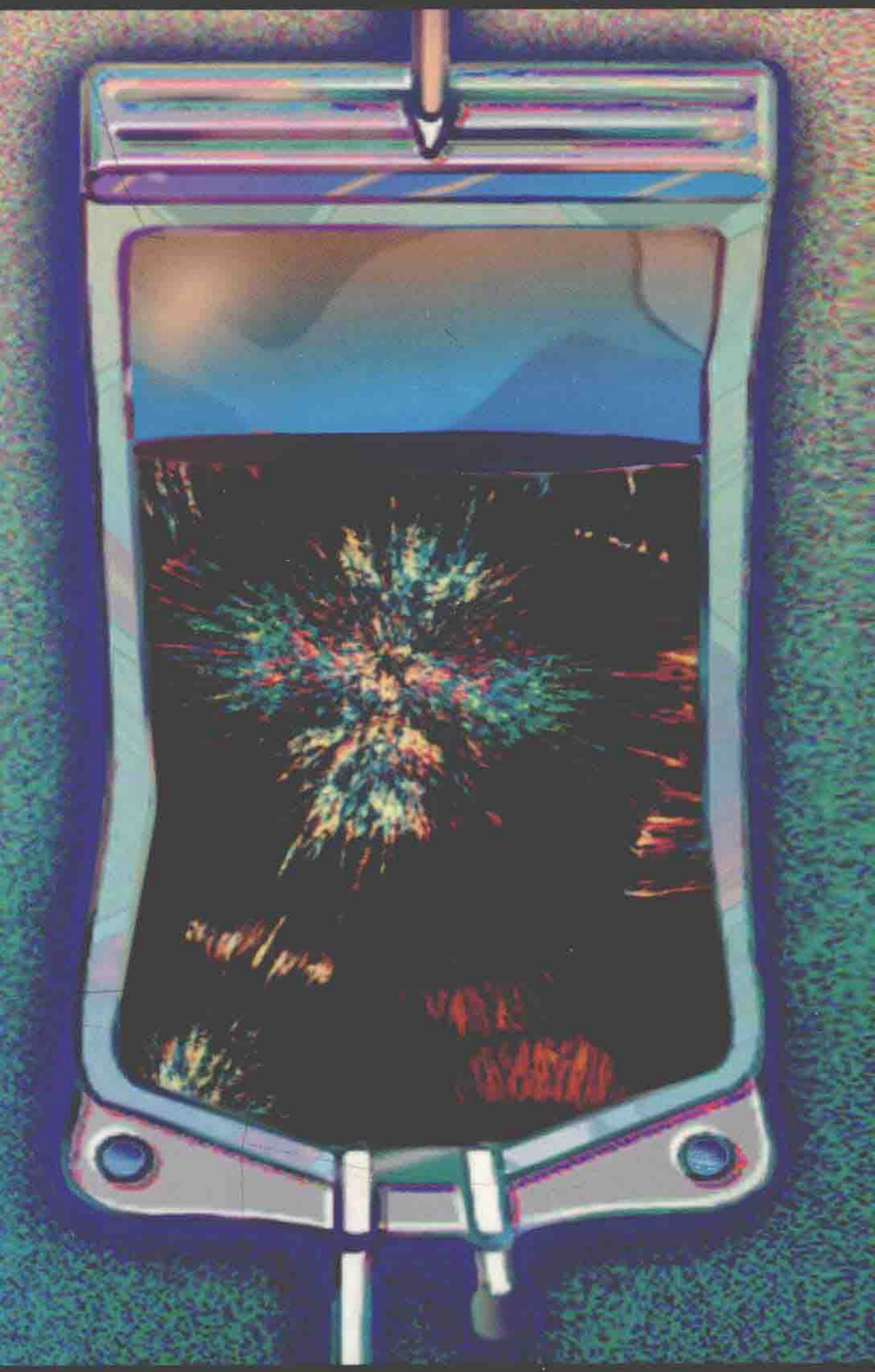
INFUSION THERAPY

TECHNIQUES & MEDICATIONS



MARILYN F. BOOKER
DONNA D. IGNATAVICIUS

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MARILYN FERRERI BOOKER, MS, RN, CRNI
Regional Director Mid-Atlantic
Premier Medical Services, Inc.
Walnut Creek, California

DONNA D. IGNATAVICIUS, MS, RN, C
Instructor, Charles County Community College
Consultant in Gerontological Nursing
La Plata, Maryland

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To Dennis, Reed, and Mary for their love,
patience, understanding, and support.
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for their support, love, and encouragement.

