Nursing care in
EYE, EAR, NOSE, & THROAT DISORDERS

SAUNDERS / HAVENER / KEITH / HAVENER

FOURTH EDITION

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FOURTH EDITION

with **386** illustrations

The C. V. Mosby Company

ST. LOUIS • TORONTO • LONDON 1979

FOURTH EDITION

Printed in the United States of America

The C. V. Mosby Company
11830 Westline Industrial Drive, St. Louis, Missouri 63141

Library of Congress Cataloging in Publication Data
Main entry under title:

Nursing care in eye, ear, nose, and throat disorders.

Bibliography: p.
Includes index.
1. Ophthalmic nursing. 2. Otolaryngological nursing. I. Saunders, William H. [DNLM: 1. Eye diseases—Nursing. 2. Otorhinolaryngologic diseases—Nursing. WY158 N974]
RE88.N8 1979 610.73'6 79-499
ISBN 0-8016-2113-5

GW/CB/B 9 8 7 6 5 4 3 2 1 02/B/218

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PREFACE

The expanding role of the nurse requires more than ever before that she be able to gather data about the patient, analyze it, and plan and implement actions. Eye, ear, nose, and throat complaints represent one third of the problems encountered in primary care. These complaints involve the vital senses and body processes such as sight, hearing, smell, taste, eating, breathing, and speech.

It is imperative that the student and the practitioner of nursing have a sound understanding of the pathophysiology, significant signs and symptoms, treatments, and prevention of these complaints. An effective teaching program requires not only a basic textbook but also a well-supervised clinical experience to develop genuine competence in this area. We sincerely hope that this extensively revised fourth edition will be helpful to the nurse of tomorrow.

Thanks go to Ruth Davis for her invaluable assistance with the chapters concerning the nursing care of patients with eye disorders. Preparation of the chapters regarding nursing care of patients with mouth, nose, ear, and throat disorders was greatly facilitated by Susan Wilson.

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SECTION ONE

THE PATIENT WITH EYE DISORDERS

1

STRUCTURE AND FUNCTION

The eye (Figs. 1-1 to 1-3) is made of three layers (sclera, choroid, and retina) of tissue, which enclose a fluid-filled center. The outer layer, which provides strength, is called the sclera posteriorly and the cornea anteriorly. Both the sclera and the cornea are very strong and resistant to stretching and tearing; however, they are quite flexible and not at all rigid like an eggshell. The firmness of the eye results from its fluid contents, which are normally under a pressure of 15 to 20 mm. Hg. Hence the structure of the eye is similar to that of an inflated basketball. If the sclera or cornea is cut, the fluid contents may escape, permitting the structure of the eye to collapse like a flat tire.

The cornea is normally completely transparent and invisible. It focuses and transmits light to the interior of the eye. Its surface must be moist at all times, or it will lose its transparency and may even develop permanent scarring. A film of tear fluid is spread on the cornea with each blink of the lids. Failure of the lids to close properly (as may happen in a patient unconscious from any cause) may result in drying of the cornea, unless the lids are adequately closed by the nurse. The physician's order for protective eye ointments should be obtained.

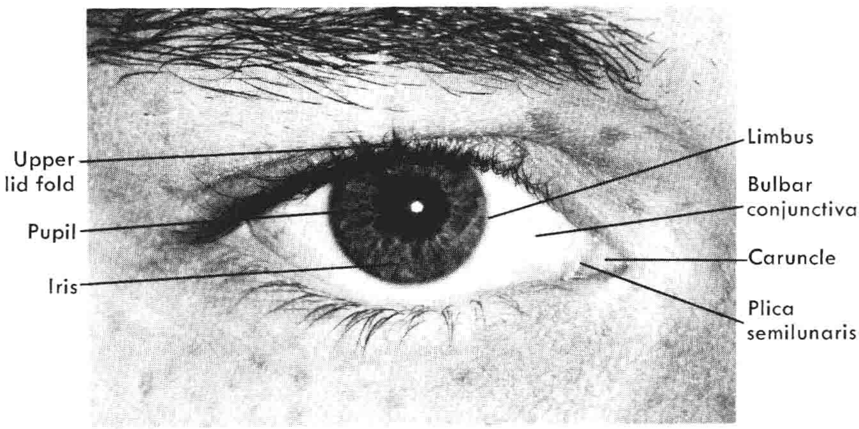

Fig. 1-1. External view of human eye.

