

## CHAPTER 36

# CALCULATION OF MEDICATION DOSAGE AND MEDICATION ADMINISTRATION

### Overview

Medical assisting students learn the importance of dosage calculation and medication administration in the ambulatory care setting. Students discover that a knowledge of pharmacology, dosage measurement systems and calculation formulas, and methods of medication administration are all needed to safely administer medications to patients. The importance of following all laws and regulations governing the administration of medications is stressed, as is the need to follow OSHA guidelines and Standard Precautions for infection control.

### Lesson Plan

I. LEARNING OUTCOMES	ABHES	CAAHEP
A. Define, spell, and pronounce the key terms as presented in the glossary.		
B. Discuss the legal and ethical implications of medication administration.	MA.A.1.6.d-e	IX.P.8
C. Describe the medication order.		
D. Identify abbreviations and symbols used in calculating medication dosage.	MA.A.1.6.c	II.C.6
E. Describe the parts of a prescription.	MA.A.1.6.c	
F. Define drug dosage.		IC.11–12
G. State what information is found on a medication label.		
H. Understand ratio and proportion.	MA.A.1.6.a	II.C.1
I. Use the metric, household, and apothecary systems of measurement and convert between the metric and apothecary systems.	MA.A.1.6.a	II.C.4–5
J. Understand units of medication dosage.	MA.A.1.6.a	II.C.4
K. Correctly calculate dosages for adults and children.	MA.A.1.6.a	II.C.1–2
L. List the guidelines to follow when preparing and administering medications.	MA.A.1.6.a-b	II.P.1
M. Administer oral medications.	MA.A.1.9.j	I.P.8
N. Select proper sites for administering parenteral medication.	MA.A.1.9.j	I.P.7, 9
O. Describe safe disposal of syringes, needles, and biohazard materials.	MA.A.10.c	III.C.4 XI.C.2, 9
P. Understand intravenous therapy.		I.P.7, 9
Q. Describe site selection for administration of injections.	MA.A.1.9.j	I.P.7, 9
R. Understand allergenic extracts.		
S. Describe inhalation medication and its administration.		
T. Analyze the professionalism questions and apply them to this chapter's content.		

### II. PROFESSIONALISM QUESTIONS

#### A. Communication

1. Did you introduce yourself? Did you identify the patient through name and birth date or other identifying feature?
2. Did you explain procedures and expectations to the patient?
3. Did you speak at the patient's level of understanding?
4. Did you allay patients' fears and help them feel safe and comfortable?

- B. Presentation
  - 1. Were you courteous, patient, and respectful to the patient?
- C. Competency
  - 1. Did you pay attention to detail?
  - 2. Did you ask questions if you were out of your comfort zone or did not have the experience to carry out tasks?
  - 3. Did you display sound judgment?
  - 4. Did you apply critical thinking skills in performing patient assessment and care?
  - 5. Did you recognize the importance of local, state, and federal legislation and regulations in the practice setting?
- D. Integrity
  - 1. Did you work within your scope of practice?
  - 2. Did you protect and maintain confidentiality?
  - 3. Did you immediately report any error you had made?
  - 4. Did you report situations that were harmful or illegal?
  - 5. Did you do “the right thing” even when no one was observing?

### III. REFERENCES

- A. Lindh, Wilburta Q., Pooler, Marilyn S., Tamparo, Carol D., Dahl, Barbara M., & Morris, Julie A., *Delmar's Comprehensive Medical Assisting: Administrative and Clinical Competencies*, 5e
- B. See text Chapter 36, References/Bibliography
- C. Any other teacher-preferred reference material

### IV. VISUAL AIDS

- A. Computer access to identified Internet resources
- B. Any other teacher-preferred visual aids (PowerPoint, etc.)

### V. EQUIPMENT AND MATERIALS

- A. Computer, TV monitor, and Internet access
- B. Various types of needles and syringes
- C. Sharps container
- D. See IV: Visual Aids

### VI. SAFETY

- A. Basic classroom procedures
- B. Adhere to Standard Precautions
- C. Maintain confidentiality of patient information (HIPAA)
- D. Attend to patient
- E. Secure drugs and prescription pads
- F. Handle needles and syringes carefully
- G. Report needlesticks immediately
- H. Correctly calculate medication dosages
  - I. Check for medication allergies

### VII. PREPARATION

- A. Arrange for visual aids equipment.
- B. Collect materials.
- C. Review Chapter 36 in the text, the Study Guide, the Competency Manual, and the Instructor's Manual.

