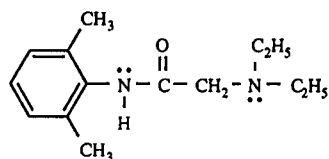


Passage IV (Questions 21-26)

Local anesthetics provide a reversible block in the conduction of impulses in nerve fibers. All local anesthetic drugs contain a lipophilic group, an intermediate chain, and a hydrophilic group. The intermediate chain may be either an ester (as in procaine) or an amide (as in lidocaine). The activity and potency of any local anesthetic depends on several aspects, including its chemical structure, and the pK_a of the substance.

Local anesthetics are weak bases, so they are kept in an acid solution in which they form a water-soluble salt. The base is lipid-soluble and can penetrate various tissue barriers. The concentration of base or cation in the solution depends on the pK_a of the local anesthetic. A decrease in the amount of base facilitates removal of the local anesthetics, resulting in a shorter duration of action. The duration of action of a local anesthetic is also affected by the local vasodilation which most of them produce. Finally, experiments have shown that a nerve which has been recently and repetitively stimulated is more sensitive to a local anesthetic than a resting nerve.



Lidocaine at pH = 9.0

Figure 1

21. Local anesthetics penetrate the blood-brain barrier with great ease, most likely because of their:

- A. large molecular size and high lipid solubility.
- B. large molecular size and low lipid solubility.
- C. small molecular size and high lipid solubility.
- D. small molecular size and low lipid solubility.

22. Based on the passage, which of the following statements is most likely true?

- A. The higher the pK_a of the local anesthetic, the lower the concentration of base in the tissue.
- B. The lower the pK_a of the local anesthetic, the higher the concentration of acid in the tissue.
- C. The higher the K_a of the local anesthetic, the lower the concentration of base in the tissue.
- D. The lower the K_a of the local anesthetic, the lower the concentration of acid in the tissue.

23. Which of the following statements is LEAST compatible with the effects of local anesthetics?

- A. Local anesthetics slow the rise of the action potential in nerve fibers.
- B. Local anesthetics slow the propagation of nerve impulses.
- C. Local anesthetics decrease threshold for electrical stimulation in nerve fibers.
- D. Local anesthetics prevent the depolarization of cell membranes.

24. The pK_a of lidocaine is somewhere between 7.6 and 7.8. The pK_a of procaine is between 8.1 and 8.6. Based on this information, which of the following statements is the MOST likely conclusion?

- A. The onset of lidocaine is more rapid, because more exists in its base form at body pH.
- B. The onset of lidocaine is more rapid, because more exists in its acidic form at body pH.
- C. The onset of lidocaine is slower, because more exists in its base form at body pH.
- D. The onset of lidocaine is slower, because more exists in its acid form at body pH.

25. If acidosis develops after a local anesthetic has penetrated a tissue barrier, it is most likely that:

- A. the amount of ionized form will be decreased, and the local anesthetic will freely cross the tissue barrier.
- B. the amount of ionized form will be decreased, and the local anesthetic will be trapped in the tissue.
- C. the amount of ionized form will be increased, and the local anesthetic will freely cross the tissue barrier.
- D. the amount of ionized form will be increased, and the local anesthetic will be trapped in the tissue.

26. The structure of lidocaine is given in Figure 1. Lidocaine is administered through injection, rather than orally. This is because lidocaine:

- A. will be deactivated by the acidic conditions of the stomach.
- B. will not be absorbed across the intestinal wall.
- C. is biotransformed by reactions occurring in the liver.
- D. is biotransformed by reactions occurring in the spleen.

Passage V (Questions 27-33)

Figure 1 shows the lens, the iris, and the eye.

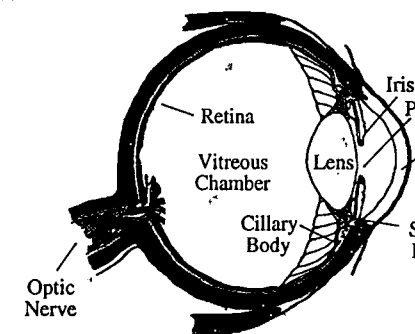


Figure 1

The opening of the pupil of the eye is controlled by two sets of muscles. The circularly arranged smooth muscle is under parasympathetic control, and the radially arranged smooth muscle is under sympathetic control. Figure 2 shows the relation between these muscles and the size of the pupil of the eye. The size of the pupil reacts to the amount of light present.

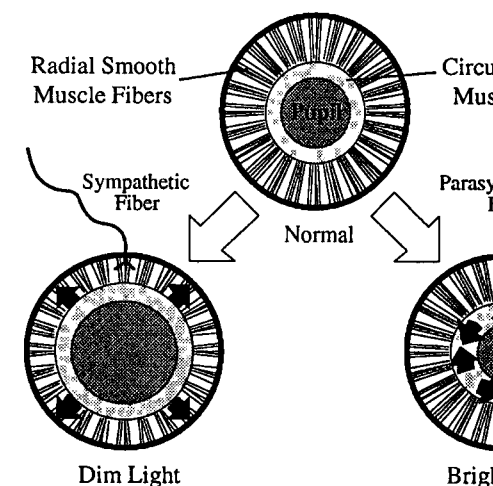


Figure 2

The lens of the eye is suspended by ciliary muscles and is surrounded by a ring of tissue called the ciliary body. Suspensory ligaments connect the lens to the ciliary body. When the ciliary muscle is relaxed, the suspensory ligaments pull the lens taut and flatten it. When we spend most of our time in far-away vision (like driving), this is ideal. For closer work, the eye must accommodate and become thicker for focusing. In this process, the ciliary muscle tightens, the suspensory ligaments become slack, and the lens becomes more convex.