Examination of the Retina

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The following text summarizes information provided in the video.

OVERVIEW

In the human body, only the retina allows the examiner to achieve direct visualization of the central nervous system and the vasculature. Therefore, the funduscopic examination is important in the detection of certain systemic diseases and diseases that primarily affect the eye. For nonophthalmologists, the direct ophthalmoscope is the preferred instrument for examination of the retina (Fig. 1).

INDICATIONS

The retinal examination is part of a complete physical examination. It is particularly important in patients with a history of such systemic diseases as diabetes, hypertension, and atherosclerosis. Patients with the human immunodeficiency virus (HIV) or the acquired immunodeficiency syndrome (AIDS) are also at increased risk for retinal diseases. Evaluation of the retina may reveal the initial signs of diabetic retinopathy, hypertensive retinopathy, macular edema, glaucoma, or macular degeneration. Diagnosis and appropriate interventions can help preserve sight and prevent disease progression.

Indications for urgent direct ophthalmoscopy include a clinical suspicion of increased intracranial pressure, occluded retinal vessels, and retinal detachment. Any of these conditions, or the sudden loss of vision or a change in vision, constitutes an ophthalmic emergency. The patient should be seen by an ophthalmologist immediately or should be sent to the emergency department.

ANATOMY

The inner structures of the eye can be visualized through the pupil, the central opening in the iris. The light rays from the ophthalmoscope pass through the cornea, pupil, and lens to focus on the retina, producing an upright, magnified image. The retina is located on the inner surface of the globe, opposite the pupillary opening. The color should appear red, orange, or brown and varies from person to person.

DIRECT OPHTHALMOSCOPIC SETTINGS

The direct ophthalmoscope consists of a handle, which contains the power supply and a light source, and a head, which contains the viewing window and lenses. The on–off switch adjusts the brightness of the light. The apertures include a large circle, a medium circle, a small circle, and a slit beam. To reduce the patient’s pupillary constriction it is best to use the ophthalmoscope at a brightness level of 80 to 90%, with the aperture set to the small or medium circle.

The ophthalmoscope contains a range of lenses with positive and negative dipters that compensate for refractive error on the part of the examiner and the patient. If the patient has hyperopia, the retina will be closer to the pupil than normal. If the patient has myopia, the retina will be farther away from the pupil.
than normal. The lenses are adjusted by turning the dial. Negative numbers focus on objects that are farther away, and positive numbers focus on objects that are closer.

**PATIENT PREPARATION**

Explain the procedure and tell the patient that direct ophthalmoscopy has virtually no risks, although there may be some discomfort caused by the bright light shining into the patient’s eyes. Ask the patient to sit, with legs uncrossed. Have the patient remove eyeglasses, if present. Contact lenses will not affect the examination and may be left in place.

**PROCEDURE**

Darken the room to maximize pupillary dilatation. Designate a point (e.g., a small painting hung on the wall) for the patient to look at that is at least 1 m away from the patient. It is easier to fixate on an image or object than a blank wall. Switch on the ophthalmoscope light, and set the dipters to 0. You may use your contralateral hand to elevate the patient’s upper eyelid. Always use your right eye to examine the patient’s right eye and your left eye to examine the patient’s left eye to avoid being nose to nose with the patient.

Start by locating the red reflex, which is the reflection of light from the retina. Hold the viewing window of the ophthalmoscope directly in front of your eye. Position the ophthalmoscope about 30 cm from the patient’s eye, slightly temporal to the center, and shine light into the pupil. A diminished red reflex or the absence of a red reflex could indicate an obstruction (e.g., cataracts).

Follow the red reflex as you gradually move closer to the patient. Turn the dial clockwise to decrease the dipters until you focus on the retina. Hold the ophthalmoscope as close to the patient’s eye as possible, since this will optimize your view. You will be able to observe only a small area of the retina in the viewing window. Tilt the ophthalmoscope as needed to visualize different areas. Find and follow a vessel as it increases in caliber, tracing it back to its origin at the optic disk. The optic disk is located approximately 15 degrees nasal to the center of the retina and should appear to be yellowish orange (Fig. 2). The optic cup is a pale central depression in the optic disk. The axons of the retinal ganglion cells exit the retina at the optic disk to form the optic nerve. In the retinal vasculature, veins are thicker and darker than arteries. The fovea is the area responsible for the highest visual acuity. It is temporal and slightly inferior to the optic disk and is surrounded by a more darkly pigmented region called the macula.

