciation is extended to Gregory Nazareno, Charlotte Deneen, Linda Grant, and Merrilee Newton for their assistance. Thanks to each of you, the users of this reference, for your quest for information and your loyalty to the references that serve your needs and thus your patients' needs. We will continue to strive to earn your trust and confidence as we look forward together to an exciting future for health care.

Judy L. Hobart

Adrienne R. Nazareno

To my husband,

Bill,

for his patience, support, and many hours of much needed and appreciated assistance and to our children, their spouses, and our grandchildren for their encouragement and understanding.

BLG

To my husband,

Greg,

for his loving support and encouragement and to my children, Danielle, Bryan, Emily, and Mark, for allowing me the freedom to pursue my professional practice.

ARN

Format and Content of *Intravenous Medications*

Designed to facilitate quick reference, each entry begins with the generic name of the drug in boldface type. Drug categories follow. The primary category may be followed by additional ones representing the multiple uses of a drug. Associated trade names are under the generic name. Boldface type and alphabetical order enable the reader to verify correct drug names easily. The use of a Canadian maple leaf symbol (🍁) preceding a trade name indicates availability in Canada only. The pH is listed in the lower right-hand corner of the title section. While this information is not consistently available, it is provided whenever possible. It represents the pH of the undiluted drug, the drug after reconstitution, or the drug after dilution for administration.

Headings within drug monographs are as follows:

Usual dose: Doses recommended are the usual range for adults unless specifically stated otherwise. This information is presented first to enable the nurse to verify that the physician order is within acceptable parameters while checking the order and before preparation. If there are any questions, much time can be saved in clarifying them.

Pediatric dose: Pediatric doses are specifically stated if they vary from mg/kg of body weight or M^2 dose recommended for adults. Not all drugs are recommended for use in children.

Infant and/or neonatal dose: Included if available and distinct from Pediatric dose.

Dose adjustments: Any situation that requires increasing or decreasing a dose will be mentioned here. The range will cover adjustments needed for the elderly, debilitated, or patients with hepatic or renal impairment, to adjustments required in the presence of other medications or as physical conditions are monitored.

Dilution: Specific directions for dilution are given for all drugs if dilution is necessary or permissible. Appropriate diluents are listed. Additional solution compatibilities may be found in the chart on the back cover. This is the only reference that provides calculation examples to simplify dilution and accurate dose measurement. Charts are available in selected monographs. If recommendations for pediatric dilutions are available, they are listed. In some situations mcg or mg/ml dilutions partially account for this variation. If there are any doubts, consult with the pharmacist and/or pediatric specialist. Generic dilution charts for grams to milligrams and milligrams to micrograms are in Appendix E.

Storage: A subheading. Content here includes such items as stability, refrigeration versus room temperature, predilution versus postdilution.

Incompatible with: Incompatible drugs are alphabetized by generic name for ease in locating the drugs with which you are working. To make identification easier, common trade names accompany generic names, or examples are presented for drug categories. Again, no other reference consistently provides this helpful information. Not all incompatibilities are absolute. They are intended to alert the nurse to a problem requiring consultation with a pharmacist or the physician. It may be that a specific order of mixing is required or that partic-

ular drugs are compatible only in a specific solution. Knowledge is growing daily in this field. After receiving specific directions from the pharmacist on correctly mixing two drugs that have a compatibility problem, write the directions on the patient's medication record or nursing care plan so others will not have to retrace your research steps when the medication is to be given again. For some drugs, additive and/or Y-site compatibilities are listed.

Requests have been received to include compatibilities for all drugs. While there is no question that this is valuable information, the specifics involved make it difficult to include. All compatibility data are based on specific concentrations of both drugs, and these concentrations may or may not be related to usual dose and dilution. Detailing all concentrations is beyond the scope of this handbook. The pharmacist has access to extensive references dedicated to compatibilities and is the best reference source when questions arise.