MFB

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patience and support.

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sense of humor, patience,
and above all, her friendship.

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Reviewers

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Donna Ayers Snelson, MSN, RN
School of Nursing, Misericordia College, Dallas, Pennsylvania

Jonathan J. Wolfe, PhD, BS Pharmacy
Pharmacy Practice, College of Pharmacy, Little Rock, Arkansas

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Preface

With changes occurring almost daily in the health care delivery system in the United States, clients receiving a variety of infusion therapies are being seen in virtually every clinical setting and in the home. The various types of infusion therapy, the medications administered, and the equipment and infusion systems employed in their delivery contribute to the challenges facing today's nursing students and practitioners. *Infusion Therapy: Techniques and Medications* was written primarily to provide nursing students with in-depth information about the various types of infusion therapy and medications not found in traditional medical-surgical texts. Nurses practicing in hospitals, long-term care facilities, clinics, and home care will find descriptions of the different types of infusion equipment and systems, step-by-step procedures, listings of complications for each type of therapy, and medication monographs helpful in their daily practices. *Infusion Therapy: Techniques and Medications* is a pocket guide that presents the information students and practitioners require in a concise yet thorough manner.

Unlike other pocket guides that address either intravenous therapy techniques or intravenous medications only, *Infusion Therapy: Techniques and Medications* contains the latest information on all types of infusion therapy in addition to complete information on medications and solutions the nurse or student may administer via any infusion route. It is really two books under one cover!

The book is divided into four parts. Part I presents the history and scope of the types of infusion therapy addressed in the book. This part also includes a discussion of the role of each practitioner on the health care team as it relates to infusion therapy, a review of pertinent anatomy and physiology, and infusion systems and equipment.

Part II, Types of Infusion Therapy, includes information on site selection, access devices, administration techniques, and complications for each type of therapy discussed. This part includes peripheral intravenous, central intravenous, subcutaneous, central nervous system, arterial, intraperitoneal, and intraosseous therapies.

Fluids and electrolytes, parenteral nutrition, and transfusion therapies are the topics covered in Part III.

Part IV contains parenteral medication monographs grouped in nine chapters by drug category, rather than merely in alphabetical order. Each chapter in Part IV opens with a general description of the categories of medication found in the chapter and of any subclassifications of medications within the category. Following this there is a discussion of the therapeutic effects, pharmacokinetics (distribution, metabolism/elimination), cautions (side/adverse effects, contraindications, pregnancy and lactation, pediatric, geriatric), and drug/food interactions generally associated with this subclassification. In addition, a table delineating the side/toxic effects the medication subclass may exert on each body system, physical assessment and laboratory indicators of the side/toxic effects the nurse may observe, and general nursing interventions make Part IV valuable as a

quick reference. This format affords the learner a general knowledge base about a particular grouping of medications that he or she can apply to other medications that belong to the same classification.

A nursing process framework is used for the medication monographs included in these chapters. The assessment section includes the medication's characteristics (action, indications, cautions, and potential drug/food interaction). The intervention section contains medication administration criteria such as mode/rate of administration, dosing across the life span, types of infusion routes, independent nursing actions, and administration in alternate settings. The evaluation section of each monograph focuses on the client's expected physical assessment and laboratory parameter outcomes. Potential negative outcomes are also listed to help delineate usual side effects from toxicities. Although most medications of a particular classification are listed, only monographs for those medications students and practitioners are most likely to see in their practice settings are included.

Marilyn Ferreri Booker
Donna D. Ignatavicius

Contents

PART IV

Infusion Medication • 323

PART V

Appendixes • 767

PART

I

INTRODUCTION TO INFUSION THERAPY

CHAPTER 1

Orientation to Infusion Therapy

Marilyn Ferreri Booker

Today's medical and nursing research provides the nurse with exciting innovations for client care. These innovations, while stimulating, are also challenging in that they require the nurse to maintain a knowledge base and skill level that keep step with the rapid changes. Infusion therapy has seen remarkable advances, many of which are because of nursing research. This book integrates findings from nursing research whenever appropriate.

