ANGIOFLUOROGRAPHY AND TOMOGRAPHY IN THE OPTICAL COHERENCE IN THE MANAGEMENT OF THE DIABETIC MACULOPATHY

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Abstract: This paper presents theoretical aspects regarding the angiofluorography and tomography in the optical coherence, two of the most valuable investigations used in the monitorisation of the diabetic patient. A comparison between the principle of functioning, the effectuation technique, the indications and the possible complications is made, also the importance of the using of those methods in establishing an optimal therapeutic conduct at the patient’s with diabetic maculopathy.

OCT (ocular tomography in the optical coherence) is a modern, rapid, non-invasive and non-contact that allows the obtaining of detailed information on the structure of the retina. OCT permits the correlation of the bottom-eye image with the bi- and tridimensional aspect of the retinal ultrastructure.

For the anterior pole, OCT is used in: the imagistic of the retina with diabetic maculopathy.

Keywords: angiofluorography, tomography in the optical coherence, maculopathy

SCIENTIFICAL ARTICLE OF TEORETICALLY PREDOMINANCE

AFG (angiofluorography) represents a functional ophthalmological exploration having as a purpose the visualization of the choroidal, retinian, iridian blood vessels although of the eye buttock lesions, evidenced after the intravenous injection of a fluorescente substances. The diagnosis of the modification of perfusion is an important element that is taken into account in the stadalisation and the treatment of several ocular affections. AFG brings precise information on the localisation and extend of the lesions observed at the FO examples;

It uses blue light with the lenght wave of 465 – 490 nm; in contact with fluorescein, appears a yellow-green light with the wave lenght of 520-530 nm, that may be registered by the photographic pellicle.

The principle of functionation consists in the photography or shot in the contrast substances (fluorescein) that is intravenously injected and realises in the ocular circulation. In the interpretation defers of two important characteristics: the retinian normal vessels aren’t permeables fluorescein, and the normal choroidian vessels are permeables fluoresceins (the choroidian capillaries presents pores); this thing is responsables by the difuse coloration of the angiofluorographic background.

AFG necessitates the photographic supervision of the passing of the fluorescein through the chorio-retinian vessels. Next to the AFG it may be practiced also the angiography with indocianine green dye, exploration that permits the study of the choroidian vessels and the optic nerve.

For the anterior pole, AFG is used in: the exploration of the conjunctival circulation, episcleral and irian, the identification of the neof ormation irian vessels in the diabetes mellitus (DZ) or the oclusion of the central retinian vein, the differentiation between the irian malign and benign tumors, the monitorisation of the vascularity of the interface grephon – host post keratoplasty.

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years) from the entire world.

Retinian edema that threatens or includes the macula may appear in any evolutive phase of the diabetic retinopathy and is produced through two mechanisms:

- The capillary occlusion that produces the macular ischemy
- The growth of the vascular permeability with fluid accumulation and exudate in the macula

In the severe, non-proliferative stages respectively proliferative of the DR and of the macular edema clinically significant is imposed the immediate application of the laser photocoagulation at the level of the eye bottom to prevent the apparition of the complications that determine the loss of sight.

**TECHNIQUE**

For the AFG the patient is prepared with at least 30 minutes before the procedure through mydriatic instillations, so the pupils are sufficiently dilatated. The fluorescein is administered intravenously, 5 ml from a solution 10%, during 2-3 seconds. After the administration of the contrast substance seriated photographs of the bottom eye are done (at an interval of one second) with the help of a camera fitted with special filters. After approximately 45 seconds from the administration, the examiner is fixing the other eye to register the images of the middle phase, then the photographs are done at an interval of 1 minute, at both eyes for the surprising of the tardive circulation times of the fluoresceine; as a result of the contrast substance injection, rarely it may appear adverse reactions: nauseas, eructations, rash, generalised itchness, bronchospasm, anaphylactic reactions.

The OCT functioning is based on an optical measuring technique named “interferometry through low coherence”; isn’t necessary to the pupile expansion, but for an easier examination midriatic instillation with approximately 20 minutes before may be done.

A source of light is directionated to the eye and is reflected by the intraocular structures with different optical properties. The intraocular distances and the sizes of the different structures are calculated on the time interval during which the light is reflected by the ocular components.

OCT is easily repeatable and it doesn’t present risks or complications.

