2011

CLINICAL PRACTICE GUIDE FOR DIABETIC RETINOPATHY FOR LATIN AMERICA

FOR OPHTHALMOLOGISTS AND HEALTHCARE PROFESSIONALS

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Organized by: The VISION 2020 Program of the IAPB for Latin America

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I. EXECUTIVE SUMMARY:

The prevalence of diabetes is increasing due to longer survival and lifestyle changes, in some countries its prevalence is reaching more than 10%. After 20 years, 90% of patients with diabetes type I, and 60% of those with type II will have some form of retinopathy; of these, 5% will require treatment to avoid irreversible blindness.

Diabetic retinopathy is the third most common cause of irreversible blindness in the world, but it is first among persons of working age (16 to 64 years) in developing countries, and causes severe economic loss. For that reason, the development of national programs for the early detection of retinopathy is urgent.

The risk of vision loss and blindness is reduced by stable metabolic control, early detection, and adequate treatment. Regular examinations and the treatment of retinopathy do not eliminate all cases of vision loss, but they greatly reduce the number of patients who are blind due to this condition.

The disease does not affect vision until very late stages, and early education of the patient is therefore necessary so that they do not neglect their checkups and so that irreversible changes that could lead to blindness do not occur.

In initiating a program for the detection of diabetic retinopathy, the following should be considered

a. **YOU SHOULD POSSESS A CLINICAL GUIDE TO DIABETIC RETINOPATHY** with a simplified classification system, recommended examination intervals, and suggestions for treatment.

b. **YOU MUST CHOOSE A SCREENING METHOD** that takes into account available equipment and human resources.

c. **YOU SHOULD ESTABLISH LASER-TREATMENT CENTERS FOR TIMELY TREATMENT.**

d. **YOU MUST EDUCATE THE PATIENT WITH DIABETES about the risk of vision loss and blindness**

e. **YOU MUST CONSIDER LONG-TERM SUSTAINABILITY through copayments or subsidies.**

Notes:

"Epidemics are the consequence of the habits of society" (Virchow 1860)

"Diabetes is fast becoming the epidemic of the 21st Century." (Pierre Lefebvre, President, International Diabetes Federation (IDF), 2006)

"The diabetes epidemic is out of control" (Press Release: IDF, December 4, 2006, Cape Town, South Africa)

II.- EDITORIALS:

The inclusion of epidemiological studies and evidence-based practices in medicine has helped to gradually give us a panoramic vision of diseases that, due to their frequency or socioeconomic impact, are recognized as public health problems. Voices of alarm were raised during the 1990s in ophthalmology by "Vision for the Future" a historic document that was an initiative of the Council and of the *Academia Ophthalmologica Internationalis*, which suggested a strategic plan to save and restore vision, and thereby join the worldwide effort of the Vision 2020 Program led by the World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB).

In its 11 years, Vision 2020 has managed to reduce the rates of trachoma, onchocerciasis, and retinopathy of prematurity as well as that of cataract. However, in the last two decades chronic degenerative diseases such as glaucoma, macular degeneration, and diabetic retinopathy (DR) have been declared as emerging diseases. The last of these has been identified as the most common cause of irreversible blindness among the working-age population.

Given this situation, Vision 2020 Latin America decided to create a subcommittee for the continent wide analysis of DR, while deciding that the first need was to arrive at a consensus as to what was happening in different regions, which was the motive for the planning of the First DR Workshop in April 2009, held in the city of Quito with the participation of colleagues dedicated to community health programs from five countries (Brazil, Chile, Colombia, Ecuador, and Mexico) and with advice from the IAPB, which provided information about the successful experiences of other countries, such as Scotland, in the early detection of DR. Key recommendations were decided on during that first workshop; however it was decided to hold a second workshop for the purpose of revisiting the conclusions to include the experience of other countries such as Costa Rica, Paraguay, and the United States (USA) and to seek further assessment from the IAPB, who provided information about events in the United Kingdom (UK). The second workshop was held in Querétaro, Mexico, where a new consensus was reached which we wish to share, as a reference point, with those colleagues and organizations that are working on the problem or participating in programs to reduce the rate of blindness caused by DR. The contributions of the Ecuadorian and Mexican ophthalmology societies deserve special mention for their hosting of the first and second workshops, as well as for their contributions during them.

We hope that these guidelines will be useful for training centers with residency programs in ophthalmology as well as for healthcare administrators and providers, and as guides for informing patients with diabetes and their families on the present and emerging needs of those affected. We maintain a commitment to secure the support of the Pan-American Association of Ophthalmology (PAAO) so that with the inclusion of the opinions of these expert colleagues this material may be disseminated among all the representative organizations of ophthalmology in all the countries of Latin America and help contribute to developing solutions for confronting this grave public-health problem for Latin America.

There can never be sufficient mention the invaluable counseling of the IAPB, the Pan-American Health Organization (PAHO) the of Vision 2020 office in Latin America, or of the generosity with which lessons learned were shared by the colleagues from many of the regions and countries represented who kindly agreed to participate, including colleagues active in the leadership of the PAAO and of a new ally, the ORBIS program and, above all, the logistic and financial support of the Christian Blind Mission International (CBM)

Sincerely,

Francisco Martinez Castro, MD

Coordinator, Subcommittee on Diabetic Retinopathy, Vision 2020 Program

A worldwide epidemic of diabetes mellitus (DM) is in progress that will double the number of persons affected by the year 2030. The epidemic is associated with growing population size, increased aging, and lifestyle changes, and affects primarily developing countries. In developed countries the average patient is over 60 years of age, but in the developing countries they are generally between 40 and 60 years of age, meaning that they are part of the working-age population. The number of people affected by the year 2030 in Latin America will increase from 13 to 33 million, and generate more aggressive complications at an earlier age, including retinopathy, along with high costs to individual health and communities. The result will be an increase in the prevalence of diabetic retinopathy since more than 75% of patients who have had the disease for 20 years or more have some form of retinopathy, which is already the leading cause of vision loss and blindness in the working-age population. The World Health Organization estimates that DR produces 4.8% of the 37 million cases of blindness in the world, causing 17% of blindness in the United States and Europe, 7% in Latin America, and 3% in India, with the percentage in Africa being unknown. DR is asymptomatic, meaning that our strategy should include: Education of the population on how to take care of their eye health while also ensuring equitable access to attention and treatment for retinopathy patients at risk of blindness to help preserve the vision of the population This is achieved with a screening program that reaches 100% of the affected population and assesses 80% and refers them to a more exact diagnostic program to classify and treat the patients according to their condition. This technical orientation makes it necessary to educate ophthalmologists and generate strategies and sustainable local programs, for which purpose political support will be needed in the area of finance. Ways to achieve all of these objectives are included in this clinical practice guide, which we hope will help achieve this goal.

To control this epidemic all the institutions dedicated to eye health in Latin America must coordinate their efforts. The Pan-American Association of Ophthalmology (PAAO) unites Latin American ophthalmology and includes committees of subspecialists who can validate the protocols for the public-health setting. It also educates ophthalmologists by holding highly attended conferences that we hope will help increase awareness of eye-health topics. The International Agency for the Prevention of Blindness (IAPB) plans and executes programs while lending operational support and channeling aid to targeted projects. It gathers information to monitor eye-health indicators and also has subcommittees of subspecialists who revise protocols. National ophthalmology medical societies should ensure cooperation among ophthalmologists to generate research and profession-wide activity in defense of these interests, while educating others about eye health, validating protocols, and performing the needed advocacy so that eye health as a sustainable initiative will be made a priority. The Pan-American Health Organization (PAHO) has defined the priorities in eye health for Latin America in a resolution that advises governments about the development of national plans. As a super-national entity, it serves as a bridge between political authorities and medical societies for the discussion of eye health programs. Only the coordination of these efforts will permit an improvement of community eye health and achieve our objective of preventing blindness. THAT IS QUITE A CHALLENGE

This initiative was born in the Subcommittee on Diabetic Retinopathy of the IAPB, directed by Dr. Francisco Martinez Castro, and has allowed us to join in workshops that developed a guide by uniting the efforts of a group of experts to carry out a review of the literature and currently available evidence. The development of strategies for the early detection and treatment of diabetic retinopathy is the responsibility of each country, depending on its situation, and must be done by organizing a program for the management of diabetic retinopathy within the framework of national programs for the management of diabetes mellitus.

Sincerely,

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IV.- INDEX:

1.-Background:

In April of 2009 the First Workshop on Diabetic Retinopathy was held in Quito Ecuador, organized under the auspices of the Subcommittee for Diabetic Retinopathy of the Vision 2020 Program for the Americas and with financial support from CBM. Among those attending were representatives from the International Agency for the Prevention of Blindness (IAPB), the Pan-American Association of Ophthalmology (PAAO), the Pan-American Health Organization, various countries, such as Chile, which already have national retinopathy programs, and other colleagues from the region who have promoted the exchange of knowledge, together with the Ecuadorian Society of Ophthalmology and the Mexican Society of Ophthalmology, which represents one of the countries most severely affected by the high prevalence of diabetes mellitus (DM). In October of 2010 a second workshop on retinopathy was held in Querétaro, Mexico that included ORBIS and the London School of Hygiene & Tropical Medicine (LSHTM), among others, to provide a forum for the participation of all the organizations dedicated to eye health and help them to join forces in pursuit of the improvement of eye health for the patient with diabetes.

These workshops allowed a group of physicians from different countries and organizations to discuss strategies and action plans that would allow for the development of a protocol to orient future blindness prevention programs for diabetic retinopathy (DR) in Latin America and the Caribbean. It was from this workshop that this clinical practice guide for diabetic retinopathy for Latin America was born. The methodology chosen for the development of the present guide was that of forming groups of experts who cooperated in two working meetings with the participation of representatives of a number of organizations to carry out a review of the literature and evidence currently available.

1.1.- Diabetes Mellitus: A worldwide epidemic:

It is estimated that there are 170 million people affected by diabetes mellitus worldwide (1), and that this number could increase to 360 million persons by the year 2030. This will affect primarily the emerging nations, including the working age population, which will create a worldwide epidemic (2). It is estimated that in the United States 6.3% of the population has diabetes (3). Studies have shown that diabetes type II can be prevented by diet and physical activity, while the persons at highest risk (with impaired glucose tolerance) can be treated with drugs to reduce the high risk of vision loss due to diabetic retinopathy (4, 5). No similar results have been found for the prevention of Type 1 Diabetes.

Diabetic retinopathy is the leading cause of blindness in many industrialized countries and the World Health Organization estimates that it already causes 5% of the 37 million cases of blindness in the world (6). More than 75% of diabetics of more than 20 years progression have some form of retinopathy according to the Wisconsin Epidemiological Study of Diabetic Retinopathy. It also demonstrated that 13% of diabetics of five-years progression show some degree of retinopathy, a figure that increases to 90% at 15 years progression in patients in whom diabetes was diagnosed before age 30 (7). When diagnosis occurs after age 30, type II is presumed, with 40% of those who are insulin-dependent, and 24% of those receiving other treatment developing retinopathy at five years of progression (8); a figure that increases to 84% of insulin-dependent patients and 53% of those receiving other treatment when the duration of diabetes reaches 15 to 20 years (9). Of the insulin-dependent patients who have been treated for more than 20 years, 60% have

proliferative retinopathy (7), as do all those with more than 30 years of treatment, of which 12% are blind. If all the patients with proliferative retinopathy had been treated early, the rate of blindness could have been lowered from 50% to 5%, reducing the cases of vision loss by 90% (10).

The increased prevalence of diabetes and increased life expectancy of the population require the development of strategies for early detection and treatment of diabetic retinopathy to avoid vision loss that could result in blindness. A system of eye care must be organized for the management of retinopathy within the national programs for the management of diabetes mellitus.

1.2. Some points that must be considered include:

a. Diabetic retinopathy is the third most common cause of irreversible blindness in the world, but it the most common cause of irreversible blindness among persons of working age in developing countries.

- In developing countries more than 50% of patients do not have access to an ophthalmologist.
- It doesn't kill, it doesn't cause pain, and due to being poorly informed, many patients see a doctor only after experiencing some vision loss, which is too late and can result in them becoming blind.
- Blindness due to diabetic retinopathy is preventable in 80% of cases with early detection and treatment along with multidisciplinary management designed to achieve good control of hyperglycemia, hypertension, and hypercholesterolemia. Education is vital in encouraging the patient and family members to use self-care in the management and prevention of complications.

b. Some 10% of patients with diabetes have severe vision loss, and 2% of these end up with retinopathy-associated blindness.

- Diabetic retinopathy can produce edema or macular ischemia, hemorrhaging in the vitreous, tractional retinal detachment, or neovascular glaucoma.
- Good metabolic control delays the appearance and slows the progression of damage. Macular edema can occur at any stage of diabetic retinopathy and is the most common cause of vision loss. Its appearance is associated with a longer duration of progression. Vitreous hemorrhage is the most common cause of blindness associated with the proliferative stages of retinopathy

c. Considering that the prevalence and incidence of diabetic retinopathy are rising, if action is not taken these figures will double by the year 2030.

