Role of Fluorescein angiography in evaluation of posterior segment disorders

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ABSTRACT

Objective: To study the role of fluorescein angiography in the evaluation of posterior segment diseases.

Materials & Methods: A hospital based prospective randomized study was done which included 80 patients. Detailed patient history was taken and a thorough ocular and systemic examination was done. All patients were examined by ophthalmoscopy (direct, indirect and slit lamp examination with +90 D lens), followed by fluorescein angiography. Ophthalmoscopic and fluorescein angiography findings were analyzed and categorized. Patients were advised necessary ocular and systemic treatment.

Results: 80 cases with posterior segment diseases were analyzed and sub-divided into categories of Diabetic retinopathy, vascular occlusive disorders, age related macular degenerations, Central serous chorioretinopathy, inflammatory disorders and miscellaneous conditions. Fundus Fluorescein Angiography (FFA) altered the diagnosis in 37.5% of cases and categorized the lesions in all cases. 11% of patients experienced adverse reactions like nausea and vomiting. On statistical analysis, FFA proved to be a far superior diagnostic modality than clinical examination (ophthalmoscopy) in diagnosing fundus pathology.

Conclusion: FFA is a superior diagnostic tool and is a necessity for evaluating, localizing and categorization of lesions in Retinal, Macular and Choroidal pathologies.

Keywords: Fundus Fluorescein Angiography, Diabetic retinopathy, Age related macular degenerations, Central serous chorioretinopathy.

INTRODUCTION

Retinal disorders are the largest cause of legal blindness in the age group of 20 to 65 years[1] . Approximately 18 million people in India have severely impaired Vision due to retinal diseases. Fluorescein angiography has contributed greatly to the diagnosis and treatment of various chorioretinal disorders like diabetic retinopathy, Cystoid macular oedema, CSR, venous occlusive disease etc[2]. It helps in examining the structures beyond the reach of clinical ophthalmoscopy.

Adolf Baeyer, a 1905 Nobel laureate in chemistry described methods for producing a number of new organic dyes – including sodium fluorescein. Earliest description of Fluorescein angiography was provided by Chaos and Flocks in 1958 by measuring retinal circulation time after injection with tryphan blue[3]. Fundus Fluorescein angiography was introduced in clinical use by novotny and alvis in 1961 who succeeded in photographic study of human retinal circulation[4]. Fundus photography and Fluorescein angiography has been extremely valuable in expanding our knowledge of anatomy, pathology and pathophysiology of retina and choroid. Fundus Fluorescein angiography helps in early diagnosis, identifying the pathology and monitoring the treatment of retinal, macular and choroidal lesions.

MATERIALS AND METHODS

The study was carried on 80 patients attending to the ophthalmology outpatient department of Prathima Institute of Medical Sciences with posterior segment pathology from December 2013 to August 2015. Study was conducted after approval for the study protocol and clearance were obtained from the ethical review committee of the institute to which the hospital is affiliated. Informed consent from all the patients included in the study was taken after explaining about the procedure and possible side effects.

Patients with retinal disorders like diabetic retinopathy, Age related macular degeneration (ARMD), vascular occlusive disorders, central serous chorioretinopathy, and inflammatory disorders were included in the study. Very old patients, pregnant women, Immunocompromised and debilitated patients, Patients with known hypersensitivity to the dye and Patients with renal insufficiency and cardiovascular diseases were excluded from the study.

A thorough and detailed history was taken of the selected patients with special emphasis on history of drug allergy and systemic illness. Patients underwent a detailed clinical examination that included unaided and best corrected visual acuity using Snellens chart and near vision. Pupil size and reactions were recorded. A detailed anterior segment examination was done using Slit lamp Biomicroscopy. Intra Ocular Pressure was measured using a Goldman's Applanation Tonometer.

A thorough, careful and detailed examination of the fundus was done firstly by a direct ophthalmoscope and subsequently with an indirect ophthalmoscope and Slit-lamp Biomicroscopy with + 90D lens was performed to look for pathologies and documented.

Procedure of Fundus Fluroscein Angiography: Patient's pupils were dilated with a combination of 5% Phenylephrine and 1% Tropicamide eye drops 30 minutes prior to the procedure. An intradermal test dose of the dye was given 10 minutes prior to the procedure. A 21 gauge scalp vein set was put in the antecubital vein. Patient was seated in front of the fundus camera and the dye was injected. Procedure was conducted under supervision of an standby anesthetist. Using a Canon fundus camera Colour fundus photographs, Monochromatic fundus photographs (red free) were taken prior to performing FFA. 3ml of 25% fluorescein dye was injected in the antecubital vein. Pictures were taken after 10sec at an interval of 1.5-2sec approx. 6 photographs were taken in succession. Patient was monitored for one hour after procedure. On analysis of findings, patient was advised general and specific ocular treatment accordingly.