### VIII. INTRODUCTORY REMARKS/ACTIONS

- A. Read Learning Outcomes in the text with students to introduce the chapter.
- B. Display various types and sizes of safety needles and syringes.
- C. Ask, “Who can tell us the differences among these safety needles and syringes?”

### IX. PRESENTATION

- A. Legal and Ethical Implications of Medication Administration
  - 1. Various laws from state to state
  - 2. Thorough knowledge of medications administered to patient

3. Ethical Considerations
  - a. Using drugs for personal benefit
  - b. Proper authorization
4. The Medication Order
  - a. Given by provider
5. The Prescription
  - a. Written legal document that gives directions for compounding, dispensing, and administering medication to patient
  - b. Nine parts
  - c. Purpose
  - d. Two types of medicines
    - (1) Prescription
    - (2) Over-the-counter (OTC)
  - e. Prescriptions for controlled substances
  - f. Approved prescription abbreviations and symbols
- B. Drug Dosage Factors
- C. The Medication Label
  1. Source of valuable information
- D. Calculation of Drug Dosages
  1. Understanding Ratio
    - a. Ratio expressed as a quotient
    - b. Ratio expressed as a fraction
    - c. Ratio expressed as a decimal
  2. Understanding Proportion
    - a. Means and extremes
    - b. Solving for  $X$
  3. Weights and Measures
    - a. Metric system guidelines
    - b. The seven common metric prefixes
      - (1) Micro
      - (2) Milli
      - (3) Centi
      - (4) Deci
      - (5) Deka
      - (6) Hecto
      - (7) Kilo
    - c. Fundamental units
    - d. Household measurements
    - e. Metric system conversion
      - (1) Proportional method for converting metric equivalents
      - (2) Moving the decimal in the correct direction
- E. Medications Measured in Units
  1. How to Calculate Unit Dosages
    - a. Proportional method
    - b. Formula method
  2. Insulin
    - a. Individualized needs and treatment
  3. Types of diabetes
    - a. Type 1, insulin-dependent diabetes mellitus
    - b. Type 2, noninsulin-dependent diabetes mellitus
    - c. Type 3, gestational diabetes
    - d. Type 4, other types of diabetes
  4. Importance of exact dosage
  5. Precautions to observe when administering insulin

- F. Calculating Adult Dosages
  - 1. Expressing the weight of medication
  - 2. Expressing the volume of medication
  - 3. The proportional method
  - 4. The formula method
- G. Calculating Children's Dosages
  - 1. Young's, Clark's, and Fried's rules replaced by more exact methods
  - 2. By body Surface Area (BSA)
    - a. Nomogram
    - b. Used for infants and children up to 12 years of age
  - 3. By Kilogram of Body Weight
    - a. Mathematical process
    - b. Proportional method
- H. Administration of Medications
  - 1. The "Six Rights" of Proper Drug Administration
  - 2. Medication Errors
    - a. When a medication error occurs
    - b. Standard procedure for reporting error
  - 3. Patient Assessment
    - a. Age
    - b. Physical condition
    - c. Body size
    - d. Gender
      - (1) Muscular build
      - (2) Skin texture
    - e. Injection sites to avoid
- I. Administration of Oral Medications (see Procedure 36-1 in the text)
  - 1. Equipment and Supplies for Oral Medications (see Case Study 36-1)
- J. Administration of Parenteral Medications (see Procedures 36-4, 36-5, 36-6, and 36-7)
  - 1. Parenteral routes
    - a. Subcutaneous
    - b. Intramuscular
    - c. Intradermal
  - 2. Multiple dose form
  - 3. Unit dose forms
  - 4. Hazards Associated with Parenteral Medications
  - 5. Reasons for Parenteral Route Selection
    - a. Rapid response time to medication
    - b. Accuracy of dosage
    - c. Need to concentrate medication in specific body part or area
    - d. Inability to administer orally because medication is destroyed by gastric juices or patient is incapable of taking medication orally
  - 6. Liquid or powder form
  - 7. Expressed in terms of volume
  - 8. Ordered in terms of weight and volume
  - 9. Parenteral Equipment and Supplies
    - a. Syringes
      - (1) Disposable
      - (2) Nondisposable
      - (3) Combination disposable/nondisposable cartridge injection
    - b. Parts of a syringe
    - c. Types of safety syringes and uses
    - d. Sizes of disposable syringes
    - e. Safety syringe–needle combinations for various parenteral routes
    - f. Needles
    - g. Safe disposal of needles and syringes
      - (1) Sharps containers
      - (2) Needlesticks