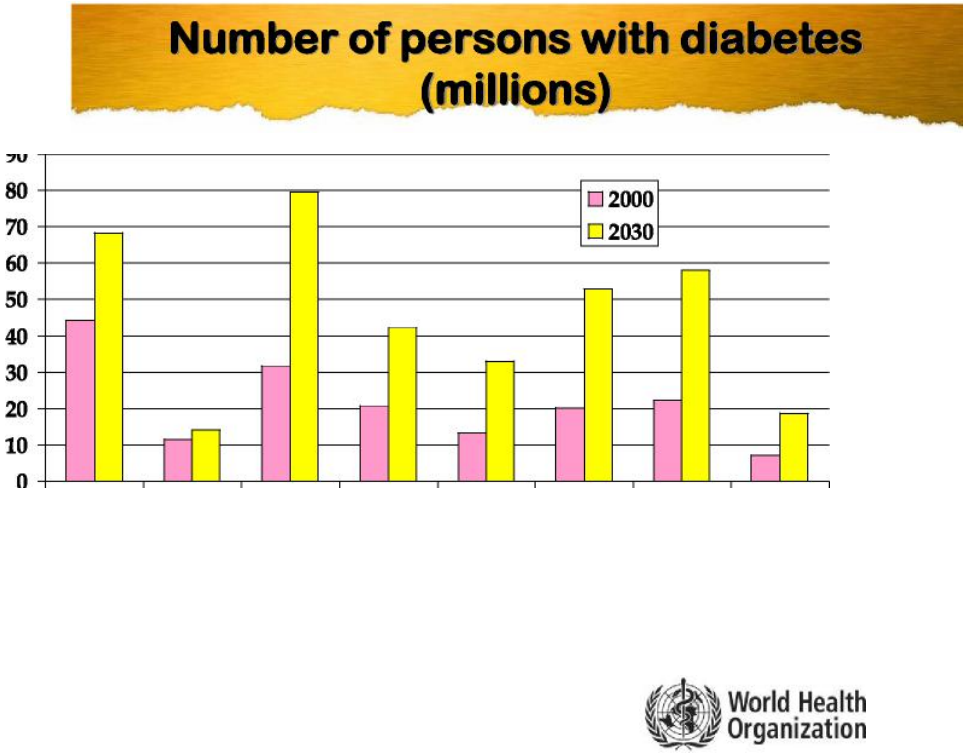
- It is urgent that action be taken to improve the coverage of early screening and laser treatment to preserve useful vision and thereby improve the patient's quality of life and reduce the associated costs of care by a factor of 10.
- This need should be acted upon by the creation of national programs for early attention of diabetic retinopathy. General practice ophthalmologists and residents should be trained in the management of diabetic retinopathy using a simplified classification system and the proper management of the different stages of diabetic retinopathy.

2.- THE EPIDEMIOLOGY OF DIABETES:

2.1 Prevalence

The prevalence of diabetes mellitus is increasing worldwide. According to WHO, 170 million persons were affected by diabetes mellitus in the year 2000, a figure expected to rise to 370 million by the year 2030, an increase of 86% (1,6 Ref. Serge Resnikoff). Latin America is no exception. It is estimated the figure of 13.3 million for the year 2000 will increase to 33 million persons by the year 2030, representing an increase of 148%. The most dramatic case is that of Mexico, where the current 6.8 million people affected will increase to 11.9 million, an increase of 175% (Figure N 1). The increase in the number of persons affected by diabetes is due to various factors:

- Population growth
- Aging population: diabetes is more common in older persons; however, due to demographic differences in wealthy countries diabetes occurs predominantly in those over age 60, while in developing countries the mean age is between 40 and 60 years,
- Urbanization associated with changes in eating habits and a more sedentary lifestyle,
- The obesity epidemic, due to greater prosperity and reduced physical activity. National surveys in Mexico show an increase in the number of persons affected from 9% in 1988 to 24% in 1999, an increase of 159%. Figure N 1: Estimated increase in population affected by diabetes, years 2000 to 2030, in different geographical areas of the world, according to the World Health Organization (2004).



For planning purposes we estimate that 10% of the population over age 20 has diabetes. However considerable variation exists relative to this estimate, for instance diabetes mellitus is more common in the indigenous population and in persons with lower educational levels.

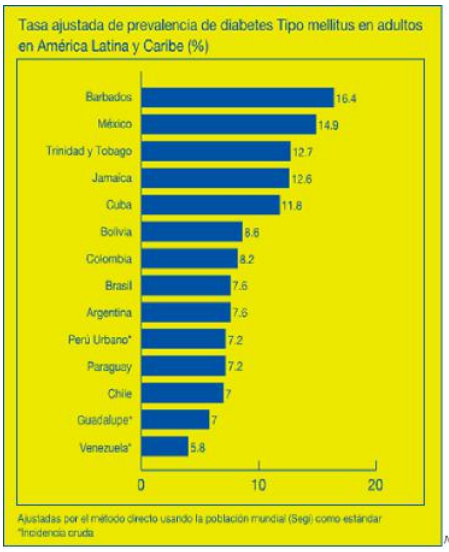
The increased prevalence of diabetes imposes greater costs on health care services. It is estimated that 10% of the current budget for the National Health Service of the United Kingdom is needed for the care of patients with diabetes and related complications. The International Diabetes Federation (IDF) estimates that the cost of care of diabetes in Latin America will exceed $33 billion dollars annually by the year 2025.

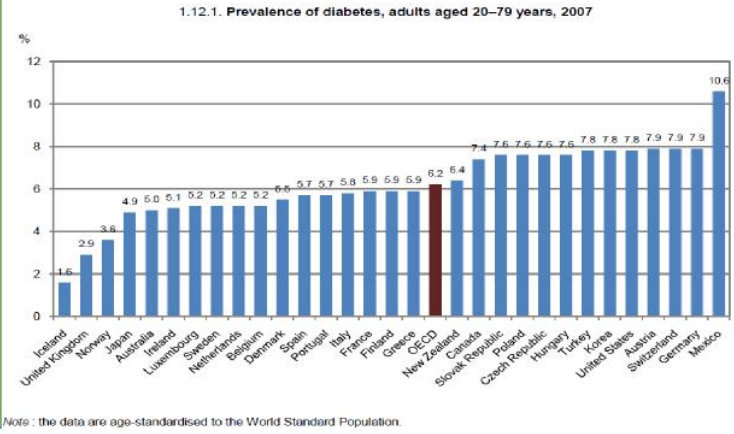
Another study determined that indirect costs due to disability or death combined with the direct costs associated with the management of diabetes would amount to no less than $65 billion in the year 2006 (see the section on advocacy).

An estimate of the increase in the prevalence of diabetes in Latin America is shown in Figure N2. In Chile, the 2003 national health survey (11) showed that 4.2% of adults over age 15 had diabetes, but this figure may by now have reached 7%. The prevalence of diabetes mellitus increases in patients over age 65 with low educational level and in persons living in urban areas (studies in Mapuche and Aimara [12]). According to a survey of schoolchildren in Chile carried out in 2007 (13), the number of overweight children has increased to 17% while the number of obese children has increased to 2.3%, findings associated with poor eating habits. It is estimated that 60% of overweight children could develop metabolic syndrome (14), leading to diabetes at earlier ages and in a more aggressive vascular form, including diabetic retinopathy (DR), with the consequent increased incidence of blindness due to damage to the retina. No program for the overall care of pre-diabetic patients with risk factors such as obesity currently exists. In programs designed to change eating habits, only 12% remained at lower weights at 18 months, and 42% abandoned the program before completing one year (15). In Mexico, the country in Latin America most affected by diabetes, the prevalence of diabetes in persons over age 20 is estimated at 11% (Figure N 3). Some very revealing figures were shown by the differences observed over a period of 11 years (1988 to 1999) between two national surveys about nutrition carried out in Mexico among the general population; they showed an increase in overweight persons of 78% and an increase of cases of obesity of from 9% to 24%, an increase of 159% (16).

Figure N 2: Estimate of the prevalence of diabetes in Latin America in 2007 according to the International Diabetes Federation.

Figure N 3: Estimate of the prevalence of diabetes according to the Organization for Economic Co-operation and Development (OECD) (Ref. Jorge Valdez, M.D.)





Note : the data are age-standardised to the World Standard Population.

2.2 Risk Factors:

The risk factors for the development of diabetes are: overweight or obesity, sedentary lifestyle, glucose intolerance, and insulin resistance or hyperinsulinemia, among others. These factors can be addressed via diet and physical activity to avoid clinical diabetes.

Recommendations:

- Use indicators provided by organizations such as the World Health Organization, the International Diabetes Federation, or the American Diabetes Association as a framework for the planning of programs.
- Ophthalmologists should actively participate in early alert programs to emphasize the risk of obesity and lack of physical activity that can lead to blindness due to diabetic retinopathy.

2.3- An Analysis of the Future: Increase in the prevalence of diabetes.

The number of patients with diabetes worldwide is expected to increase from 171 million persons in the year 2000 to 336 million by the year 2030, an increase of 86%. In Latin America it will increase from 13.3 million to 33 million by the year 2030, an increase of 146% (1). An estimate of the increase in cases of diabetes by the year 2030, carried out by the International Diabetes Federation (17) is shown in figure N4.

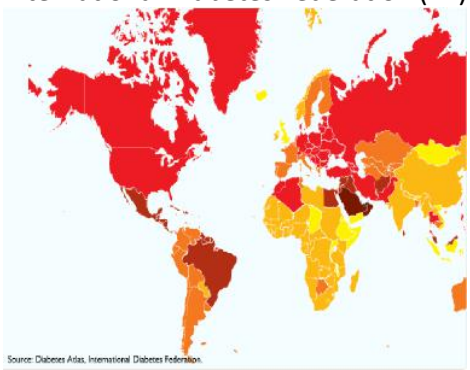


Figure N4: estimated increase of diabetes in Latin America by the year 2030, by country, according to the International Diabetes Federation

Basado en proyecciones el siguiente gráfico muestra cómo será la prevalencia de la diabetes en el año 2030 en algunos paises de América Latina y el Caribe

PAIS	2000	2030
Argentina	1.426.000	2.457.000
Bahamas	12.000	26.000
Bolivia	207.000	562.000
Brasil	4.553.000	11.305.000
Chile	495.000	1.047.000
Colombia	883.000	2.425.000
Costa Rica	76.000	237.000
Cuba	480.000	855.000
República Dominicana	245.000	594.000
Ecuador	341.000	921.000
El Salvador	103.000	320.000
Guatemala	139.000	447.000
Guyana	19.000	36.000
Haití	161.000	401.000
Honduras	81.000	269.000
Jamaica	81.000	189.000
México	2.179.000	6.130.000
Nicaragua	68.000	246.000
Panama	59.000	155.000
Paraguay	102.000	324.000
Perú	754.000	1.961.000
Trinidad y Tobago	60.000	125.000
Uruguay	154.000	224.000

3.- THE EPIDEMIOLOGY OF DIABETIC RETINOPATHY

3.1 The Prevalence of Retinopathy

Many worldwide epidemiological studies are currently available (18, 19, 20, 21, 22, 23, 24, 25) and are summarized in Table N1.

Table N1: Prevalence of diabetic retinopathy in various studies of patients with diabetes

POPULATION STUDY	PATIENTS	AGES	PREVALENCE
CURES, Chennai, India	995	40+	**19.2%**
SN-DREAMS, Chennai, India	1,414	40+	**18.0%**
Beijing, China	381	45+	**27.9%**
Barbados Eye Study, West Indies	615	40+	**28.8%**
Liverpool, UK	395	13.92	**33.6%**
Taiwan, Republic of China	11,478	40+	**35.0%**
Wakefield, UK	991	15+	**37.8%**
Handan, rural China	368	30+	**43.1%**
The Los Angeles Latino Eye Study	1,217	40+	**46.9%**
WESDR, Southern Wisconsin	1,313	40+	**50.3%**

Among the large regional screening studies is the “DIA D" study done in 1999 at the initiative of the Pan-American Association of Ophthalmology presided over by Prof. Juan Verdaguer, M.D., in which 7715 patients in 16 countries were assessed, and it was found that 40.2% of patients showed some degree of retinopathy, with 17% of the total requiring treatment, and, alarmingly, it was found that 35% of the total had never been examined by an ophthalmologist In Chile, 30% of diabetic patients assessed showed diabetic retinopathy, with from 5% to 10% of these requiring treatment by argon laser photocoagulation due to the risk of vision loss. Only 9.2% of the patients in Chile had been examined in the last 12 months (Ref.: Prof. Juan Verdaguer T., M.D.)

3.2 Study Methods:

The prevalence of diabetic retinopathy varies widely depending on the study methods used.

- Adjustments: Patients in clinical hospitals have a higher prevalence of diabetic retinopathy than patients in the community.
- Methods of detection: Fundus photography is more sensitive than indirect ophthalmoscopy.
- Definition: according to the classification stages employed
- Type of diabetes: Patients with type II diabetes or who are insulin-dependent have a higher prevalence of diabetic retinopathy than those with non-insulin-dependent diabetes.
- Duration: The greatest risk factor for diabetic retinopathy is longer duration of diabetes.

In India, when the epidemic of diabetes first appeared, the incidence of diabetic retinopathy in early days was low; it is common to relate this to a short average duration of the disease. In the United States the prevalence of diabetes has been increasing in recent decades due to greater survival rates. Both factors increase the duration of diabetes, making retinopathy relatively more common. Not all retinopathies lead to compromised vision; retinopathy that threatens vision is that which includes proliferative diabetic retinopathy and maculopathy, conditions that occur in from 3% to 12% of diabetics. Studies of prevalence in Latin America are limited, for which reason we have estimated that diabetic retinopathy is present in 30% of diabetics and that a threat to vision is present in approximately 5%

A study done in Asuncion, Paraguay reveals that of 307 patients with diabetes examined, 48.5% showed retinopathy, and of these 8.5% had proliferative retinopathy (26).

