Introduction to IV Therapy

Chapter 1

Learning Objectives

When you have completed Chapter 1, you will be able to:

- Introduction to IV Therapy
- History of IV Therapy
- Today's IV Therapy
- Indications for IV Therapy
Learning Objectives (cont)

- Describe and discuss Standard of Ethics
- Describe and discuss Legal issues Affecting IV Therapy
- Describe and Discuss Safety Guidelines
- Describe and Discuss LVN/RN scope of practice
- Describe and Discuss CA Code of Regulations
- Differentiate between laws, morals, values, and ethics
- Describe Standard of Care
- Describe Scope of Practice
- Describe Incompetence
- Describe Negligence

Chapter 1

Learning Objectives

- Identify the important factors that are important to the RN /LVN in regards to various legal issues
- Analyze the California Code of Business Regulations 2544 relating to the LVN’s and IV Therapy/Blood Withdrawal
- Student should be able to return knowledge of the LVN scope of practice act 2518.5
- Differentiate between Certification and Licensure

Chapter 1

Introduction to IV Therapy

“Modern IV Therapy is less than a century old. Yet, it was known that medications could be injected into a vein as early as the 1600s. Because of a lack of scientific methods, original attempts to deliver IV fluids and drugs met with little success. Two world wars brought in the era of modern IV therapy. However, the greatest advancements in drugs, equipment, and procedures have occurred in the past 25 years.”

Chapter 1
What is IV Therapy?

- Intravenous is a term that means “within a vein”.
- IV therapy is the infusion of fluids, medications, blood, or blood products directly into a vein.
- Intravenous (I.V.) therapy is sometimes more broadly referred to as infusion therapy.
- Infusion therapy is defined as the parenteral infusion of fluids, electrolytes, blood components, nutrients, or medications to prevent or treat deficiencies or diseases. The term parenteral refers to a route of administration of a therapeutic agent, other than the involvement of the gastrointestinal tract.

History of I.V. Therapy

- The first known attempts at establishing I.V. therapy occurred during the Renaissance with attempts to transfuse either animal blood to humans.
- R. Hermann, a German working at the Institute of Artificial Mineral Waters believed that water should be injected into the victims’ veins to replace lost fluids.
- William Brooke O’Shaughnessy stated he “would not hesitate to inject some ounces of warm water into the veins of the victims.”
- “At the end of the nineteenth century, saline- and glucose-based I.V. solutions were used to treat the critically ill.”
- During the early twentieth century, Karl Landsteiner, an Austrian physician, discovers the first three human blood groups.

Today’s IV Therapy

- I.V. therapies are not restricted to the inpatient hospital environment.
- I.V. therapies are prescribed and used commonly in same-day surgery centers, long-term care facilities, outpatient clinics, and home health settings.
- Nurses must have an understanding the basic principles of fluid and electrolyte balance.
- Selecting and maintaining appropriate I.V. delivery systems.
- Differentiate between common crystalloids, colloidal, blood component products, and parenteral nutritional solutions.
### Indications for IV Therapy

- Medication Administration
- Fluid Administration
- Blood and Blood Products
- Nutrients
- Vitamins
- PPN/TPN

### Roles and Responsibilities

**Role and responsibility in the practice of IV therapy are regulated by**
- Scope of practice
- Training and education
- Regulatory laws in state of employment
- The policies of the organization or facility of employment

**Your individual responsibilities**
- Knowing the laws that regulate your practice
- Knowing whether you have the knowledge and skills to perform the procedure
Roles and Responsibilities

Remember!

Practicing outside your scope could result in injury to the patient and possible malpractice lawsuits.

Chapter 1

Legal and Ethics

What are Ethics?

- Combination of Morals and Values
- Rules of conduct
- Philosophy
Infusion Nurses Society (INS)

The Infusion Nurses Society (INS) has established the scope of practice, competencies and educational requirements for specific forms of infusion therapy and has put forth standards of practice that is recognized worldwide. Ethical principles shall be the foundation for decision making and patient advocacy. The nursing staff should follow guidelines, resources, and policies for ethical issues that may arise when caring for their patients.

*The nurse shall act as a patient advocate; maintain patient confidentiality, safety, and security; and respect, promote, and preserve human autonomy, dignity, rights, and diversity.

http://www.ins1.org

Chapter 1

Infusion Nurses Society

- Independence
- Doing right for the Patient
- Do no harm
- Honesty
- Loyalty
- Righteousness
- Obligation to the patient
- Obligation to the profession
- Obligation to society

Chapter 1

American Nursing Association

- Respect for human dignity
- Relationships to patients
- The nature of health problems
- The right to self-determination
- Relationships with colleagues and others
- Privacy
- Confidentiality
- Addressing impaired practice

Chapter 1
IV Therapy Practice and Regulation

- IV therapy practice is closely regulated and monitored
  - Joint Commission for Accreditation of Healthcare Organizations (JCAHO)
  - Health Insurance Portability and Accountability Act (HIPAA)
  - Centers for Disease Control (CDC)
  - National Institute of Occupational Safety and Health (NIOSH)
  - Occupational Safety and Health Administration (OSHA)

Joint Commission for Accreditation of Healthcare Organizations (JCAHO)

- Accredits healthcare facilities to ensure quality patient care
- Establishes standards published in National Patient Safety Goals
- Reviews and revises them annually

JCAHO: National Patient Safety Goals

- JCAHO Patient Safety Goals that apply to the practice of IV therapy are
  - Goal 1 - Improve the accuracy of patient identification
  - Goal 2 - Improve the effectiveness of communication among caregivers
  - Goal 3 - Improve the safety of using medications
  - Goal 7 - Reduce the risk of infections associated with health care
  - Goal 8 - Reconcile medications accurately and completely across the continuum of care

Source: Joint Commission on Accreditation of Healthcare Organizations (JCAHO) Web site
Health Insurance Portability and Accountability Act (HIPAA)

- Federal law passed in 2003
- Protects the privacy and confidentiality of patient information
- Requires the patient’s permission to discuss healthcare issues with a third party

HIPAA & You

- Guidelines for care of patients with an IV
  - Close patient room doors when providing care or discussing health issues
  - Do not talk about patients in public places
  - Turn computer screens so passers-by cannot see patient information
  - Log off computer when you finish charting
  - Do not leave patient medical records open for unauthorized viewing

Centers for Disease Control (CDC)

- Federal agency with the mission to prevent and control
  - Infectious and chronic diseases, including infections related to IV therapy
  - Injuries
  - Workplace hazards
  - Disabilities
  - Environmental threats
National Institute of Occupational Safety & Health (NIOSH)

- A division of CDC
- Responsible for conducting research and making recommendations for the prevention of work-related injuries
- Research into needlestick injuries by NIOSH resulted in the use of safer medical devices such as needleless systems

Occupational Safety and Health Administration (OSHA)

- Division of the Department of Labor
- Mission – to assure the safety and health of workers by:
  - Setting and enforcing standards
  - Providing training, outreach, and education
  - Establishing partnerships
  - Encouraging continual improvement in workplace safety and health
- Established universal and standard precautions and the blood-borne pathogen standard

Needlestick Safety & Prevention Act

- Became law in 2001 through the combined efforts of NIOSH and OSHA
- Mandates the use of safety devices shown to be effective in the reduction of needlestick injuries in the clinical setting
- Authorizes OSHA to impose monetary fines on health-care facilities not using safe-needle devices
Know Your LEGAL

Your Life
Your License
Your Decision

Categories of Law

Criminal Law – designed to protect members of our society from certain harmful acts of others.

Civil Law – concerned with private rights and remedies.

Assault

Is a violent crime committed against another person. It may also include intentional physical contact without their consent.
Battery (crime)

Use of force against another person typically including physical and harmful contact

What is Malpractice?

Professional misconduct in the performance of a professional service that results in liability for negligence or damage.

The 3 D’s

An unintentional tort is caused by negligence. Negligence is also called medical malpractice.

Malpractice

2. Derelict — health care provider did not live up to the obligation of caring for a patient.
3. Damage — the breach of duty results in damages to the patient or plaintiff.
Legal Issues Affecting IV Therapy

Can you think of something that may affect IV Therapy?

Incorrect Medications

- Confused Drug Names
- Like Names
- Like Labels
- Regular vs. Lantus

Incorrect Dose

- Mg’s instead of Mcgs
- 10 Units instead of 100 units
Incorrect Time
- Gave in the AM vs. PM
- Did not hold Feedings
- Did not hold IV Fluids

Incorrect Patient
- Same Name
- Same Room
- Mother vs. Child

Improper Technique
- Repeat Sticks
- Use of wrong arm
- Use of feet
- Reuse of same needle
Causing Further Harm

- Arterial damage
- Nerve Damage
- Skin and tissue damage
- Circulatory Damage
- Infection

What Can You Do?

- Communicate Effectively
- Document Well
- Follow Scope of Practice
- Follow Policies and Procedures
- Maintain HIPPA

Safety Guidelines

Follow Safety Guidelines
INS Safety Guidelines

- Obtain Knowledge
- Learn to Use equipment correctly
- Obtain Correct Orders
- Know why you are using IV Therapy
- Know your Medications
- Assess your patient
- Maintain your IV
- Know standards of care
- Document

Negligence

As set forth in Section 2878 of the Code, gross negligence is deemed unprofessional conduct and is a ground for disciplinary action. As used in Section 2878, "gross negligence" means a substantial departure from the standard of care which, under similar circumstances, would have ordinarily been exercised by a competent licensed vocational nurse, and which has or could have resulted in harm to the consumer. An exercise of so slight a degree of care as to justify the belief that there was a conscious disregard or indifference for the health, safety, or welfare of the consumer shall be considered a substantial departure from the above standard of care. Note: Authority cited: Sections 2854, Business and Professions Code. Reference: Sections 2854, 2873, 2880, 2881, 2881.1, 2882-2884, Business and Professions Code. History: 1. New section filed 7-31-74; effective thirtieth day thereafter (Register 74, No. 31). 2. Renumbering from Section 2533 filed 9-2-75; effective thirtieth day thereafter (Register 75, No. 36).

Incompetence

2520. Incompetence.
As set forth in Section 2878 of the Code, incompetence is deemed unprofessional conduct and is a ground for disciplinary action. As used in Section 2878, "incompetence" means the lack of possession of and the failure to exercise that degree of learning, skill, care and experience ordinarily possessed and exercised by responsible licensed vocational nurses. Note: Authority cited: Section 2854, Business and Professions Code. Reference: Sections 2854, 2873, 2880, 2881, 2881.1, 2882-2884, Business and Professions Code. History: 1. New section filed 7-31-74; effective thirtieth day thereafter (Register 74, No. 31). 2. Renumbering from Section 2534 filed 9-2-75; effective thirtieth day thereafter (Register 75, No. 36).
Abuse Reporting


Pursuant to Penal Code Section 11166, licensed vocational nurses are mandated to report known or suspected child abuse cases to a child protective agency. Failure to make a child abuse report as required shall constitute unprofessional conduct within the meaning of Business and Professions Code Section 2878(a). Note: Authority cited: Section 2854, Business and Professions Code. Reference: Section 2878(a), Business and Professions Code, and Section 11166, Penal Code. History: 1. New section filed 4-8-86; effective thirtieth day thereafter (Register 86, No. 15).

2520.2. Elder Abuse Reporting.

Pursuant to Welfare and Institutions Code Section 9381, licensed vocational nurses are mandated to report any known or suspected instance of elder physical abuse to an elder protective agency. Failure to make an elder physical abuse report as required shall constitute unprofessional conduct within the meaning of Business and Professions Code Section 2878(a). Note: Authority cited: Section 2854, Business and Professions Code. Reference: Section 2878(a), Business and Professions Code, and Section 9381, Welfare and Institutions Code.

Employer Reporting

2520.5. Employer Mandatory Reporting.

Employers of licensed vocational nurses shall report, in writing, to the Board the suspension or termination for cause (as defined in Business and Professions Code Section 2878.1(c)) of any licensed vocational nurse in its employ. The report shall be made within 30 calendar days from the effective date of the suspension or termination. Failure to make the report as required under this section shall constitute a violation of Business and Professions Code Section 2878.1. Note: Authority cited: Sections 2854, Business and Professions Code. Reference: Sections 2859, 2878, 2878.1, and 2878.5, Business and Professions Code. History: 1. New section filed 9-11-2007; operative 10-11-2007 (Register 2007, No. 37).