RESULTS

A total of 80 patients who presented to the outpatient department with fundus pathology were evaluated both by ophthalmoscopy and fundus Fluorescein Angiography. 80 cases were analyzed and sub-divided into Diabetic retinopathy, Vascular occlusive disorders, Age related macular degenerations, Central serous chorioretinopathy, Inflammatory disorders and Miscellaneous conditions like Macular dystrophies and Asteroid hyalosis (Table 1).

Table 1: Classification of cases studied

Disease condition	Number	Percentage
Diabetic retinopathy	25	31.25%
Vascular occlusive disorders	20	25%
Age related macular degenerations	15	18.75%
Central serous chorioretinopathy	8	10%
Inflammatory disorders	8	10%
Miscellaneous conditions	4	5%
Total	80	100%

Diabetic retinopathy was the most common presentation in the studied population. 25 (31.25%) of 80 patients were diagnosed with diabetic retinopathy. Diabetic retinopathy was further classified into proliferative and non proliferative types and association of clinically significant macular oedema. Non proliferative diabetic retinopathy was common compared to proliferative type. Clinically significant macular oedema was found in both PDR and NPDR cases.[Table2]

Table 2: Incidence of Diabetic retinopathy

Non proliferative diabetic retinopathy with CSME	10 (40%)
Non proliferative diabetic retinopathy	5 (20%)
Proliferative diabetic retinopathy with CSME	5(20%)
Proliferative diabetic retinopathy	5(20%)

FFA is instrumental in categorizing the lesions in cases of diabetic retinopathy. It confirmed the diagnosis in 40%of cases, altered the diagnosis in 40% and categorized the lesion in 20%of cases [Table 3].

Table 3: Role of FFA in Diabetic retinopathy

	Number of cases	Percentage
FFA confirmed diagnosis	10	40%
FFA altered diagnosis	10	40%
FFA categorized the lesion	5	20%

Vascular occlusion was the second most common group studied, 20 (25%) of 80 cases were diagnosed with vascular occlusions. Branch retinal vein occlusion was the most common presentation with 15 cases accounting about 75% of all occlusions. 2 cases each of Central retinal vein occlusion and Hemi retinal vein occlusion were reported. One patient was diagnosed with Central retinal artery occlusion. Branch retinal vein occlusion was further grouped into Superotemporal and Inferotemporal BRVO with 9 and 6 cases respectively.

FFA was instrumental in identifying the macular oedema in vascular occlusions, about 12 (60%) of cases had associated macular oedema [Table 4].

Table 4: Role of FFA in vascular occlusions

BRVO with macular oedema	10
CRVO with macular oedema	1
HRVO with macular oedema	1
Total	12

Age related macular degenerations were classified into Dry ARMD and Wet ARMD. Present study analyzed 15 (18.75%) cases, 8 (53%) were Wet ARMD and 7 (47%) were Dry ARMD. In the present study FFA confirmed the diagnosis in 5 (33 %) of cases, altered the diagnosis in 3 (20 %) of cases and categorized the lesion in 7 (47%) of cases[Table 5]

Table 5. Role of FFA in ARMD cases

	Number of patients	Percentage
FFA confirmed diagnosis	5	33%
FFA altered diagnosis	3	20%
FFA categorized the lesion	7	47%

Central serous chorioretinopathy was studied in 8 (10%) patients. Single leak was seen in 6 (75%) and multiple leak in 2 (25%) of patients. Ink blot appearance and smoke stack pattern was seen in 4 patients each respectively. 8 (10%) cases of inflammatory conditions like Eales disease (3), choroiditis (3) and optic nerve lesions (2) were reported. FFA confirmed the diagnosis in 37 % of cases and categorized the lesion in 63 % of cases [Table 6].

Table 6: Role of FFA in inflammatory conditions

	Number of patients	Percentage
FFA confirmed diagnosis	3	37%
FFA altered diagnosis	0	0%
FFA categorized the lesion	5	63%

Miscellaneous conditions like Macular dystrophies and Asteroid hyalosis were included in the study. Total of 4 cases, 2 each from Macular dystrophies and Asteroid hyalosis were studied. FFA has helped in confirming the diagnosis of Macular dystrophies. FFA was useful in examining the fundus in the presence of vitreous opacities in cases of Asteroid hyalosis; both the cases had normal fundus.

9 (11.25%) of 80 patients reported with minor side effects like nausea and vomiting.