3.3 Studying the Prevalence of Diabetic Retinopathy

Population studies specifically designed to estimate the prevalence of blindness in Latin America exist, but they are not specific for diabetic retinopathy. Seven Rapid Assessment of Cataract Surgical Services (RACSS) or Rapid Assessment of Avoidable Blindness (RAAB) studies done in Latin America include data about the contribution of diabetic retinopathy to the total number of cases of blindness. According to these studies, from 1.4% (Colombia) to 15.9% (Brazil) of blind persons detected in the studies were blind primarily due to diabetic retinopathy (Table N2).

Table 2: Contribution of diabetic retinopathy to the total number of cases of blindness (data from RACSS and RAAB surveys)

Country	Sample	% of blindness	% of DR in the total cases of blindness
Brazil (27)	2224	2.0%	15.9%
Chile (28, 29)	2715	1.6%	8.5%
Columbia (30)	4082	1.8%	1.4%
Cuba (31)	2760	2.3%	9.2%
Ecuador (32)	4012	1.7%	7.1%
Dominican Republic (33)	3873	2.1%	5.0%
Venezuela (34)	3317	4.2%	2.9%

*Blindness: Visual acuity <20/400 in the better eye with available correction adjusted for age and sex, except for the Venezuelan study, which used a visual acuity of <20/200 with available correction that was not adjusted for age or sex.

The RACSS and RAAB studies are population studies that have as their objective the estimation of the prevalence of blindness and its causes and the assessment of cataract services, and are performed using interviews and examinations of persons over age 50 which are analyzed in the study (35, 36). However, as the examination is carried out in the homes of the participants with assessment of the fundus done by direct ophthalmoscopy, there is limited ability to achieve diagnoses associated with the posterior pole disease or glaucoma. The prevalence of persons blind due to diabetic retinopathy or glaucoma could therefore be underestimated.

An epidemiological study of retinopathy was done in the state of Chiapas in Mexico (Ref. Pedro Gomez, M.D.) for the purpose of establishing the prevalence of different levels of retinopathy. The study is being assessed to define its applicability to other regions. The objective of a rapid study of avoidable blindness (RAAB) is to determine the primary causes of blindness, and a component for diabetic retinopathy has been incorporated to determine the prevalence of diabetic retinopathy detected in the open population studied using an algorithm developed by the London School of Hygiene & Tropical Medicine. The methodology of this expanded RAAB adds: a.- Detect the presence of diabetes in all participants (by interview and glucose meter) and b.-Perform funduscopy on all patients with diabetes or suspected of diabetes to detect the presence of diabetic retinopathy. The diagnosis of diabetic retinopathy is validated by the field examination and the digital images of the retina as classified by experts. This study, currently being assessed, should permit: 1. 1. Estimation of the prevalence and causes of blindness and diabetes mellitus in persons over age 50; 2. Estimation of the prevalence of diabetic retinopathy and blindness due to diabetic retinopathy; and 3. Assessment of the validity of the inclusion of diabetic retinopathy as part of the RAAB in terms of diagnostic certainty, performance of the study, and cost. The importance of this study lies in its ability to estimate the prevalence of diabetic

retinopathy in a population and assess its different stages while also providing an estimate of the need for treatment.

Although its execution has not yet been validated, reports of first experiences of its usage around the world are being awaited to yield to conclusions as to whether its performance is practical or not.

3.4 Risk factors for the development of retinopathy:

The primary risk factors for the development of diabetic retinopathy are:

3.2.1 Duration of the disease

3.2.2 Poor metabolic control (hyperglycemia)

3.2.3 Arterial Hypertension

3.2.4 Hyperlipidemia including cholesterol and triglyceride levels.

3.2.5 Patient unaware of having the disease

3.2.6 Other risk factors are microalbuminuria, anemia, smoking, or pregnancy.

3.5 Blindness and compromised vision due to retinopathy:

In wealthy countries compromised vision and blindness are more common in diabetics than in non-diabetics. WHO estimates that 4.8% of worldwide blindness is caused by diabetic retinopathy, but in Latin America this figure reaches 7%. Not all of this compromised vision is caused by diabetic retinopathy; cataract is also common in diabetic patients. In the United Kingdom, 0.2% of diabetics are officially blind, and the incidence of new registration of blindness in diabetic patients is 64 of 100,000 inhabitants annually. However, this figure was obtained from an active screening and treatment program for DR, and the incidence of compromised vision is apparently higher in less developed countries or countries in which healthcare is less developed. In Mexico, with an estimated 6,800,000 diabetics in 2010, this means a minimum of 4350 persons become blind due to DR every year.

Essential facts about the epidemiology of DR:

- 20% to 30% of the diabetic population will have a certain degree of DR.
- 5% of the population with DM will have DR that threatens vision due to either proliferative DR or macular edema (ME).- 5-8% will have retinopathy that requires laser treatment.
- 3% to 10% of patients with DM will progress to diabetic macular edema (DME); of those, 30% will develop severe visual impairment associated with DME.
- 0.5% of the population with DM will require vitrectomy.
- DR is a late-appearing complication that after 20 years affects more than 90% of patients with diabetes Type I (DM1) and more than 60% with Type II (DM2) Patients with DM1 are at greater risk of developing retinopathy than those with DM2.

4. CLASSIFICATION:

Diabetic retinopathy (DR) has been classified in many different ways, and some of these systems are excessively complex and useful only as investigative tools. The International Council of Ophthalmology has suggested a simplified classification system that is clinically relevant and should be widely accepted (37, 38). The screening program in Scotland has developed such a classification system based on simple photography of the posterior pole (39).

A simplified classification system has been suggested as a simple means for assessing the state of the fundus to guide the management, treatment, and monitoring needed by the affected patient (Table 1) (40). The system creates a clinical definition to orient treatment, and should not be confused with classification systems for screening.

Table N1: Classification of diabetic retinopathy by level and indications

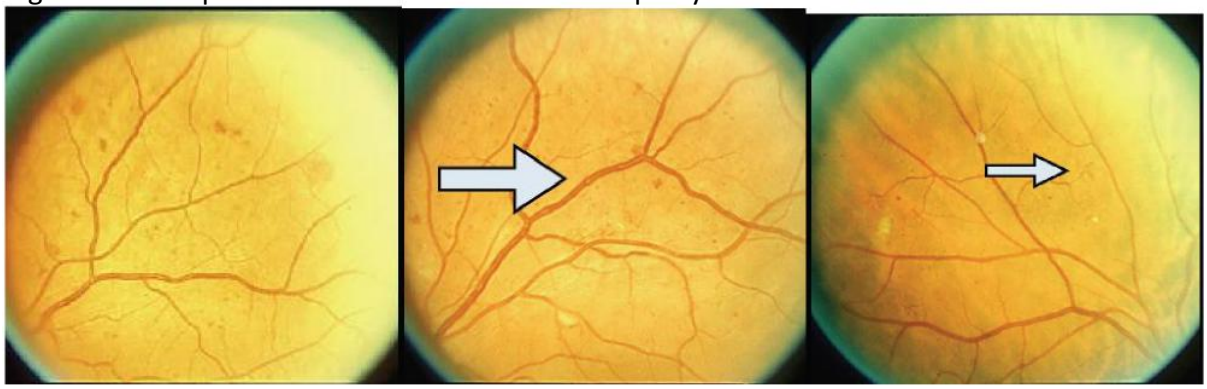
Mild:	CLASSIFICATION: Fundus	INDICATION:
NO RETINOPATHY	1 Unchanged	Optimize metabolic control: glycemia, HBP, cholesterol CHECK yearly (2 years)
Mild NPDR Risk <0.5% of PDR	2 Microaneurysms only	Optimize metabolic control: glycemia, HBP, cholesterol CHECK at 1 year
Moderate NPDR (Risk 5-20% of PDR)	3 > than nonproliferative DR, but < severe nonproliferative DR	Optimize metabolic control: glycemia, HBP, cholesterol CHECK in 1 year (6 months)
Severe NPDR (risk of progression at 1 year: 50% of PDR 15%-45% High Risk)	4 Any of the following: intra-retinal hemorrhages (≥ 20) in the four quadrants, venous beading in two quadrants and IRMA in 1 quadrant	4:2:1 Rule Refer For PANRETINAL PHOTOCOAGULATION - *Trained ophthalmologist
Post-Photocoagulation NPDR	Post-laser scarring: 3 months DETECT PRESENCE OF NEOVASCULARIZATION:	Referral to Secondary Care Facility*: ASSESS NEED FOR ADDITIONAL LASER
NPDR: no high-risk signs	5a Neovascularization In one of four quadrants and less than 1/3 optic disc.	Refer for: PANRETINAL PHOTOCOAGULATION *Trained ophthalmologist
NPDR: with signs of high-risk	5b Neovascularization In more than 1/3 optic disc, preretinal or vitreous hemorrhaging	Refer for: PANRETINAL PHOTOCOAGULATION AND/OR VITRECTOMY** **specialized ophthalmologist

Post-Photocoagulation proliferative DR	**Post-laser scarring: 3 months DETECT PRESENCE OF NEOVASCULARIZATION:**	**Refer to secondary-care facility*:** **Assess treatment: laser or vitrectomy**
UNCLASSIFIABLE DR:	**UNCLASSIFIABLE: media opacity (lens, vitreous, cornea), miosis; not cooperative or technical problem**	**Refer to secondary-care facility *:** **Assessment by Ophthalmologist**
Clinically significant MACULAR EDEMA	**Retinal edema within 1 disc diameter of the center of the fovea**	**Refer to secondary-care facility *, laser, intravitreal or vitrectomy (specialized ophthalmologist)**

NPDR: nonproliferative diabetic retinopathy
*TRAINED OPHTHALMOLOGIST: skilled in diagnosis and use of laser.
**SPECIALIZED OPHTHALMOLOGIST: retina specialist in tertiary-care centers…

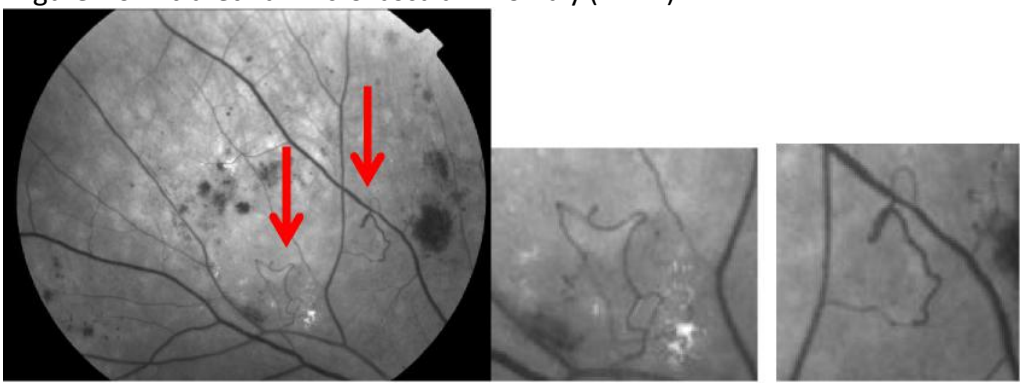
Severe nonproliferative diabetic retinopathy (SNPDR) is the stage at which treatment is considered necessary in Latin America. . Characteristics of this stage include: 1.-Hemorrhages and/or microaneurysms in 4 quadrants (Standard Photograph 2A), 2.-Venous beading in 2 quadrants (Standard Photograph 6A) and 3.- Intraretinal microvascular abnormalities (IRMA) in 1 quadrant of IRMA (Standard Photograph 8A) which are considered to meet the "4:2:1 rule" for retinal lesions. (Figures N5, N6).

Figure N 5: Components of a Severe Diabetic Retinopathy of 4:2:1 rule



Hemorrhages and/or microaneurysms Venous BeadingIntraretinal microvascular abnormalities
Source for photographs: Wisconsin Reading Center

Figure N6: Intraretinal Microvascular Anomaly (IRMA).



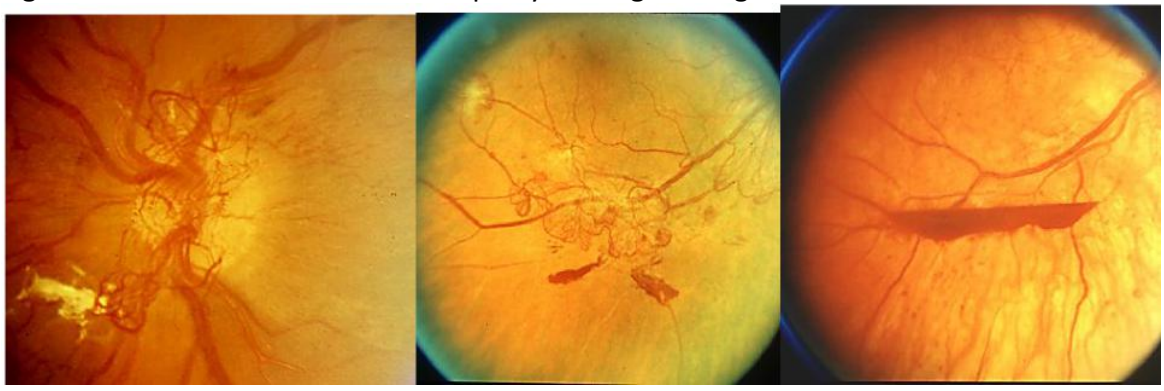
Intraretinal microvascular anomaly Source of photographs: Dr. Verdaguer

Figure N7: Severe Nonproliferative Diabetic Retinopathy requiring treatment

Severe hemorrhaging in four quadrants and, b. Venous beading

Proliferative diabetic retinopathy should be considered as high risk. At an early stage, with no signs of high-risk, there is the presence of neovascularization within 1 through 4 quadrants and with size less than 1/3 optic disc diameter. A stage with signs of high risk includes the presence of neovascularization in more than 1/3 of the optic disc due to preretinal hemorrhage or vitreous hemorrhage (Figure N8).