Blood Withdrawal


A licensed vocational nurse may withdraw blood from a patient when directed by a licensed physician. In addition, the licensed vocational nurse must have: (a) satisfactorily completed a course in blood withdrawal approved by the Board, as defined in Section 2544.2; or (b) submitted certification, satisfactory to the Board, by one of the persons specified in Section 2544.3, that the licensee has been instructed in the subject areas specified in Section 2544.2 and that the licensee has the knowledge, skills and abilities to safely practice blood withdrawal. Note: Authority cited: Sections 2854, Business and Professions Code. Reference: Sections 2544.2, Business and Professions Code. History: 1. Article 9 (Sections 2544-2544.4), filed 9-2-75; effective thirtieth day thereafter (Register 75, No. 36). 2. Amendment filed 11-16-83; effective upon filing pursuant to Government Code Section 11346.2(d) (Register 83, No. 47). 3. Amendment filed 5-4-2007; operative 6-3-2007 (Register 2007, No. 18).
LVN Scope of Practice

2518.5. Scope of Vocational Nursing Practice
The licensed vocational nurse performs services requiring technical and manual skills, which include the following: (a) Uses and practices basic assessment (data collection), participates in planning, executes interventions in accordance with the care plan or treatment plan, and contributes to evaluation of individualized interventions related to the care plan or treatment plan; (b) Provides direct patient/client care by which the licensee: (1) Performs basic nursing services as defined in subdivision (a); (2) Administers medications; (3) Applies communication skills for the purpose of patient/client care and education; and (4) Contributes to the development and implementation of a teaching plan related to self-care for the particular patient. Note: Authority cited: Section 2814, Business and Professions Code. Reference: Sections 2820, 2820.1, 2820.7, 2820.9, and 2820.10, Business and Professions Code and Sections 11153, Health and Safety Code. History: 1. New section filed 9-19-96, operative 10-19-96 (Register 96, No. 36).

LVN Standards of Practice

2518.6. Performance Standards
(a) A licensed vocational nurse shall safeguard patients'/clients' health and safety by actions that include but are not limited to the following: (1) Reporting to the Board acts specified in Sections 2878 and 2878.5 of the Business and Professions Code; (2) Documenting patient/client care in accordance with standards of the profession; and (3) Performing services in accordance with Section 281 of the Business and Professions Code. (b) A licensed vocational nurse shall adhere to standards of the profession and shall incorporate ethical and behavioral standards of professional practice which include but are not limited to the following: (1) Maintaining current knowledge and skills for safe and competent practice; (2) Maintaining patient/client confidentiality; (3) Maintaining professional boundaries with the patient/client; (4) Abstaining from chemical/substance abuse; and (5) Cooperating with the Board during investigations as required by Section 2878.1 of the Business and Professions Code. (c) A violation of this section constitutes unprofessional conduct for purposes of initiating disciplinary action. Note: Authority cited: Section 2854, Business and Professions Code. Reference: Sections 2859, 2878, 2878.1, and 2878.5, Business and Professions Code. History: 1. New section filed 9-19-96; operative 10-19-96 (Register 96, No. 36).

IV Therapy

2547. Intravenous Therapy/Blood Withdrawal
The Board will consider a licensed vocational nurse competent to start and superimpose intravenous fluids via primary or secondary infusion lines and perform blood withdrawal who has completed one of the following: (a) A course of instruction in intravenous therapy and blood withdrawal approved by the Board. (b) Submitted certification, satisfactory to the Board, by one of the persons specified in Section 2547.4, that the licensee has been instructed in the subject areas specified in Section 2547.3 and that the licensee is knowledgeable and competent in the practice of intravenous therapy and blood withdrawal approved by the Board. (c) A licensed vocational nurse who has been instructed in intravenous therapy and blood withdrawal approved by the Board.

Licensure and Certification

Licensure
- Gained by attending an accredited program
- Sitting for State of National Examination
- Must be renewed every two years
- Must obtain 30 CEU’s every 2 years

Certification
- Optional (CRNI)
- Recommended for professional advancement
- Award for recognition
- Often have to maintain with continuing education
Challenge Your Knowledge

1. You are monitoring an IV. The client complains of pain at the insertion site. The skin is cool, pale, and edematous. What are the possible complications that might be occurring?
2. If your client had either phlebitis or thrombosis, what data would you obtain to distinguish one from the other?

Apply Your Knowledge

What is IV therapy, and what products can be given intravenously?

**ANSWER:** IV therapy is a treatment that infuses fluids, medications, nutrients, and blood or blood products into a vein.

Hurrah!

Apply Your Knowledge

What law or agency requires health-care facilities to use safety devices to reduce needlestick injuries in the clinical setting?

**ANSWER:** Needlestick Safety & Prevention Act of 2001

Good Job!
Apply Your Knowledge

What are your responsibilities before performing any aspect of IV therapy?

**ANSWER:** You must know the laws that regulate your practice and whether or not you have the knowledge and skills to perform the procedure.

BRAVO!

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**Learning Outcomes**

- Describe your responsibilities in the prevention of needlesticks.
- Discuss the purpose of hand hygiene.
- Relate CDC standards for hand hygiene to the practice of IV therapy.
- Perform hand hygiene before, during, and after IV therapy procedures.
- Identify when personal protective equipment is used during IV therapy.
Introduction

- Safety and infection control are two important aspects of IV therapy
- Needlestick injuries expose health-care workers to blood-borne pathogens
  - HIV
  - Hepatitis B and C
- Cost of needlestick injuries
  - Approximately $500 - $1000 even if an infection does not develop
  - Emotional impact and health consequences are severe

Introduction

- Infection control measures protect health-care workers and patients from infection
  - Approximately 1000 health-care workers per year contract serious infections from needlesticks and sharps exposure
  - Approximately 2 infections per 1000 patient discharges are related to IV therapy
  - Any hospital-acquired infection is unacceptable

Standards for Safe-Needle and Needleless Devices

- History
  - First developed in the 1970s
  - 1992 – Food and Drug Administration recommended use of needleless systems for IV therapy
  - 2001 – Needlestick and Safety Prevention Act
    - Requires health-care facilities to provide safe-needle devices
    - Needleless systems should be used as an alternative to needles whenever possible
    - Devices with safety features should be used when a needle is required
Standards for Safe-Needle and Needleless Devices

- Individual’s responsibility to reduce chance of needlestick injury
  - Avoid using needles when possible
  - Use safe alternatives correctly
  - Do not recap needles

Infection Control

- Most common sites are:
  - Urinary: 23%
  - Lung: 22%
  - Wounds: 9%
  - Blood: 6%
  - > 60% of blood infections came from IV lines, catheters or similar devices

- IV therapy provides direct access to the vascular system
  - Puts patient at risk for local and systemic infections
  - Route for transfer of an infectious agent to a susceptible host

- Health-care personnel must
  - Understand the chain of infection
  - Prevent infection
Routes of infection

- Catheter hubs
- Skin adjacent to cannula

Signs of infection

- Erythema/cellulitis
- Tracking/palpable cord
- Oedema/swelling
- Heat
- Pain
- Pus
- Inflammatory markers

Swab when there are signs of infection

Remember: If you swab a wound you must be prepared to act on the result

Insertion sites

- Lower extremity > risk than upper extremity
- Consider density of skin flora
**Phlebitis Tool**

<table>
<thead>
<tr>
<th>Signs &amp; Symptoms</th>
<th>Score</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>No redness or pain</td>
<td>0</td>
<td>Nil</td>
</tr>
<tr>
<td>Redness, no pain or oedema</td>
<td>1</td>
<td>Use with caution, observation required</td>
</tr>
<tr>
<td>Redness, pain and warmth</td>
<td>2</td>
<td>Discontinue &amp; elevate limb</td>
</tr>
<tr>
<td>Redness, oedema, hardness &amp; palpable cord</td>
<td>3</td>
<td>Discontinue &amp; elevate limb. Report to MDT</td>
</tr>
<tr>
<td>Redness visible venous cording &amp; pain</td>
<td>4</td>
<td>Discontinue &amp; elevate limb. Report to MDT. Culture cannula tip</td>
</tr>
</tbody>
</table>

**Pathogenesis**

Most common microorganisms:
- Staph. Epidemidis
- Staph. Aureus
- Candida
- Enterococci

**Chain of Infection**

- Has six links that must be present for an infection to occur
- Transmission of infection:
  - Can occur at any of the links
- Will not occur if any link in the chain is broken
First Link - Infectious Agent

- Pathogens do not always produce an infection
- Ability to produce an infection increases with
  - Virulence (ability to cause disease)
  - Number of pathogens present
  - Susceptibility of the host
  - Presence of a portal of entry into the host

Second Link - Reservoir

- Source of the infectious agent
  - Site where it grows and multiplies
- Reservoir can be
  - Human
  - Animal
  - Contaminated equipment

Third Link - Portal of Exit

- Site at which the organism leaves the reservoir
- Major portals of exit
  - Skin
  - Respiratory tract
  - GI tract
  - Blood
  - Of concern when performing IV therapy procedures
Fourth Link - Mode of Transmission

- Modes
  - Droplet
  - Contact
  - Airborne
  - Vehicle-borne
  - Vector-borne

Mode of transmission determines the type of infection control measure you should use.

Primary Modes of Transmission

- Contact
  - Most frequent source of nosocomial infections
  - Direct – physical transfer of pathogen from reservoir to susceptible host
  - Indirect – reservoir to contaminated item to susceptible host
    - Failure to perform hand hygiene and change gloves between patients
  - Examples of infections spread by contact transmission
    - Methicillin-resistant Staphylococcus Aureus (MRSA)

- Droplet
  - Droplets from an infected person are propelled short distances to the susceptible host
    - Coughing
    - Sneezing
    - Breathing
    - Talking
  - Examples of infections spread by droplet transmission
    - Influenza
    - Mumps
    - Rubella

Chapter 2
Primary Modes of Transmission

- **Airborne**
  - Small particles carry the pathogen
  - Particles are dispersed by air currents before being inhaled by the susceptible host
  - Examples of infections spread by airborne transmission
    - Legionnaires' disease
    - Varicella
    - Tuberculosis

Modes of Transmission

- **Vehicle-borne**
  - Host comes in contact with contaminated items
    - Food
    - Linens
    - Equipment

- **Vector-borne**
  - Animal or insect spreads the disease
  - Example – the mosquito that carries the West Nile virus

Fifth Link - Portal of Entry

- How the organism enters the susceptible host
- Most pathogens enter the host the same way they exit the reservoir
  - Skin
    - Especially with any break in integrity, including an IV catheter
  - Respiratory system
Sixth Link - Susceptible Host

- Person is at risk to develop an infection when exposed to a pathogen

Impaired natural defense mechanisms due to
- Illness
- Age
- Breaks in skin integrity

Principles of Asepsis

- Hand decontamination
- Gloves
- No-touch technique
- Adequate skin decontamination (CH 0.5% in 70% isopropyl alcohol)
- Sterile, undamaged equipment
- Dress the site
- Site maintenance

Preventing Infections

- Nosocomial infections
  - Occur while patient is receiving care in a health-care facility
  - Caused directly by the health-care the patient receives
  - Preventable by implementation of infection control measures

- CDC implemented two levels of precautions
  - Standard precautions
    - Hand hygiene
    - Use of gloves
Prevention strategies

- Standardize aseptic care practices
- Be Familiar with:
  - The nursing care procedures & assessment of the patient’s vein
  - Individual treatment plans
  - The equipment in use

Standard Precautions

- Reduce the risk of transmission of organisms
  - Hand hygiene
  - Wearing gloves

- Prevent exposure to
  - Blood and body fluids
  - Nonintact skin
  - Mucous membranes

- Prevent exposure even if there is no visible blood

Standard Precautions

- Include major features of universal precautions
  - Universal precautions apply if there is visible blood

- CDC recommendations
  - Healthcare workers should NOT wear artificial nails
    - Harbor pathogens even after handwashing
  - Natural nails should not be longer than ¼ inch
Isolation Precautions

- Contact precautions
  - Gloves and gowns
    - Skin-to-skin contact
    - Contact with contaminated linen, equipment, etc.
  - Droplet precautions
    - Goggles and masks – mucous membrane protection
  - Airborne precautions
    - Special air handling and ventilation
    - Respiratory protection – HEPA or N95 respirators

Hand Hygiene

- Simplest and most important way to prevent the spread of infection

- CDC recommendations
  - Wash with soap and water when visibly contaminated with blood or other body fluids
    - Nonantimicrobial soap for routine handwashing
    - Antimicrobial soap during outbreaks of specific infections
  - If not visibly contaminated
    - Wash with soap and water

- Perform hand hygiene
  - Before and after contact with a patient and between patients
  - Before putting on gloves and after removing them
  - After contact with body fluids, mucous membranes, nonintact skin, or wound dressings
Hand Hygiene - Procedure

- Hand washing (cont.)
  - Rub all surfaces vigorously for 10-15 seconds
    - Start at fingertips and move toward wrists
    - Rubbing produces friction that aids in removal of contaminants
  - Dry hands with paper towels
    - Keep fingers pointed up

Hand Hygiene - Procedure

- Alcohol-based hand rubs
  - Used if there is no visible contamination
  - Apply small amount of cleanser to hand
  - Rub hands together vigorously until dry
    - Be sure all surfaces are covered
  - Advantages
    - Decontaminates hands faster than washing
    - Better at killing bacteria
    - Not as drying as soaps

Personal Protective Equipment

- Helps prevent the spread of infections
- Gloves
  - Provide a protective barrier
  - Prevent contamination of hands
  - Reduce the risk of exposure to blood-borne pathogens
  - Prevent the spread of pathogens to and from patients and other health-care workers
Personal Protective Equipment

- **CDC recommendations for glove use**
  - Remove gloves and perform hand hygiene after any activity that contaminates them
  - Change gloves between patients (follow with hand hygiene)

- **CDC recommendations for glove use (cont.)**
  - Change gloves during care of a single patient when moving from one procedure to another
    - Example: following a bath and before performing IV site care
  - Use disposable gloves only once

- **Nonsterile gowns**
  - Protect skin
  - Prevent contamination of clothing during patient care
  - Remove immediately and place in appropriate container when task is completed
Personal Protective Equipment

- Masks and eye protection

  - Protect eyes and mucous membranes from accidental exposure

  - Eye protection
    - Goggles or face shields
    - Eyeglasses do not protect eyes adequately

Apply Your Knowledge

What are the links in the chain of infection?