Figure 1 Figure 2

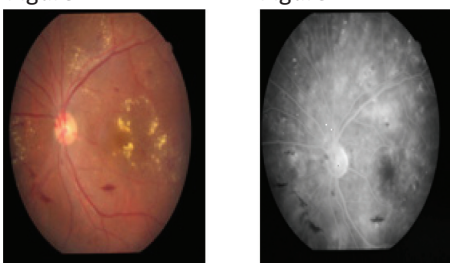

Fig. 1 Clinical picture showing hard exudates in macular area, microaneurysms and flame shaped haemorrhages.

Fig. 2 FFA showing leaking microaneurysms with macular oedema

Figure 3 Figure 4

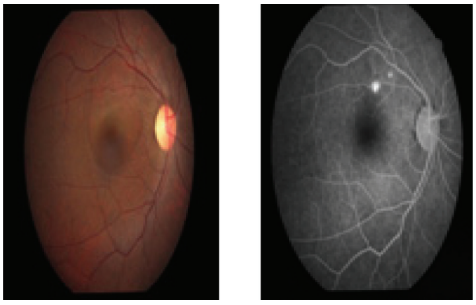

Fig. 3 Clinical appearance of CSR.

Fig. 4 FFA showing "Ink blot" appearance

Figure 5 Figure 6

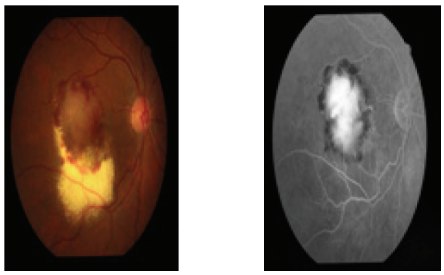

Fig. 5 Disc shaped elevated area with surrounding hemorrhages and drusens in macular area.

Fig. 6 FFA late phase showing blocked fluorescence and persistent hyperfluorescence.

Figure 7 Figure 8

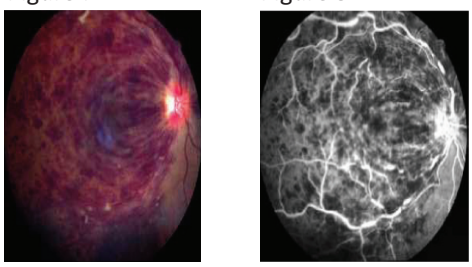

Fig. 7 Classical "Splashed tomato appearance" seen in central retinal vein occlusion.

Fig. 8 FA shows extensive hypofluorescence indicative of capillary non-perfusion and haemorrhages with staining of vessels

DISCUSSION

Posterior segment pathologies sometimes have unusual and non-specific presentations, clinical examination alone is not sufficient for diagnosis and management. Various investigations are available to achieve diagnostic accuracy. Fluorescein angiography is an imaging technique which allows in evaluating the posterior segment of the eye.

Present study demonstrated diabetic retinopathy (31.25%) as the most common presentation followed by vascular occlusion (25%), Age related macular degenerations (18.75 %), Central serous chorioretinopathy (10%), inflammatory disorders (10%) and miscellaneous conditions (5%).

WESDR (Wisconsin epidemiological study of diabetic retinopathy) stated that the incidence of diabetic retinopathy as 40.3%[5]. Kahn H A et. al in a study on blindness caused by diabetic retinopathy stated that diabetic retinopathy as the major cause of visual impairment[6] .

Of 25 cases of diabetic retinopathy, 40% of cases were NPDR with CSME, 20% cases were NPDR, and 20% cases were PDR and 20% of cases with PDR with CSME. FFA confirmed the

diagnosis in 40% and altered the diagnosis in 40% cases categorized the lesion in 20% of cases. Wykes et al in their study showed that FFA confirmed the diagnosis in 40% of cases which can be compared to the present study[7].

FFA is instrumental in categorizing the lesion of diabetic retinopathy and classifying the diabetes into Proliferative and Non proliferative diabetic retinopathy by identification of new vessels on FFA, which can sometimes be easily missed on clinical ophthalmoscopy. FFA is also helpful in identification of clinically significant macular oedema and foveal avascular zone.

Retinal vascular occlusion accounted for 25% of all the cases included in the study. BRVO was most common with 75% cases of 20 cases i.e. 15 cases. 9 patients had superotemporal BRVO and 6 cases showed inferotemporal BRVO. 2 cases each of Central retinal vein obstruction (10%) and Hemiretinal vein obstruction (10%) were reported. 1 patient of CRAO was diagnosed. Branch vein occlusion study group stated that BRVO, as most common cause of retinal vascular disease which was comparable with our study.

