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Algorithms for Estimate of the Vascular Network in Retinal Images

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Abstract: The retina is the neurosensorial tissue of the eye and is extremely rich in polyunsaturated lipid membranes. This feature makes it especially sensitive to oxygen and/or nitrogen activated species and lipid peroxidation. Several authors have postulated the importance of superoxide and peroxynitrite production in the development of diabetic complications. Analyze the validity of the non-mydriatic camera for diabetic retinopathy and the severity levels which referred to the ophthalmologist. In the present study, we have used two different antioxidants, that present as a common feature their peroxynitrite scavenging capacity, to ameliorate the oxidative stress that exists in the retina in diabetic patients. Analyze indicators of severity of retinopathy. Diabetic they can help increase the sensitivity of screening. Were used as evaluation criterion validity indicators, predictive values, indicators of clinical utility and consistency. Hyperglycemia was accomplished by the intraperitoneal injection of Alloxan in a mouse model of diabetic retinopathy. Hyperglycemia was accomplished by the intraperitoneal injection of Alloxan in a mouse model of diabetic retinopathy.

Key words: Retina · Segmentation · Blood vessel segmentation · Multiscale feature extraction

INTRODUCTION

The neurosensory retina is the tissue of the eye and is extremely rich in polyunsaturated lipid membranes [1]. Diabetes mellitus is Considered The most common cause of blindness in the working population of Industrialized Countries, With diabetic macular edema being The most common cause of visual acuity Decreased proliferative diabetic retinopathy and (PDR) being responsible for the severe visual deficits Most. THEREFORE, we have tried to establish a guide for clinical intervention whose purpose is to provide orientation on the treatment of diabetic retinopathy and its complications. This is at a time When Necessary many treatment options have emerged whose role is not yet fully defined. To establish guidelines has done extensive review of the literature and existing protocols by a committee appointed for that purpose by the Spanish Society of Retina and Vitreous and have discussed the various treatment options available today and most accepted indications according to the degree of diabetic retinopathy that the patient thus arises what do with a slight severe nonproliferative (susceptible photocoagulation sometimes) diabetic retinopathy (NPDR), moderate (both from an eye specialist area), also suggests how to deal with diabetic macular edema. The role of the various complementary investigations is discussed. This feature makes it particularly sensitive to oxygen free radicals and lipid peroxidation. In fact, there are various retinal pathologies have been linked to the overproduction of free radicals such as retinopathy of prematurity and diabetic retinopathy. Early detection of patients with diabetic retinopathy (DR) susceptible treatment would reduce the incidence of serious ocular complications and severe visual loss and an economic savings (2). That is why diabetic patients are recommended regular eye tests. The prevalence of Mellitus (DM) in our environment makes the routine visit of these patients involves a high cost in resources. If screening of diabetic pathology is carried out outside of the eye, it ay optimize the use of the same for the most severe disease. The Standard gold, according to the Early Treatment Diabetic retinopathy

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Study (ETDRS) for screening of DR is to use photographs that showed higher sensitivity and specificity than clinical examination with indirect ophthalmoscopy (3). Diabetes Mellitus is considered the most common cause of blindness in the working population in industrialized countries, with the Diabetic Macular Edema the most common cause of decreased visual acuity in diabetic and Proliferative Diabetic Retinopathy responsible deficits more severe visual. The Panretino photocoagulation manages to avoid progression to blindness in a significant percentage of patients. However, the results are much more laser control disappointing macular edema. The search for new alternatives has become a priority and although the pathogenic mechanisms involved in the development of this process are still not well known, the involvement of vascular endothelial growth factor in it has opened a new avenue of research. There are numerous publications that discuss the usefulness of intravitreal triamcinolone and antiangiogenic (anti-VEGF) in the control of diabetic macular edema [2-10].

