

Guidelines for Diabetic Retinopathy Screening in a Large Population

Rationale for diabetic retinopathy services in India.

BY P. NAMPERUMALSAMY, MD

Diabetic retinopathy (DR) is one of the most frequent causes of blindness worldwide. DR screening initiatives are directed toward improving health care services for those with the disease.

Twenty years ago in India, DR was the 17th most common cause of blindness, but it ranks now as the sixth leading cause. The World Health Organization (WHO), under its VISION 2020 initiative, aims to control eye diseases, and DR is among target diseases. Awareness of the disease and of its treatment modalities among communities and physicians, however, is low. The WHO estimates that diabetes mellitus affects more than 170 million people worldwide and that by 2030 an estimated 366 million people will have the disease. Further, more than 75% of patients who have diabetes for more than 20 years will experience vision loss from DR.¹

According to the WHO, 31.7 million people were affected by diabetes in India in 2000. This figure is estimated to rise to 79.4 million by 2030, the largest diabetic population of any nation in the world. It is estimated that 15% to 25% of the population with diabetes have DR, and other people with the disease have the potential to develop DR over a period of time.

Currently, there are only 11,000 ophthalmologists in India, and most of them are trained in cataract surgery; only 7% to 8% of the ophthalmologists are trained in the management of DR. Training for ophthalmologists in how to detect and treat DR will be key as this condition rises in frequency. Thus, we have developed three holistic models, presented in this article, that promote awareness creation, community screening, service delivery, and training to deal with the problems of diabetes and DR in the community.

MAGNITUDE OF DIABETES AND DIABETIC RETINOPATHY

The prevalence of diabetes will grow most rapidly in low and middle-income countries, among populations of working age.

Diabetic retinopathy is a microvascular complication of both type 1 and type 2 diabetes mellitus. The condition is a leading cause of new onset blindness in many industrialized countries and is an increasingly frequent cause of blindness elsewhere. WHO has estimated that DR is responsible for 4.8% of the 37 million cases of blindness throughout the world.

DISEASE CONTROL

Primary level: screening only. At the primary level, screening is performed for diabetes and DR. The principal goal of primary care is to decrease the incidence of preventable eye diseases and vision impairment. Primary level services include case identification and referral to a secondary level center.

Secondary level: medical. Secondary level eye care centers provide facilities for investigations and medical treatment (laser treatment) for diabetic retinopathy.

Tertiary level: surgical. Tertiary level eye care centers provide all type of investigations and treatment for diabetic retinopathy including laser and surgery.

DETECTION

Screening of the general population and detection of DR in the diabetic population is the first step in management of DR. Screening of the diabetic population is performed essentially by the review of medical history and blood sugar estimation. Detection of retinopathy is performed by examination of the ocular fundi. This

TABLE 1. STRATEGIES FOR CONDUCTING PRIMARY LEVEL DETECTION SERVICES

1. The first contact for diabetic patients is their family physician/general physician, diabetologist or primary health center. General physicians/diabetologists need to have short-term training on the use of direct ophthalmoscope for 2 hours at a secondary or tertiary hospital.
2. Conduct seminars for physicians and diabetologists on diabetic eye complications with focus on eye screening and its importance.
3. Display awareness posters at the primary health centers, diabetologists' clinics, and hospitals.
4. Identify patients with diabetes in the primary health centers during drug distribution day, and motivate them to attend the diabetic retinopathy screening camp (See "Model 1").
5. Organize health education program in the community. Target groups include patients with diabetes; family members of patients with diabetes; teachers; religious and other community leaders; and other individuals from nongovernmental organizations working in other fields.
6. Organize screening camps in association with local agencies/local diabetologists for DR screening for patients who have diabetes.
7. The technician at the vision center is to perform the following activities:
 - a. conduct screening for diabetes for all persons over the age of 30 using the fasting blood glucose test;
 - b. organize a diabetic retinopathy screening camp in the vision center once a year;
 - c. provide patient counseling and health education to patients with diabetes during regular eye examination; and
 - d. refer diabetic retinopathy patients to the secondary and tertiary care services for further investigation and treatment.

procedure can be done at primary, secondary, and tertiary care levels by using the available resources optimally.