Rate of administration: Accepted rates of administration are clearly stated. As a general rule, a slow rate is preferred. 25-gauge needles aid in giving a small amount of medication over time. Problems with rapid or slow injection rates are indicated here. Adjusted rates for infants, children, or the elderly are listed when available. Charts are available in selected monographs.

Actions: Clear, concise statements outline the origin of each drug, how it affects body systems, its length of action, and methods of excretion. If a drug crosses the placental barrier or is secreted in breast milk, it will be mentioned here.

Indications and uses: Uses recommended by the manufacturer are listed. Investigational or unlabeled uses are stated as such.

Contraindications: Contraindications are those specifically listed by the manufacturer. Consult with the physician if an ordered drug is contraindicated for the patient. The physician may have additional historical information that alters the situation or may decide that use of the drug is indicated in a critical situation.

Precautions: The section on precautions covers many areas of information needed before injecting any drug. The range covers all facets not covered under specific headings. There is no prioritizing; each listing is as important as the next. To make it easier for spot checks (after reading the entire monograph), additional subdivisions are now included.

Monitor: A subheading that includes information such as required prerequisites for drug administration, parameters for evaluation, and patient assessments.

Patient education: A subheading that addresses only specific, important issues required for short-term IV use. It is expected that the health professional will always review the major points in the drug profile with any conscious patient, side effects to expect, how to cope with them, when to report them, special requirements such as the intake of extra fluids, and an overall review of what the drug does, why it is needed, and how long the patient can anticipate receiving it.

Maternal/child: A subheading that addresses FDA pregnancy categories (see Appendix C for a complete explanation), any known specifics affecting patients capable of conception, safety for use during lactation, safety for use in children, and any special impact on infants and neonates.

Elderly: A subheading that is included whenever specific information

impacting this patient group is available. Always consider age-related organ impairment (e.g., cardiac, hepatic, renal, insufficient bone marrow reserve) and route of excretion when determining dose and evaluating side effects.

Drug/lab interactions: Drug/drug or drug/lab interactions are listed here. If a conflict with the patient's drug profile is noted, consult a pharmacist immediately. Increasing or decreasing the effectiveness of a drug can be a potentially life-threatening situation. Check with the lab first on drug/lab interactions; acceptable alternatives are usually available. After this consultation, notify the physician if appropriate. To facilitate recognition, common trade names accompany generic names or examples are presented for drug categories. No other reference consistently provides this helpful information.

Side effects: Alphabetical order simplifies confirmation that a patient's symptom could be associated with specific drug use. Where there is a distinct line of tolerance for side effects, they are listed as minor or major and alphabetized after each of these subheadings. If a manufacturer provides percent of frequency, that information is listed.

Antidote: Specific antidotes are listed in this section. In addition, specific nursing actions to reverse undesirable side effects are clearly stated—an instant refresher course for critical situations.

Key to Abbreviations

<	less than
>	more than
1/2 NS	one-half normal saline (0.45%)
ACE	angiotensin converting enzyme
ACT	activated coagulation time
AIDS	acquired immune deficiency syndrome
ALT	(SGPT) alanine aminotransferase
aPTT	activated partial thromboplastin time
AST	(SGOT) aspartate aminotransferase
BP	blood pressure
BUN	blood urea nitrogen
C	Celsius; centigrade
Ca	calcium
CBC	complete blood count
CHF	congestive heart failure
Cl	chloride
CNS	central nervous system
CO_2	carbon dioxide
CPK	creatine-kinase
CrCl	creatinine clearance
CRT	controlled room temperature (20° to 25°C [68° to 77°F])
CSF	cerebrospinal fluid
C/S	culture and sensitivity
CVP	central venous pressure
D10/NS	10% dextrose in normal saline
D10W	10% dextrose in water
D5/0.2NS	5% dextrose in one-quarter NS (0.2%)
D5/0.45NS	5% dextrose in one-half normal saline (½NS)
D5/LR	5% dextrose in lactated Ringer's solution
D5/NS	5% dextrose in normal saline
D5/R	5% dextrose in Ringer's solution
D5W	5% dextrose in water
DC	discontinued
dL	deciliter(s) (100 ml)
DNA	deoxyribonucleic acid
ECG	electrocardiogram
EEG	electroencephalogram
F	Fahrenheit
GI	gastrointestinal
gm	gram(s)
gr	grain(s)
gtt	drop(s)
GU	genitourinary
Hb	hemoglobin
Hct	hematocrit
Hg	mercury
HIV	human immunodeficiency virus
hr	hour