The anti-VEGF drugs are administered via intravitreal repeatedly, what a chronic disease such as diabetes is a major difficulty, hence, in parallel, it is considering the possibility of using them in combination with laser treatment for its effect more durable. Several studies in the literature indicate that retinal metabolism is impaired in diabetes. It studied rats in which diabetes was induced by alloxan injection and showed that in the retina there was an increase in the concentration of acid reactive substances, an increase in the activity of the protein C and an increase of nitric oxide. Also found that in the diabetic retina is decreased concentration. Other published studies show that retinal metabolism in diatran in diabetic retina concentration is decreased. The utility of non- mydriatic cameras with this target, showing the same efficiency and the use of three flat retinographies 45° There is at present no study focusing on the prevalence of RD in a comprehensive health area, therefore not knowing the true prevalence of the disease in our environment. Against this background of change and uncertainty is necessary to establish uniform criteria to guide in addressing these complications pending the completion of these studies and we have new guidelines to improve the visual functional outcome of these patients.

It has also recently been found that nitrotyrosine levels in plasma of the diabetic patients are elevated, suggesting the possible involvement of peroxynitrite in the development of diabetic complications (6). Several studies have used antioxidants, such as vitamin E, to try

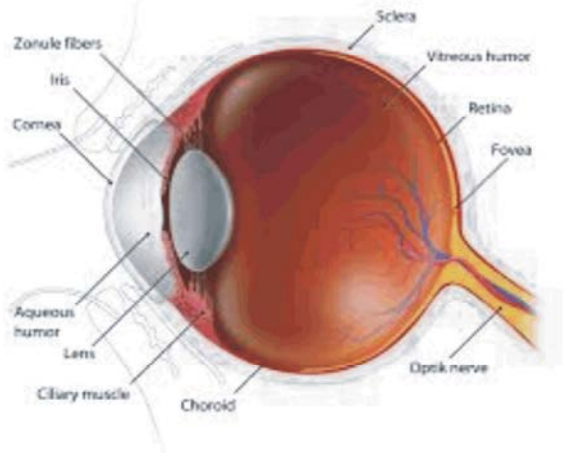

Fig 1.1: the Eye

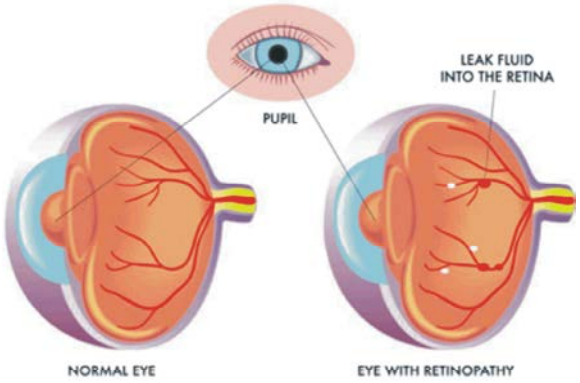

Fig 2.1: Eye With Retinopathy

to prevent the complications of diabetes and have produced conflicting results (8). It might be thought that treatment with vitamin E, symptomatic treatment would be more than a causal treatment, since only acts against free radicals already formed.

Classification of Diabetic Retinopathy (RD): According to the results of large multicenter studies, prevention of blindness RD passes through the periodic review of the fundus of diabetic patients so that they can be treated early forms with high risk of severe loss of vision or even blindness. This also requires the use of homogeneous classification criteria and treatment of diabetic retinopathy. The proposed classification pursuing this end and in fact is considered as a reference. However, it is not commonly used in clinical practice due to its complexity, as there are too many levels or stages, as they have to keep a Photograph correlation with stereoscopic

Which are considered characteristic of diabetic retinopathy, but its distribution is irregular and only become more apparent from the accumulation of

eosinophilic material. The apparent dominance of pericíticas lesions when compared with alterations of endothelial cells may be explained by the particular anatomical location of these cells, embedded in the basement membrane. As changes are propagated, edema and degeneration of arterial endothelial side leading to areas of missing hair cells and vascular occlusions that are expanding to become visible on fluorescein angiography [11-15].