HISTORY

Unlike other medical treatments, infusion therapy does not have a roster of well-known pioneers. Rather, this evolution, one of the most important aspects of client care as we know it in the twentieth century, is one of technologic advances and chemistry.

William Harvey described the anatomy of the vascular system in 1628 (*De motre cordis,* 1628). In the mid-1600s Christopher Wren, better known for his accomplishments as an architect, astronomer, meteorologist, and mathematician, observed that access to a dog's entire body could be gained via its foreleg vein. Wren presented his work to his colleagues at Oxford University and later to the Royal Society in London. In *Lancet,* 1832, Dr. Thomas Latta of Scotland out-

lined a "new" therapy for the treatment of cholera, which was spreading in epidemic proportions throughout the country. His patient was a woman who was near death from the disease. Dr. Latta wrote, "I injected one hundred twenty ounces, when like the effects of magic, instead of the pallid aspect of one whom death had sealed as his own, the vital tide was restored and life and vivacity returned."

During 1898 a number of papers and reports on the topic of infusing saline solution were written. One of the papers was authored by Dr. Thomas Reilly:

> The apparatus commonly employed in the hospitals of New York for this purpose (inEtravenous infusion) consists of a glass funnel connected by a piece of rubber tubing, three feet or more in length, to a cannula, about four inches long by one eighth of an inch in diameter curved for about an inch at its point to facilitate introduction into the vein, and is generally provided with a stopcock.

A problem that plagued intravenous (IV) infusions was pyrogenicity (the infusion of infection-producing agents). Clients receiving IV infusions had a high incidence of fever. Since 1931, terminal sterilization has allowed the commercial manufacturing of IV fluids that are contaminant free, safe, and effective. All IV solutions were in glass containers until the 1970s, when plastic bags were introduced as containers for IV solutions. These bags do not depend on air displacement for infusion and thus eliminate the risk of airborne contamination.

With more research and consequently more knowledge about fluids and electrolytes, solutions other than normal saline solution became available. Today there are hundreds of commercially prepared solutions.

Since the 1970s there have been remarkable advances in infusion therapy. Some of these advances have been in the field of pharmaceuticals, some in equipment, and some in methodologies. Today's nurses may find themselves monitoring drugs or fluid infusions through any of a number of infusion routes.

In 1987 the Centers for Disease Control (CDC) developed and promulgated its system of "universal precautions." These procedures were designed to reduce the risk of transmitting human immunodeficiency virus (HIV), the virus that causes acquired immunodeficiency syndrome (AIDS), and hepatitis B (HBV) to health care workers. In 1992 the Occupational Safety and Health Administration (OSHA) adopted the CDC's approach to infection control and protection of workers and published its "Occupational Exposure to Blood Borne Pathogens; Final Rule" (see Appendix A). These guidelines have been the impetus for the development of new lines of equipment such as "needleless systems" to protect health care workers from exposure.

SCOPE OF INFUSION THERAPY

Infusion therapy includes the administration of a drug or fluid into the vascular system, subcutaneous tissue, the central nervous system (CNS), a body cavity, or bone. There are many reasons for the physician to prescribe infusion therapy for a particular client. The therapeutic goal may be maintenance, replacement, treatment, diagnosis, monitoring, palliation, or a combination of these. The nurse may administer infusion therapy in short-term-care facilities, outpatient settings, long-term-care facilities, and in clients' homes.

In this book intravascular, subcutaneous, CNS, intraperitoneal (body cavity), and intraosseous infusions are discussed in detail. For a discussion of other body cavity infusions—pleural, pericardial, and bladder—the reader is directed to an oncology text.

INTRAVASCULAR INFUSIONS

Intravascular administration of medications and fluids results in immediate and complete absorption into the plasma.