Retinal vascular occlusions are associated with macular oedema in 12 (60%) of cases. BRVO with macular oedema was reported in 10 cases. One case each of CRVO and HRVO had macular oedema. Wykes et al reported that vascular occlusion with macular oedema is seen in 84% of cases[7]. S S Hayreh in his landmark study concluded that "In FFA extent of capillary non perfusion is a reliable criterion to differentiate CRVO into ischemic and non-ischemic types[8]. Most of the Retinal vascular occlusion are diagnosed clinically, FFA has a role in identification of capillary non perfusion and associated macular oedema and for the planning appropriate treatment.

Present study analyzed 15(18.75%) cases of ARMD , 53 % (8) were categorized into Wet ARMD and 47% (7) to Dry ARMD. In the present study FFA confirmed the diagnosis in 33 % of cases, altered the diagnosis in 20 % of cases and categorized the lesion in 47% of cases. Talks j et al reported that 81 % of cases of Wet ARMD were diagnosed only by FFA[9] . Most of the cases of Dry ARMD were diagnosed clinically; FFA had played an important role in diagnosing and categorizing the lesion in Wet ARMD. fluorescein angiography plays an important role in early detection and localization of site of CNVM in relation to the foveal avascular zone. FFA is an important investigation for diagnosis of wet ARMD.

8 (10%) cases of Central serous chorioretinopathy were reported, which were diagnosed clinically and confirmed by FFA. Single leak was seen in 75% of cases and multiple leaks in 25 % of cases. Ink blot appearance and smoke stake pattern was seen in 50 % of cases respectively. Results of the present study were consistent with study by Suresha AR et al on role of FFA in macular disorders [10]. Siddique et al, in their study reported that ink blot appearance and smoke stack appearance were seen in 67% and 33% respectively[11] . Fluorescein angiography was helpful in providing a definitive diagnosis and in detecting the exact site of leakage which is of value in laser photocoagulation.

FFA has an important role in diagnosing and categorizing the lesions in inflammatory conditions of the retina. 8 (10%) cases of inflammatory disorders were studied, 37.5% (3) cases of Eales disease, 37.5% (3) cases of choroiditis and 25% (2) cases of optic nerve lesions were reported. FFA confirmed the diagnosis in 37 % of cases and categorized the lesion in 63 % of cases. FFA was accurate in assessing the nature and extent of lesions. It helped in diagnosis of new vessels and determined if the lesions were active or healing. FFA also helped to differentiate between healed and active lesions and served as a prognostic aid in assessing the treatment. FFA is more accurate in categorizing the lesions and useful for early start of the treatment in inflammatory disorders

FFA has also helped in confirming the diagnosis and categorization of lesions in conditions like Macular dystrophies in 2 patients in the study group. Wykes et al reported that FFA confirmed the diagnosis in 100% of cases of hereditary macular dystrophies[7]. 2 cases of Asteroid hyalosis were reported, FFA was useful in examining the fundus in the presence of vitreous opacities in cases of Asteroid hyalosis; both the cases had normal fundus except for vitreous opacities.

FFA is an invasive procedure with administration of the intravenous dye into blood circulation. It may be associated with grievous side effects like shock; skin eruptions and hypersensitivity to dye, but incidence of side effects are very low. Nausea and vomiting were the common side effects reported in the study. Present study had reported 9 (11.25%) of 80 patients with side effects like nausea and vomiting. FFA is relatively safe invasive procedure. Kwan AS et al. concluded that "FFA is a relatively safe procedure, when compared to other intravenous radio contrast media angiography" [12]. FFA was found to be a relatively safe procedure among all age groups, in both sexes with no gender bias and no predilection for patients with known history of drug allergy.

Statistical analysis of the comparison of results of Clinical Ophthalmoscopy and FFA were found to be significant. FFA was found to be a superior invasive modality. In the present study, FFA altered the diagnosis in 37.5% of cases and categorized the lesions into specific entities.

CONCLUSION

Fundus fluorescein angiography helped to a great extent in diagnosis, classification and treatment of diabetic retinopathy. Fundus Fluorescein angiography was useful in differentiating CRVO into ischemic or non-ischemic type and in Identification of macular oedema and NVE.

Fundus fluorescein angiography plays an important role in early detection and localization of ARMD. Fundus fluorescein

angiography was helpful in providing a definitive diagnosis and in detecting the exact site of leakage in cases of CSR. Hence FFA is a superior diagnostic tool and is a necessity for evaluating, localizing and categorization of lesions in Retinal, Macular and Choroidal pathologies.

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