ABSTRACT
The pulsed Doppler ultrasound allows quantitative evaluation of orbital vascular structures by measuring the VPS, VFD, IR, TA, IA. We evaluated 12 patients. The ACR showed IR < 0.701 case, IR from 0.71 - 0.7912 cases and IR > 0.8011 cases, in AO their patients showed IR < 0.753 cases, IR from 0.76 to 0.805 cases and IR > 0.8116 cases. The IR and TA of the ACR are increased and the values are related to the stage of DR, IP and VP are also increased, the A and VDF showed no change compared to the control group. The IR, IP, TA, VPS of the AO were increased, VDF decreased, IA shows no change compared to the control group. The assessment of the ACR and AO to determine changes in the pulsed Doppler related to diabetes.

RESUMEN
La ecografía Doppler pulsada permite la valoración cuantitativa de las estructuras vasculares orbitarias a través de la medición de la VPS, VDF, IR, IP, TA, IA. Se valorará en modo B, Doppler color y Doppler pulsado pacientes diagnosticados por fondo de ojo de retinopatía diabética. Se valoraron 12 pacientes. La ACR demostró IR < 0.70 1 caso, IR 0.71 – 0.79 12 casos e IR >0.80 11 casos, en la AO los pacientes presentaron IR < 0.75 3 casos, IR 0.76 – 0.80 5 casos e IR >0.81 16 casos. El IR y el TA de la ACR estuvieron incrementados y los valores están relacionados con la etapa de la RD, el IP y la VPS también estuvieron incrementados, el IA y la VDF no mostraron variación en relación con el grupo control. El IR, IP, TA, VPS de la AO estuvieron incrementados, VDF disminuida, el IA no muestra variación en relación con el grupo control. La valoración de la ACR y AO permite determinar alteraciones en el Doppler pulsado relacionadas con la diabetes.

PALABRAS CLAVE
Retinopatía diabética, Doppler de ojo, índice de resistencia, índice de pulsatilidad, tiempo de aceleración, índice de aceleración, velocidad pico sistólica, velocidad flujo diastólica, Doppler pulsado.

OBJECTIVE
Set the main radiological findings on ultrasound Doppler spectral central retinal artery and ophthalmic artery in patients with diabetic retinopathy diagnosis referral service Eugenio Espejo Hospital Ophthalmology compared with a control group.

INTRODUCTION
Diabetic retinopathy (DR) is a complication of diabetes, altered endothelial layer of the retinal microcirculation the same that occurs in stages:
1. Mild non proliferative diabetic retinopathy (RDNPL) is the earliest stage of the disease and are microaneurysms in the retina, there is no vision disturbances (1).
Two. - Moderate non proliferative diabetic retinopathy (RDNPM) can be no obstruction of the vessels supplying the retina (1).
Three. - Severe non proliferative diabetic retinopathy (RDNPS): Obstruction of multiple
blood vessels sent affected areas stimuli for the formation of new vascular structures (1). April.

Proliferative diabetic retinopathy (PDR): multiple forms retinal vascular structures of thin, fragile walls that may bleed easily (1).

Main irrigation is determined by the ophthalmic artery (OA) and its branches, among which are included the central retinal artery (RCA), ciliary arteries short, long and others.

Ultrasound display is achieved 100% of the arterial tree and ophthalmic vein and its branches (2).

The color and pulsed Doppler ultrasound allows qualitative and quantitative assessment of systolic peak speed (VPS), speed end-diastolic (EDV), resistance index (RI), pulsatility index (PI), acceleration index (AI), and acceleration time (TA) in the retrobulbar and orbital movement, assessing in a non invasive hemodynamics AO and ACR.

The VPS and IA are known as markers of arterial stiffness (3). The definition and measurement of these parameters is different, therefore, the clinical significance is also different.

Previous studies demonstrated correlation between the degree of diabetic retinopathy and decreasing flow rate in the ACR but not in short ciliary arteries or in the ophthalmic artery.

In studies by Gil Hernandez et al. was determined that the blood flow velocity of the ACR (peak systolic and diastolic) decreases as retinopathy worse, but in patients with proliferative retinopathy flow is not so decreased in comparison with the values obtained in patients with moderate to severe retinopathy (4).

