

CHAPTER 17

Fluid and Electrolyte Balance

In the very first chapter of the text you learned that survival depends on the body's ability to maintain or restore homeostasis. Specifically, homeostasis means that the body fluids remain constant within very narrow limits. These fluids are classified as either intracellular fluid (ICF) or extracellular fluid (ECF). As the names imply, intracellular fluid lies within the cells and extracellular fluid is located outside the cells. A balance between these two fluids is maintained by certain body mechanisms: (a) the adjustment of fluid output to fluid intake under normal circumstances; (b) the concentration of electrolytes in the extracellular fluid; (c) the capillary blood pressure; and (d) the concentration of proteins in the blood.

Comprehension of how these mechanisms maintain and restore fluid balance is necessary for an understanding of the complexities of homeostasis and its relationship to the survival of the individual.

TOPICS FOR REVIEW

Before progressing to Chapter 18, you should review the types of body fluids and their subdivisions. Your study should include the mechanisms that maintain fluid balance and the nature and importance of electrolytes in body fluids. You should be able to give examples of common fluid imbalances and have an understanding of the role of fluid and electrolyte balance in the maintenance of homeostasis.

BODY FLUIDS

Circle the correct answer.

1. The largest volume of water by far lies (inside or outside) cells.
2. Interstitial fluid is (intracellular or extracellular).
3. Plasma is (intracellular or extracellular).
4. Obese people have a (lower or higher) water content per pound of body weight than thin people.
5. Infants have (more or less) water in comparison to body weight than adults of either sex.
6. There is a rapid (increase or decline) in the proportion of body water to body weight during the first year of life.
7. The female body contains slightly (more or less) water per pound of weight.
8. In general, as age increases, the amount of water per pound of body weight (increases or decreases).
9. Excluding adipose tissue, approximately (55% or 85%) of body weight is water.
10. The term ("fluid balance" or "fluid compartments") means that the volumes of ICF, IF, plasma, and the total volume of water in the body all remain relatively constant.



If you have had difficulty with this section, review pages 424-425.

MECHANISMS THAT MAINTAIN FLUID BALANCE

Circle the correct answer.

11. Which one of the following is a positively charged ion?
 - A. Sodium
 - B. Chloride
 - C. Phosphate
 - D. Bicarbonate
12. Which one of the following is a negatively charged ion?
 - A. Sodium
 - B. Potassium
 - C. Calcium
 - D. Chloride
13. The most abundant electrolytes in the blood plasma are:
 - A. NaCl
 - B. KMg
 - C. HCO₃
 - D. HPO₄
 - E. CaPO₄
14. If the blood sodium concentration increases, then blood volume will:
 - A. Increase
 - B. Decrease
 - C. Remain the same
 - D. None of the above

15. The smallest amount of water comes from:
 - A. Water in foods that are eaten
 - B. Ingested liquids
 - C. Water formed from catabolism
 - D. None of the above
16. The greatest amount of water lost from the body is from the:
 - A. Lungs
 - B. Skin, by diffusion
 - C. Skin, by sweat
 - D. Feces
 - E. Kidneys
17. Which one of the following is *not* a major factor that influences extracellular and intracellular fluid volumes?
 - A. The concentration of electrolytes in the extracellular fluid
 - B. The capillary blood pressure
 - C. The concentration of proteins in blood
 - D. All of the above are major factors
18. The type of fluid output that changes the most is:
 - A. Water loss in the feces
 - B. Water loss across the skin
 - C. Water loss via the lungs
 - D. Water loss in the urine
 - E. None of the above
19. The chief regulators of sodium within the body is(are) the:
 - A. Lungs
 - B. Sweat glands
 - C. Kidneys
 - D. Large intestine
 - E. None of the above
20. Which of the following is *not* true?
 - A. Fluid output must equal fluid intake.
 - B. ADH controls salt reabsorption in the kidney.
 - C. Water follows sodium.
 - D. Renal tubule regulation of salt and water is the most important factor in determining urine volume.
21. Diuretics work on all but which one of the following?
 - A. Proximal tubule
 - B. Loop of Henle
 - C. Distal tubule
 - D. Collecting ducts
 - E. Diuretics work on all of the above
22. Of all the sodium-containing secretions, the one with the largest volume is:
 - A. Saliva
 - B. Gastric secretions
 - C. Bile
 - D. Pancreatic juice
 - E. Intestinal secretions

