Chapter 5
E–Ophthalmology in the Diagnosis and Follow-Up of Chronic Glaucoma

Jose Andonegui  
Complejo Hospitalario de Navarra, Spain

Aitor Eguzkiza  
Public University of Navarra, Spain.

Mikel Auzmendi  
Public University of Navarra, Spain.

Luis Serrano  
Public University of Navarra, Spain.

Ane Zurutuza  
Complejo Hospitalario de Navarra, Spain

Mónica Pérez de Arcelus  
Complejo Hospitalario de Navarra, Spain

ABSTRACT

e-Ophthalmology is the use of information and telecommunications technologies to provide or support a group of activities related to ophthalmic care. Chronic glaucoma is an ocular disease characterized by optic neuropathy that leads to progressive loss of the visual fields and often is associated with elevated intraocular pressure levels. Glaucoma is an important public health problem because it is one of the main causes of blindness worldwide and generates an important demand for ophthalmologic consultations. The aim of this chapter is to discuss the application e-Ophthalmology-based models in the diagnosis and follow-up of chronic glaucoma. The authors describe the current status of the use of e-Ophthalmology-based models in the screening and follow-up of chronic glaucoma, the main advantages of these models, the technologic requirements for their implementation, and future trends in this field.

INTRODUCTION

e-Health can be defined as the use of Information and Communication Technologies (ICTs) to provide or support a group of health care-related activities. The same concept applied to ophthalmic care is referred to as e-Ophthalmology (Kumar & Yogesan 2005), which can be used to diagnose, administer treatments or preventive health care activities, screen for diseases, educate, or investigate. e-Ophthalmology makes medical practice independent of time and space, allows specialists
to organize their work time more efficiently, and improves the patient access to ophthalmic care.

E-Ophthalmology can be substituted for direct patient/doctor visits during follow-up of some chronic ocular diseases, allowing specialists to examine results and images using different remote diagnostic devices. Implementation of e-Health systems with a broader use of ICTs may be a very useful resource to face the complexities of future health care. The current status of the use of e-Ophthalmology-based models in screening and follow-up of chronic glaucoma, the technologic requirements needed to establish the models, their advantages, and the future possibilities in this field are described in this chapter.

This chapter also briefly addresses the main clinical characteristics of chronic glaucoma and the diagnostic tests used. Second, a literature review of reported e-Ophthalmology-based models for screening and following chronic glaucoma was undertaken and the current status of e-Ophthalmology in health care is evaluated.

BACKGROUND

Chronic Glaucoma

Chronic glaucoma is a progressive optic neuropathy associated with progressive loss of visual fields that often but not necessarily is associated with high Intraocular Pressure (IOP). The prevalence rates of chronic glaucoma in the populations of industrialized countries range from 1% to 3% (The Eye Diseases Prevalence Research Group II, 2004), and chronic glaucoma is a leading cause of blindness in our environment. Affected individuals require lifelong ophthalmic care, and chronic glaucoma represents an important problem for health authorities due to the increased number of consultations required to manage this disease. In fact, the number of follow-up visits more than tripled in the United States from 1975 to 1998 (Kosoko et al. 1998). By 2020, 80 million people are expected to have glaucoma worldwide (Quigley and Broman 2006).

Chronic glaucoma leads to progressive loss of visual fibers in the optic nerve (Figure 1). The loss is detected by progressive enlargement of the optic disc cup and is correlated with a progressive increase in the visual field detected by campimetry. This test examines the visual fields by evaluating the ability of the eye to capture and translate the sensitivity of the retina to light at each point in the visual field (Figure 2). The technique is based on a stimulus-response test in which the patient fixates on a point and is presented with intermittently displayed luminous objects at multiple predetermined points in space with a fixed illuminated background. The luminous objects provoke a stimulus in the patient. These stimuli are gradually decreased in intensity until they disappear at the limits of the visual field.

The loss of the visual fibers also can be measured by Optical Coherence Tomography (OCT), which is based on emission of light pulses of specific frequencies directed toward the retina and their posterior reception once the light pulses reach the retina. The emitted pulses can pass through the ocular tissues, which reflect only a portion of those that are captured by the machine. The signal sent is compared with the reflections captured, and the system then reconstructs a threedimensional retinal model and also can measure the retinal thickness with high accuracy (Figure 3). OCT functions in a manner similar to ultrasonography, but OCT emits pulses of light instead of ultrasound waves. This small difference provides microscopic precision to the image but limits detection of the pulses reflected to a depth of 1 to 2 millimeters.

Diagnosis and follow-up of chronic glaucoma usually are based on IOP measurement and examination of the optic disc and visual fields (American Academy of Ophthalmology 2005). OCT also can be used to measure the thickness of the nerve fiber layer around the optic disc. Ophthalmologists usually screen and follow pa-
Related Content

Content-Based Image Retrieval in Medicine: Retrospective Assessment, State of the Art, and Future Directions
[www.igi-global.com/article/content-based-image-retrieval-medicine/2239](www.igi-global.com/article/content-based-image-retrieval-medicine/2239?camid=4v1a)

Automatic Detection of Arrow Annotation Overlays in Biomedical Images
[www.igi-global.com/article/automatic-detection-arrow-annotation-overlays/61336](www.igi-global.com/article/automatic-detection-arrow-annotation-overlays/61336?camid=4v1a)

Information Technology (IT) and the Healthcare Industry: A SWOT Analysis
[www.igi-global.com/article/information-technology-healthcare-industry/2222](www.igi-global.com/article/information-technology-healthcare-industry/2222?camid=4v1a)

Changes in Brain White Matter Assessed Via Textural Features Using a Neural Network
[www.igi-global.com/article/changes-brain-white-matter-assessed/42996](www.igi-global.com/article/changes-brain-white-matter-assessed/42996?camid=4v1a)