HR	heart rate
IgA	immune globulin A
IM	intramuscular
IU	international unit(s)
IV	intravenously
K	potassium
KCL	potassium chloride
kg	kilogram(s)
L	liter(s)
lb	pound(s)
LDH	lactic dehydrogenase
LR	lactated Ringer's injection or solution
M	molar
M^2	meter squared
MAO	monoamine oxidase
mcg	microgram(s)
mCi	millicurie(s)
mEq	milliequivalent
Mg	magnesium
mg	milligram(s)
MI	myocardial infarction
min	minute
ml	milliliter
mmol	millimole(s)
Na	sodium
NaCl	sodium chloride
ng	nanogram (millimicrogram)
NS	normal saline (0.9%)
NSAID	nonsteroidal antiinflammatory drug
NSR	normal sinus rhythm
Pao_2	arterial oxygen pressure
PCA	patient controlled analgesia
pH	hydrogen ion concentration
PSVT	paroxysmal supraventricular tachycardia
PT	prothrombin time
PTT	partial thromboplastin time
R	Ringer's injection or solution
RBC	red blood cell or count
RNA	ribonucleic acid
SC	subcutaneous
SrCr	serum creatinine
S/S	signs and symptoms
SW	sterile water for injection
TT	thrombin time
VF	ventricular fibrillation
VT	ventricular tachycardia
WBC	white blood cell or count
WBCT	whole blood clotting time

Important IV Therapy Facts

- Read the Preface and Format and Contents sections at least once. They'll answer many of your questions and save time.

USUAL DOSE

- Doses calculated on body weight are usually based on pretreatment weight and not on edematous weight.
- Normal renal or hepatic function is usually required for drugs metabolized by these routes.
- Formula to calculate creatinine clearance (CrCl) from serum creatine value:

$$\text{males: } \frac{\text{Weight in kg} \times (140 - \text{age in years})}{72 \times \text{serum creatinine (mg/dl)}} = \text{CrCl}$$

females: 0.85 × male CrCl value calculated from above formula.

DILUTION

- Check all labels (drugs, diluents, and solutions) to confirm appropriateness for IV use.
- Sterile technique is imperative in all phases of preparation.
- Use a filter needle when withdrawing IV meds from ampoules to eliminate possible pieces of glass.
- Pearls: 1 Gm in 1 Liter yields 1 mg/ml
  1 mg in 1 Liter yields 1 mcg/ml
  % of a solution equals the number of grams/100 ml
  (5% = 5 Gm/100 ml)
- Pediatric dilution: If you dilute 6.0 mg/kg in 100 ml, 1 ml/hr equals 1.0 mcg/kg/min
  If you dilute 0.6 mg/kg in 100 ml, 1 ml/hr equals 0.1 mcg/kg/min
- Do not use bacteriostatic diluents containing benzyl alcohol for neonates.
- Ensure adequate mixing of all drugs added to a solution.
- Examine solutions for clarity and any possible leakage.
- Syringe prepackaging for use in specific pumps is now available for many drugs. Concentrations are often the strongest permissible, but length of delivery is accurate.

INCOMPATIBILITIES

- Some manufacturers routinely suggest discontinuing the primary IV for intermittent infusion; usually done to avoid any possibility of incompatibility. Flushing the line before and after administration may be indicated and/or appropriate for some drugs.
- The brand of intravenous fluids or additives, concentrations, containers, rate and order of mixing, pH, and temperature all affect solubility and compatibility. Consult your pharmacist with any question, and document appropriate instructions on care plan.