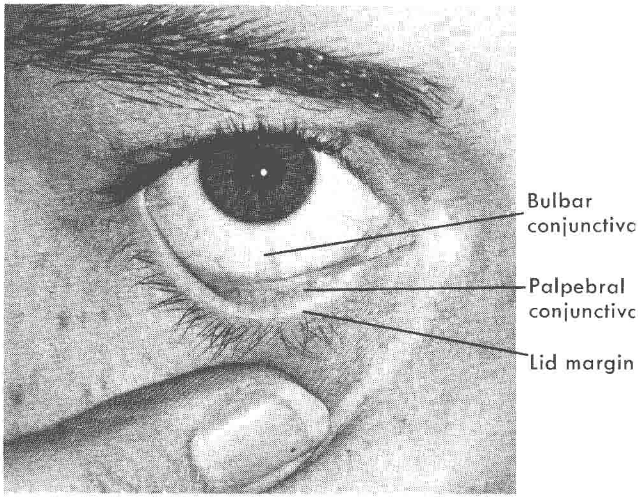

Fig. 1-2. Method of exposure of the lower conjunctiva.

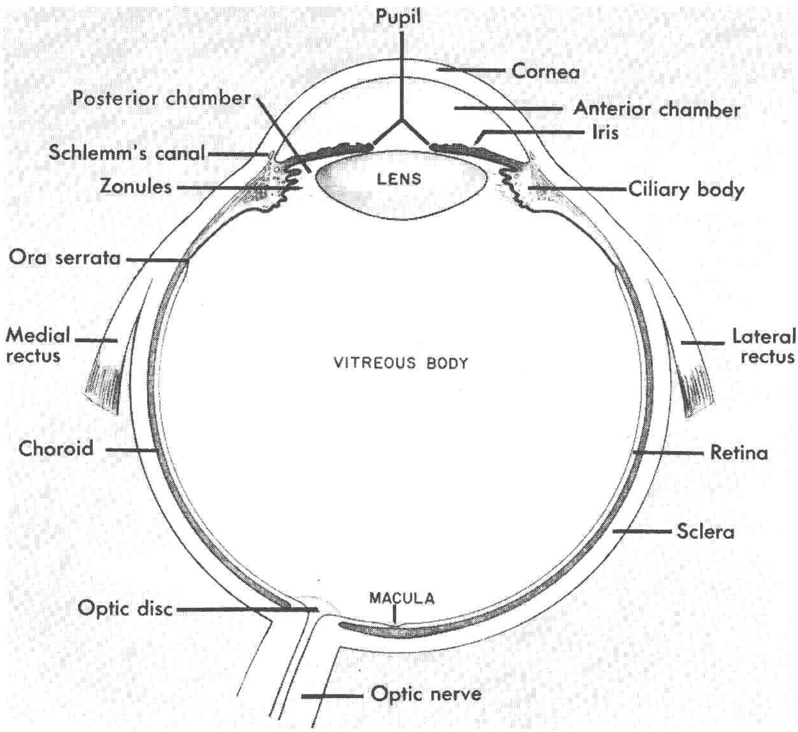

Fig. 1-3. Diagrammatic cross section of the eye.

The surface of the cornea is covered with a thin layer of epithelial cells. These cells are much more resistant to infection than are the deeper layers of the cornea; hence an abraded cornea is quite susceptible to infection. Fortunately damage to the corneal epithelium is easily recognized because of pain. The cornea has many more pain-recognizing nerve fibers than does any other part of the eye and is exquisitely sensitive.

The back of the cornea is covered by a layer of endothelial cells. Their function is to remove excess water from the cornea. If the endothelial cells are injured or diseased, the cornea becomes swollen and opaque.

The sclera is directly continuous with the edge of the cornea and encircles the eye completely, except where it joins the emerging optic nerve. Numerous arteries, veins, and nerves penetrate the sclera. The tendons of the extraocular muscles (which rotate the eye) attach to the sclera. The sclera is white and nontransparent and is responsible for the color of the white portion of the eye. The circular junction between the cornea and sclera is called the limbus.

The middle layer of the eye is called the uveal tract. It is divided into three portions—iris, ciliary body, and choroid.