**ANSWER:** The links in the chain of infection are reservoir, infectious agent, portal of exit, mode of transmission, portal of entry, and susceptible host.

What is the most common mode of transmission for nosocomial infections?

**ANSWER:** Contact transmission is the most common mode of transmission for nosocomial infections.

Apply Your Knowledge

What is the most important thing you can do to prevent the spread of infection?

**ANSWER:** Hand hygiene is the simplest and most important way to prevent the spread of infection.

You just finished bathing a patient. What should you do before you perform IV site care for the same patient?

**ANSWER:** You should remove the contaminated gloves, perform hand hygiene, and put on a new pair of gloves.
Safe-Needle Devices

- Most needlestick injuries are related to:
  - Recapping used needles
  - Improper disposal of used needles

- Safety devices protect from accidental puncture with a contaminated needle when a needle is required.

- Safe-needle devices must be activated correctly to prevent injury:
  - Keep hands behind the exposed needle when activating the safety device
  - Note the feature that indicates that the device is engaged

Ideally, safe-needle devices should:

- Be needleless or have the needle built into the system

- Require no activation by the user or be activated without exposing the user to the sharp point

- Enable the user to tell easily when the device is activated

- Be practical and easy to use

Needleless Systems

- Eliminate the possibility of a needlestick injury

- Features are integrated into the IV tubing:
  - Needleless access ports can be added to ports that are normally accessed with a needle

- Three types of needleless devices:
  - Blunt cannula and resealable port devices
  - Luer-activated devices (LAD)
  - Pressure-activated safety valve devices
Blunt Cannula and Resealable Port Devices

- First system on the market
- Enable access through a resealable port
  - Port is cleansed with alcohol prior to use
  - NEVER access port with needle
- Require specialized tip on syringe or tubing to access port

Luer-Activated Device (LAD)

- Has anti-reflux valve ports
  - Capped or capless
    - Capless version is swabbed with alcohol prior to use
    - Capped version must be covered with a new sterile cap after each use
- Activated by standard syringe or IV set
- Reseal when syringe or IV set is removed
  - Do not let IV bag run dry because blood can back up and cause catheter occlusion
  - Newer version is a positive fluid displacement device that reduces the incidence of clotted catheters
- Often used for intermittent infusions

Pressure-Activated Safety Valve Devices

- Catheter hub has a slit silicone disk with three positions
  - Closed
  - Open forward for infusion
    - Closes when solution stops infusing
    - Catheter will not occlude if IV bag runs dry
  - Open in reverse for aspiration
- Accessed by standard syringe
- Used with central line catheters
  - Built into system
  - Available as add-on port
Apply Your Knowledge

**What does the Needlestick Prevention and Safety Act require of health-care facilities?**

**ANSWER:** The Needlestick and Safety Prevention Act requires that health-care facilities provide safe needle devices such as needleless systems or needle devices with safety features.

**BRAVO!**

Apply Your Knowledge

**What are four of your responsibilities to prevent needlestick injuries?**

**ANSWER:** My responsibilities in preventing needlestick injuries are: (any of the following)
- Avoid using needles when possible
- Use safe alternatives correctly
- Do not recap needles
- Dispose of needles promptly and appropriately
- Report hazards from needles
- Report needlestick injuries promptly
- Attend training and follow infection control policies and procedures

Catheter materials

- Polyurethane = lower incidence of infection
- Avoid teflon.
Manipulating lines, replacing catheters, admin sets and fluids

- Minimise: Openings, Lumens and hubs
- Replacement:
  Risk of infection greatly increases after 72-96 hours
  (Lai 1998)
  IV standard admin sets = up to 96 hours
  Lipid emulsions = within 24 hours
  Blood infusions = within 4 hours
  IV fluid = 24 hours or when replacing admin sets or catheters
  (HICPAC 2001)

Soap and education are not as sudden as a massacre, but they are more deadly in the long run.

Mark Twain

IV Therapy Supplies and Equipment
Learning Outcomes

- Describe the various types of IV access devices.
- State the factors to be considered when selecting a venous access device.
- Identify common sizes of IV catheters and state their use.
- Discuss why the correct choice is always the shortest, smallest IV cannula that will accomplish the task.

Learning Outcomes

- Compare primary and secondary administration sets.
- Explain the differences in drip rate between macrodrip and microdrip infusion sets.
- Summarize how IV therapy fluids are supplied.
- Differentiate among types of infusion rate control devices.

Introduction

- Evolution of IV equipment
  - Glass bottles ➔ plastic fluid containers
  - Hollow-bore metal needles ➔ polyethylene catheters
  - Manual control of IV flow ➔ electronic infusion pumps
- Patient and infusion monitoring are necessary to ensure that the physician’s orders are followed
- Knowledge of equipment and supplies is essential to perform IV therapy procedures
IV therapy is an invasive procedure requiring needle placement.

- Achieved through
  - Direct access
    - Uses only a needle and syringe to access vein
    - Higher risk for side effects and adverse actions
    - Allows delivery of only a single dose of medication
  - Peripherally inserted catheter
  - Centrally inserted catheter

Catheters and Access Devices

- Choice is based on
  - Intended location
  - Needs of patient

- Types
  - Peripheral access devices
    - Most common type
    - Midline peripheral catheters
    - Peripherally inserted central venous catheters
  - Central infusion devices

Peripheral Access Devices

OVER-THE-NEEDLE CATHETERS

- Most common venous access device
- Retractable needle inside a soft, flexible hollow tube
- Only the soft catheter remains in the vein
- IV administration set is attached to catheter hub

- Advantages
  - Meet safety requirements
  - More comfortable for the patient
  - Allow patient more mobility

- Disadvantages
  - Need to be changed frequently to prevent infections
  - Short-term use only
Peripheral Access Devices

Injection Caps/Claves/Ports

- Injection cap or Clave or Ports
- Clean and Flush Every Time You Access a Port

- Require flushing with normal saline
  - Saline flush
    - Before and after administering any medication
    - Clears the IV catheter
  - Luer Activated Device
  - Reasealable Port
    - Mainly used with central lines
    - Prevents clotting between uses

NEEDLELESS SYSTEM

- Needleless Access Ports
  - Used to administer medications through an established IV line
- Advantages
  - Rapid administration
  - Patient does not receive frequent needlesticks
  - Prevents accidental needlesticks
  - Allows administration of several compatible medications

MIDLINE PERIPHERAL CATHETER

- Any catheter inserted between the antecubital area and the head of the clavicle
  - Generally inserted into an antecubital vein
  - Threaded up inside the vein about 6 inches
- Advantages
  - Can be left in place about 6 weeks
  - Less irritation of the vein
  - Less chance of dislodging this catheter
  - Patient activity is not as restricted
Central Venous Catheters

- Direct route into central veins

- Insertion by
  - Physician
  - Specially trained personnel

- Types
  - Internal catheters
  - External catheters

- Choice based on
  - Specific need
  - Patient preference

---

Central Venous Catheters

- External
  - Frequent use
  - Long infusions (several hours)
  - Requires a sterile dressing
  - May require flushing with heparin

- Internal
  - Requires no special care when not in use
  - Completely under skin
  - Requires a needle placed through the skin to access device

---

Types of Central Catheters

- Peripherally inserted central catheter (PICC)
- Triple Lumen
- Groshong
- Hickman
- Implanted Port (Medi-Port or Port-A-Cath)
### Advantages vs Disadvantages

**Advantages**
- Decreased chance of systemic infection
- Low risk of bleeding
- Generally externally unobtrusive
- Extended catheter life from months to years

**Disadvantages**
- Greater chance of insertion site infection
- Vulnerable to occlusion or damage from movement or squeezing of the arm

---

### PICC Line

**Peripherally inserted central catheter (PICC)**
- Inserted into peripheral vein and advanced until the catheter tip is in the superior vena cava or right atrium
- The PICC may have a single lumen or multiple lumens
- Tip placement must be verified by x-ray.

*Chapter 1*

---

### Groshong

**EXTERNAL**

- Thin, flexible catheter
  - Special valve in tip of catheter
    - Prevents blood from backing up into catheter
    - Requires saline flush only after use or once daily if not in use
  - Chest x-ray is necessary after insertion by the physician to make sure catheter tip is in the right location in the heart
- Can remain in place for up to 6
Hickman or Broviac

- Surgically inserted into a large target vein
- Tunneled under the skin a short distance
- Skin seals around a Dacron cuff on the catheter
- Reduces the risk of infection
- Requires flushing with saline and/or heparin
- Advantages
  - Designed for long-term use
  - Few patient restrictions

Implanted Internal Ports

- Central venous line without an external connector
- Implanted port or reservoir under the skin
- Requires a special needle to access the port through the skin
- Withstands approximately 2000 needlesticks
- Usually implanted in the chest
  - Can be placed in antecubital area of the arm
- Advantages
  - Lower risk of infection
  - Designed for long-term care and intermittent access

Venous Access Device Considerations

- Type of fluids and/or medications to be administered
- Length of time patient is to receive IV fluids
- Location, size, and condition of patient’s veins
- Age and level of activity and/or consciousness
- Method of controlling the infusion rate
Catheter Sizes

1. Sized by Length—5 to 2 inches
2. Various Diameter
3. Color-coded
4. 14- to 26-gauge catheters and introducer needle
5. The smaller the diameter, the larger the gauge

Catheter Sizes (cont’)

- Larger-gauge catheters (14- & 16-gauge)
  - Trauma emergencies or surgery
  - Rapid administration of blood and fluids
- Intermediate-gauge catheters (18- & 20-gauge)
  - Most commonly used
  - IV fluids, medications, and blood administration
- Small gauge catheters (22- to 26-gauge)
  - Small, poorly accessible vein
  - Elderly and small children

Select the shortest and smallest cannula needed to deliver the ordered fluids, blood products, and medications.

- Larger, larger catheters increase the risk of
  - Thrombus formation
  - Infection
  - Infiltration
  - Phlebitis

Apply Your Knowledge

What do you consider when choosing a venous access device?