IV Administration

The IV route is the most common method of administering fluids or drugs. IV therapy is the delivery of fluids or drugs into a vein. The vein may be peripheral or central. The peripheral veins used in IV therapy are usually those in the extremities. Central venous therapy is usually designated by the placement of the tip of the access device. For the purpose of this book a catheter whose tip is in the superior or inferior vena cava is considered "central." Both central venous and peripheral IV therapy allow for systemic access via the plasma circulation. The venous system is used for maintenance, replacement, treatment, diagnosis, monitoring, and palliation.

Arterial Administration

For intraarterial therapy the access device is in an artery. As is true for the IV route, fluids or drugs administered arterially enter the plasma circulation directly. Common uses of arterial therapy are treatment, diagnosis, monitoring, and palliation.

SUBCUTANEOUS INFUSIONS

Absorption is slower following subcutaneous administration than following intravascular administration. Drugs and fluids enter the plasma through the spaces between the cells of the capillary wall. The most common type of subcuta-

neous tissue administration the nurse may see is subcutaneous drug administration. Hypodermoclysis (the infusion of an isotonic solution into the subcutaneous tissue) is seldom seen and is not discussed in this book.

In subcutaneous drug administration the nurse administers the drug in small volumes of fluid, usually no more than 1 mL/min, into the space between the cutaneous tissue and the muscle. This method of administering drugs is commonly used for maintenance, treatment, and palliation. Some drugs commonly given subcutaneously include heparin, insulin, morphine, and hydromorphone (Dilaudid).

CNS INFUSIONS

CNS infusions are seen in the administration of anesthesia, analgesia, chemotherapy, and antibiotics. Unlike intravascular or subcutaneous infusions, in which the plasma acts as the fluid or drug transport agent, drugs administered into the CNS use the cerebrospinal fluid for transport to the site of intended action. Drugs administered via the CNS act in the CNS to provide the desired effects of the treatment. CNS access can also be used for monitoring and palliation.

Two methods are used to gain access to the CNS: epidural and intrathecal.

Epidural Administration

Epidural administration involves placing an access device into the epidural space. In epidural administration the drug diffuses slowly from the epidural space into the cerebrospinal fluid in the subarachnoid space.

Intrathecal Administration

Intrathecal administration may be into the spine or the cerebrum. In both cases the drug is administered directly into the cerebrospinal fluid. In spinal intrathecal administration a catheter is placed into the spinal column with the tip of the catheter in the subarachnoid space between the dura and the spinal cord. This area contains the cerebrospinal fluid and the nerve roots. In cerebral intrathecal administration the cerebral port or reservoir (Ommaya reservoir) is placed in the ventricle over the frontal lobe just under the scalp. The catheter attached to this device provides direct access to the cerebrospinal fluid.

BODY CAVITY INFUSIONS (IRRIGATION)

There are a number of other types of administrations the nurse may see. Most of these are for treatment or palliation

in the client with cancer. The desired site of action is local rather than systemic.

Pleural Administration

Pleural administration involves the placement of a thoracotomy tube or intrapleural needle into the pleural space for the administration of the drug. This therapy is used for intermittent drug administration, not continuous infusion.

Pericardial Administration

After performing a pericardiocentesis (the insertion of a needle into the space between the pericardial sac and the cardiac muscle tissue for the removal of fluid), the physician administers the drug. The needle is then withdrawn.

Intraperitoneal Administration

Intraperitoneal therapy involves the administration of a drug or solution into the intraperitoneal cavity via a peritoneal trocar, Tenckhoff catheter, or implanted port. Medication in solution is administered into the peritoneum and is allowed to dwell there for a specified period of time. It is then drained in a manner similar to that in a peritoneal dialysis procedure. This procedure is covered in more detail in Chapter 11.

Bladder Administration

Bladder administration is similar to intraperitoneal administration. Medication is administered through an indwelling urinary catheter. The nurse permits the medication to dwell for the amount of time ordered by the physician and then drains the fluid from the bladder or has the client void.

INTRAOSSEOUS INFUSIONS

Entry into the medullary cavity of the long bones of children is the basis of the intraosseous infusions. An intraosseous or bone marrow needle is inserted through the bone into the vascular-rich medullary cavity. Drugs and fluids administered in this manner are rapidly absorbed into the plasma because of the vast circulatory network in the long bones.

MODE/RATE OF ADMINISTRATION

Unfortunately, there seems to be no convention among health care professionals for the terms used to describe con-