Primary level services. This level includes physicians, diabetologists, general ophthalmologists, and vision centers where the focus is basic screening of diabetics for DR to increase awareness about the diabetic eye complications to the diabetic patients coming to them. These centers must network with ophthalmologists for referral of all diabetic patients. Specific strategies can be seen in Table 1.

Secondary and tertiary level services. These levels involve referral from the primary level for further investigation and treatment (Model 1).

MODEL 1: DR SCREENING CAMP

In a DR screening camp, a team of medical and paramedical personnel with sufficient equipment, who work linearly with the diabetes screening team, screen diabetic patients for DR. The major activities in community outreach camps are screening, diagnosing, advising patients with early DR on medical management, and referring those requiring further treatment to secondary and tertiary care centers.

There are two types of DR screening camps. One is for known diabetics and the other one is for diabetes detection and DR screening.

The first type of screening camp is conducted in association with diabetologists or general medical practitioners for their patients with diabetes.

The second type of screening camp is diabetic detec-

tion in the general public and DR detection in diabetics. This type of camp needs specific publicity and separate infrastructure. Screening for diabetes and DR is done simultaneously. The patients who are identified as having diabetes are screened for DR through dilated fundus with help of direct and indirect ophthalmoscope by ophthalmologists.

Screening for diabetes is usually accomplished through a blood test (finger prick sample) because testing urine samples requires extra facilities and is beset with sanitary concerns. Moreover, it is a less reliable test.

Because the second type of camp includes all elements of the first, the following overview of preparation and protocol focuses on the second type of camp for both diabetes and DR screening.

CAMP PLANNING

There are five basic pre-camp issues to be resolved prior to the operation of the camp. Each is listed below with examples of issues to be considered.

Selection of geographic target area. Area identification is the first and foremost step to a successful DR screening camp. Because population density is higher in urban areas, diabetic prevalence is higher in urban areas. There are also more diabetic care centers in urban areas.

Partner identification. After the area is selected, a survey is made to identify the service organizations. For diabetes detection it is important to seek the help of medical practitioners and physicians who have clinical labs.

Partner responsibilities. Because more than one partner is involved in these camps, it is important to immediately clarify the roles and responsibilities of each partner to avoid confusion among the partners. It is also most important to discuss with partners the minimum budget for conducting a camp, selection of site, date, and time; adequate space, toilets, and furniture; and nearby public transportation.

Publicity. Because the concept of a DR screening camp is relatively new, specific publicity may be required. Publicity material should contain information on where, when, for what, and for whom these camps are useful. Moreover, if promotional activities are started at least 15 days before the camp, patients with diabetes might be more likely to plan to attend the camp.

Resources. The camp organizer must plan for manpower and materials such as dilating drops, camp case sheets, and pamphlets needed for the camp.

DR SCREENING CAMP PROTOCOL

Diabetes screening. The details of the patient's name, age, sex, and address are registered in the register notebook and patients are given a card for diabetic screening. Then, patients undergo random blood glucose tests with the help of a strip and a glucometer. A patient's height, weight, and blood pressure are also measured. The patient is asked whether he is a known diabetic or has come to learn about his/her diabetic status.

This information is entered in the card. All the patients are referred to the physician for his advice. The physician sees all the patients, gives advice and refers diabetic patients for DR screening. Non-diabetic patients receive the physician's advice only. Information, education, and communication materials are given to all outpatients at the registration counter.

Diabetic retinopathy screening. All diabetic patients are registered in separate register. A screening card with the details collected in the diabetic screening is provided. Snellen visual acuity testing is then performed in a separate room.

After the visual acuity test, ocular history is taken and eyes are examined for cataracts, glaucoma, or other visual complications. Intraocular pressure is then measured with a tonometer.

All patients with diabetes must be dilated. Examination for DR takes place in a darkened booth (constructed onsite using dark cloth) using direct and indirect ophthalmoscope, which provides a wide field of vision with low magnification. Patients who show signs of DR are referred on.