Figure N8: Proliferative diabetic retinopathy with signs of high risk.

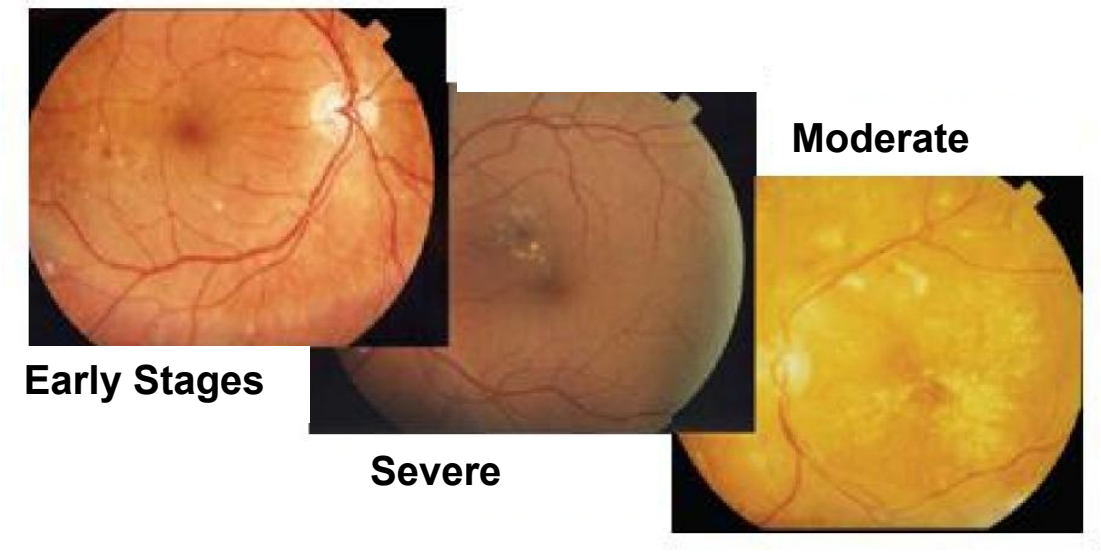


Proliferative DR with signs of high risk a) neovascularization of the optic disc and, b) pre-retinal hemorrhage Source of photos: Fundus Photograph Reading Center, Department of Ophthalmology and Visual Sciences, University of Wisconsin - Madison, USA.

A healthy macula presents no sign of thickening or serous exudates.

Thickening of the macula can cause poor vision, corresponding to clinically significant macular edema (CSME), which is the most common cause of vision loss in diabetic patients, and which can affect up to 28% of patients over age 25 with type II diabetes. According to the Early Treatment Diabetic Retinopathy Study (ETDRS), CSME includes retinal thickening within 500 µm (1/3 disc diameter) of the center of the macula, thickening of the retina associated with hard exudates within 500 µm of the center of the macula or retinal thickening equal to or greater than 1 disc diameter and partially within 1 disc diameter of the center of the macula. Another international classification uses retinal thickening associated with the presence of lipid exudates. A mild case exists when exudates are located at the posterior pole, distant from the fovea. In a moderate case, exudates threaten the fovea, and in severe cases the exudates involve the fovea (Figure N8).

Figure N8: Diabetic Macular Edema in its mild stage (non-involved center), moderate stage (center threatened), and severe stage (center involved).



Source for photographs: Wisconsin Reading Center

Fluorescein angiography is useful in the study of diabetic macular edema (DME) and allows it to be classified as one of three types:

1. Ischemic macular edema: Enlargement of the foveal avascular zone (FAZ) with occlusion of the perifoveal retinal capillaries in from 1 to 4 quadrants

2.- Focal DME. When leakage of the dye originates predominantly from retinal microaneurysms. According to the ETDRS, 66% or more of the leakage comes from microaneurysms. This type of DME is associated with circinate lipid rings in whose center microaneurysms are present.

3.- Diffuse DME: More than 33% of leakage in diffuse DME comes not from microaneurysms, but incompetent perifoveal retinal capillaries. In practice, many cases are of a mixed nature (focal and diffuse).

RECOMMENDATIONS:

- Clinical classification is necessary for the management and treatment of a patient affected by DR. This classification must assess the risk of blindness according to the retinal changes found and guide the conduct of a multidisciplinary team.

- Visual acuity is not a factor at any stage of classification, because it is affected only in the very late stages.
- Diabetes is a multisystemic disease. We must warn patients affected by severe diabetic retinopathy that this disease entails a risk three times greater than normal for cardiovascular problems (42), and that if proliferative retinopathy develops it is associated with nephropathy in 50% of cases (43, 44).
- For patients who are impossible to classify, we must assign priority to their referral according to the state of the contralateral eye, duration of diabetes, or metabolic control.
- In cases of long progression, angiography can be done to assess the peripheral retina to detect any peripheral ischemia that may require photocoagulation, or to explain macular edema.

5.- DETECTION OF DIABETIC RETINOPATHY

5.1 Introduction

The concept of screening is that of the mass assessment of subjects who are asymptomatic for a certain disease, and without their having consulted spontaneously. From a theoretical point of view, this medical technique is justified when the disease affects the lives of those who have the disease, is significantly prevalent, allows effective treatment, and is one for which an efficient and highly sensitive diagnostic method exists (45, 46). Screening offers a test for a population, in this case all patients with diabetes mellitus, and those who test positive are referred for further investigation or treatment. The word "screening" comes the idea of the screen, such as a window screen, used as a filter; however, a certain number of patients pass through the screen who have the disease without it being detected (false negatives), while certain others may have been identified as having the disease who really do not (false positives). False negatives and false positives are an inherent part of any screening program; however programs of this type must be careful to minimize the number of these errors by using a quality control process. Therefore, screening 'reduces the risk' for a specific population; it does not eliminate it completely. The greatest attention must be paid in a screening program to reducing the number of false negatives, since these are persons who actually have the disease, but in whom it has not been detected.

WHO has established 10 principles for establishment of a screening program for any disease (47).A screening program for DR with the digital camera meets these criteria perfectly because DR is a recognized public health problem, it's natural history and epidemiology is well understood, it is characterized by a latent period lasting a number of years, the laser provides appropriate treatment, we know who we must treat, and the cost of treating at-risk patients is much lower than the cost generated by treatment in advanced stages. We possess the equipment for diagnosis and treatment, we have a test that is simple, quick, precise, and painless in the form of the camera, and the test is easily accepted by the at-risk population. The last principle to be remembered is that for screening to be an ongoing and systematic process depends on good management of the process, which is fundamental.

5.2 Methods of detection:

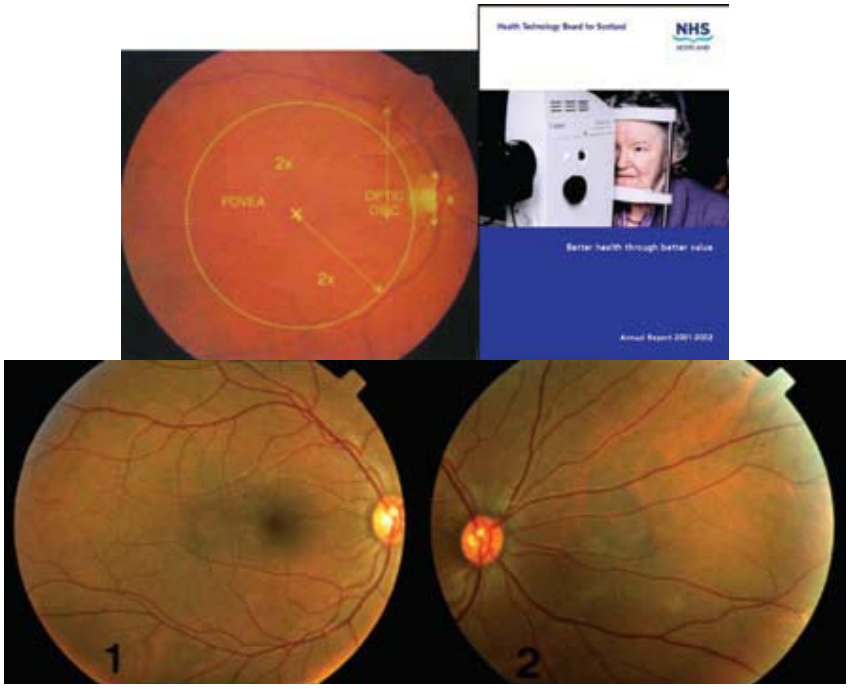
1. Funduscopy done by an ophthalmologist: The examination must be done by an ophthalmologist with a slit lamp and the aid of a special hand lens while the patient's pupil is dilated (48, 49). This manner of doing the funduscopy is considered the "gold standard" to which all other screening methods are compared, as it is currently the method of the greatest specificity and sensitivity.
2. Funduscopy performed by physicians who are not ophthalmologists (general practitioners, internists, or endocrinologists): Direct ophthalmoscope funduscopy without dilation of the pupil has little sensitivity or specificity since the field of vision is restricted, there is no depth perception, and the physician performing usually does not have the appropriate training for the diagnosis and classification of DR, resulting in a large number of false positives and false negatives (49, 50), for which reason this procedure has been discarded as an effective test for DR screening (48, 51, 52).
3. Funduscopy with photographic cameras: Digital photographic systems have been assessed and found to have a sensitivity and specificity comparable to the traditional

method of funduscopy while also being quick, easy to use, convenient for the patient, and most of all, cost effective because only patients with DR are referred to the ophthalmologist, and less specialized personnel can be used in the early stages of the process (50).

One method uses 8 photographic shots of the different quadrants of the retina of each eye. This system, although of excellent specificity and sensitivity, is inappropriate for large-scale screening since it takes a great deal of time, requiring 16 photographs per patient and dilation of the pupil, is tiring for patients and also requires storage of a large number of images that are time-consuming to interpret (49, 53, 54).

Other methods use one or two photographs of each eye (Figure N9) with a non-mydriatic methods and achieve adequate sensitivity and specificity while also being compatible with large-scale projects since the camera shot is performed rapidly (53, 55, 56). The instrument is a special device by which trained personnel take photographs of the fundus of the eye with a digital camera; whereupon the image is sent to a computer for storage or to a tertiary center for later interpretation by an ophthalmologist (56, 57, 58). In a few cases, such as for persons with very small pupils or with initial cataract, the pupil must be dilated in order to take a photograph of adequate quality (53, 58, 59, 60).In Scotland, a single photograph of each eye is used for screening, while in England two are taken of each eye (56, 59).Arguments exist in favor and against each of these choices related to the rapidity of the procedure, patient tolerance, information storage, and the interpretation workload as well as other factors. Both methods are accepted for large-scale programs as long as adequate quality control measures are used (57, 58, 61).

Figure N9: Telemedicine for screening patients with diabetes according to the two-photo (EURODIAB) (62) or single-photo (Scottish) method (63, 64).



Double photo with dilation: courtesy of: Dr. J VerdaguerSingle-photo with non-mydriatic camera
Courtesy of: Dr. D Yorston

The great majority of diabetics who enter screening programs using the photographic camera do not require further examination by an ophthalmologist except in cases of retinopathy, doubtful diagnoses, or cases where the photograph cannot be interpreted. In Scotland, only 20% of screened diabetics must be assessed by an ophthalmologist, thereby reducing overloading in ophthalmology departments and reducing waiting time for visits (57, 58, 61, 65, 66). Digital photography systems therefore allow an increase in the number of patients assessed and consequently improve funduscopy coverage of the population while allowing the use of telemedicine for screening in locations where an ophthalmologist is not available (64, 67).

However, we must not forget that some disadvantages also exist for the digital method, such as the high cost of implementation, no less than $20,000, the difficulty of diagnosing macular edema and retinopathy in areas outside the photographic field, and the possibility of computer problems that cause loss of information.

5.3 Screening and diagnosis

It is important to stress the difference between a screening system and a diagnostic system. A screening system passes the population studied through a filter, to determine which patients have reached a predetermined threshold for a condition and should be referred for more specific studies to verify the finding. Screening must be done with a test that is rapid, simple, and well tolerated by the patient, and which detects persons who are at risk without attempting to reach a definitive diagnosis. On the other hand, more complex, costly, and time-consuming testing is needed to confirm a diagnosis, and for our purposes must be done by an ophthalmologist.