MATERIALS AND METHODS

The increased visibility of the capillary network in fluorescein angiography is another characteristic feature of incipient diabetic retinopathy. The retinal vessels lack a systemic autonomous innervation, so to maintain a constant blood flow rely on a mechanism called autoregulation. Thus, under hypoxia dilate to provide better blood supply. Also the disappearance of pericytes support capillary walls can contribute to permanent loss of control of vascular tone, resulting in a diffuse and chronic distension of the walls of the vessels. Hyperglycemia alone alters autoregulation. In addition, note signs of deterioration thereof as retinopathy worsens.

Since then it has been recognized that these areas of capillary occlusion are a characteristic feature of diabetic retinopathy angiography. They are one of the two fundamental retinal changes. To occlude some capillaries, the blood is diverted to other vessels which are dilated and function as vascular shunts. In fact, the progressive capillary occlusion increases the rate of flow in the retinal vessels of large caliber, apparently due to this bypass mechanism, considered responsible for numerous vascular anomalies that appear gradually in the retina.

Shows a clear separation between normal eyes used as controls and diabetic retinopathy. Diabetic eye without visible retinopathy can be distributed almost equally into three groups: one group in which Fluorophotometric values are within normal limits, a second group with leakage of dye in the limit of normal and a third group with leakage clearly abnormal. There is evidence that this increased permeability may have prognostic value, ie, indicating that the eyes are likely to progress more rapidly to severe retinopathy. In the first long-term study on vitreous fluorophotometry in diabetic patients. Thus, vascular disorders involving retinal small vessels are the first to appear in the diabetic retina. There is some evidence, obtained with other imaging methods, that early alterations of neural tissue are produced.

Fig 3.1: Diabetic retinopathy: Fluorescein angiography showing multiple microaneurysms

Finally, the same conclusions can be drawn from the electrophysiological abnormalities detected in the diabetic retina. The most significant and early in eyes with diabetic retinopathy is the decrease in the amplitude of the oscillatory potentials of the electroretinogram. Interestingly, in this case, changes in the potential are clearly not related to capillary perfusion and microaneurysms, intraretinal hemorrhages, hard exudates.

Retinal microaneurysms are usually the first sign of diabetic retinopathy ophthalmoscopy. They are located mainly in the inner nuclear layer and the deep retinal capillary network in ophthalmoscopy, microaneurysms. They can then charge a yellowish hue by thickening of the basement membrane due to the associated hyperpermeability. Finally, occluded. Microaneurysms are filled during the initial venous phase of fluorescein angiography, which shows typically originate in the venous side of the vascular network.

Fluorescein angiography shows, particularly well when the microaneurysms. However, in more advanced stages of the disease, when occluded, can not identify; therefore microaneurysms counts based on this technique are only reliable diagnostic indicators of retinal damage in the early stages of diabetic retinopathy.

The intraretinal hemorrhages are other dominant ophthalmoscopic signs of diabetic retinopathy. They originate from the breaking of microaneurysms, capillaries and venules and are located mainly in the outer and inner plexiform layers nuclear. In diabetic eye, intraretinal hemorrhages are characteristically more abundant in the posterior pole. The presence of numerous peripheral bleeding should raise the suspicion of other systemic disease.

RESULT

Diabetic retinopathy preproliferative is an intermediate stage between background retinopathy and proliferative retinopathy. Characteristically preproliferative phase increase in the signs of retinal ischemia. They consist of cotton wool spots, venous beading and loops, microvascular abnormalities intrarretinianasy large areas of capillary non-perfusion.

Preproliferative retinopathy in the area is no longer isolated from the lack of capillary perfusion prevails, but large areas of the retina are totally excluded from blood flow. The lack of retinal perfusion may be suspected in ophthalmoscopy, but can only be properly demonstrated by fluorescein angiography. In some eyes this increase in non- perfused areas best seen in the avascular zone of the fovea. Expanding due to the progressive occlusion.