23. The higher the capillary blood pressure, the _____ the amount of interstitial fluid.
- Smaller
 - Larger
 - There is no relationship between capillary blood pressure and volume of interstitial fluid
24. An increase in capillary blood pressure will lead to _____ in blood volume.
- An increase
 - A decrease
 - No change
 - None of the above
25. Which one of the fluid compartments varies the *most* in volume?
- Intracellular
 - Interstitial
 - Extracellular
 - Plasma
26. Which one of the following will *not* cause edema?
- Retention of electrolytes in the extracellular fluid
 - Increase in capillary blood pressure
 - Burns
 - Decrease in plasma proteins
 - All of the above may cause edema

If the statement is true, write "T" in the answer blank. If the statement is false, correct the statement by circling the incorrect term and writing the correct term in the answer blank.

- _____ 27. The three sources of fluid intake are the liquids we drink, the foods we eat, and the water formed by the anabolism of foods.
- _____ 28. The body maintains fluid balance mainly by changing the volume of urine excreted to match changes in the volume of fluid intake.
- _____ 29. Some output of fluid will occur as long as life continues.
- _____ 30. Glucose is an example of an electrolyte.
- _____ 31. Where sodium goes, water soon follows.
- _____ 32. Excess aldosterone leads to hypovolemia.
- _____ 33. Diuretics have their effect on glomerular function.
- _____ 34. Typical daily intake and output totals should be approximately 1200 ml.
- _____ 35. Bile is a sodium-containing internal secretion.
- _____ 36. The average daily diet contains about 500 mEq of sodium.



If you have had difficulty with this section, review pages 425-432.

FLUID IMBALANCES

Fill in the blanks.

(37) _____ is the fluid imbalance seen most often. In this condition, interstitial fluid volume (38) _____ first, but eventually, if treatment has not been given, intracellular fluid and plasma volumes (39) _____. (40) _____ can also occur, but it is much less common.

Giving (41) _____ too rapidly or in too large amounts can put too heavy a burden on the (42) _____.



If you have had difficulty with this section, review page 432.

APPLYING WHAT YOU KNOW

43. Mrs. Titus was asked to keep an accurate record of her fluid intake and output. She was concerned because the two did not balance. What is a possible explanation for this?

44. Nurse Briker was caring for a patient who was receiving diuretics. What special nursing implications should be followed for patients on this therapy?

45. WORD FIND

Can you find 12 terms from this chapter? Words may be spelled top to bottom, bottom to top, right to left, left to right, or diagonally.

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S T V H O M E O S T A S I S H
I E D E M A S Q A L P U E G L
M M L U F L U I D O Y O I S L
W S B E A E C O L D P N I E R
L I T A C V S H Q O C E H B C
L L X J L T E A W Y B V Q Q O
I O O P E A R U C T C A A R I
N B H R X S N O I I P R T C N
S A O X M G J C L N J T B A H
I N X X D V U D E Y K N Y O C
E A A J Q D I U R E T I C S X
I F C J A M P V E N B E Y F W
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S W Y A P V Q N S K T K W B P
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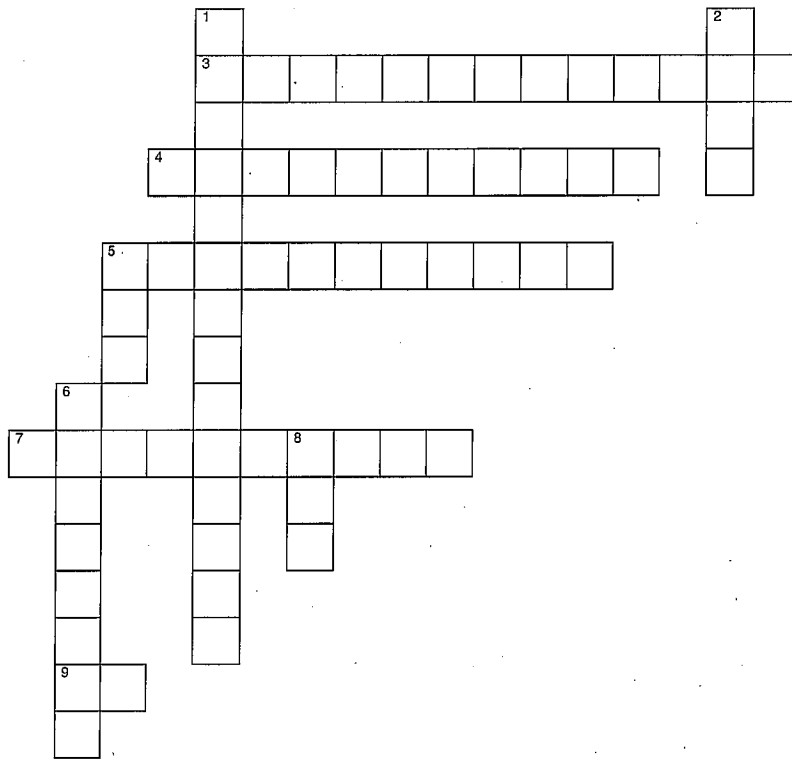
Aldosterone	Edema	Imbalance
Anabolism	Electrolyte	Intravenous
Catabolism	Fluid	Ions
Diuretics	Homeostasis	Kidney