5.4 Target Population

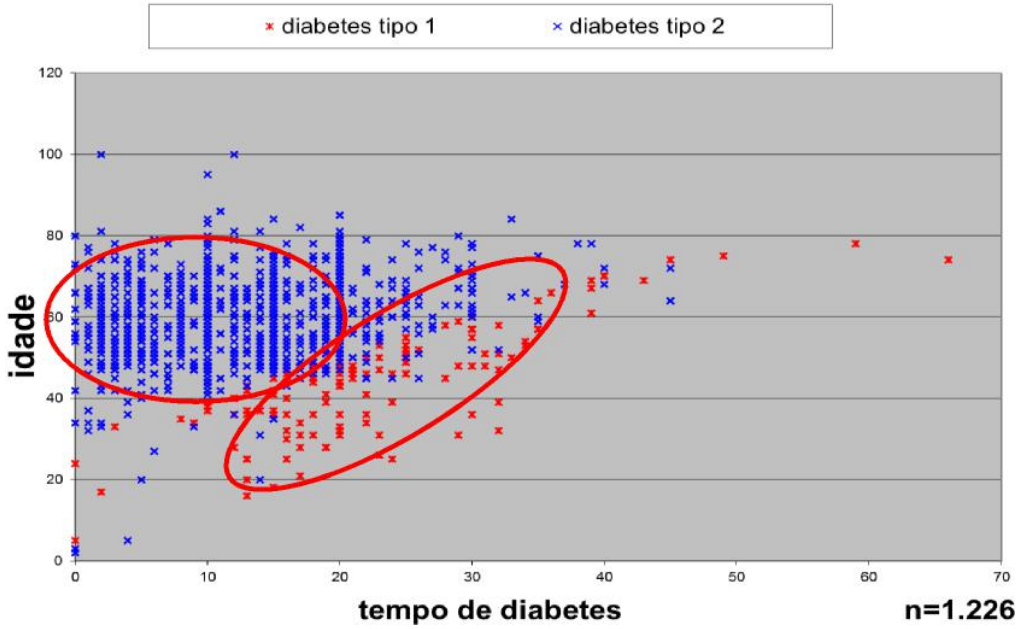
The population to be screened consists of all known diabetics in a given area or region whether they have type I, type II, or gestational diabetes.

When that is not possible, we should consider concentrating on high-risk groups, with priority being given to all those with Type 1 (10% of cases), persons over age 50 (in Mexico, perhaps all over age 40), those with Type 2 diabetes of more than 10 years progression, and those who are pregnant or show nephropathy or poor metabolic control.

The standard of care would be to examine all patients with type II diabetes beginning at the time of diagnosis, and all those with type I diabetes patients beginning five years after diagnosis. In Graph N1 one can see that there is disparity in timing relative to diagnosis of laser treatments done on persons with type I diabetes compared to the cases of diabetes type II, for which treatments are spread over all the phases of progression from the time of diagnosis.

Graph N1: Distribution of patients with high-risk retinopathy by age and time passed since diagnosis(Source: Dr. Paulo Henrique Morales).

FIGURA 8- DISTRIBUIÇÃO DOS PACIENTES COM RETINOPATIA DIABÉTICA DE ALTO RISCO NAS DIFERENTES IDADES E TEMPO DE DIAGNÓSTICO



5.5 Complementary examinations

Once patients with retinopathy and risk of vision loss have been identified, or in cases where there is a doubt about the diagnosis, the ophthalmologist may decide to

use other complementary examinations such as retinal fluorescein angiography or optical coherence tomography (OCT). The methods used for diagnosis, necessary to determine the actions to be taken, are:

a.- Angiography: Presents initial vascular lesions, non-perfused areas, ischemic areas, intraretinal microangiopathy, and neovascularization. This allows definition of the laser treatment to be done and assessment of the therapeutic response.

b.- Ultrasound is indicated to assess areas of vitreoretinal traction or retina detachment, or in the case of vitreous hemorrhages that obscure the view of the retina. It is advisable to schedule the surgery.

c.- Optical coherence tomography (OCT): Assess macular edema and therapeutic responses as well as the vitreoretinal interface.

RECOMMENDATIONS:

- Regular exams should be done at intervals of no greater than one year to avoid late detection and treatment and the ensuing risk of irreversible vision loss.
- In type I diabetes the risk of diabetic retinopathy begins at five years after diagnosis or 3.5 years post-puberty, but almost 38% of patients with type II diabetes initially present with undiagnosed diabetic retinopathy.
- During pregnancy, up to 78% of cases show progression of retinopathy, for which reason exams are recommended every three months.

6.-TREATMENT:

6.1. Orientation for clinical therapy

Diabetic retinopathy is asymptomatic in a large number of patients even in its most severe forms, and due to the need for early treatment, the question of how to accomplish early detection and treatment must be considered. Assessment according to the type of diabetes is shown in table N3.

TABLE 3: Ophthalmological assessment according to the type of diabetes

Age and diabetes type		1st Review	Follow up
Type 1	0 to 15 years	5 years after diagnosis of DM	Annual
TYPE 1 TYPE 2	15 to 30 years or More than 25 years	At the time of diagnosis of DM	Annual
Gestational		Before pregnancy or during 1st trimester	Every 3 months

6.2.-Medical treatment

Strict metabolic control delays the progression of diabetic retinopathy. Strict control of arterial hypertension, lipid profile, and nephrology also offer advantages in delaying the progression of diabetic retinopathy (Table N4). None of the suggested medical treatments are a substitute for laser photocoagulation. Insulin does not aggravate the course of retinopathy, but strict metabolic control can cause worsening of DR, a possibility to which we must be alert.

Table 4: Orientation of medical treatment

ACTION	RECOMMENDATION
GLYCEMIC CONTROL	Any reduction of HbA1c avoids progression of DR. Patients with DR, HbA1c (glycosylated hemoglobin) <7.0% is ideal.
Control of Hypertension	Any reduction of diastolic or systolic pressure is useful in inhibiting the progression of DR.
Lipid Control	Reducing levels of LDL cholesterol reduces the risk of macrovascular complications and is useful for the macular edema.

Ref: Brazilian Society of Retina and Vitreous)

6.3 Treatment of diabetic retinopathy:

The treatments currently used for diabetic retinopathy are:

- Laser photocoagulation
- Intravitreal medical therapy
- Surgical treatments using vitrectomy

The visual prognosis for patients with proliferative diabetic retinopathy is poor without proper treatment. Studies of its natural history show that 50% of cases with proliferative retinopathy become legally blind at five years progression according to earlier studies (53).

6.3a Laser photocoagulation

The treatment for diabetic retinopathy is laser photocoagulation. Treatment by photocoagulation done in a proper and timely fashion succeeds in delaying or avoiding progression in 90% of cases of advanced or initial non-proliferative diabetic retinopathy, thereby allowing the preservation of useful vision. Laser treatment of patients with high-risk proliferative retinopathy reduces severe vision loss (20/400 or worse) by 50%.

Various types of lasers exist, each with different wavelengths; however there is no evidence that any particular one is superior. Solid-state lasers are those currently in most common use, and require the least maintenance. Diode lasers produce a deep burning effect, which produces a painful sensation. Solid-state Nd:YAG lasers work in the green spectrum, and its light is visible. It performs in a way that is similar to the argon laser. Treatment is performed with a laser mounted with a biomicroscope, which is indispensable in macular treatment, or with binocular-indirect ophthalmoscopy or an endolaser (endovenous laser) probe for surgery.

INDICATIONS FOR LASER PHOTOCOAGULATION:

- Severe nonproliferative diabetic retinopathy
- Proliferative diabetic retinopathy (rubeosis iridis)
- Diabetic macular edema

Early photocoagulation may be recommended in very special cases such as when cataract surgery is imminent, systemic complications such as nephropathy in dialysis exist, or when there is proliferative retinopathy in a single eye and the contralateral eye does not respond to laser, or for patients with poor systemic control and poor compliance, or who live distant from the treatment center or in extremely rural areas.
The recommended photocoagulation techniques are:

1.- Mild panretinal photocoagulation (extensive, mild, open)
2.- Full panretinal photocoagulation (complete, closed, true)

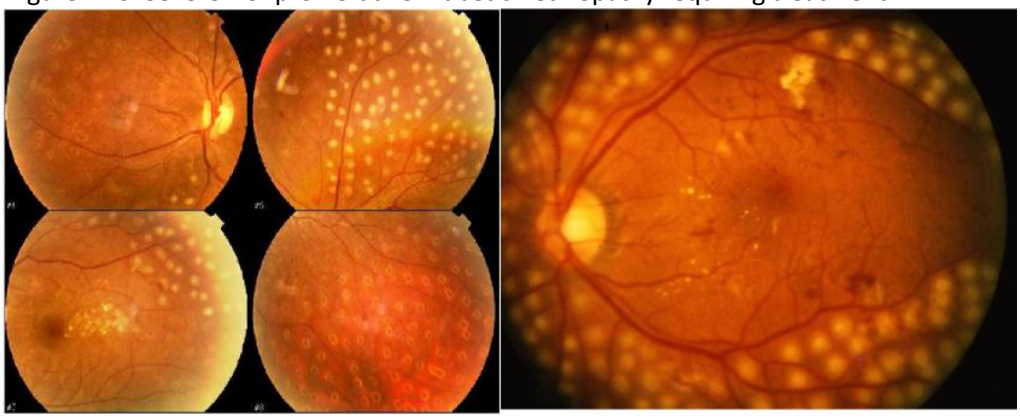
MANAGEMENT OF DIABETIC RETINOPATHY:

In Latin America a consensus exists to treat cases of severe nonproliferative retinopathy or retinopathy in proliferative phases without signs of high risk with mild, or extensive photocoagulation of 1000 or less non confluent burns separated by the distance of one burn-area) and with sufficient intensity to "gently cleanse" the retina applied in one or two sessions.

A magnifying lens such as the quadraspheric lens is used, the Goldman lens has a spot size of 500 µm and 300 µm in the wide-angle magnifying lens (Figure N10). This treatment can stabilize retinopathy at this stage, and is not disfiguring since it respects the visual field and dark adaptation.

Proliferative retinopathy with high-risk signs is treated with "full", or "complete" photocoagulation in which greater ablation of the retina is the goal. This requires 1200 or more burns, to cleanse the retina (greater intensity) separated by the distance of one-half burn, avoiding the macular area, and carried out in from 2 to 4 sessions in treating all of the retina except for an area of one disc diameter around the optic nerve and the space surrounding the center of the fovea between the fovea and optic disc. The treatment can compromise the visual field or dark adaptation and can reduce central vision due to aggravation of macular edema, facts of which the patient must be informed, remembering always that this treatment is done to stabilize the retinopathy and halt its progression, not to improve visual acuity. Other complications include vitreous hemorrhage, accidental photocoagulation of the fovea, or exudative detachment of the retina or choroid. It is indicated for cases of rubeosis and/or neovascular glaucoma. The presence of scarring due to panretinal photocoagulation makes observation of revascularization using non-contrast examinations impossible.

Figure N10: Severe Nonproliferative Diabetic Retinopathy requiring treatment



Courtesy of: Dr. J Verdaguer

CERTAIN CONCEPTS CONCERNING INITIAL MANAGEMENT WITH LASER

- A lack of laser treatment or treatment rejection can lead to irreversible vision loss, and for this reason screening should be done at least once a year.

- A high percentage of cases of retinopathy stabilize when treated with from 1500 to 2000 laser burns. In cases when retinopathy progresses, more photocoagulation should be done. - If the proliferative changes are not reversed, some 500 burns should be added. If proliferative diabetic retinopathy progresses in spite of full panretinal photocoagulation, the patient should be referred to a retinal-vitreous surgeon for treatment.

P.S. A laser photocoagulation center is needed for every 250,000 to 500,000 inhabitants. It is estimated that 5% of diabetics assessed in Latin America should be treated by laser.

6.3b.- Intravitreal therapy:

Intravitreous drugs have a temporary effect, and should therefore not be considered a substitute for laser treatment, nor should they be used in an isolated fashion or as monotherapy, but should be taken as adjuvant therapy, especially for the management of macular edema or prior to vitrectomy. However, no evidence exists concerning their long-term effects, nor do we have clinical guides concerning their use in retreatment.

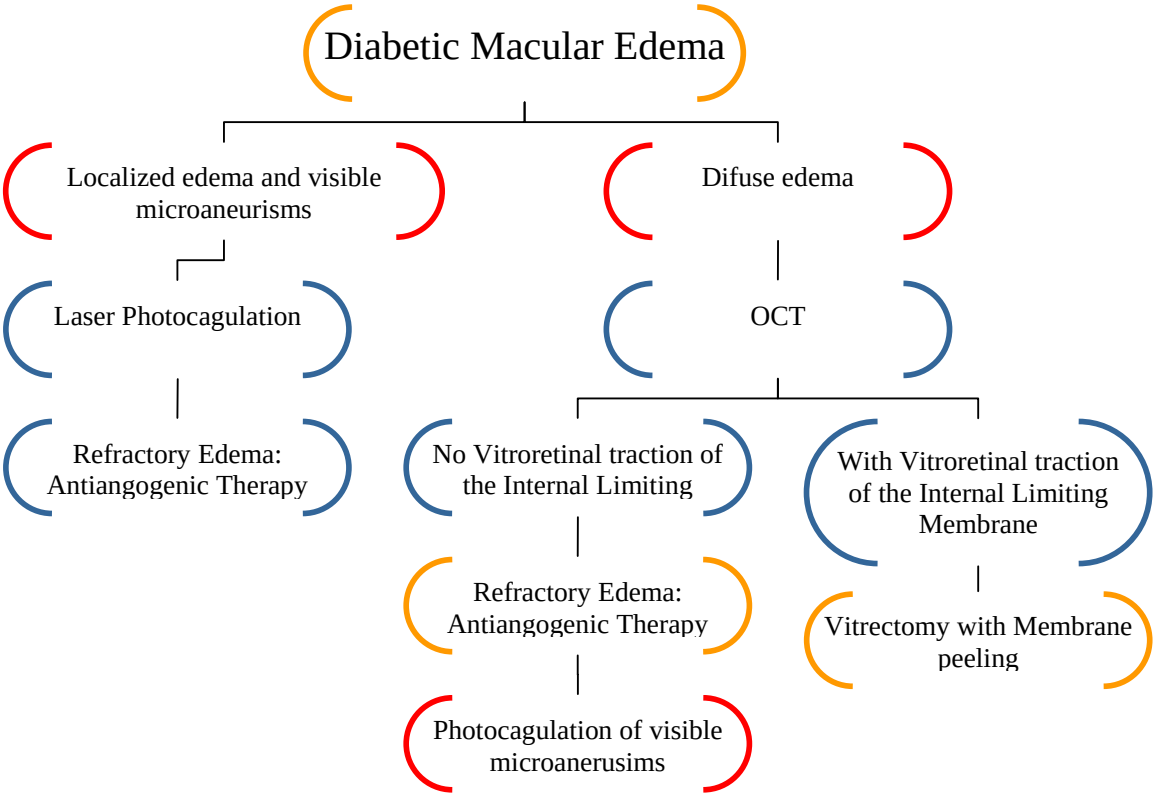
Several pharmacological components have been proposed for the adjuvant management of clinically significant macular edema or neovascularization including steroids such as triamcinolone acetonide or long-acting dexamethasone (Ozurdex-Allergan) that are coming onto the market, or antiangiogenic (anti-VEGF) agents including the available drugs bevacizumab, ranibizumab, and pegaptanib.