**ANSWER:** You should consider the:

- Type of fluids and/or medications to be administered
- Length of time the patient is to receive IV fluids
- Location, size, and condition of the patient’s veins
- Age and level of activity and/or consciousness
- Method of controlling the infusion rate

**Bravo!**
Administration Equipment

- IV administration set
  - Drip chamber
    - Allows observation of drip rate
    - Reduces air bubbles in line
  - Clamp to regulate or stop flow
  - Connector to attach to access device
  - Connector or port to add a secondary administration set
  - Prefilled, sterile bag of fluids or medications
  - Filters
  - Extension sets
  - Adaptors and connectors

Primary Administration Sets

- Long line that connects the solution bag with the IV catheter
  - Gravity flow sets
  - Infusion pump sets
- Two basic drip rates for manual control sets
  - Macrodrip
  - Microdrip
  - Drip rate printed on the package

Primary Administration Sets

- Macrodrip tubing
  - Large drops form in drip chamber
  - 10-15 drops/mL
  - Uses
    - Infusions of 80 mL or more
    - Operating room infusions
    - Emergencies when large volumes are needed quickly
Primary Administration Sets

- **Microdrip tubing**
  - Small drops form in drip chamber
  - 60 drops/mL
  - Uses
    - Volumes of less than 80 mL/hr
    - KVO (keep vein open) infusions
    - When small volumes or accuracy is needed

- **Flow rate for gravity flow sets**
  - Calculate drip rate (Chapter 8)
  - Count drops falling in drip chamber
  - Regulate
    - Roller or screw clamp
    - Slide clamp
    - Stops flow without changing flow rate
    - “Dial-a-flow” controller

- **Injection ports**
  - Tubing
    - Attach secondary line
    - Inject compatible fluids or medications into the primary line
  - IV bag
    - Inject additives into IV solution

- **Tubing choice**
  - Length to accommodate patient mobility
  - Avoid tubing so long it dangles on the floor
Secondary Administration Sets

- **Extension tubing**
  - Easy access for intermittent infusions
  - Reduces site trauma
  - Re-sealable injection cap enables access
  - Adds length to primary tubing if needed

- Piggyback or secondary sets
  - Administration of medications through existing primary line
  - Attach to primary line using a needleless port

---

Secondary Administration Sets

- **Y set or Y set with micro filter**
  - Blood administration
  - "Arms" of Y set
    - One to blood
    - One to 0.9% saline
    - Used to prime tubing prior to infusion
    - Meet at drip chamber
  - In-line micro-aggregate filter
    - Usually below drip chamber

---

Accessory Devices

- **Filters**
  - Prevent impurities and particulate matter from entering bloodstream
  - Add-on or part of administration set
  - Preferable that they are part of the infusion set
  - If add-on filter is used, carefully follow manufacturer’s
Accessory Devices

- Connectors and adaptors
  - Stopcock device
    - Controls direction of flow of IV fluid
    - 3-way and 4-way stopcocks

- T ports, J loops, and U connectors
  - Used to disconnect a patient from a continuous IV
  - Enable patient to shower, walk, etc.

Apply Your Knowledge

What is the difference between microdrip and macrodrip IV tubing?

**ANSWER:** Microdrip tubing delivers solution with smaller drops at 60 drops per milliliter. Macro drip tubing delivers solution with large drops at 10-15 drops per milliliter.

When do you use microdrip tubing? A macrodrip tubing?

**ANSWER:** Microdrip tubing is used for:
- Infusions of less than 80 mL/hr
- KVO infusions
- When small volumes or accuracy is needed

Macro drip tubing is used for:
- Infusions of 80 mL or more
- Operating room infusions
- Emergencies when large volumes are needed quickly

Fluids

- Most fluids are in soft flexible plastic bags
  - Check label for contents
  - Check contents for clarity
  - Check for leaks or punctures

- Glass bottles are used if a solution or medication is incompatible with plastic
Fluids

- **Volume**
  - Large bags - 500 mL, 1000 mL, and 2000 mL
  - Small-volume bags – 50 mL to 250 mL
    - Used for IV medications
  - Monitor at regular intervals
  - Document amount patient receives

- Injection port present for addition of medications to bag or bottle

Label Reading

<table>
<thead>
<tr>
<th>Normal Saline</th>
<th>Dextrose</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.9% is NS</td>
<td>5% is D5 or D5W</td>
</tr>
<tr>
<td>0.45% is ½ NS</td>
<td>10% is D10</td>
</tr>
<tr>
<td>0.33% is 1/3 NS</td>
<td>20% is D20</td>
</tr>
<tr>
<td>0.225% is ¼ NS</td>
<td>50% is D50</td>
</tr>
</tbody>
</table>

Label Reading (Cont.)
Apply Your Knowledge

Plastic IV solution bags should be checked before starting an infusion. What should you look for?

**ANSWER:** You should check the label to be sure you have the right solution. Check the bag for leaks and punctures, and check the solution for clarity.

GREAT!

IV Regulators

- Ensure that fluid infuses at the correct rate
- Monitoring
  - Manual
    - Rate controllers
  - Electronic flow control devices (IV regulators)
    - Infusion pumps
    - Syringe pumps
    - Patient-controlled analgesia pumps
Manual Monitoring

- **Gravity-drip IVs**
  - Bag hung about 36 inches above patient
  - Clamp (roller or screw) is used to regulate flow rate

- **Factors affecting gravity infusion**
  - Not related to patient
  - Temperature of fluid
  - Height of container
  - Position of drip chamber
  - Size of catheter
  - Patient-related
    - Patient coughing

Volume Control Sets/Volutrol/Burette

- Improve accuracy of administration for smaller volumes
  - 100-150 mL
    - Calibrated in 1-mL increments

- Medication can be added to burette (CHAMBER HOLDING CONTROLLED AMOUNT OF FLUID)

Rate Controllers

- Rely on gravity to infuse solutions
- Tubing threaded through controller
- Do not pump fluid
- Sensor monitors preset flow rate
- Alarm sounds if rate is not maintained
Infusion Pumps

- Enable precise control over
  - Flow
  - Amount delivered

- Preferred method to regulate IV infusion flow rate

- Pump fluid through tubing into vein
  - Alarm sounds if rate is not maintained
  - Monitor for infiltration

Syringe Pumps

- Syringe is inserted into pump

- Administer medications that cannot be combined with other medications or solutions

- Useful when precise control rate is necessary
  - Pediatric use

Patient-Controlled Analgesia (PCA) Pumps
Apply Your Knowledge

What factors not related to the patient affect the drip rate of a gravity flow IV?

**Correct!**

- Temperature of fluid
- Height of container
- Position of drip chamber
- Size of catheter

What is the preferred method for regulating an IV infusion flow rate?

**ANSWER:** The preferred method for regulating an IV infusion flow rate is by an electronic infusion pump.
Peripheral IV Therapy

Relative to Central IV Therapy

Peripheral IV Therapy

- Preferred for short-term therapy
- Peripheral IV line consists of a short catheter inserted into a peripheral vein (any vein not in the chest or abdomen)
- Use
  - Emergency care
  - Administration of medications and replacement fluids
  - Infusion of blood or blood products

Advantages
- Easy to monitor
- Easy access to veins

Disadvantages
- Peripheral veins become inflamed from medications
- Infiltration (solution leaks into surrounding tissue)
- Catheters must be removed and replaced every 72 hours even without inflammation or infiltration
- Patient discomfort due to frequency of replacement requirements

Chapter 1
Complications and Risks

- Complications can be
  - Localized around the IV insertion site
  - Systemic
    - Within the vascular system, away from the insertion site
    - Can be life-threatening

Infiltration

- Inadvertent administration of a nonvesicant (does not cause blisters) solution into surrounding tissue
- Localized complication due to
  - Improperly placed or secured catheter
  - Dislodgement of the catheter
  - Thin or fragile veins
  - Infusion pumps with pressure setting greater than 10 psi

Infiltration

- Signs and symptoms
  - Swelling
  - Discomfort
  - Burning
  - Tightness
  - Cool skin
  - Blanching – whitish color of skin when pressure is applied
Infiltration

- Severe infiltration can cause
  - Nerve or muscle damage
  - Loss of function in affected extremity

- Reduce risk of infiltration by careful monitoring of site

Check for infiltration
- Apply slight pressure about 3 inches below catheter tip
- If solution continues to run it is probably infiltrated

Infiltration

- Edema of extremity may indicate infiltration; however, edema may not be due to infiltration in immobilized or debilitated patients

- Checking for blood return is not a reliable method of determining whether an IV is infiltrated, especially in fragile veins or veins that have had previous venipunctures

Infiltration

- If the IV infiltrates
  - Stop infusion
  - Remove catheter
  - Determine severity of infiltration using the INS Infiltration Scale
    - Rating of Grade 2 or more must be reported as an unusual occurrence and an incident report must be completed
  - New IV started – usually in the other arm
Infiltration

- Severity of symptoms depend on the amount and type of solution or medication that infiltrated into the tissue.

- Treatment
  - Warm or cold compresses may be effective
    - Check facility policy to determine if physician’s order is required
  - Elevation
    - If patient desires
    - Does not affect rate of fluid absorption

INS Infiltration Scale

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Skin blanched</td>
<td>1</td>
</tr>
<tr>
<td>Erythema &lt;1 inch in any direction around the IV site</td>
<td>2</td>
</tr>
<tr>
<td>Slit and be touch</td>
<td></td>
</tr>
<tr>
<td>Possible pain</td>
<td></td>
</tr>
<tr>
<td>Skin blanched, translucent</td>
<td>3</td>
</tr>
<tr>
<td>Erythema &gt;3 inches in any direction around the IV site</td>
<td></td>
</tr>
<tr>
<td>Skin and be touch</td>
<td></td>
</tr>
<tr>
<td>Mild to moderate pain</td>
<td></td>
</tr>
<tr>
<td>Exfoliate or desquamate</td>
<td></td>
</tr>
<tr>
<td>Tender to light touch</td>
<td></td>
</tr>
<tr>
<td>Skin blanched and exuding</td>
<td>4</td>
</tr>
<tr>
<td>Erythema &gt;6 inches in any direction around the IV site</td>
<td></td>
</tr>
<tr>
<td>Pitting edema</td>
<td></td>
</tr>
<tr>
<td>Circulation impaired</td>
<td></td>
</tr>
<tr>
<td>Capillary refill delayed by 4 seconds</td>
<td></td>
</tr>
<tr>
<td>Distillation of any fluid product, irritant, or vesicant</td>
<td></td>
</tr>
</tbody>
</table>

Extravasation

- Infiltration of vesicant (causing blisters) drugs, such as chemotherapeutic drugs, into surrounding tissue
  - Requires emergency treatment

- Tissue damage
  - Can result in ulceration
  - Can lead to infection, disfigurement, loss of function, or amputation

- Causes are the same as for infiltration
Extravasation

- Signs and symptoms are the same as those for infiltration, with the exception that vesicant drugs cause burning or pain around the site rather than discomfort.
- Always rated as a Grade 4 on the INS Infiltration Scale.
- Incident report must be completed.
- Infusion must be stopped immediately, but **DO NOT** remove catheter until antidote is infused.

Phlebitis

- Inflammation of the vein.
- Mechanical causes:
  - Large catheter in a small vein
  - Improperly secured catheter allowing movement
  - Over-manipulation of the catheter
- Chemical causes:
  - Irritating or vesicant medications or solutions
    - Acidic
    - Alkaline
    - High osmolarity
  - Particulates in the IV solution – use a filter.

Phlebitis

- Prevention:
  - Silicone or polyurethane catheters are less irritating.
  - Intermittent infusions with saline locks are less irritating.
  - Add extra diluent if patient can tolerate extra solution.
  - Slow the infusion rate of irritating solutions.
  - Use the smallest catheter appropriate for infusion in larger veins.
  - Replace peripheral catheters every 72 hours.
- Observe previous sites for several days after...
Phlebitis

- Signs and symptoms
  - Erythema (redness) and/or tenderness at tip of catheter
  - Puffiness over vein
  - Warmth to touch at the site
  - Slowed infusion rate
  - Elevated temperature

- Instruct patient to report immediately any of the signs or symptoms listed above

Phlebitis Scale

Central IV Therapy

- Permits infusion of fluids or medications directly into a large central vein or the right atrium of the heart
- Used in emergencies and when a peripheral access cannot be started
- For long-term therapy, large volumes, or multiple infusions
- To obtain blood samples, decreasing the number of venipunctures a patient receives
Central IV Therapy

**Advantages**
- Ability to infuse fluids and medications that are irritating to peripheral veins
- Rapid onset of action due to faster rate of distribution to the body
- Ability to administer multiple medications at once if multiple-lumen central catheter is used
- Ability to measure central venous pressure as well as other physiological values
- Catheter remains in place for duration of therapy unless it becomes infected

**Disadvantages**
- Higher risks of Bleeding, Bacteremia, Air embolism
- Central catheters require more skill and time to insert and are more costly than peripheral IV catheters to maintain

**Central IV Therapy Complications**

**Fluid overload**
- **Cause**
  - Patient receives too much fluid
  - Patient unable to tolerate increased amounts of fluid
- **Symptoms**
  - Respiratory distress
  - Neck vein distension
  - Increased blood pressure
- **Your actions**
  - Slow IV rate to KVO
  - Notify physician who will order Diuretics, Oxygen
  - Elevate head of bed about 45 degrees
Hypersensitivity (allergic) reaction
- Check with patient and medical record for allergies
- Observe patient closely during the administration of the first dose of new medication
- Signs and symptoms
  - Rash, itching
  - Tearing eyes, runny nose
  - Bronchospasm (constriction of air passages)
  - Wheezing
  - Anaphylaxis (severe and sometimes fatal systemic reaction)
- Your actions
  - Stop medication
  - Notify physician
  - Maintain IV
  - Support respirations
- Treatment
  - Epinephrine
  - Antihistamines
  - Steroids

Infection
- Signs
  - Red
  - Purulent drainage
- Your actions
  - Stop IV
  - Remove catheter
  - Notify physician
  - Culture drainage
  - Monitor patient for signs of sepsis

Air embolus
- Especially with central lines
- Air enters line at a separation and enters the heart
- Symptoms
  - Respiratory distress
  - Possible mid-chest and shoulder pain
  - Possible nausea and lightheadedness
- Emergency situation
  - Clamp off catheter
  - Place patient on the left side with head down
  - Start oxygen
  - Notify physician
Apply Your Knowledge

List four signs or symptoms of an infiltrated IV.