TECHNIQUES

- Never hang plastic containers in a series connection; may cause air embolism.
- Confirm patency of peripheral and/or central sites. Avoid extravasation.

- Avoid accidental arterial injection; can cause gangrene.

RATE OF ADMINISTRATION

- Life-threatening reactions (time-related overdose or allergy) are frequently precipitated by a too-rapid rate of injection.

PATIENT EDUCATION

- A well-informed patient is a great asset; review all appropriate drug information with every conscious patient.

SIDE EFFECTS

- Reactions may be caused by a side effect of the drug itself, allergic response, overdose, or the underlying disease process.

FOR FURTHER READING

Additional and more detailed information on included drugs may be found in the following publications:

American Hospital Formulary Service Drug Information 98: Bethesda, MD, 1998, American Society of Hospital Pharmacists. (Updated quarterly.)

Facts and comparisons, St. Louis, 1998, Facts and Comparisons Division, JB Lippincot Company. (Updated monthly.)

Fisher, David S et al: The cancer chemotherapy handbook, ed 5, St. Louis, 1997, Mosby–Year Book.

The Johns Hopkins Hospital: The Harriet Lane handbook, ed 14, St Louis, 1996, Mosby–Year Book.

Journal of the American Medical Association: Guidelines for cardiopulmonary resuscitation and emergency cardiac care; recommendation of the 1992 National Conference, Oct 28, 1992, 268(16):2171-2302.

Manufacturer's literature.

Merck Manual of Diagnosis and Therapy, ed 16, 1992, Merck Research Laboratories, Rahway N.J.

Skidmore-Roth, Linda: Nursing drug reference, St Louis, 1998, Mosby–Year Book.

Tatro DS, Pharm D, eds: Drug Interaction Facts, St Louis, 1998, Facts and Comparisons Division, JB Lippincot Company. (Updated quarterly.)

Trissel LA: Handbook on injectable drugs, ed 9, 1996, and supplement, 1997. American Society of Hospital Pharmacists, Inc.

United States Pharmacopeia: Drug Information for the Health Care Professional, ed 18, Rockville, MD, 1997, United States Pharmacopeial Convention. (Updated monthly.)

Wingard LB, et al: Human pharmacology, St Louis, 1991, Mosby–Year Book.

Contents

ABCIXIMAB

Platelet aggregation inhibitor
Antithrombotic
Monoclonal antibody

ReoPro, c7E3, 7E3

pH 7.2

USUAL DOSE

Recommendations in this monograph are based on protocols from the clinical trials and communications with the manufacturer, as well as the package insert.

In all situations, premedication with histamine H_2 antagonists (e.g., famotidine [Pepcid], ranitidine [Zantac]) may be appropriate; prophylaxis should be considered when certain conditions are present (e.g., patients with HACA antibodies, readministration of abciximab).

Percutaneous coronary intervention: 0.25 mg/kg administered 10 to 60 minutes before percutaneous transluminal coronary angioplasty or atherectomy (PCTA). Follow with a continuous infusion of 0.125 mcg/kg/min (weight adjusted) to a maximum of 10 mcg/min (non-weight adjusted) for 12 hours. Used concurrently with heparin and aspirin. Establish a separate IV site for heparin. The initial bolus of heparin should be based on the results of the baseline ACT according to low-dose weight-adjusted guidelines in the following chart, but not exceeding a total bolus dose of 7000 units.