- Triamcinolone, which is used for diffuse macular edema. A randomized study to assess its efficacy compared to photocoagulation did not show superiority over a period of three years follow-up, but did find an increased risk of cataract and ocular hypertension (69).
- Antiangiogenic agents, improve macular edema and reduce neovascularization of the retina. A recent clinical trial on the management of diabetic macular edema carried out by the Diabetic Retinopathy Clinical Research Network*(DRCR.net) (70), randomized 854 eyes into four groups and show that ranibizumab (Lucentis™) associated with immediate or deferred laser treatments (≥ 24 weeks) achieved better results than treatment with laser alone or associated with triamcinolone. This study did not evaluate other anti-VEGF drugs such as bevacizumab (Avastin®), although studies such as the Pan-American Collaborative Retina Study Group (PACORES) (71) suggest that this drug is equally effective in the treatment of DME. Small studies that have used bevacizumab or ranibizumab in the management of macular edema have found an initial mild improvement with regression of the edema, but required several injections to achieve prolonged control (72), which can also have adverse effects. Anti-VEGF agents have also been used in diabetics prior to vitrectomy for the purpose of facilitating surgery.

MANAGEMENT OF MACULAR EDEMA

The ETDRS study showed that treatment of clinically significant macular edema with focal or grid laser reduces the risk of vision loss by 50% compared with the control group (24% vs. 12%). A simplified system of management is suggested (Figure N11) using a modified version of the ETDRS protocol and requiring a angiographic study to classify the macular edema as focal or diffuse and to exclude macular hypoperfusion as well as performance of optical coherence tomography (OCT) to detect vitreomacular traction.

TABLE 11: Simplified management of diabetic macular edema



In sum, fluorescein angiography (FA) and OCT should be done on all patients with diabetic macular edema to guide the management of the disease.

a.- In patients with typical focal DME, with a circinate ring that involves or threatens the macula and leaking microaneurysms in the center of the ring and outside the foveal avascular zone, the treatment should be direct and selective focal laser photocoagulation of the leaking microaneurysms, leaving a slight mark with a spot of 50 microns at the minimum time.

b.- The evidence supplied by DRCR.net has modified our treatment method for patients with diffuse or mixed DME. The best results were obtained with intravitreous injections of antiangiogenic agents followed by delayed laser treatment (6 months). A minimum of four injections are used, after which an assessment is done, with it being possible to halt injections if vision has normalized or if the central foveal thickness is less than 250 µm. Laser treatment involves treating all the microaneurysms and using a grid over the thickened retina, extending from 500 to 3000 µ above, below, and nasal of the fovea, except within 500 microns of the optic nerve. Laser treatment may be repeated if DME persists and the treatment is judged incomplete.

- Treatment with intravitreal triamcinolone followed by laser should only be considered in pseudo-aphakic patients.
- This treatment should be followed by monthly checkups of the patient for the first year. Only half of patients have substantial improvement of vision using this regimen. The patient should be advised of this fact.

c.- If macular ischemia is detected in the fluorescein angiography with occlusion of the perifoveal capillaries, medical therapy is discouraged because the treatments are ineffective.

d.- If the OCT shows vitreomacular traction as the cause of DME, the treatment to use is surgical, using a vitrectomy.

RECOMMENDATION:

- Do not forget that the first measure to be taken in the management of DME is to optimize, to the extent possible, glycemic control and hyperlipidemia. Treatment of DME should be carried out by a retina specialist.

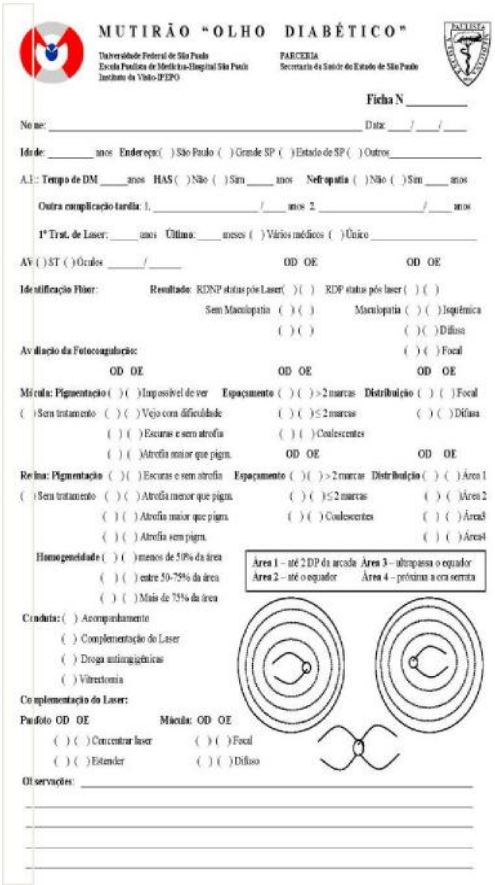
6.3.c.- Surgery: Vitrectomy

The basic objective of a vitrectomy is the removal of vitreous hemorrhages while repositioning the retina and avoiding progression of retinopathy by removing the hyaloid membrane posterior to the vitreous, which serves as a base for neovascularization and thereby triggers contraction of the fibrovascular tissue, which may cause tractional detachment of the retina. This facilitates the laser treatment that will finally stabilize the retinopathy in many cases.

The indications for vitrectomy in diabetic retinopathy are:

1. In severe vitreous hemorrhages which are not being reabsorbed, an early vitrectomy is recommended accompanied by endophotocoagulation in those patients previously untreated with laser or who have lost vision in the other eye, and in patients with type I diabetes and rubeosis iridis
2. Active PDR that persists in spite of full panretinal photocoagulation
3. Pre-retinal or partial vitreous hemorrhage which does not allow for effective photocoagulation
4. Tractional retinal detachment with macular involvement.
5. Mixed tractional/rhegmatogenous retina detachment
6. Patients with DME and significant vitreoretinal traction

Vitrectomy, in cases with a good prognosis and with no macular involvement, is one of the most effective methods for vision recovery from blindness associated with diabetic retinopathy, with vision superior to 20/100 achieved in almost 80% of cases, although this functional result does depend on retinal circulation and the anatomic condition of the eye before surgery. Under favorable conditions more than 90% of retinopathy cases are stabilized over the long term if no surgical complications are present within the first few postoperative weeks.


MUTIRÃO "OLHO DIABÉTICO"

Universidade Federal de São Paulo
Escola Paulista de Medicina-Hospital São Paulo
Instituto da Visão-IPEPO

PARCERIA
Secretaria da Saúde do Estado de São Paulo

Ficha N _____

Nome: _____ Data: ___/___/____

Idade: _____ anos Endereço: ( ) São Paulo ( ) Grande SP ( ) Estado de SP ( ) Outros _____

A.I.: Tempo de DM _____ anos HAS ( ) Não ( ) Sim _____ anos Nefropatia ( ) Não ( ) Sim _____ anos

Outra complicação tardia: 1. _____ / _____ anos 2. _____ / _____ anos

1º Trat. de Laser: _____ anos Último: _____ meses ( ) Vários médicos ( ) Único _____

AV ( ) S/T ( ) Óculos _____ / _____ OD OE OD OE

Identificação Fiber: Resultado: RDNP status pós Laser( ) ( ) RDP status pós laser ( ) ( )
Sem Maculopatia ( ) ( ) Maculopatia ( ) ( ) Isquêmica
( ) ( ) ( ) ( ) Difuso
Avaliação da Fotocoagulação: ( ) ( ) Focal
OD OE OD OE OD OE

Mácula: Pigmentação ( ) ( ) Impossível de ver Espaçamento ( ) ( ) > 2 marcas Distribuição ( ) ( ) Focal
( ) Sem tratamento ( ) ( ) Vejo com dificuldade ( ) ( ) ≤ 2 marcas ( ) ( ) Difuso
( ) ( ) Escuras e sem atrofia ( ) ( ) Coalescentes
( ) ( ) Atrofia maior que pigm. OD OE OD OE

Retina: Pigmentação ( ) ( ) Escuras e sem atrofia Espaçamento ( ) ( ) > 2 marcas Distribuição ( ) ( ) Área 1
( ) Sem tratamento ( ) ( ) Atrofia menor que pigm. ( ) ( ) ≤ 2 marcas ( ) ( ) Área 2
( ) ( ) Atrofia maior que pigm. ( ) ( ) Coalescentes ( ) ( ) Área3
( ) ( ) Atrofia sem pigm. ( ) ( ) Área4

Homogeneidade ( ) ( ) menos de 50% da área
( ) ( ) entre 50-75% da área
( ) ( ) Mais de 75% da área

Área 1 – até 2 DP da arcada Área 3 – ultrapassa o equador
Área 2 – até o equador Área 4 – próximo a ora serrata

Conduta: ( ) Acompanhamento
( ) Complementação do Laser
( ) Droga antiangiogênicas
( ) Vitrectomia

Complementação do Laser:
Pan foto OD OE Mácula: OD OE
( ) ( ) Concentrar laser ( ) ( ) Focal
( ) ( ) Estender ( ) ( ) Difuso

Observações: _____

The surgery should be performed by a trained surgeon with the appropriate equipment such as a vitrector, microscope, image-reversing observation system, high velocity vitrectomy machine, endolaser, and safety glasses. The best manner to reduce costs is by increasing the number of patients treated per unit.

It is necessary to have a vitrectomy surgical unit for every million inhabitants and perform at least 500 procedures annually.

6.D Quality Control for Photocoagulation

Once photocoagulation has been performed, what has been done must be recorded in the surgical protocol according to the condition of each patient. It must be noted in the protocol whether a full or mild photocoagulation was done, whether it was possible to complete it or if untreated areas exist, the number of burns made, average potency, the quadrants treated, and treatment performed in the macular area, along with other variables according to the standards of each laser facility.

We should also monitor a panretinal photocoagulation done at each training or patient treatment center for the purposes of training or if necessary, for improvement of the procedures. Assessment by ophthalmoscopy and angiography of 5% of the procedures performed to evaluate the procedure should be considered. A good example to follow is that of the Federal University of São Paulo Brazil, where a quality control protocol is in existence and has been demonstrated by Dr. Paulo Henrique Morales (Figure N12). Figure 12: Quality control protocol used at the Federal University of São Paulo (Source: Dr. Paulo Morales)

6.E Recommendations

Guidelines for the management of retinopathy are shown in Table N5 as a quick guide. TABLE 5: Guidelines for Treatment of Retinopathy

Panretinal photocoagulation	Use of a mild (complete) pattern is recommended in patients with severe nonproliferative DR or proliferative DR with no high risk signs. A full (extensive) pattern is indicated immediately for patients with proliferative DR and signs of high risk.
Macular photocoagulation	In patients with focal DME. In diffuse or mixed DME, complementing intravitreal antiangiogenic agents. Angiography should always be used to exclude macular ischemia.
Intravitreal steroids	Triamcinolone as adjuvant treatment for management of macular edema only in cases of diffuse DME in pseudophakic patients, followed by focal and/or grid laser. Risk of ocular hypertension. Not a substitute for laser treatment and increases risk of cataract
Antiangiogenic agents	Treatment of diffuse or mixed macular edema in association with focal and grid laser. Reduces neovascularization in the retina Requires repeated injections.
Vitrectomy	Early vitrectomy (no more than 3 months) in patients with vitreous hemorrhage or proliferative DR not responding to photocoagulation or without previous photocoagulation. Treatment of choice in cases of diffuse macular edema or with evidence of vitreomacular traction.

RECOMMENDATIONS:

- A photocoagulation facility is needed for every 250,000 to 500,000 inhabitants. - Panretinal photocoagulation (PFC) must be completed to have an effect.
- PFC may produce mild loss of central and peripheral night vision. One should be warned that during treatment in cases of proliferation, a vitreous hemorrhage may occur.
- Intravitreal injections are temporary treatments and adjuvant to laser or vitrectomy, and should be avoided when inappropriate.
- This treatment *can* halt the progression of DR, with control of diabetes being the most important indication, especially for diabetic macular edema.
- A surgical facility for vitrectomy is needed for every 1 million inhabitants and should perform a minimum of 500 operations annually.