DID YOU KNOW?

The best fluid replacement drink is $\frac{1}{4}$ teaspoon of table salt to 1 quart of water.

FLUID/ELECTROLYTES

Fill in the crossword puzzle.



Across

3. Result of rapidly given intravenous fluids
4. Result of large loss of body fluids
5. Compound that dissociates in solution into ions
7. To break up
9. A subdivision of extracellular fluid (abbreviation)

Down

1. Organic substance that does not dissociate in solution
2. Dissociated particles of an electrolyte that carry an electrical charge
6. "Causing urine"
8. Fluid inside cells (abbreviation)

CHECK YOUR KNOWLEDGE

Multiple Choice

Circle the correct answer.

- Which of the following statements, if any, is *not* true?
 - The more fat present in the body, the more total water content per unit of weight.
 - Infants have more water in comparison with body weight than adults.
 - As age increases, the amount of water per pound of body weight decreases.
 - All of the above statements are true
- Avenues of fluid output include which of the following?
 - Skin
 - Lungs
 - Kidneys
 - All of the above
- Excessive water loss and fluid imbalance can result from which of the following?
 - Diarrhea
 - Vomiting
 - Severe burns
 - All of the above
- What factor is primarily responsible for moving water from interstitial fluid into blood?
 - Aldosterone secretions
 - Pressure in blood capillaries
 - Protein concentration of blood plasma
 - Antidiuretic hormone secretions
- What is the chief regulator of sodium levels in body fluids?
 - Kidney
 - Intestine
 - Blood
 - Lung
- If blood sodium concentration decreases, what does blood volume do?
 - Increases
 - Decreases
 - Remains the same
 - None of the above
- Which of the following is *true* of body water?
 - It is obtained from the liquids we drink.
 - It is obtained from the foods we eat.
 - It is formed by the catabolism of food.
 - All of the above are true
- Edema may result from which of the following?
 - Retention of electrolytes
 - Decreased blood pressure
 - Increased concentration of blood plasma proteins
 - All of the above

9. The most abundant and most important positive plasma ion is which of the following?
 - A. Sodium
 - B. Chloride
 - C. Calcium
 - D. Oxygen
10. Which of the following is *true* when extracellular fluid volume decreases?
 - A. Aldosterone secretion increases.
 - B. Kidney tubule reabsorption of sodium increases.
 - C. Urine volume decreases.
 - D. All of the above

Completion

Complete the following statements using the terms listed below:

- | | |
|-----------------|-------------------------|
| A. Aldosterone | H. Antidiuretic hormone |
| B. Edema | I. Dehydration |
| C. Proteins | J. Extracellular fluid |
| D. Decreases | K. Plasma |
| E. Diuretic | L. Urine |
| F. Electrolytes | M. Interstitial fluid |
| G. Positive | N. Fluid balance |

11. Any drug that promotes or stimulates the production of urine is called a _____.
12. The presence of abnormally large amounts of fluid in the intercellular tissue spaces of the body is called _____.
13. Water located outside of cells is called _____. It can be divided into two categories. If it is located in the spaces between the cells, it is called _____. If it is located in the blood vessels, it is called _____.
14. Compounds like sodium chloride that form ions when placed in solution are called _____.
15. When the adrenal cortex increases its secretion of aldosterone, urine volume _____.
16. Most fluids leave the body in the form of _____.
17. When fluid output is greater than fluid intake, _____ occurs.
18. How much water moves into blood from interstitial fluid depends largely on the concentration of _____ present in blood plasma. These substances act as a water-pulling or water-holding force.
19. Urine volume is regulated primarily by a hormone secreted by the posterior lobe of the pituitary gland called _____ and by a hormone secreted by the adrenal gland called _____.
20. Homeostasis of fluids is also known as _____.