- K. Intravenous Therapy
  - 1. Patient needs and conditions
  - 2. Patient safety
  - 3. Types of solutions
  - 4. Legal aspects
- L. Site Selection and Injection Angle
  - 1. Angles of injection
  - 2. Subcutaneous injection sites
  - 3. Marking the Correct Site for Intramuscular Injection
    - a. Dorsogluteal site
    - b. Ventrogluteal site
    - c. Deltoid muscle
    - d. Vastus lateralis site
- M. Basic Guidelines for Administration of Injections
  - 1. Withdrawing medication from a vial (see Procedure 36-2 in the text)
  - 2. Withdrawing medication from an ampule (see Procedure 36-3 in the text)
  - 3. Administering subcutaneous, intramuscular, and intradermal injections (see Procedure 36-4 in the text)
  - 4. Administering a subcutaneous injection (see Procedure 36-5 in the text)
  - 5. Administering an intramuscular injection (see Procedure 36-6 in the text)
  - 6. Administering an intradermal injection (see Procedure 36-7 in the text)
  - 7. Reconstituting a powder medication for administration equipment (see Procedure 36-8 in the text)
- N. Z-Track Method of Intramuscular Injection
  - 1. Procedure 36-9 in the text
  - 2. Imferon
  - 3. Irritating to subcutaneous tissues
  - 4. May discolor skin
  - 5. Pull skin to side before insertion
  - 6. Injection technique
- O. Administration of Allergenic Extracts
  - 1. Guidelines
  - 2. Allergic reactions
  - 3. Allergist syringes
- P. Administration of Inhaled Medications
  - 1. Inhalation therapy
  - 2. Inhaler
  - 3. Implications for Patient Care
  - 4. Administration of Oxygen
    - a. Hypoxemia
    - b. Oxygen tanks
    - c. Dosage
    - d. Methods of oxygen delivery
  - 5. Oxygen safety precautions
- X. APPLICATION
  - A. Use the Learning Outcomes at the beginning of Chapter 36 in the text as the basis for questions to assess comprehension.
  - B. See the Classroom Activities section below for numerous application activities.
  - C. Assign students to complete Chapter 36 in the Study Guide.
  - D. Complete the Procedures in Chapter 36, using the Competency Manual to evaluate.
- XI. EVALUATION
  - A. Evaluate any assigned application activities.
  - B. Evaluate student participation during classroom activities.
  - C. Grade responses to Chapter 36 in the Study Guide.
  - D. Evaluate student performance on Chapter 36 Procedures.

## Classroom Activities

1. Have students practice injecting an orange at the various injection angles.
2. Hand out an outline of the human body and have students label site selection locations for administration of injections.
3. Obtain various types of empty prescription bottles. Have students complete the information listed in the text for a particular drug. Students should consult the *Physician's Desk Reference* (PDR).
4. Quiz the class on the common prescription abbreviations and symbols listed in the text.
5. Have students practice identifying the parts of a prescription.
6. Have students practice ratio and proportion examples.
7. Have students practice converting various weights and liquid volume amounts to metric equivalents.
8. Assign students to research the different types of diabetes.
9. Assign students to make posters displaying the "six rights" of proper drug administration.
10. Allow lab time for students to simulate the entire procedure from the provider writing the order to the administration of the medication. Assure that students have the opportunity to simulate the administration of medications via multiple routes.
11. Begin every class period with a short quiz using three to five provider orders and medications on hand.

## Answers to Case Studies

### Case Study 36-1

Refer to the scenario at the beginning of the chapter.

1. Explain the consequences of preparing and administering a medication without a medicine card.
2. Is it possible under normal circumstances to commit to memory the medication, dose, route, patient, and documentation?