7 PREVENTION AND EDUCATION:

7.1 Background:

The vital points to be made known about diabetes are:

- That diabetes carries a real risk of blindness,
- That diabetic retinopathy is asymptomatic in its early stages and is detected by funduscopy,
- That annual examination of the retina by a trained ophthalmologist or by photography is essential for all diabetic patients,
- That treatment helps to retain useful vision if it is done before vision loss occurs,
- That ophthalmologists must know how to assess, classify, and treat DR, and That photocoagulation must be part of residency programs in ophthalmology.

RECOMMENDATIONS:

A retina department is needed for every 500,000 inhabitants.
Alliances must be formed with practicing experts in diabetes and other health care professionals for the purposes of education and prevention of blindness caused by DR.

7.2 Primary Prevention in Diabetes Mellitus:

The objective of primary prevention is for the general population to avoid developing diabetes. This is achievable through education of the general population in the control of risk factors and lifestyle improvement. Primary prevention is the most effective action from the cost-benefit point of view. Management of diabetes is the responsibility of both medical personnel and the patient.
Messages that should be transmitted include:

- That diabetes is preventable with a healthy lifestyle including control of weight and physical activity. The five recommendations made are: move around, drink water, eat fruits and vegetables, monitor yourself, and share the information (73).
- Having regular medical checkups for early diagnosis reduces the risk of complications.

7.3 Prevention in Diabetic Retinopathy

The objective is for the diabetic patient to avoid complications such as diabetic retinopathy. Prevention of retinopathy in diabetes mellitus is carried out at three levels:

7.3.1 Primary Prevention: Avoiding retinopathy in diabetic patients.

Strict control of glycemia, blood pressure, and lipid levels has been shown to delay the appearance of diabetic retinopathy (74,75). In type II diabetes, strict control of glucose also reduces the risk of maculopathy.
To avoid diabetic retinopathy (DR) we must:

1. Health education: Change the lifestyle of patients with risk factors such as obesity, metabolic syndrome, or hyperinsulinemia.
2. Monitor the control of diabetes with glycosylated hemoglobin
3. Physical activity and reduce overweight
4. Remember that any diabetic can develop DR that leaves him or her blind without early treatment

5. That vision does not provide a useful indicator of the severity of DR
6. Perform periodic funduscopy

7.3.2 Secondary Prevention: Detect and treat diabetic retinopathy early to avoid vision involvement and thereby reduce costs:

1. Improve screening coverage for all registered diabetic patients Consider using telemedicine
2. Ensure early treatment with laser upon detecting severe nonproliferative diabetic retinopathy or retinopathy in any proliferative stage.

7.3.3 Tertiary Prevention This includes restoring lost vision or post-loss rehabilitation:

1. Management of clinically significant macular edema, whether with laser (focal), intravitreal injection (in diffuse edema without traction), or vitrectomy (diffuse with macular traction)
2. Management of vitreous hemorrhage with early and appropriate vitrectomy, since this is one of the most effective techniques for reversing blindness
3. Consider supporting with visual aids for low vision if needed

7.4 The Value of Education in Prevention Programs

Education of the patient and family should be done with clear messages. This is a shared responsibility of the treating physicians, ophthalmologists, other healthcare personnel, and community leaders for the purpose of achieving early detection and early referral. Some recommendations are:

- *Education* is a priority in prevention, and must contain clear warning messages as well as patient orientation to avoid vision loss.
- Educational programs should promote *self-care* by the patient and the at-risk population, who must be identified at the primary level.
- Education must be continuous and be coordinated with medical, professional, and technical education to be sustainable. Programs must be assessed and measured by the results to identify good practices and ensure their promotion and duplication.
- Educational intervention at the primary level is low-cost, and has the objective of changing lifestyles to avoid development of diabetes. At the secondary level, education must encourage patients to get checkups, and at tertiary level encourages patients to comply with the indicated treatment.
- Education for primary healthcare personnel must include nurses, technical assistance, and community leaders or other motivated personnel for functions such as promotion, registration of diabetic patients, education, and logistical support.

Recommendations to Implement in Preventative Programs:

- These programs must have the support of community leaders to identify patient knowledge, attitudes, and practices in order to modify them and counteract traditions, myths, and fears to encourage changes and compliance with treatment.
- Programs for the prevention of DR must be optimized by including and involving other relevant medical specialties in order to achieve joint multidisciplinary goals.

8. HOW TO CREATE A RETINOPATHY PROGRAM:

8.1 Starting a diabetic retinopathy program:

The following recommendations should be considered:

a. Have and use a clinical guide with a simple classification system that is clinically relevant and achieves minimal interobserver variability that can be monitored. This should serve as the basis for an educational program for the patients, physicians, and ophthalmologists.

b. Choose a screening strategy that takes into account the equipment and human resources available. A number of detection strategies have been described, and we must choose one that is sustainable and acceptable to patients and healthcare professionals.

c. Create laser treatment centers. In Latin America, is estimated that at least one laser center capable of offering intravitreal injections is needed for a population of 250,000 to 500,000 Additionally, one vitrectomy-capable surgical center capable of handling 500 cases annually while optimizing results and minimizing costs is needed for each million inhabitants.

d. Long-term sustainability plan using copayment or subsidies that may be provided by governments, nongovernmental organizations, insurers, service organizations (such as the Lions or Rotary clubs), or organizations of diabetes patients.

Based on future projections of diabetes, a set of recommendations were agreed on in the first workshop in Quito in 2009. These included determining which countries had defined diabetic retinopathy as a health priority and proposing a study in Latin America carried out by ophthalmology societies to gather information concerning the availability and geographical distribution of:

a. Special equipment (laser, vitrectomy) for retinopathy programs in the public and private sectors

b. Human resources such as ophthalmologists with training in the treatment of diabetic retinopathy and paramedical personnel

In addition, multidisciplinary teams should be formed to assist patients with diabetes in an integrated manner and consider suggestions such as

a. Formation of screening teams, only when it is possible to provide adequate treatment to the patients detected
b. That residency programs in ophthalmology in Latin America include training in detection and laser photocoagulation for nonproliferative retinopathy
c. Include general-practice physicians, internists, endocrinologists, family members, and others affected by diabetes and/or retinopathy in programs for the detection and management of related eye problems

8.2 Components of a screening program:

The following description of a screening program for DR is based on that used in Scotland, one of the leading countries in this field. It is a national screening program that uses digital photography and a system of levels or networks for image interpretation. The program is structured so that patients with diabetes are photographed at the local level and the photos are sent electronically to regional centers for reading and interpretation by Internet or in digital format such as on DVDs. Two types of screening locations are used: One type is fixed, located in various clinics or hospitals, while mobile units consist of a photographer who travels with the camera to distant sites or those that are difficult to access.

The photographs are classified in the first stage as with/without retinopathy

(58) by trained personnel and certified as such. Photographs showing DR, that are uncertain, or not interpretable, are referred to a second level for interpretation, and cases showing high risk of vision loss are immediately referred for evaluation by an ophthalmologist.

Photographs that cannot be interpreted because they are not clear or are not correctly centered are considered technically defective (54). The majority are due to untreated cataract, although others are caused by poor dilation, the presence of intraocular lenses, or media opacity, among other causes. All patients whose photographs show technical defects should be referred to an ophthalmologist (54, 58, 76).Quality management is important since a large number of technical defects will mean a greater number of referrals to the ophthalmologist, a situation that should be avoided. Once the photographs have been interpreted and classified, a national call center will be in charge of contacting the patient and scheduling the next screening visit. If consultation with an ophthalmologist is needed, the same center is responsible for making the corresponding arrangements.

Software is being looked into that would automatically detect the presence of DR without the need for trained personnel, which would increase interpretation speed (77, 78) and delivery of results, in turn reducing the cost (61). However, none of these programs are yet ready to use with patients since they are in an experimental phase.

8.2.1 Identification of diabetic patients

Before carrying out a DR detection program, it is necessary to know which patients in the selected population have diabetes. This can be accomplished using a registry of patients with diabetes, or from patient records, or the records of insurance companies or clinics, or even by public calls for volunteers with diabetes.

8.2.2 Mechanism for patient recall: System for appointments and calls

One essential component is a system for registering diabetics to be screened in a database. This registry is the trigger for the system of appointments and reminders for funduscopy screening for all the patients in a region by letter, text message, or by telephone. The majority of diabetics will be screened only once a year. Those who do not attend should be called in again. Doing this requires maintaining an accurate database of patients who have been screened to guarantee the continuity of the program.

8.2.3 Alternatives in case of technical problems: A small portion of patients to be screened cannot undergo this for technical reasons such as physical or mental disability that does not allow them to position themselves correctly for the camera or who do not cooperate. These patients should be screened by an ophthalmologist in the usual manner, using indirect ophthalmoscopy or a slit lamp. Ideally this should be done at the same time and place in which photographic screening is being conducted.

8.2.4 System of referrals and counter-referrals: Screening using photography is not a system of diagnosis, and only indicates the presence or absence of retinopathy. The patients identified should be referred to an ophthalmologist for definitive diagnosis and for treatment in cases of high risk of blindness. The system of counter referrals is equally important for learning what has been done with the patient in question. Other diseases such as a glaucomatous optic disc or suspected glaucoma or age related macular degeneration will also be detected by screening programs and such patients should also be entered into the referral system.

8.2.5. Quality control: False positives and false negatives will occur in any screening program, the objective being to safely minimize the number these events and identify

any failure in the screening system. A randomly chosen sample of images created by the trained personnel should be rechecked by an experienced ophthalmologist. If discrepancies are found, training should be improved.

8.2.6 Program strategy Table N6 shows the camera or ophthalmoscopy strategies used for patients known or not known to have diabetes.

Table N6: Recommendations by patient condition and detection method.

Known diabetics →	**Not known to be diabetics**
Regional/National Program	**Screening Campaign**
Known diabetics in an area are invited for screening	**Community is invited to screening**
Disadvantages: Expensive. Requires database and costly administration. Disadvantages: Requires ophthalmologist willing to do weekly exams. Limited quality control. Can be costly over long term.	Advantages: Possible to screen all diabetics in a region Referrals can be planned. Superior quality control. Advantages: Low cost. Easy to implement. Should include all diabetics attending the clinic. Interrelates ophthalmological and other diabetic care.
Disadvantages: Who attended is unknown. Referrals arrive sporadically and irregularly. Limited quality control. Depends on volunteer ophthalmologists and therefore not sustainable.	Advantages: Mobilized by radio, newspapers, etc. Reaches large number of people who wouldn't normally have access Telemedicine is possible. Advantages: Population mobilized by radio, newspapers, etc. Reaches large number of people who wouldn't normally have access Telemedicine not possible.

8.2.7 Recommendations

1. The photographic screening method can attain high funduscopy coverage among persons with diabetes in a determined region, increasing the productivity of the professionals involved.
2. The photographic screening method drastically reduces waiting times for screening (improving accessibility) and optimizes specialized human resources, referring a small number of the subjects with diabetes to an ophthalmologist (20%), and reducing costs by using technical personnel in the first step of the process.
3. The photographic screening method also permits diagnosis of other eye diseases in the diabetic population who report for screening, such as cataract, drusen, macular degeneration, or signs of glaucoma and other diseases.
4. The funduscopy photographs remain stored digitally as a medical documents and can be used in telemedicine, for teaching, or for quality control of the interpretation.
5. To implement a photographic DR screening system, the medical organizations participating should possess:

> A computerized information system with an up-to-date database for diabetics in the region.

> a trustworthy system for referrals and counter referrals

> an efficient electronic or manual appointment management system (call center).

The program should be ongoing, systematic and long-term, and administrative management is an important part of this.

8.3- Advocacy in diabetic retinopathy:

8.3.1 What is advocacy? (lobbying or advocacy): Advocacy is the ability to influence actors with decision-making power to develop processes that help to improve the eye health of the most vulnerable population.

8.3.2 How to include advocacy in a program In preparing a plan the objective must be chosen intelligently, following a basic outline:

1.- 1. Where we are: the current situation and prevalence of the disease
2.- What the problem is: To define the problem, we must listen to the community.
3.- The healthcare resources available: Identify physicians, hospitals, resources, infrastructure and other things that could be useful.
4.- What we are already doing: Small changes can have a big impact.
5.- What is lacking: Once the unmet need has been defined, we must use advocacy to reach our objective.
6.- Where do we want to go?: There are always a number of good ways to solve a problem.

8.3.3 What is the current situation? A universal problem in ophthalmology the inability to satisfy the demand associated with:

1.- Deficits in the ability to provide attention associated with demographic changes (aging), changes in lifestyle (diabetes), and economic and cultural inequality or rural locations, among other factors.

2.- Changes in the population, with more vulnerable groups such as children, the elderly, and women and a "subsidy culture" that creates patients with high expectations

and access to the mass media thereby increasing lawsuits related to medical practice (and thereby further "judicializing" medicine) if they are not satisfied with the results.