All patients with diabetes are provided information on the diagnosis of diabetes and DR and are provided

with resources for more information and, if necessary, treatment.

REMOTE DR DIAGNOSIS

Advances in the application of information technology (IT) in the medical community have enabled practitioners to use remote diagnosis, or telemedicine. Within India, both government and private-sector health care institutions have undertaken many telemedicine initiatives. The Indian Space Research Organization has been supporting tertiary hospitals to establish links with remote places like the Northeast on a pilot basis. By sharing the satellite bandwidth and hardware, access to quality health care for the remote population is possible.

Because most diagnoses in ophthalmology are image based, the specialty is particularly suited to telemedicine. Currently, most ophthalmic equipment in India is integrated with IT that allows image capture and the transfer of images complying with standards such as Digital Imaging and Communications in Medicine (DICOM). Similarly, the government is working to ensure IT penetration, even in rural areas.

Primary level services. The vision center model envisaged by VISION 2020: The Right to Sight, a global initiative launched jointly by the WHO and the International Agency for the Prevention of Blindness, is being adopted by eye care programs throughout India. The core objective of these vision centers is to provide comprehensive care by integrating IT effectively to provide quality eye care at the doorsteps of the rural population, including ophthalmic consultation and treatment referral.

Strategies. The diabetic patients' fundus images can be taken by the technician with the help of an ordinary digital camera attached to a slit lamp and sent to the base hospital for consultation.

Secondary level. This level incorporates the remote diagnosis approach for diabetes centers (Models 2 and 3).

MODEL 2: TELEMEDICINE VIA DIABETOLOGIST

Experiments are under way in India for placing fundus cameras in diabetologists' offices and sending images to the base hospital through the Internet. The advantage of this approach is the opportunity to extend the reach of screening by collaborating with other specialists, such as diabetologists, to carry out effective screening. Thus, patients receive expert consultation without having to make a visit to a tertiary eye hospital.

Aravind Eye Care System (India) has developed a Web browser based software, ADRES 3.0 (Aravind Diabetic Retinopathy Evaluation Software). It supports integration of nonmydriatic fundus camera image capture, struc-

tured clinical data using a user-friendly interface, and simple workflow with appropriate authorization to access the case sheets. This system has two modules: Client and Provider. The Client module is where patients' images are captured. The Provider module is used by the reader to examine and grade the captured image.

Requirements for Model 2 include a nonmydriatic fundus camera, ADRES 3.0 software, and Internet access. Required manpower includes an ophthalmic technician and a fundus photographer.

MODEL 3: MOBILE TELEMEDICINE

Mobile telemedicine enables the early detection of DR or other blinding eye conditions in patients with diabetes by deploying qualified technicians at the screening level to capture high-quality images. In this model, a mobile van travels to rural areas or to physicians' offices where patients diagnosed with diabetes at that site are screened in the mobile van.

The mobile van is equipped with a nonmydriatic camera to capture fundus images and a video slit lamp to capture images of the anterior segment. This equipment is connected to a computer and to a videoconferencing unit. Images captured are sent to a reading and grading center located at the base hospital. The ophthalmic images and their digital case sheets are electronically transferred.

These images are read and graded by trained graders. From the grader's input for each image, the software automatically elicits the severity level along with advice for treatment in a report format. This information is relayed back immediately to the camp site where the report is printed and given to the patient, who then receives counselling based upon the report. The turn-around time for the whole process is around 1 hour.

CONCLUSION

The models presented here, which are currently being employed and evaluated in India, have excellent potential for creating awareness for a devastating condition that is not yet completely understood by the community at large. By promoting diabetes education and screening for the disease and the resulting eye diseases, blindness may be prevented for many people who otherwise may not have access to information and care. ■

P. Namperumalsamy, MD, is Chairman of the Aravind Eye Care System in Tamilnadu, India. He states that he has no financial relationships to disclose. Dr. Namperumalsamy can be reached via e-mail at dr.nam@aravind.org.