Low-Dose Weight-Adjusted Heparin *Target ACT ≥200 seconds*			**Standard-Dose Weight-Adjusted Heparin** *Target ACT ≥300 seconds*		
Initial Bolus	**ACT (sec)**	**Heparin**	**Initial Bolus**	**ACT (sec)**	**Heparin**
Not to exceed 7,000 units in patients >100 kg	<150	70 units/kg	Not to exceed 10,000 units in patients >100 kg	<150	100 units/kg
	150 to 199	50 units/kg		150 to 225	75 units/kg
	≥ 200	No heparin		226 to 229	50 units/kg
				≥300	No heparin
Additional bolus every 30 min or a 7-unit/kg/hr continuous infusion	<200	20 units/kg	Additional bolus every 30 min or a 10-unit/kg/hr continuous infusion	<275	50 units/kg
	≥200	No heparin		275 to 299	25 units/kg
				≥300	No heparin

Check the ACT (Hemochron instrument used to measure) a minimum of 2 minutes after the initial and each additional heparin bolus. Give additional bolus doses of 20 units/kg until the target ACT of 200 seconds is achieved before PTCA (a target ACT of up to 300 seconds using standard weight-adjusted doses of heparin has been used, but may increase the risk of severe bleeding [see preceding chart]). During the procedure administer additional bolus doses every 30 minutes to

maintain the target ACT. Alternately, after the target ACT is reached, a 7-unit/kg/hr continuous infusion may be administered with no further measurement of ACT for the duration of the procedure. Unless contraindicated, administer aspirin, 325 mg, 2 hours before PTCA and once daily thereafter. At the completion of the procedure it is recommended that the heparin be discontinued and that the removal of the sheath be accomplished within 6 hours (see Monitor for specific criteria). If prolonged therapy or later sheath removal is clinically indicated, do not discontinue heparin, but continue the 7 unit/kg/hr heparin infusion. Check the aPTT in 6 hours and adjust rate of heparin based on a target aPTT of 60 to 85 seconds. (Note Precautions/Monitor.)

Unstable angina not responding to conventional medical therapy with planned PTCA intervention within 24 hours: Heparin is started before the abciximab; use a separate IV line. Maintain the APTT between 60 and 85 seconds during the Abciximab and heparin infusion period. Recent recommendations suggest that the low-dose weight adjusted doses of heparin and anticoagulation guidelines described under percutaneous coronary intervention are also appropriate for the planned PTCA intervention in unstable angina. The recommended dose of abciximab is 0.25 mg/kg as an IV bolus followed by a continuous infusion of 10 mcg/min for a minimum of 18 hours up to a maximum of 26 hours (PTCA usually accomplished between 18 and 24 hours). Discontinue abciximab 1 hour after the PTCA (i.e., removal of guidewire). Unless contraindicated, administer at least 250 mg of aspirin at the time heparin is begun and aspirin 50 to 500 mg daily through day 30. Oral or IV Nitroglycerin may also be indicated throughout the course of treatment. The process after the completion of the procedure is the same as in percutaneous coronary intervention.

DILUTION

Available in 5 ml vials (2 mg/ml). Solution must be clear. Must be filtered with a non-pyrogenic, low-protein binding 0.2 to 0.22 micron filter before administering the bolus and the infusion. Filtering of the infusion may be done during preparation or at administration, using the appropriate in-line filter. Do not shake.

Direct IV: Bolus injection may be given undiluted.

Infusion: Withdraw desired dose and further dilute with NS or D5W (5 ml [10 mg] diluted with 250 ml NS or D5W equals 40 mcg/ml).

Storage: Refrigerate prior to use. Do not freeze. Check expiration date on vial. Contains no preservative; discard any unused portion.

INCOMPATIBLE WITH

Manufacturer states that abciximab should be administered through a separate intravenous line; no other medication should be added to the infusion solution.

RATE OF ADMINISTRATION

Direct IV: An initial dose as a bolus injection, filter at this point if not done when withdrawing from vial.

Infusion: See Usual Dose. Must be administered through an in-line non-pyrogenic, low protein binding filter (0.2 or 0.22 microns), if not done during preparation, and controlled by a continuous infusion pump. A 40-mcg/ml solution (10 mg in 250 ml) at a rate of 10.5 ml/hr will deliver 7 mcg/min, and 15 ml/hr will deliver 10 mcg/min. Discard unused portion at the end of the infusion.