**ANSWER:** Four signs of an infiltrated IV are (any four of the following):
- Swelling
- Discomfort
- Burning
- Tightness
- Cool skin
- Blanching – whitish color of skin when pressure is applied
- IV does not run or runs at a slower rate

**Good Job!**

Apply Your Knowledge

What are three advantages of Central IV therapy?

**ANSWER:** (Any three of these)
- Ability to infuse fluids and medications that are irritating to peripheral veins
- Rapid onset of action due to faster rate of distribution to the body
- Ability to administer multiple medications at once if multiple-lumen central catheter is used
- Ability to measure central venous pressure as well as other physiological values
- Catheter remains in place for duration of therapy unless it becomes infected

**GREAT!**

Apply Your Knowledge

True or False

Short-term IV therapy is best accomplished using a tunneled IV catheter.

**ANSWER:** False; tunneled catheters are used for long-term therapy.

What is the best method to use for short-term IV therapy?

**ANSWER:** Peripheral IV catheter
Technology means the systematic application of scientific or other organized knowledge to practical tasks.

Kenneth Galbraith

Intravenous Fluids, Components, and Compatibility

Learning Outcomes

When you have completed Chapter 4, you will be able to:

- Describe four reasons for administering IV therapy.
- Compare peripheral and central IV therapy.
- Differentiate among hypotonic, isotonic, and hypertonic fluids.
- Describe the uses for solutions containing sodium chloride, dextrose, a combination of sodium chloride and dextrose, and electrolytes.
- Discuss the purpose for infusing blood or blood products.
- Relate the importance of ABO and Rh compatibility to the infusion of blood or blood products.
- Describe the purpose of total parenteral nutrition.
Learning Outcomes

- List factors that affect compatibility of IV solutions and medications.
- Describe your responsibilities in avoiding incompatibility problems.
- Compare the advantages and disadvantages of IV medication administration.
- Identify the different classes of IV medications.
- Describe your responsibility in the safe administration of IV medications.

Introduction

Why do we use IV fluids?

How Do They Work?

Reasons for IV Therapy

- IV fluid used to restore and maintain the body’s fluid balance is chosen for its effect on
  - The intercellular fluid (ICF) compartment
  - The extracellular fluid (ECF) compartment

- The effect on the fluid compartments is due to the concentration of solution, or its OSMOLARITY
  - ICF and ECF normally have the same osmolarity
  - A low serum osmolarity (part of ECF) = fluid overload
  - A high serum osmolarity = dehydration

- IV solutions have different concentrations of dextrose (glucose) or sodium chloride (NaCl)
Body Fluid Compartments

- Intracellular fluid (ICF)
  - Fluid inside the cell
- Extracellular fluid (ECF)
  - Fluid outside the cell
- Interstitial fluid (ISF)
  - Fluid that surrounds the cells
  - Part of extracellular fluid
- Intravascular
  - Blood plasma
  - Part of extracellular fluid

Fluid and Electrolyte Balance

- Maintained by
  - Fluid movement between the major fluid compartments
  - Electrolyte balance between the intracellular and extracellular compartments
  - Other fluid processes
    - Renal
    - Cardiovascular
    - Respiratory
    - Endocrine

Fluid Movement

- Fluids move continually between major fluid compartments via
  - Osmosis
  - Capillary filtration
  - Capillary reabsorption
- Nutrients, waste products, and other substances are moved into and out of cells by
  - Diffusion
  - Active transport
- Fluid and solute movement is affected by cell membrane permeability and concentrations of solutes in the fluid
**Fluid Movement**

- **Osmosis**
  - Passive
  - Water moves from an area of higher concentration across a membrane to an area of lower concentration until solute concentration is equalized

- **Capillary filtration**
  - Forces fluid and solutes through the capillary wall from the intravascular fluid into the interstitial fluid

- **Capillary reabsorption**
  - Keeps capillary filtration from removing an excess of intravascular fluid

**Solute Movement**

- **Diffusion**
  - Passive process that requires no energy
  - Solutes move from an area of higher concentration across a membrane to an area of lower concentration to equalize areas

- **Active transport**
  - Active process that requires energy
  - Solutes move from an area of lower concentration across a membrane to an area of higher concentration to equalize areas

**Other Fluid Regulation Processes**

- **Renal**
  - Retention or excretion of urine
  - Excretion of metabolic wastes & toxic substances

- **Cardiovascular**
  - Blood circulation through the kidneys
  - Fluid volume
  - Distribution of fluids in the body

- **Respiratory**
  - Loss of water during exhalation
Other Fluid Regulation Processes

- **Endocrine**
  - Regulated by hormones
    - Antidiuretic Hormone (ADH) regulates water retention
    - Aldosterone affects fluid balance by regulating sodium retention

- **Thirst**
  - Occurs with a loss of 2% of body weight or increase in solute concentration
  - Drink **Gains must equal losses** dilutes solute concentration

Thirst

- Occurs with a loss of 2% of body weight or increase in solute concentration
- Drink Gains must equal losses dilutes solute concentration

Types of IV Solutions - Isotonic

- **Uses**
  - Hydration when the patient is dehydrated
  - Replacement of extracellular fluid loss, such as blood loss
  - Treatment of hypernatremia (excess serum sodium)

- **Cautions**
  - Watch for fluid overload
  - Isotonic solutions do not provide adequate calories
  - They may lead to protein loss

- **Common isotonic solutions**
  - D5 W

Chapter 4

Chapter 1
Types of IV Solutions - Hypertonic

- Have a higher osmolarity than serum
- Pull fluid from the Interstitial and ICF spaces into the intravascular space
  - Increase circulating volume
- Fluid then moves from the cells to replace that lost from the interstitial space

Types of IV Solutions - Hypertonic

- Uses
  - Treat patients with low serum electrolyte levels
  - Stabilize blood pressure
  - Assist in regulating urine output
  - Reverse gastric fluid loss from diarrhea, vomiting, NG suctioning
  - Reverse the effects of dehydration caused by overuse of hypotonic solutions

- Cautions
  - Observe for circulatory overload
  - Do not use if patient has cardiac or renal disease

- Examples
  - \( D_\text{10W} \)
  - \( D_{1/2}\text{NS} \)
  - \( D_2\text{NS} \)

Chapter 4

Types of IV Solutions - Hypotonic

- Have a lower osmolarity than serum
- Cause a shift of fluids out of the intravascular space
  - Decrease circulating volume
- Fluid goes into the cells

Chapter 4
Types of IV Solutions - Hypotonic

- **Uses**
  - Reverse dehydration caused by overuse of diuretics
  - Treat patients with high serum electrolyte levels

- **Cautions**
  - Should not be used for patient with cerebral edema
  - Increased intracranial pressure
  - Burns
  - Trauma
  - Low protein levels from malnutrition or liver disease

- **Example**: 0.45 NS

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Sodium Chloride (NaCl) Solutions

- **Variety of concentrations**
  - 0.9% NaCl – isotonic
  - 0.45% NaCl – hypotonic
    - Supplies normal daily amounts of salt and water
  - 3% or 5% NaCl – hypertonic
    - Used to correct severe sodium loss and water overload

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NaCl Solutions

- **Uses**
  - Treatment of shock
  - Treatment of hyponatremia (low serum sodium)
  - Fluid challenges
  - Replacement in diabetic ketoacidosis
  - Resuscitation in trauma emergencies
  - Infused with blood transfusions

- **Cautions**
  - Can lead to fluid overload
  - Observe patients carefully – especially with Congestive heart failure (CHF)
  - Edema
  - Hypernatremia

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Dextrose Solutions

- Provide calories as carbohydrates to help meet body’s metabolic needs
- Higher concentrations of dextrose are needed for adequate caloric intake
  - 20% to 70% dextrose solutions - hypertonic
  - Require central lines to prevent irritation of the vessels
  - Must be decreased slowly, never stopped abruptly
- D5W - isotonic - only 17 calories per 100 mL
- D10W - hypertonic - 34 calories per 100 mL

Uses

- Provide free water
- Treat hyperkalemia (high serum potassium)
- Treat dehydration

Cautions - high concentrations of dextrose

- can cause cellular dehydration by pulling fluid from the cells into the ECF space
- Must be decreased slowly over 48 hours to prevent an excess of insulin production by the pancreas

NaCl and Dextrose Combination Solutions

- Prevent some of the adverse effects that occur when each is administered separately

Uses

- Fluid replacement of losses due to
  - Sweating
  - Vomiting
  - Gastric suction

Observe for fluid overload in patients with heart, kidney, or liver disease
Electrolytes

Electrolytes are chemicals that separate into charged particles (ions) that conduct electricity needed for normal cell function.

- **Major positively charged ions**
  - Sodium
  - Potassium
  - Calcium
  - Magnesium

- **Major negatively charged ions**
  - Chloride
  - Phosphate

Electrolyte Balance

- The intracellular and extracellular compartments maintain balance in the number of positive and negative ions even though they contain different solutes.

- The interstitial and intravascular compartments have the same chemical composition, so electrolytes can move freely back and forth between the compartments.

Electrolytes

- **Replace patient losses**
  - Choice based on
    - Renal and cardiac function
    - Acid-base balance
    - Losses of electrolytes
    - Disease-specific needs

- May be infused in large-volume bags or in small volumes via a secondary set as an IVPB

- **Cautions**
  - Potassium is irritating to veins
  - Calcium forms a precipitate if given with bicarb, damages tissue if it infiltrates
Multiple Electrolyte Solutions

- Replacement or maintenance depending on the concentration of electrolytes
- May contain lactate or acetate
- Prevent or treat disruption of the body’s acid/base balance
- Metabolic acidosis
- Uses
- Trauma and burns
- GI tract losses and dehydration
- Sodium loss
- Acidosis

Replace fluids and electrolytes for losses due to:
- Dehydration
- Hemorrhage
- Vomiting or diarrhea
- Maintain the patient’s fluid and electrolyte balance

May contain lactate or acetate
- Prevent or treat disruption of the body’s acid/base balance
- Metabolic acidosis

Uses
- Trauma and burns
- GI tract losses and dehydration
- Sodium loss
- Acidosis

Miscellaneous Solutions

- Sodium Bicarbonate
- Neutralizes excess acid and restores the acid/base balance
- Complications
- Metabolic alkalosis
- Hypokalemia (low serum potassium)
- Hypoaldemia
- Sodium retention
- Infiltration results in tissue damage

- Alcohol solutions
- Hypertonic mixtures of ethyl alcohol and dextrose
- Complications are related to rapid infusion or continuous use
- Hypervolemia
- Intoxication
- Dilution of electrolytes
- Acid/base imbalances
- Should not be used for patients with a history of alcoholism

Apply Your Knowledge

What are the three categories of IV solutions, and what is their relationship to serum?

The three categories of IV solutions and their relationship to serum are:
- Isotonic – same osmolarity or concentration as serum
- Hypertonic – higher osmolarity or concentration than serum
- Hypotonic – lower osmolarity or concentration than serum

What is the purpose of an infusion of blood or blood products?