The iris is the muscular membrane that gives the eye its blue, gray, or brown color. It surrounds the pupil, which appears black because no light can be seen to emerge from the eye. (The pupil is **not** a black structure but is simply a hole in the center of the iris.) Two muscles in the iris change the size of the pupil (see Fig. 6-1). The iris sphincter encircles the pupil, and its contraction decreases the pupil diameter. The iris dilator runs radially from the pupil to the iris periphery, and its contraction enlarges the pupil. The sphincter is supplied by the parasympathetic nervous system, may be activated by such drugs as pilocarpine or echothiophate (Phospholine), and is paralyzed by drugs such as atropine or cyclopentolate (Cyclogyl). The dilator is sympathetically innervated and may be activated by drugs such as phenylephrine (Neo-Synephrine) or epinephrine (Adrenalin). The function of the iris is to adjust the pupil size appropriately to adapt the eye to the existing brightness of light. As is well known, the pupil becomes large in the dark and small in bright light.

The ciliary body (Fig. 1-4) cannot be seen in observing the patient's eye, but it encircles the eye just behind the iris. The ciliary body has both muscular function and secretory function. The circular portion of the ciliary muscle lies on its inner surface and by its contraction relaxes the tension of the zonular fibers. (These fibers are attached to the lens and will be described with it.) The longitudinal portion of the ciliary muscle lies on its outer surface and by its contraction opens the trabecular spaces through which the aqueous fluid escapes from the eye. The ciliary processes lie just behind the peripheral iris and produce the aqueous fluid, which fills the anterior portion of the eye.

The choroid is a richly vascular layer and supplies the nutrition of the outer half of the retina. The outer layer of the choroid is composed of large vessels; the inner layer is composed of fine capillaries. If the retina falls

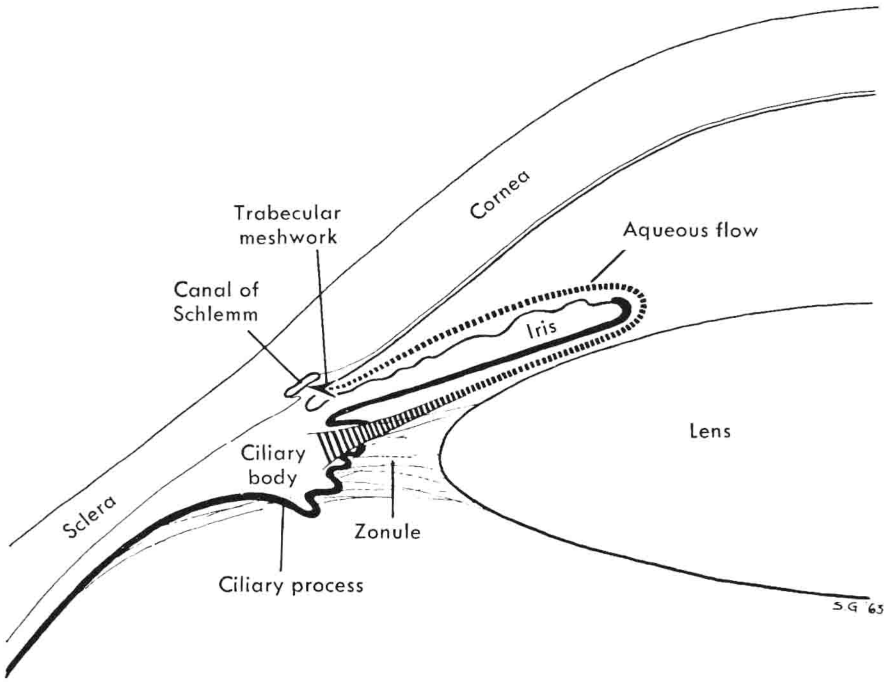

Fig. 1-4. Diagrammatic section of the anterior eye and the aqueous circulation.

away from its normal position (retinal detachment), it no longer receives its nourishment from the choroid and hence loses vision. The choroid lines the entire posterior portion of the eye and extends from the ciliary body to the optic nerve.

The innermost layer of the eye, the retina, is the part that perceives light. The retina is an enormously complex and precise network of nerve cells and fibers. Each retina contains more than 125 million nerve cells, which are able to "see" light. Many millions of additional nerve cells coordinate and transmit the impulses from the seeing cells to the optic nerve. The optical portion of the eye (cornea and lens) focuses the details of the outside world into a tiny image on the retina. The pattern of this retinal image is detected by the multimillions of retinal cells and is relayed via the optic nerve to the brain.

The visual cells are more compactly arranged in the center of the retina, which is called the macula. The very center of the macula is called the fovea centralis. Because of the arrangement of visual cells, the central retina, which sees straight ahead, has a considerably better visual acuity than the peripheral retina, which sees to the side.