The cup-to-disk ratio, or the ratio of the diameter of the optic cup to the diameter of the optic disk, is normally 0.3. A higher cup-to-disk ratio, particularly a ratio above 0.5, may indicate glaucoma. Swelling of the optic disk (Fig. 3) can have multiple causes, including papilledema, optic neuritis, and anterior ischemic optic neuropathy. Any of the conditions associated with a swollen optic disk requires an emergency workup and an evaluation by an ophthalmologist.

Next, examine each quadrant of the retina, tracing vessels away from and back toward the optic disk. You may ask the patient to look in a particular direction to facilitate visualization of the corresponding part of the retina. For example, if you wish to view the upper right quadrant, ask the patient to look to the upper right.

Nonproliferative diabetic retinopathy may cause microaneurysms, exudates, dot–blot hemorrhages, and flame hemorrhages. The proliferative form of diabetic retinopathy features neovascularization. Hypertension can result in changes in the color and caliber of blood vessels, giving them the appearance of copper wire or silver wire. “Arteriovenous nicking” refers to the narrowing or disappearance

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**Figure 2. Normal Retina.**
Direct ophthalmoscopy can be used to visualize key features of the retina, including the optic cup, optic disk, retinal arteries and veins, fovea, and macula.

**Figure 3. Swollen Optic Disk.**
A swollen optic disk is an ophthalmic emergency and requires prompt evaluation by an ophthalmologist.
of the vein on each side of an arteriole. Cotton-wool spots result from axons that were damaged by infarction and local ischemia. The occlusion of retinal arteries is usually caused by atherosclerosis or emboli and requires an emergency workup for systemic stroke. The appearance of a cherry-red spot in the fovea is a sign of occlusion of the central retinal artery. Occlusion of the central retinal vein may result in retinal hemorrhages.

An easy method of locating the macula is to ask the patient to look directly at the ophthalmoscope light. You may observe the foveal reflex, which is caused by pitting of the fovea. Because shining the light directly onto the fovea may cause discomfort in the patient, it is best to perform this part of the examination at the end. The wet form of age-related macular degeneration, as opposed to the dry form, involves vision loss caused by choroidal neovascularization.

**Limitations**

Since direct ophthalmoscopy is performed without dilatation of the pupil, it provides only a limited view of the retina and is best used for screening rather than diagnostic purposes. If there is clinical suspicion of ocular disease, the patient should be referred to an ophthalmologist for a dilated-fundus examination that will be performed with the use of specialized equipment.

Patients with cataracts may have a diminished or missing red reflex. To obtain the best visualization of the fundus, the size of the aperture may be reduced in order to minimize light scattering. It may not be possible to visualize the fundus in patients with dense cataracts. Patients with dense cataracts should be evaluated by an ophthalmologist.

**Troubleshooting**

Although the funduscopic examination is challenging for beginners, it becomes easier with practice. Familiarize yourself with the ophthalmoscope before examining patients. When examining patients, dim the room lights to maximize the dilatation of the pupils and improve the visual contrast of the fundus. First elicit the red reflex, since the red reflex indicates successful illumination of the retina. To locate the optic disk, approach the patient at an angle of about 15 degrees temporal to center; if the retina is not visualized, make small adjustments in the angle relative to the patient’s visual axis.

Technological advances include the development of instruments that facilitate examination of the retina by nonophthalmologists. Some of these devices contain cameras. However, these new devices are not yet widely available.

**Summary**

Direct ophthalmoscopy is an important technique for examination of the retina that can be mastered with practice. It can be performed in minutes during the general medical examination and poses virtually no risks to the patient. Ophthalmoscopy allows the general practitioner to evaluate the retina for pathologic changes, particularly in patients with common systemic diseases such as diabetes, hypertension, or atherosclerosis. Ophthalmoscopy can also help to identify ophthalmic emergencies that require immediate attention.

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**References**


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