Infusing blood or blood products will do the following:
- Restore circulating volume
- Improve the ability of the blood to carry oxygen
- Replace blood components such as clotting factors

Great!
## Peripheral Parenteral Nutrition (PPN)

- Lower concentration of dextrose – less than 10% dextrose
- Minimum calorie and protein needs
- Used only for short-term therapy due to phlebitis and infiltrations
- Contraindications
  - Severe malnourishment
  - Intolerance for large fluid volumes
  - Inaccessible peripheral veins
  - Nutritional needs that cannot be met by PPN
  - Functional GI tract

## Delivering Nutrients and Nutritional Supplements

- Parenteral nutrition is the infusion of nutritional requirements for patients unable to obtain adequate amounts by oral or enteral (directly into the gastrointestinal tract) routes
- Peripherally administered solutions are generally less concentrated and provide only partial nutritional requirements
- Centrally administered solutions are usually highly concentrated and can provide total requirements

## Additives – Parenteral Nutrition

- An additive is any substance that is not part of a commercially available product
- Parenteral nutrition is the IV infusion of
  - Amino acids
  - Dextrose
  - Fat
  - Electrolytes
  - Vitamins
  - Trace elements
Total Parenteral Nutrition (TPN)

- Restores or maintains nutritional status
- Long-term therapy
  - Do not stop abruptly
- Infused via a central line due to high concentration of solution
- Contraindications
  - Functional GI tract
  - Inability to access central line
  - Poor prognosis
  - Short-term need (less than 5 days)
  - Risks outweigh benefits

Heparin

- Prevention or treatment of clotting disorders
  - Prevents clots from expanding
  - Prevents development of new clots
- Must be infused via pump
  - Rate titrated based on PT/INR
    - Tests how long blood takes to clot
- Monitor patient closely for bleeding
  - Venipunctures
  - During oral care/shaving

Insulin

- Infusions of low-dose regular insulin
  - Initially administered in NaCl solutions
  - Dextrose is added after blood glucose is lowered to about 250mg/dL
- Used to treat ketoacidosis — acidosis due to high glucose levels
- Titrated based on blood glucose levels
  - Monitored frequently using a blood glucose meter
Vitamins

- Required for growth, maintenance, and metabolic processes
  - Requirement may be altered by disease processes
- Preparations – both fat-soluble and water-soluble vitamins
  - Vitamin K is not part of commercial preparations
  - Can be used alone or additional amounts can be added to meet patient requirements
- Uses
  - Vitamin C – promotes healing
  - Folic acid – macrocytic (large RBCs) anemia
  - Folic acid and thiamine – vitamin deficiencies associated with alcoholism
  - B vitamins – needed for metabolism of carbohydrates and maintenance of GI function

Compatibility

- The ability of components of an IV solution to be mixed and administered with
  - No chemical or physical changes
  - No loss of therapeutic effect
- Factors influencing compatibility
  - Order of mixing
  - Drug concentrations
  - Length of time drugs are in contact with other drugs or solutions
  - Temperature
  - Exposure to light

Incompatibility

- Reaction or interaction of additives with each other or with the solution
- Changes the expected action of the medication or solution
- May cause loss of therapeutic effect
  - Types
    - Chemical
    - Physical
    - Therapeutic
Incompatibility

- Chemical incompatibility
  - May or may not be visible
    - Change in color

- Physical incompatibility
  - Forms a precipitate that may or may not be visible
    - Solution may become hazy or cloudy or form gas bubbles

- Therapeutic incompatibility
  - Undesirable reaction that occurs when two or more drugs are given together
    - One inhibits or increases the effects of the other

Incompatibility

- Avoid incompatibility problems
  - Change solutions every 24 hours
  - Carefully check bags before hanging
  - Do not infuse if solution is cloudy or has a precipitate
  - Select correct diluent to reconstitute the drug
  - Do not mix drugs needing a special diluent with other drugs
  - Select the correct solution for the infusion

Apply Your Knowledge

What is the difference between peripheral parenteral nutrition and total parenteral nutrition solutions?

**Answer:** PPN is used for short-term therapy and provides a minimum of caloric and protein needs. PPN solutions are less concentrated than TPN solutions. TPN restores or maintains nutritional status, can be used for long-term therapy, and must be infused via a central line.

What happens when solutions are incompatible?

**Answer:** Incompatibility is a reaction or interaction of additives with each other or with the solution that changes the expected action of the medication or solution and may cause loss of the therapeutic effect.
Classification of Medications

- Generic or trade name
  - Generic – based on chemical composition
  - Trade – copyrighted name by the marketing drug company

- Prescription or nonprescription (over-the-counter)

- Functional or therapeutic
  - Most common classification
  - Categorized according to one of these
    - Clinical indication for the medication
    - Body system affected by the medication

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Anti-infectives

- Destroy or inhibit the growth of the infecting organism
  - Administered to achieve therapeutic blood levels

- Prior to administering
  - Determine location
  - Identify the infecting organism
    - Check for patient allergy!

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Anti-infectives

**Antibiotics**

- Bacterial infections
  - Action
    - Bacteriostatic - inhibit growth
    - Bactericidal - kill bacteria
  - Selection based on pathogen
    - Broad-spectrum – effective against many different pathogens
  - Pathogen-selective antibiotics
    - Gram-positive bacteria
    - Gram-negative bacteria

- Major types
  - Penicillins
  - Cephalosporins
  - Aminoglycosides
  - Tetracyclines
  - Erythromycins
  - Sulfonamides
  - Quinolones
  - Chloramphenicol

Chapter 4
Anti-infectives

**Antifungals**
- **Action**
  - Fungicidal – kill fungi
  - Fungistatic – stop growth
- **Fungal infections**
  - Difficult to treat
  - Most often in immunosuppressed patients
- **Examples**
  - Amphotericin B
  - Fluconazole

**Antivirals**
- **Treatment of serious viral infections**
  - AIDS
  - Herpes
- **Selectively toxic to viruses, preventing replication**
- **Choice of antiviral is based on the infecting virus**
- **Examples**
  - Acyclovir
  - Ganciclovir

Cardiovascular

**Medications for congestive heart failure (CHF)**
- CHF – heart is no longer able to pump enough blood to satisfy the oxygen and nutrient needs of vital organs
- **Treatment**
  - Digoxin – improves contractility
  - Diuretics – decrease circulating volume
    - Example: furosemide
  - **Vasodilators – decrease the pressure the heart has to pump against to expel blood**
    - Example - dopamine

**Antihypertensive medications**
- Given to lower blood pressure
- IV is used when rapid onset is needed
  - Monitor patient closely to prevent blood pressure from becoming too low
- **Examples**
  - Beta-adrenergic blockers – metoprolol, propranolol
  - Calcium channel blockers – verapamil, diltiazem
  - Angiotensin converting enzyme (ACE) inhibitors – enalapril
  - Vasodilators may be given for a hypertensive emergency – nitroprusside
CNS Medications

**Anticonvulsants**
- IV to stop a seizure quickly
  - Example: Phenytoin

**Sedatives**
- Calming effect
  - Example: Phenobarbital

**Narcotic analgesics**
- Pain prevention or relief
  - Administered via a lockable pump
  - Example: Morphine

**Anxiolytic agents**
- Lessen anxiety
  - Example: Lorazepam

GI Medications

**Antulcer medications**
- Reduce acid secretion in the stomach
- Prevent/treat stress ulcers
- Examples:
  - H₂ blockers – ranitidine
  - Proton pump inhibitors – omeprazole

**Antiemetics**
- Control nausea and vomiting
  - Block receptors in the CNS – phenergan
  - Improve gastric motility – metoclopramide
- Patient must be monitored to prevent CNS depression

Chemotherapeutic Agents

- Categorized according to action on cell production
  - Cycle-specific agents
    - Inhibit mitosis (cell division) or
    - Interfere with DNA synthesis, preventing reproduction
  - Cycle-nonspecific agents
    - Act on cells that are not undergoing division
    - Interfere with or inhibit DNA replication, synthesis, or repair
- Selection is based on type and stage of the cancer
- Chemotherapeutic drugs can be combined to enhance the effect of each so that smaller doses
Chemotherapeutic Agents

- Given in repeated doses in a repeated cycle
  - Permits growth of normal cells
- Complications
  - Bleeding
  - Anemia
  - Infection
  - Anorexia and/or nausea and vomiting
  - Alopecia – loss of hair
  - Stomatitis – inflammation of oral mucosa
  - Phlebitis and sclerosing of veins

Administration of IV Meds

- Requires same care and safety practices as other routes of medication administration
- Check for patient allergy to medication prior to administration
- Know about the medication
  - Normal dose
  - Proper administration
  - Possible side effects

Rights of Med Administration

- Right medication
- Right patient
- Right time
- Right route
- Right dose
Apply Your Knowledge

**What is the most common classification system for IV medications?**

**ANSWER:** The most common classification system for medications is according to their function or therapeutic effect.

**What should you know before administering any medication?**

**ANSWER:** You should know the medication's normal dose, proper administration technique, and possible side effects as well as whether the patient has an allergy to the medication.

**BRAVO!**

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**All labor that uplifts humanity has dignity and importance and should be undertaken with painstaking excellence.**

Martin Luther King

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**Monitoring and Maintaining IV Therapy**
Learning Outcomes

- Identify the proper labeling technique for peripheral IV solutions, for medications given IV PB, and for blood products given intravenously.
- Apply, monitor, or replace an IV dressing when necessary.
- List the complications of IV therapy.
- Describe the signs and symptom of an infiltrated IV.
- Describe the signs and symptoms of a patient who has developed phlebitis from an IV.

Learning Outcomes

- Describe the steps taken to prevent infiltration and phlebitis.
- List the common problems that can occur during IV therapy.
- Troubleshoot IV flow rate problems, including IVs that have stopped or are flowing too slow or too fast.
- Describe the steps taken to prevent bleeding or hematoma formation at an IV site.

Introduction

- Patients with IVs require constant care and monitoring
- Communication of information is critical to this care
  - Shift report
  - Documentation in the medical record
  - Labels on IV bags and insertion site
Monitoring IV Therapy

- Observe IV insertion site and fluid container at regular intervals

- Document observations
  - Appearance of site
  - Whether solution is infusing on schedule
  - Patient condition/complaints
  - Vital signs
    - Temperature
    - Hypertension
    - Shortness of breath

Apply Your Knowledge

What do you document when monitoring IV therapy?

**Answer:** You should document observations including the appearance of the site, accuracy of the infusion, patient condition and complaints, vital signs, problems encountered, and actions taken to correct problems.
Labeling

- Accurate labeling
  - Facilitates care
  - Reduces the chance for errors

- Labels must
  - Be legible
  - Contain relevant information

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Labeling

- Site must be labeled
  - After starting a new IV
  - When dressing is changed

- Site label for new IV
  - must contain
    - Date and time IV was started
    - Gauge and length of the catheter used
    - Initials of person starting the IV

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Labeling

- Label site when dressing is changed
  - Original information above
  - Date and time of the dressing change

- Primary and secondary administration sets
  - Date and time hung
  - Initials of person hanging solution bag
Pharmacy Label

- Pharmacy may prepare
  - Large-volume IV solutions
  - Secondary IV medications bags

- Labeled with
  - Patient’s name and unique identifier
  - Type and amount of solution
  - Type and amount of additive
  - Infusion rate
  - Date and time of the infusion

Pharmacy Label

- Add time strip for
  - Large-volume solution bags

- Secondary IV bags if
  - Solution is greater than 100 cc
  - Infusion time is longer than 1 hour

- Always triple-check fluid or medication label prior to beginning the infusion

Labeling – Blood or Blood Products

- Blood is labeled for a specific patient

- Information on bag label
  - Unit number
  - Type of blood product
  - Preservative
  - Expiration date
  - Blood type and Rh

- Patient identifiers on a separate tag attached to the bag

- Blood administration tubing and IV site are labeled as described previously
Apply Your Knowledge

RIGHT!

When do you label an IV site?

**ANSWER:** The IV site must be labeled when it is started and with each dressing change.

What information should be written on the label for an IV site?

**ANSWER:** The site label for a new IV must contain the date and time the IV was started, the gauge and length of the catheter used, and the initials of person starting the IV.

Supply and Site Change

- IV site, tubing, and dressing must be changed every 72-96 hours
- Solution changed every 24 hours.
- Gauze dressing every 48 hours

Site Dressing and Changes

- Semipermeable membrane dressings
  - Allow visualization of the IV site
  - Allow patient to bathe
  - Must be changed every 72 hours

- Gauze dressings
  - Better if patient is diaphoretic (sweaty) or if site is oozing
  - Must be changed every 48 hours

What is missing from this IV site with a semipermeable dressing?

THE LABEL – DATE, TIME, INITIALS, TYPE AND SIZE OF CATHETER
Site Dressings and Changes

- Observe the site each time you enter the patient’s room
  - Look for moisture, oozing, or bleeding
  - Be sure dressing is not loose
- Change if any of the above are noted, even if it is prior to the recommended standard time

Apply Your Knowledge

What should you observe for when checking an IV site?

**ANSWER:** You should observe for moisture, oozing, or bleeding, and make sure that the dressing is not loose.

How often are the IV site and IV site dressing changed?

**ANSWER:** IV sites should be changed every 72 hours. Gauze dressings should be changed every 48 hours and transparent semipermeable membrane dressings should be changed every 72 hours.