With respect to vascular resistance in AOFT only appreciate it increased in patients with PDR (4), this contrasts with the experience of Tamaki et al who found this also increased in diabetics with normal ocular background (5).

MATERIALS AND METHODS

They include service referred patients presenting Ophthalmology diagnosis of diabetes mellitus type I and II with non-proliferative diabetic retinopathy and proliferative diabetic retinopathy by fundus observed are excluded patients with a diagnosis of hypertension.

The review will be conducted in the area of ultrasound imaging service Eugenio Espejo Hospital (HEE) with ultrasound equipment ESAOTE My lab brand 20 Plus, with high-frequency linear transducer, will choose the vascular program will start the study mode B, using high resolution systems, harmonic to avoid artifacts, then perform color Doppler PRF range between 1.0 - 2.8, 5MHz frequency, color gain to eliminate artifacts, color box is rectangular without inclination, we will finally pulsed Doppler The sample volume was placed in the middle region of the central retinal artery and ophthalmic artery, the sample size is 1 mm, 50-94% speed, angle of insonation between 0 and 60 degrees, we assess VPS, VDF, IR, IP, TA, IA central retinal artery and ophthalmic artery.

RESULTS:

We studied 12 patients (24 globes), 4 men and 8 women, divided into age groups, average 58 years, 6 patients had RDNPL-M, 4 patients and 2 patients RDNPS RDP. Pulsed Doppler ultrasound were performed to 6 normal subjects (12 globes) values obtained spectral wave parameters that serve as control group. Figure 1 and 2.

FIG. 1 Doppler spectrum typical of a standard AO.

FIG. 2 Doppler spectrum typical of a standard ACR.
Table 1. - Parameters obtained from pulsed Doppler study in the ACR

<table>
<thead>
<tr>
<th>IR</th>
<th>Cases</th>
<th>IP</th>
<th>Cases</th>
<th>IA</th>
<th>Cases</th>
<th>TA</th>
<th>Cases</th>
<th>VPS</th>
<th>Cases</th>
<th>VDF</th>
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<td>&lt;51</td>
<td>3</td>
<td>&lt;10,9</td>
<td>5</td>
<td>&lt;1,9</td>
<td>6</td>
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<tr>
<td>0,71-0,79</td>
<td>12</td>
<td>1,3-1,9</td>
<td>15</td>
<td>1000-1999</td>
<td>9</td>
<td>51-99</td>
<td>10</td>
<td>11-14,9</td>
<td>11</td>
<td>2-3,9</td>
<td>12</td>
</tr>
<tr>
<td>&gt;0,80</td>
<td>11</td>
<td>2-2,9</td>
<td>3</td>
<td>&gt;2000</td>
<td>3</td>
<td>100-150</td>
<td>6</td>
<td>15-19,9</td>
<td>7</td>
<td>&gt;4</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;3</td>
<td>1</td>
<td></td>
<td></td>
<td>&gt;150</td>
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<td>&gt;20</td>
<td>1</td>
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Table 2. - Parameters obtained from pulsed Doppler study in the AO

<table>
<thead>
<tr>
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<th>Cases</th>
<th>IP</th>
<th>Cases</th>
<th>IA</th>
<th>Cases</th>
<th>TA</th>
<th>Cases</th>
<th>VPS</th>
<th>Cases</th>
<th>VDF</th>
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<tbody>
<tr>
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<td>3</td>
<td>&lt;1,7</td>
<td>6</td>
<td>&gt;2000</td>
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<td>&lt;51</td>
<td>3</td>
<td>&lt;10,9</td>
<td>5</td>
<td>&lt;1,9</td>
<td>6</td>
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<tr>
<td>0,76-0,80</td>
<td>5</td>
<td>1,7-1,9</td>
<td>7</td>
<td>2000-3999</td>
<td>9</td>
<td>51-99</td>
<td>10</td>
<td>11-14,9</td>
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<td>2-3,9</td>
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<tr>
<td>&gt;0,80</td>
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<td>2-2,5</td>
<td>7</td>
<td>4000-6000</td>
<td>3</td>
<td>100-150</td>
<td>6</td>
<td>15-19,9</td>
<td>7</td>
<td>&gt;4</td>
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<td></td>
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<td>&gt;6000</td>
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<td>5</td>
<td>&gt;20</td>
<td>1</td>
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The ACR in the control group showed less than 0.70 IR, IP less than 1.3, less 51 msec TA, IA with a range between 660-2050 mm / s, lower VPS 11 cm / s, EDV lower 4 cm / sec.