**DIABETIC MACULOPATHY**

The aspect of the lesions at AFG:

- focal maculopathy (Fig. 1) - presents as a circumscribed area of “leakage” (tardive focal hyperfluorescence); it is evidenced edema and complete rings perifoveolare or incompletely by tuagh exudation all around a microanevrism;
- diffuse maculopathy (Fig. 2) - is observed a generalised “leakage” (precocious stained hyperfluorescence of the microanevrismel and diffuse tardive hyperfluorescence with the maculate “in a flower petal”; is manifested through diffuse retinian thickness associated with cystic manifestations, sometimes the fovea being completely covered by edema;
- the ischimical maculopathy(Fig. 3) – the are of non-perfusion is evidenced through broading and irregular foveolar hypofluorescence; is manifesting through low visual acuity with an apparently normal clinical aspect of the fovea;
- mixed maculopathy (Fig. 4) – appears through the combination of the diffuse macular edema with ischemia;

Indications of AFG efectuation:

- in the planning of the clinically significative treatment of the macular edema (EMCS);
- in all the cases in which the deterioration of the visual acuity isn’t explained through the canvas of the eye bottom (ischimical maculopathy);
- in the differentiation of the retinian neo-vascularisation of the IRMA;
- the diagnosis and demarcation of the choroidian neovascular membrane;
- the defining of the macular leakage extension after the retinian venous obstructions ;
- the subclinical diagnosis of the cystic macular edema;
- the differential diagnosis between the neo-vessels and the collateral vessels;
- determination of the under-retinian degree of leakage in the central serous retinopathy;

![Fig. 1 Focal maculopathy](image1)

![Fig. 2 Diffuse maculopathy](image2)

![Fig. 3 Ischemic maculopathy](image3)

![Fig. 4 Mixed maculopathy](image4)

The aspect of the lesions at OCT:

- Hard exudates (Fig.5) - hyperreflective points with a posterior cone of shade localized at the level of the external plexiform layer;
- Macular edema – the growing of the retinal thickness with or without the erasing of the foveal depression and the hyporeflectivity of the optic sign from the level of the extern retinian layers;
- The pre-retinian membranes – thick hyporeflective bands detached on the anterior retinal layers;
- Trational retinian foveal decolation (Fig.7) - the posterior hyaloid is attached only at the level of the fovea whose contour appears deformed;

![Fig. 5 Hard exudate](image5)

![Fig. 6 Cystic macular edema](image6)

![Fig. 7 Trational retinian decolation](image7)

Indications of effectuation of the OCT:
- in the monitoring of the therapy answer: the quantification of the retinian thickness, the realisation of the central fovea volume and of the retinian maps, helps at the monitoring of the therapy effects (LASER, intraretinian injections with Triamcinolone or Avastin);
- when the surgical treatment is indicated: vitrectomy through pars plana. The secondary cystic macular edema secondary to the foveal traction and the thickening-elongation of the hyaloid membrane isn’t benefiting of the laser photocoagulation and represents an indication for vitrectomy;
- the diagnosis of the pathology of the pigmented epithelium (EP) and of the choroid: dis-epithelization or breacking of the EP, retinian neo-vascular membranes;
- the determination of the retinian thickness with or without the cancellation of the foveal depression in the macular edema (diabetic and cystic);
- the diagnosis and stadalisation of the macular hole;
- evidentiating the tomographic aspect of the epiretinal membranes and of the vitreo-macular tractions;
- measuring the layer of retinian nervous fibers (RNFL), useful in the precocious diagnosis and pursuing the glaucoma progression;

International clinical studies have mentioned the characteristics of the clinical significant macular edema (EMSC):
- Any area of edema present at maximum 500 \( \mu m \) of the centre of the fovea (+/- exudate);
- Retinian edema equal or bigger than 1DP (1500 \( \mu m \)) situated at less than 1 DP of the centre of the fovea;

**THE TREATMENT OF THE DIABETIC MACULOPATHY** necessitated a regular surveillance of the eye bottom, with the examination of the AFG and/or OCT.
- Focal laser photocoagulation of the microanevrisms- is appling in the case of a leakage localised around a microanevrism (the spot characteristics: diameter of 50-100\( \mu m \), time of 0.05-0.1sec, energy 100mW). It is avoided the avascular foveolar area (ZFA); control at 3 months;
- Photocoagulation in grating of the areas of retinian thickness – represents a strategy of treatment of the diffuse macular edema (the characteristics of the spot: diameter of 100-200\( \mu m \), at one spot distance, during 0. 01sec, energy 80-100mW). It is avoided the foveolar avascular area (ZFA); control at 3 months;

**CONCLUSIONS**

A precocious and correctly diagnosis, also the evaluation of the laser treatment efficiency requires the use of the angiofluorography and of the tomography in optical coherence as precise and objective methods, indispensable in the monitoring of the diabetes patient.

AFG offers a topographic image of the retina that helps the establishing of the treatable lesions, but it doesn’t evidentiate the changes that appear in the interior of the retinian layers;

OCT confers a image in the interior of the retinal layers and may detect fluid accumulation, formation of cystic spaces, hard exudates and serous decolation of the retina; diagnoses the vitreo-macular traction, hyaloid membrane thickeened, tensioned and fibrous pre-retinian membrane.

AFG and OCT are complementary investigations, each having a well established role in the diagnosis evaluation, the therapeutic strategy and monitorisation of the evolution in the diabetic maculopathy.

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