The optic nerve leaves the eye about 3 mm. nasal to the fovea centralis. The nerve exit creates an oval retinal defect, measuring about 1.5 mm. across. This defect is responsible for the physiologic blind spot, which is present in every eye, about 15 degrees to the side, and is 5 to 8 degrees across.

The retina has two types of visual cells, called rods and cones. The rods are very sensitive cells that are used for vision in dim light. The cones are used for daylight vision. Colors are recognized by cones but not by rods. The ingenious combination of these different types of visual cells permits the human eye to see usefully through a wide range of illumination—from the intense light of noonday to the dimness of a starlit night.

Within the eye and just behind the iris is the lens. This transparent structure consists of a very thick gelatinous mass of fibers encased in an elastic capsule. Attached at about the equator of the lens are a number of delicate ligaments, the zonular fibers, which suspend the lens in proper position behind the pupil. The zonular fibers are attached to the ciliary body, and their tension may be varied by contraction or relaxation of the circular portion of the ciliary muscle. The shape of the lens changes, depending on the tension of the zonular fibers. The function of the lens is to focus light on the retina, which it does automatically in younger persons. With age the lens structure becomes rigid, and the eye loses its ability to change focus (accommodate). Sometimes an older lens loses its transparency; this condition is called cataract.

Most of the space inside the eye is behind the lens. This area is filled with a viscous fluid of a consistency somewhat resembling gelatin. This vitreous gel is formed only during the growth of the eye, remains relatively inert during life, and is never regenerated if damaged. The vitreous framework often disintegrates and becomes watery in older persons. Fragments of embryonic blood vessels or of partially disintegrated vitreous framework are often suspended in the vitreous and cast visible shadows (floaters) on the retina. Loss of vitreous as the result of injury or as an operative complication is serious because the tension exerted by the framework of the remaining vitreous may distort the internal ocular structures.

The anterior chamber is the space between the iris and cornea; the posterior chamber is the space between the iris and lens. Both anterior and posterior chambers are filled with the aqueous. Aqueous is a crystal clear, watery solution of nutrients that is formed by the ciliary body; it bathes and feeds the lens, circulates anteriorly through the pupil, and flows out of the eye through a circular meshwork situated just peripherally to the cornea. This meshwork (trabecular spaces) may be considered as an extremely fine sieve, the apertures of which can be varied somewhat by contraction or relaxation of the longitudinal muscle of the ciliary body. This sieve is so fine that it creates a resistance to the outflow of aqueous, thereby causing a rise in pressure as the aqueous flow is held back. The normal intraocular pressure is regulated by means of the trabecular meshwork. In about 2% of older persons the trabecular meshwork becomes sclerotic and obstructed; aqueous cannot escape at the proper rate, and the intraocular pressure rises to abnormal heights. This elevated intraocular pressure is called glaucoma.

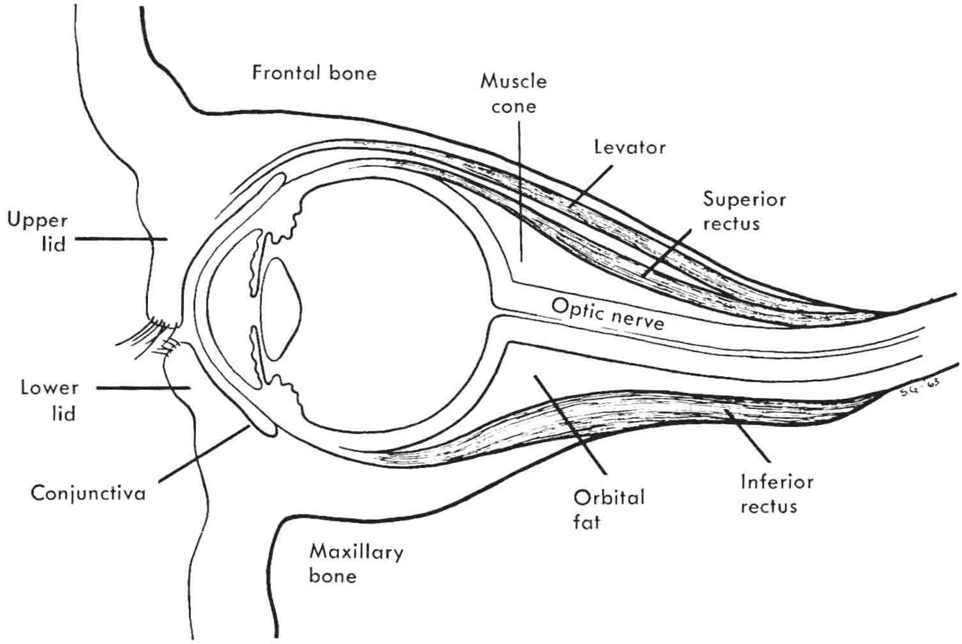

Fig. 1-5. Diagrammatic section of the orbit.