The AO in the control group showed less than 0.75 IR, IP less than 1.7, less 51 msec TA, IA with a range between 3130-6680 mm / sec, VPS lower 32 cm / s, lower VDF 10 cm / sec. The values obtained in pulsed Doppler ultrasound of the ACR and AO in patients with RD are shown in Table 1 and 2. Respective spectral wave shown in Figure 3 and 4.

DISCUSSION

Ocular ultrasound characteristics eyeball location and constitution has become an ideal method for the visualization of structures that shape and for the diagnosis of diseases that can not be displayed on the fundus examination.

The color Doppler ultrasound and pulsed Doppler has the advantage of being easily accessible, besides having no ionizing radiation, the easily reproduced and repeated as often as necessary without this leading to additional risk to the patient, and do not need medication administration prior to examination.

Diabetes causes disturbances in the microcirculation by endothelial dysfunction (6) causing perfusion disorders (4), which will
result in ultrasound significant decrease VPS in patients with ocular ischemic syndrome (7), artery occlusion central retinal (8) and venous thrombosis (9). Pulsed Doppler ultrasound to determine the hemodynamic characteristics of the affected blood vessels of a non-invasive and fast, making a quantitative analysis of the VPS, VFD, IR, IP, TA, IA (Fig. 1 and 2).

Despite having the right equipment, to implement all the technical specifications, meet the anatomical landmarks, the most difficult structure presented in his view was the ACR, having in many cases change the angle of the transducer, reducing the PRF and profits color for identify, minimal eye movements that were modified by the position of the sample volume by placing it on the short ciliary arteries giving us a spectral wave obviously wrong and inappropriate values.

Since Kohner et al published in his work on blood flow and diabetes, multiple theories related blood flow changes with the progression of diabetic retinopathy.

The flow of the ACR should be antegrade, looking low resistance, with rounded systolic peak and continuous flow in diastole, features also observed in control patients (10). We observed female predominance, however the values did not change significantly in male patients.

In studies by Gil Hernandez et al. in 2001 (4), it was determined that the VPS and VDF blood flow decreases as the ACR worsening retinopathy, but not so decreased in patients with PDR unlike our study which determined that the VPS is increased and is not related to the degree of retinopathy. VDF and ACR IA RD patients did not show variations when compared with the control group.

Patients with diabetic retinopathy have IR ACR> 0.71 (increased relative to the control group) of which values between 0.71 and 0.79 relate RDNPL-M and IR RDP and greater than 0.80 is related to RDNPS. IP and ACR MT also are increased, the IP does not show significant variation in the different stages of the disease and not the TA in which a value between 51-100 msec is associated RDNPS and RDP and longer to 100 msec is associated RDNPL-M. With respect to vascular resistance in the AO Gil Hernandez et al (4) showed increased IR in patients with PDR (4) and this was also demonstrated in our study.

Masanorilno-ue et al. In 2000 (11) found increased and decreased IP VDF equally we find the IP and TA increased relative to the control group and by the IR showed no variation in the different stages of retinopathy, VDF was diminished in patients with RDNPL-M and however RDNPS values were normal in patients with PDR.

In the study Osamu et al in 2008 (12) was determined that the VPS in AO was increased in patients with diabetes as well as in our work we find increase in the values of the same VPS that were associated with the stage the RD and values between 33 and 39 cm / sec were related RDNPL-M and RDNPD, and values greater than 40 cm / sec is associated with RDP. The AO IA shows no change when compared with the control group. However the presence of RD to the acceleration ramp and IA is high in both the ACR and the AO.

CONCLUSION
Pulsed Doppler ultrasound and AO ACR provides information for the diagnosis of diabetic retinopathy, and may even determine the evolutionary stage of the same value the IR and TA in the ACR and the VPS and VDF in the AO, the findings are not modified sex or the type of diabetes. This is a preliminary study, it needs a larger number of patients so that our results are statistically significant.

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