In diabetic patients is usually preceded by a stage of preproliferative retinopathy characterized by progressive signs of extensive, as multiple relatively large cotton wool spots, intraretinal vascular abnormalities and various venous anomalies such as beading, training bags and reduplication clusters bleeding rounded and occluded vessels. Peripherals are initially located in the plane of the retina, but quickly pierce the internal limiting membrane, become prerretinianos and form adhesions with the overlying vitreous. While the vitreous remains attached to the retina neovessels not give symptoms but end up causing vitreous retraction. Traction is this effect which leads to the progressive complications associated with retinal neovascularization as vitreous hemorrhage and progressive distortion of images.

Fig 4.1: Diabetic retinopathy. Fluorescein angiography showing large areas of vascular occlusion and papillary neovascularization.

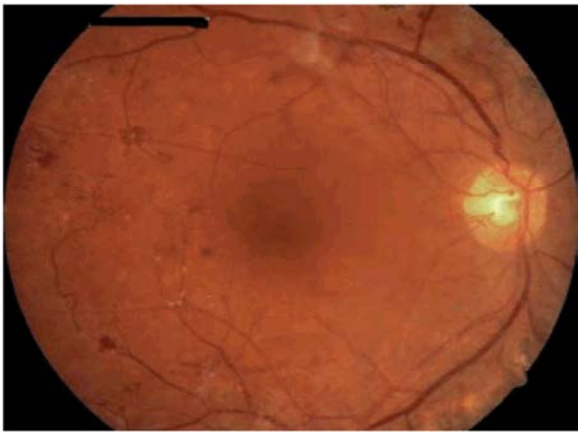

Fig 4.2: Diabetic retinopathy. Retinography showing hemorrhages and areas of suspected retinal neovascularization

As the vitreous shrinks, possibly by abnormal permeability of neovascularization, neovascular tufts strip and causes peritoneal and intravitreal hemorrhage, a frequent cause of severe vision loss in diabetes. Vitreous changes associated with contraction of the fibrovascular tissue cell proliferation and eventually lead to a detached retina localized or extensive. The visual prognosis of eyes with neovascularization is bad.

DISCUSSION

Although diabetes is a systemic disease, diabetic retinopathy was unilateral up to a third of cases, suggesting that unilateral found signs of retinopathy, the differential diagnosis should be considered even in people without established diagnosis of diabetes. In early stages, the microstructural alterations vasculature ophthalmoscopically detectable, are difficult to differentiate, which is possible by fluorangiography with which the degree of severity of the retinopathy is confirmed in more than 50 % of cases, coincident with previous works that mention the five most common conditions that require the use of diagnostic fluorangiography.

Macular edema, retinopathy of this important demonstration that only clinically detected in 50 % of cases, is the leading cause of legal blindness in diabetics. In severe cases the extravasated fluid in the outer plexiform layer is important enough to be detected, which is frequently observed in eyes with other signs of severe nonproliferative diabetic retinopathy. In more advanced stages, signs of retinal hypoxia, including multiple hemorrhages, soft exudates, tortuosity, venous dilation,

intraretinal abnormalities, dilated capillary microcirculation that function as collateral and large areas of capillary perfusion unobservable appear.

It has contributed very significantly to the understanding, diagnosis and treatment of many diseases. It is a relatively simple test that uses fluorescein whose toxic effects such as extravasation and local necrosis, inadvertent arterial injection, nausea, vomiting, vasovagal reactions, allergic, anaphylactic, neurological disorders and death are idiosyncratic reactions described above, dependent on individual susceptibility however, in this study only urticaria, fever and chills exceptionally presented, which coincides with other series [16-21].

CONCLUSION

Macular edema, retinopathy of this important demonstration that only clinically detected in 50 % of cases, is the leading cause of legal blindness in diabetics. In severe cases the extravasated fluid in the outer plexiform layer is important enough to be detected, which is frequently observed in eyes with other signs of severe nonproliferative diabetic retinopathy. In more advanced stages, signs of retinal hypoxia, including multiple hemorrhages, soft exudates, tortuosity, venous dilation and intraretinal abnormalities, dilated capillary microcirculation that function as collateral and large areas of capillary perfusion unobservable appear.

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