To prepare and administer a medication without a medicine note or card is a dangerous undertaking. It is almost impossible to commit to memory all of the information needed to prepare and administer a medication without a medication note or card to refer to. It is highly unlikely that all of the information necessary (patient name, location, drug, dose, route, time, and documentation) can be remembered. The wrong patient could receive the medication instead of the patient for whom it was intended. The medication may be taken to the incorrect room; the name of the medication itself could be incorrect, especially because there are so many sound-alike, look-alike medication names. The dose, if incorrectly remembered, could be too much (overdose) or too little (not enough). If given by the incorrect route, an oral medication given by injection would have a faster action than intended, and an intended injected given by mouth would not be absorbed as quickly (or may be contraindicated by mouth). If medicine is not given at the appropriate time (as prescribed by the provider), the therapeutic effect may not be obtained. A medication may be given too early or too late. Documentation is important for other health care workers to see in order to know whether or not the medication was given, and the note entry is a legal requirement. A medicine note or card, when used correctly, will avoid mistakes when preparing or administering medications.

### Case Study 36-2

Abigail Johnson, a patient of Dr. Lewis, has been unable to keep her type 2 non–insulin dependent diabetes mellitus under control with oral hypoglycemics, and Dr. Lewis has decided that Abigail needs to begin to take insulin injections. Today in the clinic, her fasting blood glucose level is 190 mg/mL. Dr. Lewis prescribes Humulin® insulin 10 units subcutaneously stat.

1. What size insulin syringe should be used?

The size of syringe used would be a U-100 insulin syringe.

2. What does the medication label state are the number of units per milliliter? Show how to calculate the correct dosage.

The medication label would indicate 100 units per milliliter. If you use the correct syringe, a U-100, and draw 10 units of insulin, the correct dose will be accurately measured.

3. Discuss the route of administration and the specifics regarding insulin administration that require it to be given slightly differently from other subcutaneous injections.

Route of administration for insulin is a 90-degree angle with an SC needle. Specifics for insulin administration require that you: (a) rotate your site for each injection, (b) give subcutaneously at a 90-degree angle, (c) do not massage the injection site following administration, and (d) be certain that insulins are compatible before mixing them together in the same syringe.

4. Describe several topics of discussion in which you would engage Abigail to help her learn how to better control her disease.

(a) Encourage her to attend diabetes education classes at a local hospital or clinic. (b) Stress the importance of monitoring blood and urine for glucose levels. (c) Stress importance of adhering to the diet as prescribed by the provider. (d) Engage in regular exercise.

### Case Study 36-3

Alice Chambers weighs 28 pounds. Her pediatrician orders erythromycin 50 mg/kg/day po TID.

1. Calculate Alice's weight in kg.

28 pounds divided by 2.2 equals 12.7 kilograms

2. Calculate the dose of erythromycin Alice needs.

3. How much will Alice receive at each dosing?

Alice weighs 12.7 kg. She is to receive 50 mg/kg/day.

50 mg  $\times$  12.7 = 635 mg/day in three divided doses.

635 mg divided by 3 equals 212 mg at each dose.

4. If the erythromycin is available as erythromycin 400 mg per 5 mL, calculate the dose to be given TID.

Set up the equation as follows:

Needed

Available  $\times$  vehicle = dose

635 mg po TID is ordered.

635 mg

400 mg  $\times$  5 mL = dose

1.59  $\times$  5 mL = 7.9 mL (8 mL)

### Answers to Certification Review

1. b. prescription
2. b. NPO
3. a. Type 1
4. a. when calculating children's dosages
5. b. intradermal injection
6. d. a and b
7. d. all of the above
8. d. All of the above
9. c. recognize that an error has occurred.
10. a. anatomic structures

This project was funded at \$3,000,000 (100% of its total cost) from a grant awarded under the Trade Adjustment Assistance Community College and Career Training Grants, as implemented by the U.S. Department of Labor's Employment and Training Administration. Rogue Community College is an equal opportunity employer/program. Auxiliary aids and services, alternate form and language services are available to individuals with disabilities and limited English proficiency free of cost upon request.

This work is licensed under a Creative Commons Attribution 4.0 International License.