Beyond the trabecular meshwork is a circular channel called the canal of Schlemm. This canal conveys the aqueous to scleral veins, through which it returns to the bloodstream.

The eyes are suspended in the orbits (Fig. 1-5) by means of muscles, ligaments, vessels, nerves, and a cushion of fat.

Six extraocular muscles are attached to each eye. Four of these muscles are attached just in front of the equator of the eye, to the top, bottom, and inner and outer sides. These four muscles extend straight back to the apex of the orbit and are therefore called the rectus (straight) muscles. According to their position in the eye, they are designated as the superior rectus, inferior rectus, medial rectus, or lateral rectus muscle. The remaining two muscles insert on the back of the eye (top and bottom) and extend obliquely forward and medially to their origin from the orbital wall. Hence they are called oblique muscles and are designated the superior oblique muscle and the inferior oblique muscle.

The extraocular muscles of the eyes are remarkably coordinated so that they automatically aim the two eyes at exactly the same point in space, regardless of whether it is near or far, high or low, right or left. The extraocular muscles are innervated by the third, fourth, and sixth cranial nerves; therefore brain diseases that damage these nerves may be recognized because of the corresponding muscle paralysis.

Ligaments and sheets of connective tissue ensheath the extraocular

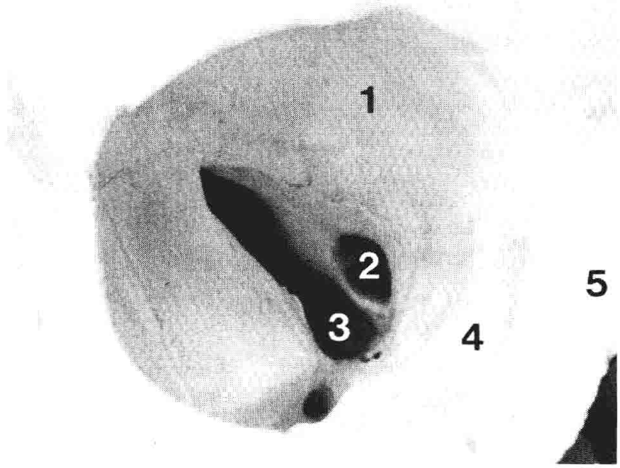

Fig. 1-6. Orbit. The bony orbital cavity, **1,** communicates with the brain via the optic foramen, **2,** which transmits the optic nerve, and the superior orbital fissure, **3,** which transmits most of the other nerves and vessels entering the orbit. The lacrimal fossa, **4,** contains the lacrimal sac; **5** is the nasal bone.

muscles, the optic nerve, and the posterior part of the eye and help to support the eye by means of their attachments to the bony orbital walls.

Much of the posterior orbit is filled with semifluid orbital fat, which acts as a soft cushion supporting the eye. Loss of this fat by injury results in an unsightly sunken appearance of the eye.

Assorted vessels and nerves are also contained within the orbit. Most of the arterial circulation of the eye originates from the ciliary arteries. About a dozen posterior ciliary arteries enter the back of the eye by passing through the sclera. Six or seven anterior ciliary arteries run within the rectus muscles and enter the eye at their insertions. Blood leaves the eye through four or more large vortex veins that emerge from the posterior sclera and also through the conjunctival veins anteriorly. The inner part of the retina has a separate circulation that enters through the optic nerve and is entirely independent of the circulation of the rest of the eye. These vessels are called the central retinal artery and the central retinal vein. Because of this vascular anatomy, occlusion of the central retinal artery can result in death of the retina and blindness, although the appearance of the eye as a whole is unchanged.

The space contained within the rectus muscles is called the muscle cone. The third, fifth, and sixth nerves pass through the superior orbital fissure to enter the muscle cone. Because of this anatomic fact, retrobulbar injection of an anesthetic into the muscle cone will block movement of the lateral rectus (sixth nerve); superior, medial, and inferior rectus (third nerve); and orbital pain sensation (fifth nerve). Such an anesthetic is commonly