Common Problems and Solutions – IV Access

- Rashes, dermatitis, or dark skin
  - Light source directed toward side of extremity may improve visibility
- Hard, sclerosed veins
  - Use smaller veins if accessible
  - May require a central line if no adequate peripheral vein is available
Common Problems and Solutions – IV Access

- Obese patients – veins may be
  - Shallow due to displacement by adipose tissue
  - No special problem
  - Buried deep in the tissue
  - Longer catheter (2 inches) is needed to access veins

- Edema
  - Displace tissue fluid by pressing on site
  - Insertion of catheter must be done quickly before fluid returns
  - May cause collapse of catheter, stopping infusion
    - Move to less edematous site
    - Use larger antecubital vein

Common Problems and Solutions – IV Access

- Elderly patient or any patient with fragile veins
  - Use smallest gauge catheter possible
  - Use lower angle of insertion
  - Stabilize vein by pulling skin tight
  - DO NOT put tourniquet in place too early or too tightly to

Flow Rate Problems and Solutions

- Equipment-related problems
  - Troubleshoot problems and adjust flow rate
    - Infusion too fast
      - Observe patient for fluid overload or medication overdose
    - Infusion too slow
      - Patient not receiving correct amount of solution or medication
      - IV catheter may clog, requiring a restart
      - DO NOT speed up IV flow rate to "catch up"
    - Recalculate rate based on amount of solution left and time remaining from the original order
Flow Rate Problems and Solutions

- **Vein related problems**
  - Infiltration and phlebitis
    - Slow rate
  - Venous spasm is the contraction of a vein that stops blood flow
    - Cold or irritating solution
    - Solution infusing too fast
  - Venous spasm will slow or stop rate and cause pain starting at the IV site and moving up the arm

- **Solutions**
  - Prevention measures
    - Prevent
      - Warm solution to room temperature
      - Dilute additives properly
      - Maintain proper flow rates

Documentation for IV Therapy

- **Document accurately and completely**
  - Document what you did before you started, what and how did you prepare?
  - After initiation of venous access
  - During course of treatment
  - After discontinuation

Documentation After IV Initiation

- In the medical record or the IV flow sheet document
  - Date and time
  - Size and type of catheter
  - Number of attempts
  - Insertion site
  - Solution and additives/medications
  - Flow rate/pump information
  - Type of dressing applied
  - Name or initials of person performing procedure
Documentation After IV Discontinuation

- Observe site and catheter carefully when you discontinue the IV.

- Document
  - Your observations
  - Patient’s response to procedure
  - Date and time IV was discontinued
  - Reason IV was discontinued
  - Condition of the catheter and whether the catheter is intact

Documentation After IV Discontinuation

- Document
  - Arm board use and reason
  - Follow-up actions
    - Application of dressing
    - Restart of IV at another site
  - Signs of infection at catheter site, if present
    - Take appropriate actions and document them in medical record
    - Notify physician
    - Take cultures if ordered

Abbreviations in Documentation

- Use only approved abbreviations
  - Recognized by facility where you work
  - Approved by JCAHO – see the Do Not Use Abbreviations list
  - Undesirable Abbreviations list

- Avoid dangerous or ambiguous abbreviations
  - Write out to avoid mistakes
Apply Your Knowledge

When should you document IV therapy?

ANSWER: You should document accurately and completely after initiation of venous access, during the course of treatment, and upon discontinuation of IV therapy.

Apprehension, uncertainty, waiting, expectation, fear of surprise, do a patient more harm than any exertion.

Florence Nightingale

Preparation and Patient Communication

AND PHLEBOTOMY
Introduction

- Insertion of an IV is an essential skill in health care and requires:
  - Practice to perfect technique
  - Adherence to standard precautions and aseptic technique when preparing equipment and inserting an IV
  - Compliance with needle safety policy and sharps disposal to prevent inadvertent needlesticks

Anxiety; Real or Not?

- Excessive, ongoing worry and tension
- An unrealistic view of problems
- Restlessness or a feeling of being "edgy"
- Irritability
- Muscle tension
- Sweating
- Difficulty concentrating
- Nausea
- Trembling
- Being easily startled

What is a patient?

- Someone we care for
- Our client
- Someone we are suppose to advocate for
- An individual
- Unique
What is Preparation?

- Gather and Prepare equipment
- Reduce their anxiety
- Select Site
- Prepare Site
- Perform Procedure
- Do no further Harm
- Prepare Family, Parents etc. etc.

What is Comfort?

- Reassurance
- Honesty
- Integrity
- Limit and/or Reduce pain
- Provide for Basic Needs

Do you know your patient?

- How old are they?
- Where do they live?
- What is their culture?
- How do they tolerate pain?
- Medical Hx?
- Surgical Hx?
What type of HX?

- Mastectomy
- IVDA
- Hepatitis
- Dialysis Graft
- CHF

Patient Support

- Hope
- Encouragement
- Education
- Compassion

Address Pain

- Pt’s are simply afraid of the unknown
- Afraid of Pain
What can you do?

1. Sit down.
2. Talk to the patient.
3. Ask questions.
4. Hold their hands.
5. Tell them your name.
6. Instruct pt on the insertion of the I.V. catheter
7. Teach pt step by step the procedure for peripherally inserted catheters
8. Teach them all potential complications
9. Ensure provider has informed consent.
10. Instruct the patient about infusion pump(if necessary)
11. Include troubleshooting instructions and telephone numbers for 24-hour assistance.
12. Instruct patient on expected actions and adverse reactions of the prescribed medication

Failure to Prepare

- Vaso-vagal Syncope
- Vasoconstriction of vessels
- Repeated IV attempts
Preparation for the IV Infusion

- Prior to starting an IV, you must
  - Check the physician’s order
    - Type and amount of fluid to be used
    - Rate of infusion
  - Know the purpose of the infusion
    - Needed for a surgical or diagnostic procedure
    - To administer medications
  - Evaluate the patient
  - Prepare the patient for the procedure

Patient Preparation

- Patient preparation
  - Explain procedure and purpose for the IV
    - Use nonmedical terms when possible
    - Answer any questions
    - Teach about post-IV insertion care
  - Psychological preparation
    - Allow the patient/family member to express fears and concerns
    - Validate the patient’s/family’s feelings

- Physical preparation
  - Ensure patient comfort and privacy
  - Change to an IV-style gown, if available
  - Clip hair – never shave – around the potential IV site
  - Apply topical anesthetic cream or prepare subcutaneous injection of local anesthetic such as Xylocaine, if used and if part of your scope of practice
Apply Your Knowledge

List four things you should do prior to starting an IV.

**ANSWER:** Prior to starting an IV you should:
- Check the physician’s order
- Know the purpose of the infusion
- Evaluate the patient
- Prepare the patient for the procedure

Good Answer!

Screening Before an IV Infusion

- Check for allergies
  - Medications
  - Tape
  - Latex
  - Alcohol or povidone iodine

- Check for conditions affecting placement
  - Do not start distal to edema, cellulitis, burns, injury, etc.
  - Do not use arm with fistula for dialysis

Screening and Monitoring During IV Administration

- Follow identification process for each new IV fluid container
  - Prepare solutions and/or IV medication for only one patient at a time

- Review medical record and physician’s orders for any changes

- Reassess patient and answer any further questions

- Monitor fluid container and infusion pump to ensure accurate delivery rate
Screening and Monitoring During IV Administration

- Monitor I & O and vital signs
  - Report fluid imbalances

- Observe the IV site
  - Check at regular intervals and whenever you enter the room
  - Check for signs of phlebitis and infiltration
    - Redness
    - Swelling
    - Warmth
  - Check for moisture around site

Apply Your Knowledge

When should you check the physician's orders before administering IV medications or solutions?

**Answer:** You should check the physician's orders three times before administering IV medications or solutions:

1. When you obtain the medication or solution from the pharmacy or from the supply area
2. During preparation
3. Immediately prior to starting the infusion

Site Selection for Peripheral IVs

- General rules for site selection
  - Start distally and work proximally
  - Avoid patient's dominant hand
    - Use feet or legs only if arms are inaccessible

- Specific rules for site selection
  - Choose peripheral veins that are
    - Straight and large
    - Easily accessible
    - Surrounded by healthy subcutaneous tissue
Site Selection for Peripheral IVs

Specific rules (cont.)
- Use largest, most prominent vein for first attempt
- Use upper extremities in order of preference
  - Dorsal surface of hand
  - Radial and ulnar veins of forearm
  - Cephalic vein
  - Basilic vein
- Lower extremities in order of preference
  - Dorsal surface of foot
  - Saphenous vein of ankle

Site Selection for Peripheral IVs

- Situations may dictate site selected
  - Emergency care
    - Forearms
      - Median cubital vein in the antecubital fossa
  - Trauma
    - Median cubital vein in the antecubital fossa
      - Accommodates large-bore needles
      - Easy to access in an emergency
  - Children and infants
    - Scalp veins
  - Newborns
    - Umbilical vessel

Peripheral Veins

- Similar to arteries
  - Transport blood at lower pressure
  - Thinner than arteries
- Three layers
  - Outer layer of tissue
  - Middle layer of muscle
  - Smooth inner layer of epithelial cells
- Receive waste-rich blood from capillaries and transport it back to heart and lungs
Peripheral Veins

- Valves in the veins
  - Prevent backflow
  - Allow blood to flow against force of gravity
- Avoid
  - Accessing a vein near a valve
    - Catheter can become occluded when the valve closes if the tip lies within the valve
  - Locations at which veins cross over joints
  - Areas near previous IVs or venipunctures

Peripheral Veins

- Digital dorsal veins
  - Lateral portion of fingers
    - Location is easily accessible
  - Small-gauge catheters
    - 22- or 24-gauge
  - Require support
    - Prevent loss of flow when finger bends
  - Not a primary choice

Peripheral Veins

- Dorsal metacarpal veins
  - Back of hand
  - Most distal site of extremity
    - Good first choice
  - Require support to prevent movement of catheter
Peripheral Veins

- Cephalic veins
  - Forearm
    - Provide natural splint
    - Accommodate larger catheters
  - Accessory cephalic vein
    - Back of forearm
    - Accommodates larger catheters

Peripheral Veins

- Basilic vein
  - Along ulnar portion of forearm
  - Fairly large
  - Numerous valves

- Median cephalic and median basilic veins
  - Antecubital fossa
  - Not good for prolonged infusions
  - Median antebrachial vein

Peripheral Veins

- Less commonly used sites
  - Veins of legs and feet
    - Veins on ventral surface of wrist
      - Not ideal choice because of nearness to arteries
    - Scalp veins
      - Children and infants
      - Small-gauge, short-length, winged scalp vein needles
Apply Your Knowledge

What are the general rules for site selection for an IV?

ANSWER: When choosing a site for insertion of an IV you should:
- Start distally and work proximally
- Avoid the patient’s dominant hand

Which vein is the first choice for an IV site?

ANSWER: The dorsal metacarpal veins are the first choice when choosing a site for inserting an IV.

Good Job!

Special Populations – Geriatric

- Avoid the back of the hand
  - Lacks skin turgor
  - Limited subcutaneous tissue
- Superficial veins
  - Weaker
  - More prone to infiltration
- May only need hand pressure rather than tourniquet
- Carefully monitor infusion rate and VS
  - Always use pump
  - Avoid fluid overload

Special Populations – Obese

- Difficult to see and palpate veins
- Tips
  - Warm compresses for vasodilation
  - Displace edema and extra tissue
  - Use anatomical landmarks
    - Superficial vein on thumb side of wrist
  - Use multiple tourniquets

Chapter 5
Special Populations – Pediatric

- Explain carefully if patient is old enough to understand
  - Appropriate language
  - Be honest
  - DO NOT have parent restrain child
  - Immobilization – hold or wrap

Special Populations – Pediatric

- Venipuncture sites
  - Upper extremities preferred
    - 1st choice – forearm veins
    - 2nd choice – tributaries of cephalic and basilic veins, dorsal venous arch
    - 3rd choice – ventral surface of wrist on inner aspect of wrist
  - Alternative sites
    - Scalp veins for infants less than 1 year old
    - Saphenous vein – last resort site
    - Check facility policy before using these sites

Apply Your Knowledge

What issues you may face when starting an IV in a geriatric patient?

ANSWER: The skin of most geriatric patients lacks skin turgor and has limited subcutaneous tissue. Superficial veins are weaker and more prone to infiltration. IV infusions must be monitored carefully to avoid fluid overload.

Great!
Blood Withdrawal

Introduction

- Phlebotomy means to cut into a vein.
- This procedure of cutting or puncturing a vein is performed by a phlebotomist.
- The primary role of a phlebotomist is to obtain blood specimens for testing.
- Other roles include packaging urine specimens, accepting incoming specimens, and routing.
History of Phlebotomy

- Removing blood from veins dates back to about 1400 B.C. when leeches were applied to the skin of sick people.
- In the early 1800's, medicinal leeches were used for the procedure known as bloodletting.
- Bloodletting was typically performed by barbers or anyone claiming medical training.