This shortfall in ophthalmological care due to increased demand is politically "very profitable". Combined with the above, the lack of awareness among the medical community of the necessity for advocacy impedes the development of technically oriented strategies, and favors the opportunistic efforts of quacks, commercial optometry, or programs imposed from outside. This is why there is a lack of eye health policies due to a lack of technical support from public health sectors for the development of clinical protocols, meaning that many good ideas are lost for lack of advocacy. An action plan begins with a strategy for solutions that must be agreed to in the framework of a "working group" following the idea of "*one vision one voice*", adjusted to the local circumstances, by identifying the decision-making target and seeking alliances with groups friendly to our proposals and with whom we may work together. The message must be clear and have precise objectives directed at the most vulnerable population, and have the objective that someone (a person or audience) "buys" the idea. In this effort 50% of the task is in having a good idea, and 50% is in knowing how to present the idea, meaning that the transmission of the message is dependent on the art of presentation. The worst thing to do is to transmit a message that is not convincing, does not seem to follow a logical sequence, and is not oriented to the audience. The message, directed at the most vulnerable population, must ensure better coverage while also ensuring quality care, and show means for sustainability in the face of continuing costs. Once the message has been formulated, we come to the stage of negotiation, where we must: a. Prepare the meeting, b. Include an initial informative phase to generate empathy and mutual confidence, c. Have clear objectives with goals, while knowing how much to cede while avoiding making commitments in return. Finally, we must advance the consensus, leaving other matters for future analysis and arrange a follow-up meeting.

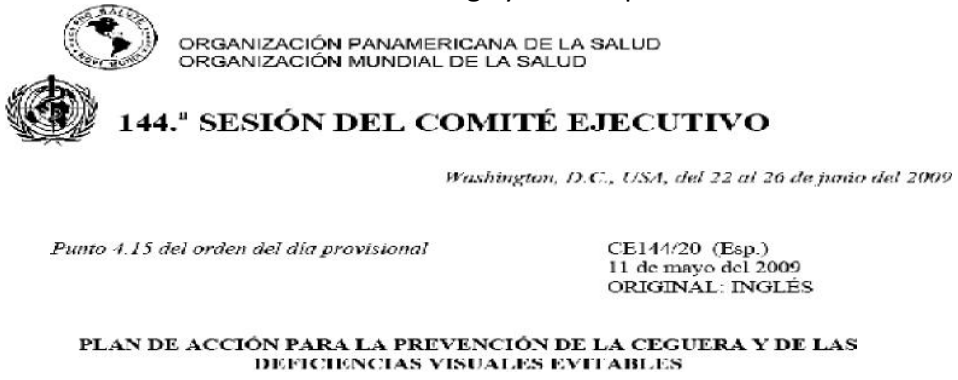
To generate eye-health policies **requires political will** that can be created by effective advocacy and turns a problem into an opportunity for an accomplishment that makes eye health a priority. The root problem is a lack of political motivation leading to a conflict of interests in which the vision of the ophthalmologist is directed solely at technical aspects of the disease in the patient, whereas the political world sees through the prism of caring for the welfare of a community that will bear the cost of projects, or with an eye to votes, meaning that the views taken by ophthalmologists and politicians are different. What is technically correct may not be politically acceptable.

8.3.4 The final objective is to establish eye health as a priority, and that requires political will that is generated by advocacy and turns a problem into an opportunity to develop a constructive proposal and win a place in political agendas. In the end this must generate a sustainable program or law based on our proposal that constitutes a long-term plan that will have social impact, for which resources and political will is needed. The important thing is to be seen as the technical reference point for ophthalmology in the development of sustainable programs that will be important to public health and of interest to the population:

8.3.5 Tools available for advocacy:

1.- The Pan-American Health Organization (PAHO) defined the priorities for eye health for Latin America in an executive session held in November 2007.One of the agreed to priorities was diabetic retinopathy due to the magnitude of the problem and the estimations that the prevalence of diabetes is growing, that 20% to 30% of diabetics suffer retinopathy, and that at 20 years progression 75% of diabetics have retinopathy for which appropriate treatment reduces the risk of blindness by 90%, and that at 15 years progression 2% of patients are blind and 10% have severe visual disabilities. It also assigns tasks such as that of tying screening by funduscopy with national programs, training of physicians and healthcare personnel, and improved capacity for screening and laser treatment with emphasis on patient education. All of this culminated in a resolution in the 144th Session of the executive committee of the PAHO, in which an action plan (Figure N13) was approved that treated visual impairment as a regional problem related to poverty and social exclusion. It also recognizes that the majority of causes of blindness and visual impairment are avoidable, and that addressing them improves opportunities for education and employment (79).

Figure N13: Resolution of the PAHO defining eye health priorities in Latin America



ORGANIZACIÓN PANAMERICANA DE LA SALUD
ORGANIZACIÓN MUNDIAL DE LA SALUD

144.ª SESIÓN DEL COMITÉ EJECUTIVO

Washington, D.C., USA, del 22 al 26 de junio del 2009

Punto 4.15 del orden del día provisional

CE144/20 (Esp.)
11 de mayo del 2009
ORIGINAL: INGLÉS

PLAN DE ACCIÓN PARA LA PREVENCIÓN DE LA CEGUERA Y DE LAS DEFICIENCIAS VISUALES EVITABLES

An analysis of the cost of diabetes in Latin America exists, done by Dr. Alberto

Barcelo, Regional Advisor on Diabetes for PAHO and WHO which estimates the total cost of diabetes in the Americas (Figure N14) at $202 billion, including $132 billion spent in the United States, $65 billion in Latin America and the Caribbean, and $5 billion in Canada.

The indirect costs include loss of income before age 65 (retirement age), and those related to deaths ($339 billion) and permanent ($726 billion) or temporary ($2 billion) disability as well as loss of tax revenue that would otherwise be generated by the 15 million diabetics in the region. The direct costs are those related to medications, hospitalization, doctor visits, and complications from diabetes. For retinopathy itself, the annual cost is some $265 million annually (80, 81, 82).

8.3.6 Summary of advocacy in diabetic retinopathy:

MESSAGES FOR THE HEALTHCARE AUTHORITY OR LEGISLATOR:

CURRENT PROBLEM: "NUMBERS" the magnitude of the problem

- Diabetes affects from 7% to 10% of the population over age 20.
- Need for screening: Retinopathy affects 30% of diabetics.
- Need to treat: Some 5% of diabetics are at risk of blindness.
- Compare the cost of diabetes ***if nothing is done***
- Diabetes will continue increasing in the future with an uncertain future!

The eye health plan must be in the interest of the community and directed at vulnerable groups to achieve equity while "improving coverage with quality care".

WHO SHOULD ADVOCACY BE DIRECTED AT?

The objective is to create an awareness of advocacy in different sectors such as:

1.- Ophthalmology organizations: residents, ophthalmologists, medical societies, and collaborators (assistants, nurses, leaders, and health care agents).

2.- Political actors with a role in healthcare policy: ministries and legislators involved in the health area, general practice physicians, related medical specialties, and insurance companies.

3.- Community: Active participation in defense of health policy: Patients, medical professionals, and related industries and institutions spreading the message through the press and journalists with interest in the topic.

HOW TO DO ADVOCACY:

HEALTH AUTHORITIES AND LEGISLATORS: Remember that these people have little time and we must inform them of the current and future dimensions of the problem with diabetes and what screening and treatment is needed. We can tell them about the cost of diabetes, and that retinopathy is a priority in the PAHO health plan.

DIABETES SPECIALISTS: They should have time available and we must press them to work together with us in meetings with health authorities and to include retinopathy

in their own education.

GENERAL PRACTITIONERS: It is important to educate general practitioners concerning the impact of retinopathy as a vision-limiting disease and on how to educate diabetic patients concerning the need for examination of the fundus.

OPHTHALMOLOGISTS: Ophthalmologists must be educated on the magnitude of the problem and treatment guides must be prepared that consider unresolved problems that will affect the future of screening, which may be done digitally, and of the treatments, including photocoagulation, that may be performed by general ophthalmologists.

PATIENTS: Patients are often "organized", which will help persuade them to incorporate the topic as a lobbying objective with the health authorities. They can assist in education and ensuring adequate treatment. They can also help to reach the press.

PRESS/TELEVISION for educating the community with a clear message

MEDICINE-RELATED INDUSTRIES: Take advantage of the industry's "social marketing" to present the problem and make a single request, such as a piece of equipment or its refurbishment.

9.- EVIDENCE IN THE PREVENTION AND TREATMENT OF DIABETIC RETINOPATHY:

Clinical studies that date back more than 30 years show the benefits of adequate treatment of diabetes and the early treatment of retinopathy in reducing the risk of vision loss.

1.- The Diabetic Retinopathy Study (1971-1975) demonstrated that panretinal photocoagulation reduced the risk of severe vision loss in diabetic retinopathy by 60% (DRS Study Group: 83).

2.- The Early Photocoagulation for Diabetic Retinopathy study (1979-1990) showed that panretinal photocoagulation reduced the risk of severe vision loss by at least 2% and that focal photocoagulation reduces the risk of moderate vision loss in diabetic macular edema by 50% without adverse effects on the progression of retinopathy (ETDRS Study Research Group: 84, 85).

3.- The Diabetic Retinopathy Vitrectomy Study (1977-1987) showed that in favorable cases of unresolved vitreous hemorrhage, early vitrectomy achieved better vision results (Diabetic Retinopathy Vitrectomy Group: 86).

4.- Studies of the control of diabetes, the epidemiology of complications, and interventions in diabetes (1983-1993) have shown that strict glycemic control lowers the risk of retinopathy by 76% and the risk of progression by 54% in patients with type 1 diabetes (**Diabetes Control and Complications Trial Research Group**: 87, 88, 89). The studies also revealed that good glycemic control reduced development of severe or proliferative retinopathy by 47%, the need for laser therapy by 56%, and the risk of macular edema by 23%, while also establishing a lineal relationship between glycosylated hemoglobin and the risk of vision complications; however, they also warned that patients under strict glycemic control also have more severe potentially dangerous hypoglycemic events. In general, for each 1% reduction in glycosylated hemoglobin the risk of developing retinopathy is reduced by 35%, while the risk of progression is reduced by 39% (90) (ref. Dr. Paulo Morales).

5.- UK Prospective Diabetes Study (1977-1999). The **UK Prospective Diabetes Study** (91) is similar to the previously mentioned study, but investigates type II diabetes. It demonstrated the need to control diabetes as well as the risk of high cholesterol or serum lipids increasing the risk of retinal complications in patients with diabetes. It also showed that intense control of blood pressure reduced the risk of developing retinopathy by 47% in patients followed for nine years. In addition, it discovered that reducing systolic blood pressure by 10 mm Hg, was associated with a 13% drop in the risk of developing any microvascular complication (UKPDS: 92, 93, 94).

The last two studies mentioned establish the value of glycosylated hemoglobin and control of blood pressure and serum lipid levels as indicators of the risk of developing diabetic retinopathy However, diabetic patients with regular control of blood glucose can also develop retinopathy. Other risk factors for developing retinopathy include proteinuria or albuminuria, pregnancy, smoking, or anemia.

10.- ADDITIONAL COMMENTS:

There is much to do, but we are certain that the material provided by the 1st (2009) and 2nd (2010) workshops to attempt to standardize the criteria, with needed adjustment to the varied conditions and resources of each region and individual country in Latin America, will do much to help achieve goals such as:

- Formation of a directorate of colleagues committed to the crusade to reduce the impact of blindness due to diabetic retinopathy,
- Creation of a census of technological resources available in each region,
- Design of effective educational programs committed to assessment of the results of detection and referral efforts,
- If the desired results are not achieved, strategies, including our own criteria, must be reconsidered or even redesigned if necessary.

According to the current estimates of the World Health Organization, diabetic retinopathy is responsible for 4.8% of blindness worldwide, leaving some 1.8 million persons blind, and that means that it is time to take action that really changes current conditions since these figures are expected to double by 2025. And if nothing is done, this public health problem will have yet greater impact in developing countries, where it is already the leading cause of blindness in working age persons, with all the economic losses that this implies.

Unfortunately, in Latin American countries such as Mexico, the prevalence of diabetic retinopathy in people over age 20 is approaching 20%, a fact that should make us eager to accept the commitment to establishing newer strategies for early detection and referral for diabetes mellitus patients.

Finally, we must remember:

a. Treatment of diabetic retinopathy that is detected and treated early is highly effective (80%), and less costly than that required in later stages.

b. With our current knowledge of the pathophysiology of the disease and using proven strategies while incorporating the treatment options outlined above, we can achieve the kind of results already demonstrated by national programs such as those in Scotland, where the incidence of blindness has been reduced to 0.2%.

The leadership of ophthalmological societies dedicated to providing service to the population of Latin America must form synergistic alliances with governments, non-governmental initiatives, and those proceeding from medical industries or the private sector and other stakeholders in the fight against diabetes to help national programs for the detection and treatment of diabetic retinopathy to have a favorable impact.

We hope that the information we have shared here will help standardize the criteria for the management of diabetic retinopathy and contribute to the legitimate aspiration of achieving a solution for this severe public health problem.

We, the participants of the First and Second workshops on Diabetic Retinopathy held in Quito Ecuador in 2009 and Querétaro Mexico in 2010 here subscribe our names with the support of the VISION 2020 Program for Latin America.

11. USEFUL SOURCES:

11.1.- Synergistic alliances

To improve our knowledge of diabetic retinopathy as a training priority requires being familiar with the recognized reference organizations as sources of trustworthy information, these include:

1.- The VISION 2020 Program for Latin America http://www.v2020la.org (Diabetes Subcommittee)
2.- The Pan-American Association of Ophthalmology, Committee for the Prevention of Blindness, www.paao.org
3.- The Pan American Health Organization: http://new.paho.org/hq
4.- The guides published by the World Health Organization http://www.who.int/research/es/.
5.- The International Diabetes Federation: http://www.idf.org/
6.- The American Diabetes Association: http://www.diabetes.org/
7.- Christoffel Blinden Mission: http://cbm.org
8.- Diabetic Retinopathy for the Comprehensive Ophthalmologist: http://www.drcobook.com/

11.2.- Additional recommended reading

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