Roles and Responsibilities of the Nurse

PATIENT IDENTIFICATION
- Check armband or ID label in acute care settings

Proper Identification Is a Three-Step Process

Specimen Collection and Handling

Physician orders indicate type of specimen and time of collection

**Most Commonly Used Methods**

- **Venipuncture**: Insertion of a needle into a vein to remove blood
- **Dermal Puncture**: Use of puncture device to obtain capillary blood by pricking the skin
Roles and Responsibilities

Professionalism

• Be professional
• Apply good interpersonal skills
• Dress professionally

Verbal and nonverbal communication should be appropriate, such as:

• Avoiding the use of slang
• Speaking in a calm, clear voice
• Avoiding inappropriate terms
• Maintaining eye contact
• Neat, well-groomed appearance
• Respecting personal space

The nurse must be able to communicate using nonmedical terms.

Patient Identification

Be sure to determine the correct spelling of a patient’s last name prior to obtaining a blood specimen!! Also, check at least one other patient identifier.

The correct spelling of the patient’s name should be on:

• ID band
• Specimen label
Butterfly Infusion Set with Syringe System

- Used to collect blood from people with small, fragile veins, such as the elderly and children
- Provides greater control with non-stable patients
- This system is completely sterile.
- This picture shows an adapter that can be used with the evacuated system.

Using a Butterfly Needle Set

- Be sure not to pull the syringe plunger back too fast or too hard because it can cause hemolysis of the specimen

NOTE: When using a syringe and butterfly needle set, the equipment setup must include the evacuated tubes needed for specimen transfer from a syringe.

Hemolysis

Hemolysis of blood samples should be avoided at all costs. A hemolyzed sample will produce erroneous results for most laboratory tests.

Always make sure to select the appropriate tube size and needle to prevent hemolysis.
Specimen Collection Equipment

**Sharps Container**
- Needle disposal containers
- Protect health care personnel from accidental needlesticks
- Made of nonpenetrable plastic and are red or bright orange in color with a biohazard label
- Stores used needles, lancets, and other sharps

**Evacuated Tubes**
- Contain a premeasured vacuum
- Most widely used system for blood collection
- Range in size from 2mL to 15mL and both adult and pediatric sizes are available
- Fill automatically with blood due to the vacuum

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**Remove the Tourniquet**

Failure to remove the tourniquet following venipuncture can cause temporary or permanent injury to the patient and is an act of negligence!!
Specimen Collection Equipment

Evacuated Tubes (cont’d)

Evacuated tubes with a plastic splashguard safety device reduce the aerosol mist when the tube stopper is removed during specimen processing.

Multiple tubes may be required for collection of various specimens, and the order in which you use the tubes is important. This is known as the “order of draw.”

Order of Draw

Multiple Tubes Using a Vacuum Tube System

Sterile Specimens → Coagulation Tubes
  Blood Culture Tubes → Light Blue
  SST → Serum
    Gold or Red/Black → Light Green
    Lavender
    Gray

Blood Cultures: 2 bottles equals 1 set. 1 Purple (yellow) 1 Blue


**Light Blue Tube**: PT, PTT, INR, D-Dimer

**Golden Top (SST)**: CMP, BMP, Liver Function, Troponin, Cardiac Panels

**Red Top**: Waste, Drug levels, Peaks and Troughs
**Light Green** - CMP, BMP, Liver Function, Troponin, Cardiac Panels

**Lavender Tube** - CBC, H&H, Ammonia (on ice), BNP

**Grey Tube** - Alcohol, Lactic Acid (on ice)
Pink Top: Type and Cross or Type and Screen, Rh Factor

Transporting the Specimen

**Special Handling Procedures**

- Certain specimens must remain cool, so they are placed in an ice-water mixture.
- Specimens to be kept warm and protected from light can be wrapped in aluminum foil.

Dermal Puncture

**Collection Devices and Equipment**

- Safety lancets
- Gloves
- Alcohol pads
- Sterile gauze
- Sharps disposal container
- Microspecimen container

To prevent puncturing a bone, the puncture depth should not exceed 2.0 mm, especially when performing heel sticks on infants.

**NOTE:** A warm towel or cloth applied to the dermal site will increase blood flow.
Dermal Puncture

Microcollection Containers

- Microcollection containers provide a larger collection volume than capillary tubes.
- They come with a variety of anticoagulants and use a color-coded system.

Dermal Puncture

Selecting the Site for Dermal Puncture

- Heels are the site of choice in infants who are less than 1 year old
- Fingers are used in adults and children
- Attempt to find an unused area
- Area should be warm, pink, and free of scars
- Do not use the arch of the foot, the back of the heel, or the plantar area of the foot

The site selected for the heel should be well away from the heel bone because puncture of the calcaneus can cause osteomyelitis.

Dermal Puncture

- For older children and adults, the preferred site is the palm side of the ring or middle finger
- Do not cut in the same direction as the fingerprint

NOTE: Warming the finger or heel will increase blood flow
If the patient is sleeping:

- Gently wake him or her and explain why you are there
- Try not startle the patient
- Be sure to talk in a soft manner
- Inform the patient before turning on the lights

Never attempt to collect a specimen from a sleeping patient!

Introduction

You will need to be competent in all areas of blood transfusion. This chapter will direct your learning but it is up to you to put the knowledge and skills into practice.
Does the patient need the transfusion?
Does the patient want the transfusion?
- Written consent
- Cross matched
- How many units to infuse

Blood and Blood Product Transfusion

You should be familiar with each of these blood products:

- Whole Blood
- Packed Cells
- Platelets
- Fresh Frozen Plasma (FFP)
- Cryoprecipitate

Blood and Blood Products

- Adults have about 5 liters of circulating blood
- Blood is the main transport system for
  - Oxygen
  - Nutrients
  - Hormones
- Infusing blood or blood products
  - Restores circulating volume
  - Improves the ability of the blood to carry oxygen
  - Replaces blood components such as clotting factors
Blood and Blood Products

- Replace components via transfusion
  - Infuse only with normal saline

- Autologous
  - Blood obtained from the recipient
  - Decreases the risk associated with transfusions

- Donor
  - More readily available
  - Must be carefully screened and tested to ensure safety
  - Typed and cross-matched with the recipient to confirm compatibility

Plasma Expanders - Synthetic

- Increase the circulating volume

- Dextran
  - Treats shock due to
    - Trauma
    - Burns
    - Hemorrhage

- Complications
  - Anaphylaxis
  - Fluid overload
  - Dilution of electrolytes

Plasma Expanders - Synthetic

- Mannitol
  - Sugar alcohol substitute

- Uses
  - Diuresis – remove excess body fluids
  - Excretion of toxic substances
  - Treatment of increased intracranial pressure and cerebral edema

- Complications
  - Fluid and electrolyte imbalances
  - Cellular dehydration
  - Fluid overload
  - Nervous system toxicity
Plasma Expanders - Synthetic

- Hetastarch
  - Similar to albumin
  - Causes fluid to be pulled into the intravascular space
  - Used to treat shock due to decreased circulating volume
- Complications
  - Anaphylaxis
  - Altered platelet function
  - Volume overload

Plasma Expanders - Albumin

- Natural plasma protein obtained from blood
- Expands circulating volume and increases plasma protein volume
- Uses
  - Treatment of shock due to circulating volume deficit
  - Provide protein
  - Bind bilirubin
- Complications
  - Fluid overload
  - Anemia
  - Bleeding
  - Dilution or depletion of electrolytes
  - Allergic reactions

ABO Blood Groups

- Type A
  - A person with type A blood can receive type A or type O in an emergency
- Type B
  - A person with type B blood can receive type B or type O in an emergency
- Type AB
  - Universal recipient – because it carries neither anti-A or anti-B antibodies a person with type AB blood can receive any of the four types of blood
- Type O
  - Universal donor – because this type has no antigens, it can be transfused in an emergency into anyone regardless of blood type
  - Can only receive type O blood
ABO Blood Groups

- Mismatched donor blood/recipient
  - Hemolytic reaction
    - Can occur with as little as 10 mL of blood/blood product
    - Antibodies to blood antigens attach to red blood cells, causing clumping
    - This activates the body's immune system, which destroys the red cells and releases hemoglobin
    - Hemoglobin can lead to renal failure
  - Symptoms
    - Headache
    - Chest pain
    - Chills and fever
    - Back pain

Rh (Rhesus) Factor

- Major inherited blood antigen
  - Blood is either Rh-positive or Rh-negative
  - Donor and recipient should match for Rh factor
    - Initial exposure of a Rh-negative recipient to Rh-positive blood generally does not cause a reaction
    - Future exposures to Rh-positive blood may result in a hemolytic reaction

Indications for Blood Transfusion

Acute Anemia

1. Symptomatic hypovolemia and blood loss.
2. Peri-operative – ‘replacing losses’
3. Haemolysis (treat the underlying cause)
4. Severe, critical illness.
The Principle Aims of Blood Transfusion are to:-

1. Improve oxygen carrying capacity of blood.
2. Symptomatic improvement.
3. Reduce hypovolemia.
   - 1 UNIT of Blood should increase the Hb by approx. 1g/dL.
   - If no improvement or reduction in Hb – think about ongoing blood loss or destruction.
   - You need treat the underlying cause.

Errors are the most common cause of blood transfusion problems – DON'T BE A STATISTIC!

Patient Details required

- Full names
- DOB
- Hospital Number
- Blood Bank ID Number
- Blood Group (if known)
- Previous transfusion and allogenic history

Transfusion details
- Reason for request, Present Hb (if known)
- Location, Date and Time of expected transfusion
- Date of request
- Type of blood (packed cells, whole blood, G&S only), Number of units.
Sample Collection

- Check patient details on wrist band
- Use Pink Top Tube
  Hand Label Tub with
  - Full names of patient
  - DOB, Hospital number
  - Signature of person taking blood
  - Date
- Take blood down to the blood bank if required urgently –

  PATIENT LABELS WILL NOT BE ACCEPTED!

The Right Blood,
The Right Patient,
The Right Time!

Blood Transfusion

- It takes TWO to check details of blood unit
- Check details on the unit of blood against those written on the form against patient’s wrist band. ALL MUST BE CORRECT!
- DO NOT PUT UP UNITS WHICH YOU ARE NOT HAPPY ABOUT!
- CHECK DOCTORS ORDERS
Setting up the transfusion

1. Set up a transfusion
2. Two people to check details
3. Blood transfusion record, Unit(s) of blood
4. Patient with IV access (I)
   and wrist id band
5. Sterile blood Y set
Pharmacology & Calculations

- Calculate the flow rate for electronic infusion devices and manually controlled IV infusions.
- Adjust the flow rate for IV infusions.
- Calculate the infusion time based on volume and flow rate.

Introduction

The basic principles of Pharmacology are different when administering IV medications versus giving medications by mouth. When giving medication intravenously a nurse can add to but it is impossible to take away. Once it has been administered the only thing a nurse can do is prepare for what is coming next.

Giving medication through the IV is a more accurate and rapid method but it is also a more dangerous method if the nurse makes a mistake.

Calculating Drops per Minute

- Macrodrip tubing has larger drops and will have one of the following drop factors:
  - 10 gtt/mL
  - 15 gtt/mL
  - 20 gtt/mL

- Microdrip tubing has a drop factor of 60 gtt/mL
Calculating Flow Rates

- Physician’s order will include
  - Amount of an IV fluid to be given
  - Length of administration time

- You will use these two values to calculate flow rate for the infusion
  - mL/hour
    - Most common calculation
    - Used with most infusion pumps
  - Drops/minute
    - Used for manually regulated infusions
    - Used to check functioning of infusion pumps

What is Flow Rate

- Electronic Pump = mL per hour
- Manually = Drops per Minute

- Flow rate means how fast your IV is infusing where in mL/hr or Gtts/Min

Three Step Method

- Step 1: Total volume divided by total hours = mL/hr
- Step 2: mL/hr divided by 60 = mL/min
- Step 3: mL/min multiplied by Drip factor
- Equals Drops per Minute or Gtts/min
Step 1
Total volume divided by total hours
1000 \div 8 \text{ hours} = 125 \text{ml/hr}
Answer: 125 \text{ml/hr}

Step 2
1. Take the answer from step one
2. 125 \text{ml/hr} divide by 60
3. 125 \div 60 = 2.08 \text{ or 2 (If your answer is .5 Round )}
Answer: 2 \text{ml/min}

Step 3
- Take the answer from Step Two and multiply it by your Gtt Factor. (Gtt factor is found on the IV Tubing Package)
- 2ml/min times 15 equals???

2 \times 15 = 30 \text{ gtts per min}
Answer: 30 \text{gtts/min}
Education is not the filling of a pail, but the lighting of a fire.

William Butler Yeats